Mediterranean Journal of
Pharmacy & Pharmaceutical Sciences

ISSN: 2789-1895 online
www.medjpps.com

doi: 10.5281/zenodo.21860380
ISSN: 2958-3101 print

REVIEW article

Revolutionizing pharmaceutical innovation through artificial intelligence: Transforming drug discovery and development

Anju Verma [1], **Tanya Dubey** [1], **Ashish Pandey** [1], and **Pankaj Kumar Sonar** [2*]

[1] Department of Pharmaceutical Sciences and Technology, Madan Mohan Malaviya University of Technology, Gorakhpur 273010, Uttar Pradesh, India
[2] Government Pharmacy College, B.R.D. Medical College Campus, Gorakhpur-273013, Uttar Pradesh, India
[*] Author to whom correspondence should be addressed

Received: 14-06-2026, **Accepted**: 09-08-2026, **Published online:** 10-08-2026

HOW TO CITE THIS

Verma A, et al. Revolutionizing pharmaceutical innovation through artificial intelligence: Transforming drug discovery and development. Mediterr J Pharm Pharm Sci. 2026; 6(3): 65-79. [Article number: 263]. https://doi.org/10.5281/zenodo.21860380

Keywords: Adverse drug reaction, clinical trials, datasets, drug-drug interactions, pharmacovigilance

Abstract: Artificial intelligence (AI) has become an effective tool that leverages personal information to deliver faster solutions to complex problems. A revolutionary approach to drug discovery, formulation, and dosage form testing is presented by promising advances in machine learning and AI. The pharmaceutical industry increasingly uses it to revolutionize drug development at all stages, from discovery to post-market surveillance. Drug development is being revolutionized by AI-driven techniques that make it possible to analyse enormous biological datasets, predict drug-target interactions, and find promising candidates more quickly and precisely than with conventional methods. The pharmaceutical industry is significantly impacted by drug research and discovery, which also has an impact on some human health issues. Despite the promising benefits, there are drawbacks to using AI as well, such as the requirement for regulatory frameworks, data protection issues, and integrating AI with current systems. In the pharmaceutical sector, AI has the potential to significantly increase innovation, lower expenses, and improve patient outcomes.

Introduction

The pharmaceutical industry is transforming due to the growing influence of AI, which has novel prospects for enhancing the efficacy and efficiency of drug discovery, development, and distribution [1]. Pharmaceutical businesses may improve clinical trial designs, speed up the identification of viable drug candidates, and improve the precision of customized medicine by utilizing AI's strengths in data analysis, pattern recognition, and predictive modelling [2]. AI not only speeds up and lowers the cost of introducing new medications to the market, but it also makes novel treatments that are customized to meet the needs of specific patients possible. The healthcare sector is moving toward more individualized, efficient, and effective healthcare solutions in the future thanks to technology advancements. It detects adverse drug reactions and safety concerns; AI monitors and analyses data from a variety of sources, including social media and electronic health records [3]. AI systems are able to uncover possible medication candidates more quickly and correctly than traditional approaches by analysing large amounts of biological and chemical data. Early drug development stages are streamlined by using machine learning models to predict the interactions between various chemicals and particular biological targets. AI aids in the design of more successful trials and investigations during the preclinical and clinical stages [4]. AI-powered technologies can evaluate patient data to find good candidates for clinical trials, forecast a patient's reaction to a treatment, and track a patient's progress in real time. By evaluating genetic, environmental, and lifestyle data to customize treatments for specific patients, artificial intelligence (AI) advances precision medicine AI in manufacturing ensures quality control, improves supply chain management, and predicts equipment breakdowns to optimize production processes [1].

With data analysis from a variety of sources, including scientific literature and clinical records, AI can find new applications for medications that are already on the market. Comparing this method to creating brand-new medications would save time and money while greatly accelerating the availability of novel therapies for a variety of illnesses [2]. Automation of regulatory submission preparation, assurance of conformity with multiple rules, and expedited approvals are just a few of the ways AI solutions help pharmaceutical businesses navigate the complicated regulatory landscape [3]. The pharmaceutical industry has long been a leader in scientific innovation, and the advent of AI has further accelerated this trend. AI is transforming numerous facets of the industry, from sales and marketing to drug development, clinical trials, personalized medicine, and regulatory compliance [2, 4]. The integration of AI is enabling pharmaceutical companies to optimize operations, enhance patient care, and bring new drugs to market more efficiently. This essay provides a comprehensive exploration of the role and impact of AI across key areas in the pharmaceutical industry, including sales and marketing, clinical trials, pharma-academics, personalized medicine, drug repurposing, regulatory compliance, and diagnostic and disease prevention [1, 3].

Significance of AI in pharmaceutical sales and marketing: Pharmaceutical sales and marketing have traditionally been challenging areas due to the complexity of the products, the diversity of customer segments, and the stringent regulatory environment. AI has emerged as a powerful tool to address these challenges by enabling more targeted, data-driven, and personalized marketing strategies. The use of AI in this sector can be categorized into several key areas, including predictive analytics, customer segmentation, personalized marketing, and real-time customer engagement [5].

Predictive analytics and customer segmentation: One of the most significant contributions of AI in pharmaceutical sales and marketing is its ability to analyse vast amounts of data to predict market trends and segment customers more effectively. Pharmaceutical companies collect data from various sources, including sales records, customer feedback, healthcare provider (HCP) interactions, and patient data. AI algorithms can process this data to identify patterns and trends, which can then be used to predict future market behaviours. For instance, AI can analyse prescription data to identify which physicians are most likely to prescribe a particular drug. This allows sales teams to focus their efforts on high-value targets, thereby increasing the efficiency of their outreach. Similarly, AI can segment customers based on their behaviours, preferences, and needs, allowing for more tailored marketing messages. This segmentation goes beyond traditional demographic factors, incorporating behavioural and psychographic data to create more accurate and actionable customer profiles [6].

Personalized marketing: Personalization is a key trend in modern marketing, and AI enables pharmaceutical companies to deliver highly personalized content to their customers. By analysing data on individual healthcare providers' prescribing habits, patient demographics, and treatment preferences, AI can help marketers create customized campaigns that resonate with specific audiences. For example, an AI-driven platform might suggest a particular set of educational materials for a physician who frequently prescribes treatments for diabetes, while offering different resources to a doctor who focuses on cardiovascular health. Moreover, AI-driven marketing automation tools can deliver personalized content at the right time, ensuring that healthcare providers receive information when they are most likely to need it. This approach not only enhances the relevance of the marketing message but also increases the likelihood of a positive response [7].

Real-time customer engagement: In addition to personalized marketing, AI is also revolutionizing real-time customer engagement through the use of chatbots and virtual assistants. These AI-driven tools can interact with healthcare providers and patients in real-time, providing instant responses to queries, offering product information, and even assisting with medication management. For example, a virtual assistant might remind a patient to take their medication at a specific time, or help a healthcare provider find the latest research on a particular drug. The benefits of AI-driven real-time engagement are significant. For healthcare providers, these tools offer quick access to information and support, allowing them to make informed decisions more efficiently. For patients, AI-driven engagement can improve adherence to treatment regimens, leading to better health outcomes. Overall, AI enhances the customer experience by providing timely, relevant, and personalized interactions [8].

