

# Utilization of Artificial Intelligence in Healthcare System, Pharmaceutical Industry & Education

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**Abstract:** Artificial intelligence is wide ranging branch of computer science concerned with building smart machines capable of performing tasks that typically require human intelligence. It can be amazingly useful in ranging data and presenting results that promotes better decision making and help saving human effort, cast and time. The artificial intelligence used in most of field of Pharmacy and Now it going too expanded into education and Industry. For this review study we used eligible articles which are published in Scopus, Elsevier and Pubmed database. In this study, we discuss about use of artificial intelligence in Pharmacy Education, Industry and Also healthcare systems. The top 5 companies Start using AI in manufacturing, Data collection and much more and Pharmacy education adopting AI for teaching and evaluating students easily. The bigger the healthcare sector gets more sophisticated and more technologically advanced infrastructure it will need.

**Keywords:** Artificial intelligence, Pharma Industry, Education, Healthcare System

## I. INTRODUCTION

According to Father of artificial intelligence (AI) was John McCarthy. It is “The science & engineering of making intelligence machines”. The field AI originates from computer science and engineering, but it is strongly in-fluenced by other disciplines such as philosophy, cognitive science, neuroscience, and economics. (1)

The main objective of this Artificial intelligence is to identify useful information processing problems and give an abstract Account of how to solve them. Such an account is called as method and it corresponds to a theorem in mathematics. Artificial intelligence is as a field that deals with the design and application Algorithms for analysis of learning from and interpreting data. Artificial intelligence an compasses Many branches of statistical and machine learning, pattern recognition, and clustering, similarity based methods Over the last five years, the use of artificial Intelligence in the pharma and biotech industry has redefined how scientists develop new drugs, Tackle disease, and more.(2)

AI is wide ranging branch of computer science concerned with building smart machines capable of performing tasks that typically require human intelligence. It can be amazingly useful in ranging data and presenting results that promotes better decision making and help saving human effort, cast and time. (3) (4)

## II. HISTORY

Artificial intelligence (AI) was first described in 1950; however, several limitations in early models prevented widespread acceptance and application to medicine. In the early 2000s ,many of these limitations were overcome by the advent of deep learning now that AI system are capable of analyzing complex algorithm and self learning we enter a new age in medicine where AI can be applied to clinical practice through risk assessment models, improving diagnostic accuracy and workflow efficiency. This presents a brief historical perspective on the evolution of AI over the last several decades and the introduction and development of AI in medicine in recent years. (3)



## 2.1 Types of Artificial Intelligence

### A. Reactive Machines

An example is Deep Blue, the IBM chess program that beat Garry Kasparov in the 1990s. Deep Blue can identify pieces on the chessboard and make predictions, but it has no memory and cannot use past experiences to inform future ones. It analyzes possible moves it's own and it's opponent and chooses the most strategic move. Deep Blue and Google's AlphaGO were designed for narrow purposes and cannot easily be applied to another situation.

### B. Limited Memory

These AI systems can use past experiences to inform future decisions. Some of the decision-making functions in self-driving cars are designed this way. Observations inform actions happening in the not-so-distant future, such as a car changing lanes. These observations are not stored permanently.

### C. Theory of Mind

This psychology term refers to the understanding that others have their own beliefs, desires, and intentions that impact the decisions they make. This kind of AI does not yet exist.

### D. Self-awareness

In this category, AI systems have a sense of self, have consciousness. Machines with self-awareness understand their current state and can use the information to infer what others are feeling. This type of AI does not yet exist. (5)

## 2.2 Application of AI

### A. Drug Discovery

- This phase of R&D is focused on finding new drug molecules effective against a particular diseased biological target.
- To increase the success rates of new drugs while decreasing operational costs at the same time.
- AI can be used to find candidate molecules for drugs, develop compounds from scratch, and aid the process of the molecules, with better efficacy.
- AI also helps in better understanding the disease's mechanisms.

### B. Drug Development

- Drug development through clinical trials runs a high risk of failure due to human errors in data processing and candidate monitoring.
- AI systems and algorithms process vast amounts of information quicker and with precision, maintain proper records and ensure transparency when it comes to clinical trial data.
- It can be used to optimize the entire trial process, including trial designing and site selection.
- AI also enables faster and accurate gathering of clinical data, identification and monitoring suitable candidates for trials, predicting risk and toxicity, and monitoring drug adherence in trial candidates.

### C. Manufacturing

- The drug manufacturing process, again, can take longer when not optimized through technology.
- AI can be used for pharma quality control, reducing design time, inventory management, predictive maintenance, demand forecasting, logistics optimization and end-to-end-visibility.
- AI also makes the entire manufacturing process more accurate through proper planning of the supply chain.