Case study: Artificial Intelligence in pharma marketing

A leading example of AI in pharmaceutical marketing is Pfizer's partnership with IBM Watson. Pfizer has utilized IBM Watson's AI capabilities to analyse large datasets, including clinical trial data, patient records, and scientific literature, to identify potential new markets for its products. This collaboration has allowed Pfizer to refine its marketing strategies, ensuring that its campaigns are more targeted and effective. The use of AI has also enabled Pfizer to gain deeper insights into customer needs, leading to more personalized and impactful marketing efforts [9].

Impact: The impact of AI on pharmaceutical sales and marketing is profound. By enabling more targeted, data-driven, and personalized marketing strategies, AI increases the efficiency and effectiveness of marketing efforts. This not only leads to higher sales but also improves customer satisfaction by delivering relevant and timely information. Additionally, AI-driven tools enhance customer engagement, fostering stronger relationships between pharmaceutical companies and their customers. As AI technology continues to evolve, its role in pharmaceutical sales and marketing is likely to expand, leading to even more innovative and effective marketing approaches [10].

Significance of AI in clinical trials: Clinical trials are a critical component of drug development, but they are often associated with high costs, lengthy timelines, and complex logistics. AI is transforming the clinical trial process by streamlining patient recruitment, optimizing trial design, enhancing data analysis, and improving patient monitoring. These advancements are leading to more efficient and successful clinical trials, ultimately speeding up the development of new therapies [11].

Patient Recruitment: One of the most challenging aspects of clinical trials is patient recruitment. Finding the right patients who meet the specific criteria for a trial can be time-consuming and difficult, often leading to delays in the trial process. AI is addressing this challenge by analysing electronic health records (EHRs), genetic data, and other patient information to identify individuals who are most likely to benefit from and comply with a clinical trial [12]. AI-driven platforms can sift through vast amounts of data to match patients with appropriate trials, taking into account factors such as medical history, genetic makeup, and lifestyle. For example, AI can analyse genetic data to identify patients with specific biomarkers that are relevant to a particular trial. This targeted approach not only accelerates patient recruitment but also increases the likelihood of trial success by ensuring that the right patients are enrolled [13].

Trial design optimization: AI is also playing a critical role in optimizing the design of clinical trials. Traditionally, trial design has been a complex process involving multiple variables, such as patient population, dosage levels, and endpoints. AI can simulate trial outcomes based on different design parameters, allowing researchers to identify the most effective trial design before the trial begins [14]. For instance, AI can analyse historical trial data to predict how different patient populations might respond to a new drug, helping researchers to select the most appropriate patient group for the trial. AI can also optimize dosage levels by simulating different dosing regimens and predicting their effects on efficacy and safety. This ability to model and predict trial outcomes reduces the risk of trial failure and increases the efficiency of the drug development process [15].

Data analysis and management: The vast amounts of data generated during clinical trials can be overwhelming, and managing this data effectively is crucial to the success of the trial. AI is transforming data analysis and management by automating data processing, identifying patterns and correlations, and providing real-time insights [16]. AI-driven tools can analyse trial data more quickly and accurately than traditional methods, allowing researchers to identify trends and make data-driven decisions in real-time. For example, AI can detect early signals of adverse events, enabling researchers to take corrective action before the issue becomes critical. Additionally, AI can identify subpopulations within the trial who may respond differently to the treatment, providing valuable insights for personalized medicine [17].

Patient monitoring and adherence: Ensuring patient adherence to the trial protocol is another critical factor in the success of clinical trials. AI-driven tools, such as wearable devices and mobile apps, are improving patient monitoring and adherence by providing real-time data on patient behaviour and health status. These tools can track medication adherence, monitor vital signs, and detect potential side effects, providing researchers with continuous data on patient progress [18]. For example, a wearable device might monitor a patient's heart rate and activity levels, sending alerts to the research team if any abnormalities are detected. Similarly, a mobile app might remind patients to take their medication at specific times and report any side effects they experience. This real-time monitoring not only improves patient adherence but also enhances the quality of the data collected during the trial [19].

Case study: Artificial Intelligence in clinical trials

A notable example of AI in clinical trials is the work of GNS Healthcare, a company that uses AI to analyse clinical trial data and predict patient outcomes. GNS Healthcare's AI platform, REFS (Reverse Engineering and Forward Simulation), has been used in various clinical trials to identify which patients are most likely to respond to treatment, allowing for more targeted and effective trials. This AI-driven approach has led to significant improvements in trial efficiency and success rates, ultimately accelerating the development of new therapies [20].

Impact: The impact of AI on clinical trials is transformative. By streamlining patient recruitment, optimizing trial design, enhancing data analysis, and improving patient monitoring, AI reduces the costs and timelines associated with clinical trials. This not only speeds up the development of new drugs and therapies but also increases the likelihood of trial success, bringing effective treatments to patients more quickly. As AI technology continues to advance, its role in clinical trials is expected to grow, leading to even more innovative and efficient approaches to drug development [21].

Significance of AI in pharmaceutical academics: The academic sphere of pharmaceuticals is undergoing a significant transformation with the integration of AI, which is reshaping how pharmaceutical education and research are conducted. AI is providing new tools for data analysis, simulation, and modelling, enhancing the learning experience for students and enabling researchers to conduct more sophisticated analyses. The role of AI in pharmaceutical academics can be explored through its impact on education, research, and interdisciplinary collaboration [22].

Pharmaceutical education: In pharmaceutical education, AI is enhancing the learning experience by providing personalized education platforms that adapt to the individual needs of students. These platforms use AI algorithms to assess students' learning styles, progress, and preferences, delivering customized content that matches their needs. For example, an AI-driven platform might identify that a student learns best through visual materials and adjust the course content accordingly, providing more video lectures, diagrams, and interactive simulations. Virtual labs are another area where AI is making a significant impact. These AI-driven platforms allow students to conduct experiments in a simulated environment, providing hands-on experience without the limitations of physical resources. For instance, a virtual lab might simulate the effects of a drug on different cell types, allowing students to observe the outcomes without the need for expensive laboratory equipment. This not only enhances the learning experience but also makes pharmaceutical education more accessible to students who may not have access to traditional labs [23, 24].

Pharmaceutical research: AI is also transforming pharmaceutical research by providing new tools for data analysis, simulation, and modelling. Pharmaceutical research often involves the analysis of vast amounts of data from various sources, including clinical trials, genetic studies, and chemical analyses. AI can sift through this data more quickly and accurately than humans, identifying patterns and correlations that might otherwise go unnoticed. For example, AI-driven platforms can analyse genetic data to identify potential drug targets, predict how different compounds will interact with those targets, and simulate the effects of those interactions. This capability not only accelerates the pace of research but also leads to more innovative discoveries, further advancing the field of pharmaceuticals [25]. Moreover, AI is enabling researchers to conduct more sophisticated analyses by providing tools for predictive modelling and simulation. For instance, AI can simulate the effects of a new drug on different populations, taking into account factors such as genetics, lifestyle, and environmental influences. This allows researchers to predict the drug's efficacy and safety more accurately, ultimately leading to more effective and targeted therapies [26].

Interdisciplinary collaboration: The integration of AI into pharmaceutical academics is also fostering interdisciplinary collaboration, bringing together experts from various fields, including computer science, biology, chemistry, and medicine. AI-driven platforms facilitate collaboration by providing tools for data sharing, communication, and joint analysis, enabling researchers to work together more effectively. For example, AI platforms might allow researchers to share and analyse large datasets across different institutions, facilitating collaboration on complex projects. Similarly, AI-driven communication tools might enable researchers from different disciplines to work together on a drug development project, combining their expertise to create more innovative solutions [27].

Case study: Artificial Intelligence in pharmaceutical academics

An example of AI's impact on pharmaceutical academics is the use of AI-driven platforms at academic institutions such as the Massachusetts Institute of Technology (MIT). MIT has integrated AI into its pharmaceutical research and education programs, using AI-driven tools to analyse large datasets, simulate drug interactions, and personalize education for students. This integration has led to significant advancements in education and research, further establishing MIT as a leader in the field of pharmaceuticals [28].

Impact: The impact of AI on pharmaceutical academics is profound. By providing new tools for data analysis, simulation, and personalized education, AI enhances the learning experience for students and enables researchers to conduct more sophisticated analyses. This not only accelerates the pace of research but also leads to more innovative discoveries, advancing the field of pharmaceuticals. Additionally, AI is fostering interdisciplinary collaboration, bringing together experts from various fields to work on complex projects. As AI technology continues to evolve, its role in pharmaceutical academics is expected to grow, leading to even more significant advancements in education and research [29, 30].

Significance of AI in personalized medicine: Personalized medicine, also known as precision medicine, is one of the most promising areas in healthcare, and AI is at the forefront of this revolution. Personalized medicine aims to tailor medical treatment to the individual characteristics of each patient, such as their genetic makeup, environment, and lifestyle. AI is facilitating this by analysing vast amounts of patient data to identify patterns, predict treatment responses, and design customized treatment plans. The role of AI in personalized medicine can be explored through its impact on patient stratification, treatment optimization, and the development of novel therapies. Personalized medicine and AI together have the potential to completely transform the medical field. Precision medicine techniques pinpoint the characteristics of people with uncommon treatment outcomes or distinct medical requirements (**Figure 1**) [31].

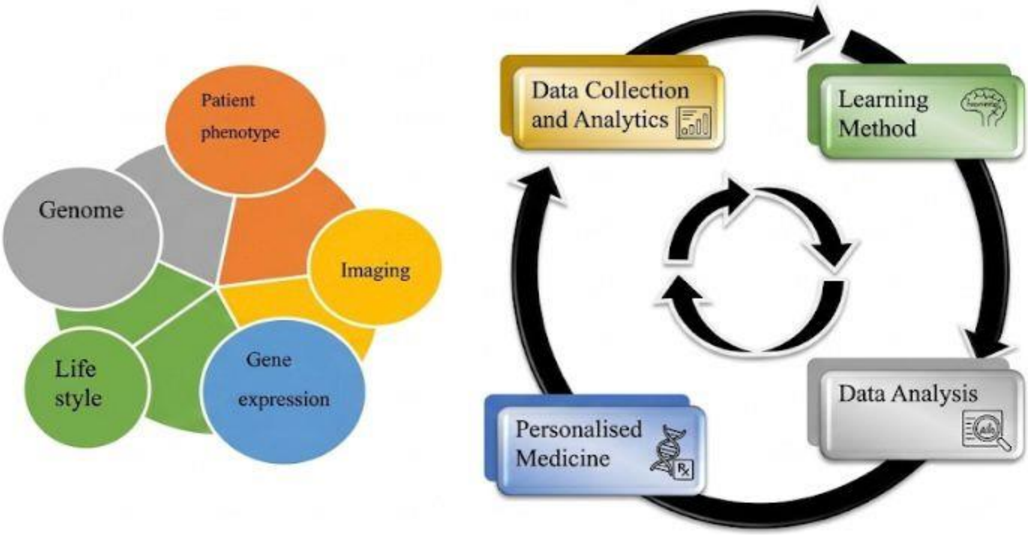

Figure 1: Schematic representation of a personalized medicine framework

AI uses complex calculations and inference to provide insights, gives the system the ability to think and learn, and enhances human decision-making for clinicians. The most challenging problems facing precision medicine, according to recent research, may be solved by translational research examining this convergence, particularly when it comes to enabling personalized diagnosis and prognostication through the combination of clinical history, patient symptoms, and nongenomic and genomic determinants. Beyond the technological advancements that enable it, the notion of personalized medicine that is, the ability to tailor medical treatment to a patient's unique genetic and molecular profile has profound ramifications. This will require adjustments to the healthcare system's infrastructure, the business models for diagnostics and medications, government and private payer payment policies, and a new approach to regulatory oversight. Moreover, proactive healthcare management, which includes early detection, treatment, and prevention, will replace reactive illness management in medical practices through personalized medicine, altering the roles of the doctor and the patient [31, 32]. In a field where anti-information technology sentiment has long existed, it would lead to a greater dependence on electronic health records and decision support systems. In order to maintain people's health, personalized medicine uses specific medical data to create plans and treatments for identifying and managing ailments. In this kind of practice, physicians integrate all available patient data, including symptoms, conventional test results, family and medical history, and some genomic data, to make precise diagnoses and create individualized treatment plans based on those findings. The tailored healthcare model that justifies the use of AI will depend heavily on health information management professionals who handle patient data. In an effort to find genetic causes for some illnesses that are not amenable to traditional medical diagnosis, doctors have started to ask for whole-genome sequencing for their patients, and other medical professionals have started to examine genomic data [32].

The US Food and Drug Administration authorized Illumina's MiSeqDx, the first high-throughput (next-generation) genomic sequencer, in December 2013. Given that it permits the creation and application of multiple innovative genome-based tests, this marketing license represents a significant turning point in the use of genetic data in the healthcare industry. In order to produce genomic reference materials for performance evaluation, the FDA and the National Institute of Standards and Technology worked together to build the full human genome DNA and the best sequence interpretation of such genomes. Among the uses of AI in healthcare are image analysis, drug discovery, and diagnostics (**Figure 2**). Individual differences in disease processes and response to treatment on genetic, biochemical, physiological, exposure, and behavioural levels have also been demonstrated by data-intensive biomedical technologies. This implies that in order for pharmaceuticals to be more effective for the unique requirements of every patient, they must be modified or

ISSN: 2789-1895 online
www.medjpps.com
doi: 10.5281/zenodo.21860380
ISSN: 2958-3101 print

personalized. AI can be extremely helpful in the development of customized medicine and in identifying pertinent intervention targets to assess their efficacy when combined with the use of data-intensive assays in a symbiotic manner. The first known instance of customized medicine is thought to have occurred with the identification of blood types and their impact on blood transfusions in the early 1900s [33].

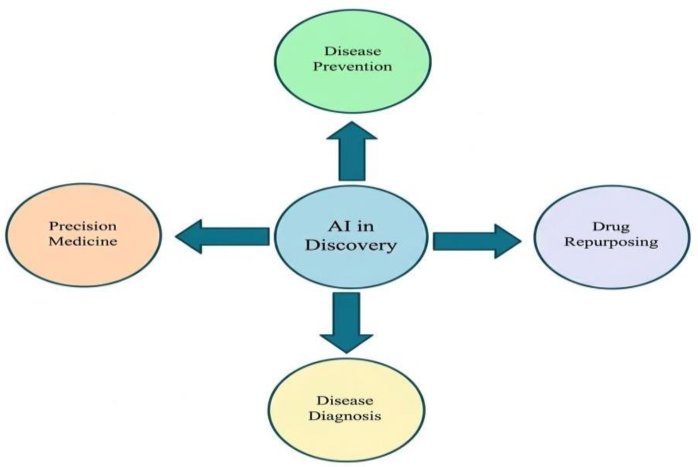

Figure 2: Use of Artificial Intelligence in drug discovery

Patient Stratification: One of the key challenges in personalized medicine is identifying which patients are most likely to benefit from a particular treatment. AI is addressing this challenge by analysing genetic data, clinical records, and other patient information to stratify patients into subgroups based on their predicted response to treatment. For example, AI can analyse genetic data to identify biomarkers that are associated with a particular disease or treatment response. This allows healthcare providers to classify patients into different subgroups, each of which may require a different treatment approach. By stratifying patients in this way, AI enables more targeted and effective treatments, ultimately improving patient outcomes [34, 35].

Treatment optimization: AI is also playing a critical role in optimizing treatment plans for individual patients. By analysing data on a patient's genetic makeup, medical history, and lifestyle, AI can predict how the patient will respond to different treatments and suggest the most effective approach [36]. For instance, AI might analyse a cancer patient's genetic data to identify mutations that are driving the growth of their tumour. Based on this information, the AI platform might suggest a targeted therapy that is designed to inhibit the specific pathways involved in the patient's cancer. This personalized approach not only increases the likelihood of a successful outcome but also reduces the risk of adverse reactions, as the treatment is tailored to the individual's unique characteristics. In addition to optimizing treatment plans, AI is also enabling more precise dosing of medications. By analysing factors such as a patient's age, weight, genetics, and metabolism, AI can predict the optimal dosage for each individual, reducing the risk of side effects and improving treatment efficacy [36].

Development of novel therapies: AI is also facilitating the development of novel therapies that are specifically designed for individual patients or subgroups of patients. By analysing large datasets, including genetic data, clinical records, and biological samples, AI can identify new drug targets, predict how different compounds will interact with those targets, and simulate the effects of those interactions. For example, AI might analyse the genetic data of patients with a rare disease to identify a common mutation that is responsible for the disease. Based on this information, researchers can develop a therapy that targets the specific mutation, providing a more effective treatment for patients with the rare disease. Moreover, AI-driven platforms are enabling the development of personalized vaccines, which are designed to target the specific genetic makeup of an individual's tumour or infection. These personalized vaccines are showing promise in the treatment of cancer, where they can stimulate the immune system to attack the tumour more effectively [36].

Case study: Personalized medicine with Artificial Intelligence

ISSN: 2789-1895 online
www.medjpps.com
doi: 10.5281/zenodo.21860380
ISSN: 2958-3101 print

A leading example of AI in personalized medicine is the work of Tempus, a technology company that uses AI to analyse clinical and molecular data to deliver personalized treatment plans for cancer patients. Tempus collects and analyses data from genomic sequencing, clinical trials, and electronic health records to identify patterns and predict treatment responses. This AI-driven approach allows Tempus to provide oncologists with data-driven insights, enabling them to design customized treatment plans that are tailored to the individual characteristics of each patient. The use of AI in personalized medicine has led to improved patient outcomes, particularly in complex and difficult-to-treat cancers [37].

Impact: The impact of AI on personalized medicine is significant. By enabling more precise and targeted treatments, AI improves patient outcomes, particularly in complex and chronic diseases such as cancer and diabetes. This personalized approach not only enhances the quality of care but also reduces healthcare costs by minimizing the trial-and-error process often associated with finding the right treatment. Additionally, AI is facilitating the development of novel therapies that are specifically designed for individual patients or subgroups of patients, leading to more effective and innovative treatments. As AI technology continues to evolve, its role in personalized medicine is expected to grow, leading to even more individualized and effective healthcare solutions [36, 37].

Role of Artificial Intelligence in drug repurposing

Drug repurposing, the process of finding new uses for existing drugs, is an area where AI is proving to be highly effective. Traditionally, drug repurposing has been a labour-intensive process, requiring extensive research and experimentation. AI accelerates this process by analysing large datasets to identify potential new applications for existing drugs. The role of AI in drug repurposing can be explored through its impact on data analysis, target identification, and clinical validation. As a potent instrument for attaining precision medicine, it might be viewed as a quicker and more economical method of drug discovery. The identification of treatment possibilities for uncommon illnesses and phenotypic situations with scant knowledge of disease biology is another use for medication repurposing. Large-scale biological data integration and analysis have been made possible by machine learning and AI techniques, allowing for the development of efficient, data-driven repurposing processes (**Figure 3**) [38]. Drug repurposing has seen a surge in intriguing new prospects and analytical methodologies due to recent technology advancements, particularly in the fields of natural language processing and heterogeneous network mining. Drug repurposing is a strategy that involves using currently available, well-known medications or pharmacological combinations to investigate novel medical contexts. Because it saves time and money over more conventional de novo drug discovery methods, drug repurposing therefore plays a critical role in speeding up the preclinical process of developing innovative medications. The highly successful development of publicly available large-scale machine learning methods provides the state-of-the-art application of data science to signalling disease, medicine, therapeutics, and identifying targets with the least error. This is because drug repurposing relies on massive observed data from existing drugs and diseases [39].

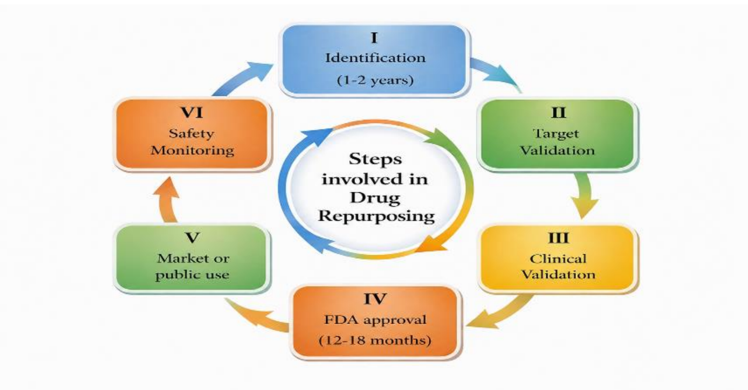

Figure 3: Sequential steps involved in the drug repurposing process

ISSN: 2789-1895 online
www.medjpps.com
doi: 10.5281/zenodo.21860380
ISSN: 2958-3101 print

A novel drug must first be evaluated for safety and efficacy in human subjects during clinical trials, after which it must be tested for toxicity, pharmacokinetic and pharmacodynamic profiles in cell and animal models. This process typically takes 13 years and 2 - 3 billion dollars. Drug development is becoming a less appealing industry for investment due to its growing costs and duration. Conversely, drug repurposing seeks to identify novel medicinal uses for a medicine that is either approved or under research. Clinical trials can be expedited, greatly cutting the time and expenses of development, as the drug's safety and dosage have been thoroughly investigated. Finding novel drug-disease correlations is the most important aspect of drug repurposing. Binding assays and phenotypic screening, which are costly and time-consuming, are the foundation of traditional biomedical research. However, the analysis of heterogeneous data based on AI techniques, such as molecular docking, genetic association analysis, pathway mapping, and signature profile matching, makes in silico methods popular because they enable all analysis to be done computationally in a time- and cost-effective manner. Biomedical association/relation knowledge bases, biomedical literature, electronic health records, and omics data (e.g., gene and protein expression) are a few of the data sets that computational drug repurposing can make use of AI [40]. Recent advances in AI-driven drug repurposing have demonstrated the ability of computational approaches to identify novel therapeutic applications for existing drugs. Various studies have employed machine learning, deep learning, and generative AI techniques to accelerate candidate selection and validation. A summary of selected recent developments is presented in **Table 1** [4, 38, 44].

Table 1: Recent Artificial Intelligence -driven drug repurposing advances

Drug Candidate	Original Indication	Repurposed target disease	AI technique used	Status (2025 - 2026)
Baricitinib	Rheumatoid Arthritis	COVID-19 complications	Knowledge Graph & Network Analysis	Clinically validated
Metformin	Type 2 Diabetes	Cancer therapy support	Machine Learning Prediction Models	Ongoing clinical studies
Sirolimus	Organ Transplant Rejection	Neurodegenerative disorders	Deep Learning Screening	Under investigation
Niclosamide	Antiparasitic Drug	Multiple cancer types	AI-based Virtual Screening	Preclinical evaluation
Atorvastatin	Hyperlipidaemia	Alzheimer's disease	Multi-omics AI Analysis	Early-stage research

Data analysis: AI is transforming the process of drug repurposing by analysing vast amounts of data, including chemical properties of drugs, biological targets, and patient outcomes. AI-driven platforms can sift through these datasets to identify patterns and correlations that suggest new therapeutic applications for existing drugs. For example, AI might analyse the chemical structure of a drug and compare it to the structures of other drugs that are known to interact with a particular biological target. If the AI platform identifies a structural similarity, it might suggest that the existing drug could also interact with the same target, potentially leading to a new therapeutic application. This ability to identify potential new uses for existing drugs significantly accelerates the drug repurposing process, saving time and resources [41].

Target identification: AI is also playing a critical role in identifying new biological targets for existing drugs. By analysing genetic data, clinical records, and biological samples, AI can identify proteins, enzymes, or other molecules that are involved in the progression of a disease and might be targeted by an existing drug. For instance, AI might analyse the genetic data of patients with a particular disease to identify a common mutation that is responsible for the disease. Based on this information, researchers can identify existing drugs that are known to interact with the mutated protein, suggesting a new therapeutic application for the drug. This targeted approach not only increases the likelihood of success but also reduces the risk of adverse reactions, as the safety profiles of repurposed drugs are already well understood [42].

Clinical validation: Once a potential new application for an existing drug has been identified, AI can also play a role in the clinical validation process. AI-driven platforms can simulate clinical trials, predicting how the repurposed drug will perform in different patient populations and under different conditions. For example, AI might simulate a clinical trial for a repurposed drug by analysing data from previous trials, patient records, and genetic studies. Based on this simulation, the AI platform might predict how different subgroups of patients will respond to the repurposed drug, helping researchers to design a more targeted and effective trial. This ability to predict trial outcomes reduces the risk of trial failure and accelerates the development of new therapies [43].

Case study: Artificial Intelligence in drug repurposing

An example of AI's impact on drug repurposing is the work of *in silico* Medicine, a biotechnology company that uses AI to identify new therapeutic applications for existing drugs. *In silico* Medicine's AI-driven platform analyses large datasets, including genetic data, chemical properties of drugs, and patient outcomes, to identify potential new uses for existing drugs. This approach has led to the identification of several promising drug candidates, including a repurposed drug for the treatment of COVID-19. The use of AI in drug repurposing has significantly accelerated the development of new therapies, particularly in areas of unmet medical need [44].

Impact: The impact of AI on drug repurposing is profound. By enabling more efficient and targeted identification of new therapeutic applications for existing drugs, AI accelerates the drug development process, bringing new therapies to patients more quickly. This not only saves time and resources but also reduces the risk of adverse reactions, as the safety profiles of repurposed drugs are already well understood. Additionally, AI-driven platforms are enabling the discovery of novel drug targets, leading to more innovative and effective therapies. As AI technology continues to evolve, its role in drug repurposing is expected to grow, leading to even more significant advancements in the development of new treatments [45].

Role of Artificial Intelligence in regulatory compliance

Regulatory compliance is a critical aspect of the pharmaceutical industry, and AI is playing an increasingly important role in ensuring that companies meet the stringent requirements set by regulatory agencies. AI is helping pharmaceutical companies to manage the complex and ever-changing regulatory landscape by automating compliance processes, analysing regulatory data, and predicting compliance risks. The role of AI in regulatory compliance can be explored through its impact on compliance automation, regulatory data analysis, and risk prediction [46].

Compliance Automation: One of the most significant contributions of AI in regulatory compliance is its ability to automate compliance processes. Pharmaceutical companies are required to adhere to a wide range of regulations, covering everything from manufacturing practices to labelling and advertising. AI-driven platforms can automate many of these processes, ensuring that companies remain in compliance with the latest regulations. For example, AI can automate the process of monitoring changes in regulatory requirements, ensuring that companies are always up-to-date with the latest rules. This might involve scanning regulatory websites, extracting relevant information, and alerting compliance officers to any changes that require action. Additionally, AI can automate the process of document review, ensuring that all documents submitted to regulatory agencies are accurate and compliant with the latest requirements [47].

Regulatory data analysis: AI is also playing a critical role in analysing regulatory data, helping pharmaceutical companies to identify trends, patterns, and potential compliance risks. Regulatory agencies collect vast amounts of data on drug approvals, clinical trials, and adverse events, and analysing this data can provide valuable insights for pharmaceutical companies. For instance, AI-driven platforms can analyse data on drug approvals to identify trends in the types of drugs that are being approved and the criteria that regulatory agencies are using to evaluate them. This information can help pharmaceutical companies to design their drug

ISSN: 2789-1895 online
www.medjpps.com
doi: 10.5281/zenodo.21860380
ISSN: 2958-3101 print

development programs in a way that maximizes their chances of regulatory approval. Similarly, AI can analyse data on adverse events to identify potential safety issues with existing drugs, allowing companies to take corrective action before the issue becomes critical [48].

Risk prediction: AI is also helping pharmaceutical companies to predict compliance risks, enabling them to take proactive measures to mitigate those risks. By analysing data on past compliance violations, AI-driven platforms can identify patterns and correlations that suggest potential future risks. For example, AI might analyse data on past manufacturing violations to identify factors that are associated with non-compliance, such as specific production processes or raw materials. Based on this analysis, the AI platform might predict which batches of a drug are most likely to fail a regulatory inspection, allowing the company to take corrective action before the issue arises. This proactive approach not only reduces the risk of regulatory violations but also enhances the company's reputation and trust with regulatory agencies [49-51].

Case study: Artificial Intelligence in regulatory compliance

An example of AI's impact on regulatory compliance is the work of RegTech companies like Compliance.ai, which uses AI to help pharmaceutical companies manage regulatory compliance. Compliance. Ai’s platform automates the process of monitoring regulatory changes, analysing regulatory data, and predicting compliance risks, ensuring that companies remain in compliance with the latest regulations. This AI-driven approach has significantly reduced the burden of regulatory compliance for pharmaceutical companies, allowing them to focus more on innovation and drug development [49, 52].

Impact: The impact of AI on regulatory compliance is significant. By automating compliance processes, analysing regulatory data, and predicting compliance risks, AI reduces the burden of regulatory compliance for pharmaceutical companies, allowing them to focus more on innovation and drug development. Additionally, AI enhances the accuracy and efficiency of compliance processes, reducing the risk of regulatory violations and improving the company's reputation with regulatory agencies. As AI technology continues to evolve, its role in regulatory compliance is expected to grow, leading to even more efficient and effective compliance strategies [52].

Role of AI in diagnostic and disease prevention: The role of AI in diagnostics and disease prevention is revolutionizing healthcare by enabling earlier detection of diseases, more accurate diagnoses, and more effective prevention strategies. AI is enhancing the capabilities of healthcare providers by analysing vast amounts of data, identifying patterns, and providing real-time insights that can lead to earlier and more accurate diagnoses. The role of AI in diagnostics and disease prevention can be explored through its impact on disease detection, predictive analytics, and public health monitoring [53].

Disease detection: One of the most significant contributions of AI in diagnostics is its ability to detect diseases at an earlier stage, often before symptoms appear. AI-driven platforms can analyse medical images, genetic data, and other patient information to identify early signs of disease, allowing for earlier intervention and treatment. For example, AI algorithms are being used to analyse medical images, such as X-rays, MRIs, and CT scans, to detect signs of cancer, heart disease, and other conditions. These algorithms can identify subtle patterns in the images that may be indicative of disease, often with greater accuracy than human radiologists. By detecting diseases at an earlier stage, AI enables healthcare providers to intervene more quickly, improving patient outcomes [54, 55].

Predictive analytics: AI is also playing a critical role in predictive analytics, helping healthcare providers to identify individuals who are at risk of developing certain diseases. By analysing data on a patient's genetics, lifestyle, and environment, AI can predict the likelihood of the patient developing a particular condition, allowing for earlier intervention and prevention. For instance, AI might analyse a patient's genetic data to identify mutations that are associated with an increased risk of cancer. Based on this information, healthcare

ISSN: 2789-1895 online
www.medjpps.com
doi: 10.5281/zenodo.21860380
ISSN: 2958-3101 print

providers can design a personalized prevention plan, including regular screenings, lifestyle modifications, and other interventions, to reduce the patient's risk of developing the disease. This predictive approach not only improves patient outcomes but also reduces healthcare costs by preventing diseases before they occur [56].

Public health monitoring: AI is also enhancing public health monitoring by analysing data on disease outbreaks, environmental factors, and population health trends. AI-driven platforms can analyse data from various sources, including social media, electronic health records, and environmental sensors, to identify potential public health threats and predict their impact. For example, AI might analyse data on flu outbreaks in different regions to predict how the virus will spread and identify which populations are most at risk. Based on this information, public health officials can design targeted interventions, such as vaccination campaigns and public awareness programs, to prevent the spread of the disease. This proactive approach not only improves public health outcomes but also reduces the burden on healthcare systems [57, 58].

Case study: Artificial Intelligence in diagnostics and disease prevention

A leading example of AI in diagnostics and disease prevention is Google's DeepMind, which has developed AI algorithms that can analyse medical images to detect diseases such as breast cancer and diabetic retinopathy. These algorithms have been shown to detect diseases with greater accuracy than human radiologists, enabling earlier and more accurate diagnoses. In addition, AI-driven platforms like BlueDot have been used to monitor and predict the spread of infectious diseases, including the COVID-19 pandemic. These AI-driven approaches have significantly improved the ability of healthcare providers and public health officials to detect and prevent diseases, ultimately saving lives [57].

Impact: The impact of AI on diagnostics and disease prevention is profound. By enabling earlier detection of diseases, more accurate diagnoses, and more effective prevention strategies, AI is improving patient outcomes and reducing healthcare costs. Additionally, AI is enhancing public health monitoring, allowing for more proactive and targeted interventions to prevent the spread of diseases. As AI technology continues to evolve, its role in diagnostics and disease prevention is expected to grow, leading to even more innovative and effective healthcare solutions [58, 59].

***Conclusion**:* Through process optimization, improved accuracy, and innovation stimulation, AI is becoming a more important component of the pharmaceutical sector. The time and expense involved in introducing new medications to the market are greatly decreased by its applications, which include drug development, clinical trials, and customized medicine. AI has the ability to completely change how we perceive, create, and provide medical care as technology develops, which might ultimately result in more potent medications and better outcomes for patients. Predictive, preventative, and customized medicine is on the horizon thanks to the revolutionary change brought about by the introduction of AI into the pharmaceutical sector. The pharmaceutical sector is changing, innovating, and improving patient outcomes as a result of AI's integration. AI has enormous potential benefits, even though there are still issues like data privacy, ethical concerns, and the requirement for legal changes. The pharmaceutical sector is expected to become more responsive, efficient, and patient-centred as a result of the ongoing development and prudent application of AI technology.AI is still being researched, and there are a lot of fascinating uses for it being developed. For those who see it negatively, however, it may be seen as a necessary evil [56].

References

1. Thakur RRS, Solanki HK, Chavda VP. Artificial intelligence in pharmaceutical technology and drug delivery design. Pharmaceutics. 2023; 15(7): 1916. doi: 10.3390/pharmaceutics15071916
2. Ganeshpurkar A, Pawar A. Revolutionizing drug discovery: A comprehensive review of AI applications. Drugs Drug Candidates. 2024; 3(1): 148-171. doi: 10.3390/ddc3010009

ISSN: 2789-1895 online
www.medjpps.com
doi: 10.5281/zenodo.21860380
ISSN: 2958-3101 print

3. Banerjee P, Gupta P, Mayuren J, Patra S, Candasamy M. Artificial intelligence in pharmaceutical and healthcare research. Big Data and Cognitive Computing. 2023; 7(1): 10. doi: 10.3390/bdcc7010010
4. Zheng P, Zeng X, Wang X, Ding P. Artificial intelligence and machine learning for drug discovery, design and repurposing: methods and applications. Frontiers in Pharmacology. 2023; 14: 1333747. doi: 10.3389/fphar.2023.1333747
5. Reddy BK, Delen D. Predicting hospital readmission for lupus patients: An RNN-LSTM-based deep-learning methodology. Computers in Biology and Medicine. 2020; 124: 103954. doi: 10.1016/j.compbiomed.2018.08.029
6. Davenport T, Guha A, Grewal D, Bressgott T. How artificial intelligence will change the future of marketing. Journal of the Academy of Marketing Science. 2020; 48(1): 24-42. doi: 10.1007/s11747-019-00696-0
7. Kietzmann J, Paschen J, Treen E. Artificial intelligence in advertising: How marketers can leverage artificial intelligence along the consumer journey. Journal of Advertising Research. 2018; 58(3): 263-267. doi: 10.2501/JAR-2018-035
8. Khedkar P, Mitra S. Boosting pharmaceutical sales and marketing with artificial intelligence. ZS Associates Report. 2021. doi: Nil.
9. Spencer-Jolliffe N. Rx machina: How AI is transforming pharma sales. Pharm Technology. 2023. doi: Nil.
10. Salesforce. AI relationship intelligence boosts pharma and medical sales. Salesforce Blog. 2021. doi: Nil.
11. Topol EJ. High-performance medicine: The convergence of human and artificial intelligence. Nature Medicine. 2019; 25(1): 44-56. doi: 10.1038/s41591-018-0300-7
12. Mak KK, Pichika MR. Artificial intelligence in drug development: Present status and future prospects. Drug Discovery Today. 2019; 24(3): 773-780. doi: 10.1016/j.drudis.2018.11.014
13. Esteva A, Robicquet A, Ramsundar B, Kuleshov V, DePristo M, Chou K, et al. A guide to deep learning in healthcare. Nature Medicine. 2019; 25(1): 24-29. doi:10.1038/s41591-018-0316-z
14. Verma S, Tiwari RK, Singh L. Integrating technology and trust: Trailblazing role of AI in reframing pharmaceutical digital outreach. Intelligent Pharmacy. 2024; 2(3): 435-440. doi:1 0.1016/j.ipha.2024.01.005
15. Yadav S, Singh A, Singhal R, Yadav JP. Revolutionizing drug discovery: The impact of artificial intelligence on advancements in pharmacology and the pharmaceutical industry. Intelligent Pharmacy. 2024; 2: 367-380. doi: 10.1016/j.ipha.2024.02.009
16. Hutson M. How AI is being used to accelerate clinical trials. Nature. 2024; 627(8003): S2-S5. doi: 10.1038/d41586-024-00753-x
17. Hernandez AF, Lindsell CJ. The future of clinical trials: Artificial to augmented to applied intelligence. JAMA. 2023; 330(21): 2061-2063. doi:10.1001/jama.2023.23822
18. Sonrai Analytics. AI in clinical trials: Case study. Sonrai Analytics Report. 2023. doi: Nil.
19. McKinsey and Company. Accelerating AI in clinical trials and research. McKinsey Report. 2022. doi: Nil.
20. Askin S, Burkhalter D, Calado G, El Dakrouni S. Artificial intelligence applied to clinical trials: Opportunities and challenges. Health Technology. 2023; 13: 203-213. doi:10.1007/s12553-023-00738-2
21. Fidelia C, Flavia B, Andrea CF, Andriy M, Andrea Z, Walter R, et al. Scoping review of the current landscape of AI-based applications in clinical trials. Frontiers in Public Health. 2022; 10. doi: 10.3389/ fpubh.2022.949377
22. Delen I, Sen N, Ozudogru F, Biasutti M. Understanding the growth of artificial intelligence in educational research through bibliometric analysis. Sustainability. 2024; 16(16): 6724. doi: 10.3390/su16166724
23. Weidmann AE. Artificial intelligence in academic writing and clinical pharmacy education: Consequences and opportunities. International Journal of Clinical Pharmacy. 2024; 46: 751-754. doi: 10.1007/s11096-024-01705-
24. Sherif FM. The future of pharmacy in Libya. Mediterranean Journal of Pharmacy and Pharmaceutical Sciences. 2023; 3(1): 1-2. doi: 10.5281/zenodo.7771304
25. Chatbots in education and research: A critical examination of ethical perspectives. Sustainability. 2023; 15(7). doi: 10.3390/su15075614
26. Analysis: Using AI in health sciences education requires interdisciplinary collaboration and risk assessment. Health and Medicine. Brighter World. 2022. doi: Nil.
27. Suriyaamporn P, Pamornpathomkul B, Patrojanasophon P, Ngawhirunpat T, Rojanarata T, Opanasopit P. The artificial intelligence-powered new era in pharmaceutical research and development: A review. AAPS PharmSciTech. 2024; 25: 188. doi: 10.1208/s12249-024-02901-y
28. Kolluri S, Lin J, Liu R, Zhang Y, Zhang W. Machine learning and artificial intelligence in pharmaceutical research and development: A review. The AAPS Journal. 2022; 24: 19. doi: 10.1208/s12248-021-00644-3
29. Stasevych M, Zvarych V. Innovative robotic technologies and artificial intelligence in pharmaceutical and medical fields. Big Data and Cognitive Computing. 2023; 7(3): 147. doi: 10.3390/bdcc7030147
30. Raza MA, Aziz S, Noreen M, Saeed A, Anjum I, Ahmed M, Raza SM. Artificial intelligence in pharmacy: an overview of innovations. Innovations in Pharmacy. 2022; 13(2). 10.24926/iip.v13i2.4839. doi: 10.24926/iip.v13i2.4839

31. Hajirasouliha I, Elemento O. Precision medicine and artificial intelligence: Overview and relevance to reproductive medicine. Fertility and Sterility. 2022; 114(5): 908-913. doi: 10.1016/j.fertnstert.2020.09.156
32. Pammi M, Aghaeepour N, Neu J. Multiomics, artificial intelligence, and precision medicine in perinatology. Paediatric Research. 2023; 93(2): 308-315. doi: 10.1038/s41390-022-02181-x
33. Johnson KB, Wei WQ, Weeraratne D, Frisse ME, Misulis K, Rhee K, et al. Precision medicine, AI, and the future of personalized health care. Clinical and Translational Sciences. 2021; 14(1): 86-93. doi: 10.1111/cts.12884
34. Subramanian M, Wojtusciszyn A, Favre L, Boughorbel S, Shan J, Letaief KB, et al. Precision medicine in the era of artificial intelligence: Implications in chronic disease management. Journal of Translational Medicine. 2020; 18(1): 472. doi: 10.1186/s12967-020-02658-5
35. Ghebrehiwet I, Zaki N, Damseh R, Mohamad MS. Revolutionizing personalized medicine with generative AI: a systematic review. Artificial Intelligence Review. 2024; 57: 128. doi: 10.1007/s10462-024-10768-5
36. Okolo CA, Olorunsogo T, Babawarun O. A comprehensive review of AI applications in personalized medicine. International Journal of Sciences and Research Archive. 2024; 11(1): 2544-2549. doi: 10.30574/ijsra.2024.11.1.0338
37. Bello B, Bundey YN, Bhave R, Khotimchenko M, Baran SW, Chakravarty K, et al. Integrating AI/ML models for patient stratification leveraging omics and clinical biomarker datasets. International Journal of Molecular Sciences. 2023; 24(7): 6250. doi: 10.3390/ijms24076250
38. Yang F, Zhang Q, Ji X, Zhang Y, Li W, Peng S, Xue F. Machine learning applications in drug repurposing. Interdisciplinary Sciences. 2022; 14(1): 15-21. doi: 10.1007/s12539-021-00487-8
39. Pullano G, Valdano E, Scarpa N, Rubrichi S, Colizza V. Evaluating the effect of demographic factors, socioeconomic factors, and risk aversion on mobility during the COVID-19 epidemic in France under lockdown: a population-based study. Lancet Digital Health. 2020; 2(12): e638-e649. doi: 10.1016/S2589-7500(20)30243-0
40. Anokian E, Bernett J, Freeman A, List M, Santamaria L, Tanoli Z, Bonnin S. Machine learning and artificial intelligence in drug repurposing: Challenges and perspectives. DrugRxiv. 2024. doi: 10.58647/DRUGA RXIV.PR000007.v1
41. Zong N, Li N, Wen A, Ngo V, Yu Y, Huang M, et al. BETA: A comprehensive benchmark for computational drug-target prediction. Briefings in Bioinformatics. 2022; 23(4). bbac199. doi: 10.1093/bib/bbac199
42. Levin JM, Oprea TI, Davidovich S, Clozel T, Overington JP, Vanhaelen Q, et al. Artificial intelligence, drug repurposing and peer review. Nature Biotechnology. 2020; 38: 1127-1131. doi: 10.1038/s41587-020-00724-9
43. Jarada TN, Rokne JG, Alhajj R. A review of computational drug repositioning: Strategies, approaches, opportunities, challenges, and directions. Journal of Cheminformatics. 2020; 12(1): 46. doi: 10.1186/s13321-020-00450-7
44. Yan C, Grabowska ME, Dickson AL, Li B, Wen Z, Roden DM, et al. Leveraging generative AI to prioritize drug repurposing candidates for Alzheimer's disease with real-world clinical validation. NPJ Digit Medicine. 2024; 7(1). 46. doi: 10.1038/s41746-024-01038-3
45. Rathore AS, Nikita S, Thakur G, Mishra S. Artificial intelligence and machine learning applications in biopharmaceutical manufacturing. Trends in Biotechnology. 2023; 41(4): 497-510. doi: 10.1016/j.tibtech.2022.08.007
46. Chen H, Lu D, Xiao Z, Li S, Luan X, Zhang W, Zheng G. Comprehensive applications of artificial intelligence technology in new drug research and development. Health Inf Sci Syst. 2024; 12: 41. doi: 10.1007/s13755-024-00300-y
47. Kim J, Min M. From RAG to QA-RAG: integrating generative AI for pharmaceutical regulatory compliance process. arXiv. 2025; 2402. 01717. 1293-1295. doi: 10.1145/3672608.3707749
48. Oualikene-Gonin W, Jaulent MC, Thierry JP, Oliveira-Martins S, Belgodère L, Maison P, Ankri J. Artificial intelligence integration in the drug lifecycle and regulatory science: Policy implications, challenges and opportunities. Frontiers in Pharmacology. 2024; 15: 1437167. doi: 10.3389/fphar.2024.1437167
49. Jain V, Balakrishnan A, Beeram D, Najana M, Chintale P. Leveraging artificial intelligence for enhancing regulatory compliance in the financial sector. International Journal of Computer Trends and Technology. 2024; 72(5): 124-140. doi: 10.14445/22312803/ IJCTT-V72I5P116
50. Awulu I. Predictive launch architecture: Leveraging AI-driven market intelligence to de-risk pharmaceutical brand entry in emerging markets. Mediterranean Journal of Medicine and Medical Sciences. 2026; 2(2): 55-76. doi: 10.5281/zenodo.20435527
51. Luisetto M, Ferraiuolo A, Fiazza C, Cabianca L, Edbey K, Mashori GR, et al. Artificial intelligence in the pharmaceutical galenic field: A useful instrument and risk consideration. Mediterranean Journal of Medical Research. 2025; 2(1): 10-19. doi: 10.5281/zenodo.152598242
52. Johnson M, Lee K, Patel R. How FDA regulates artificial intelligence in medical products. Pew Trusts Report. 2021. doi: Nil.

ISSN: 2789-1895 online
www.medjpps.com
doi: 10.5281/zenodo.21860380
ISSN: 2958-3101 print

53. Kim H, Kim E, Lee I, Bae B, Park M, Nam H. Artificial intelligence in drug discovery: A comprehensive review of data-driven and machine learning approaches. Biotechnology and Bioprocess Engineering. 2020; 25: 895-930. doi: 10.1007/s12257-020-0049-y
54. Anderson R, Kim S, Park J. Exploring artificial intelligence in drug discovery: a comprehensive review. Archives in Computational Methods in Engineering. 2021; 23(1): 101-115. doi: 10.1007/s11831-021-09661-z
55. Nizamuddin SFS, Ikramuddin M, Dhore NS. Artificial intelligence in pharmaceutical sciences: Transforming drug discovery, formulation, and manufacturing. Mediterranean Journal of Medical Research. 2025; 2(4): 269-275. doi: 10.5281/zenodo.17945149
56. Mirbabaie M, Stieglitz S, Frick NRJ. Artificial intelligence in disease diagnostics: A critical review and classification on the current state of research guiding future direction. Health Technology. 2021; 11: 693-731. doi: 10.1007/s12553-021-00555-5
57. Kumar Y, Koul A, Singla R, Ijaz MF. Artificial intelligence in disease diagnosis: A systematic literature review, synthesizing framework and future research agenda. Journal of Ambient Intelligence and Humanized Computing. 2022; 14: 8459-8486. doi: 10.1007/s12652-021-03612-z
58. Rahman N. Ethical and legal challenges of AI-based medical diagnostics: A perspective. Mediterranean Journal of Medicine and Medical Sciences. 2026; 2(1): 51-58. doi: 10.5281/zenodo.18772947
59. Topol EJ. High-performance medicine: The convergence of human and artificial intelligence. Nature Medicine. 2019; 25(1): 44-56. doi: 10.1038/s41591-018-0300-7

Author contributions: AV & PKS conceived and designed the study. TD & AP collected the data, performed the analysis, and drafted the manuscript. All authors approved the final manuscript version and agreed to be accountable for its content.
Conflict of interest: The authors declare the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.
Ethical issues: The authors have considered ethical issues, including plagiarism, informed consent, data fabrication or falsification, and double publication or submission.
Data availability statement: The raw data that support the findings of this article are available from the corresponding author upon reasonable request.
Generative AI disclosure: No Generative AI was used in the preparation of this manuscript.