### D. Sales and Marketing

- End-to-end visibility provided by AI for drug commercialization is a great value-add for pharma companies.
- AI can help pharma companies coordinate product launches better, provide physician decision support and marketing operations, predict market access, and aid pricing decisions.
- Some pharma marketers are using AI to understand customer journeys at a deeper level.

### **E. Remote Patient Monitoring and Support**

- Patient monitoring helps them develop more precise drugs and therapies.
- Applying AI towards patient safety is extremely important, particularly in detecting potential adverse effects of their drugs in real-time.
- AI to assess a user's mood, record data, manages symptoms, and provide helpful information about prescription drugs.
- AI-enabled patient support programmers and diagnostics can transform pharma's relationship with its customers, improve drug adherence and retention, aid disease prevention and deliver better patient outcomes. (6)

### **III. PHARMA COMPANIES USING ARTIFICIAL INTELLIGENCE**

Over the years, AI has streamlined and impacted the pharmaceutical industry in many ways, from creating new and better drugs to combating rare diseases.

We take a look at the implementation of Machine Learning in five pharmaceutical companies and examine the AI applications for each company individually.

#### **3.1 Pfizer**

Pfizer is an American multinational pharmaceutical corporation, and one of the world's 2019s largest pharmaceutical companies. The company develops and produces medicines and vaccines for a wide range of medical disciplines, including immunology, oncology, cardiology, endocrinology, and neurology. In 2019, Pfizer announced a partnership with Concreto HealthAI, in order to advance the work in Precision Oncology using AI and real-world data. "Pfizer believes real-world data has tremendous potential to inform how we develop and use medicines to improve patient outcomes", said Chris Boshoff, Ph.D and Chief Development Officer in Pfizer's Global Product Development department. By combining Pfizer's real-world data with Artificial Intelligence and data science, the company aims to identify new and more precise treatment options, completely redefine study designs, and speed up the completion time of the outcomes studies.

#### **3.2 Janssen Pharmaceutica**

Janssen Pharmaceutica is a pharmaceutical company headquartered in Beerse, Belgium, and is part of the Johnson & Johnson family of companies. In 2019, Janssen announced collaboration with a French startup in order to develop an AI-powered drug design system. Based on its capacity to explore chemical space (the space covering all possible molecules and chemical compounds) with speed and efficiency, the new AI system should enable the identification of molecules that meet the desired criteria in each research project.

#### **3.3 Sanofi**

Sanofi is a French multinational pharmaceutical company headquartered in Paris, France. The company works in the field of development, manufacturing, and marketing of pharmaceutical drugs. Sanofi covers seven major therapeutic areas included cardiovascular, central nervous system, diabetes, oncology, internal medicine, thrombosis, and vaccines. In 2018, Sanofi partnered with an AI startup in order to build an AI solution which would automate medical literature review. The AI document processing solution is using natural language processing (NLP) to read and review scientific articles, summarize them, and determine to which departments they are most relevant. The business benefit is obvious: "Reviewing scientific information is fundamental to everything we do, and AI is disrupting how that happens, making it much faster, far simpler, and much more accurate" – explained a Sanofi representative participating in the project pilot.

#### **3.4 Novartis**

Novartis is a Swiss multinational pharmaceutical company based in Basel, Switzerland. It is one of the largest pharmaceutical companies by both market capitalization and sales. As a leading global pharmaceutical company, Novartis uses innovative science and digital technologies to create transformative treatments in areas of medical need. In September 2019, Novartis and Microsoft announced a multiyear partnership that will leverage data and Artificial Intelligence to transform how medicines are discovered, developed, and commercialized. Novartis aims to address some of the biggest challenges facing the pharmaceutical industry today, by bringing AI expertise to every employee so they can work to discover new medicines at scale and reduce costs.

### **3.5 Bayer**

Bayer is a German multinational pharmaceutical and life science company, with headquarters in Leverkusen, Germany. In January 2020, Bayer partnered with a UK-based AI-driven drug discovery company to a multi-target collaboration. They aim to identify and optimize novel lead structures for potential drug candidates to treat cardiovascular and oncological diseases. The AI collaboration has the potential to accelerate drug discovery and improve drug development productivity in terms of quality, cost, and by reducing the time of the drug discovery and development cycle. “We are going towards digital transformation in R&D as we believe that digital technologies such as AI can simplify and speed up the discovery and development of new drugs for patients”, said Dr. Joerg Moeller, Bayer’s Head of Research and Development.(7)

AI is currently helping pharmaceutical companies improve clinical trials in three major ways:

#### **A. Improving Patient Recruitment**

In 2018, Mayo Clinic reported that IBM Watson had helped improve clinical trial enrolment by 80% by better matching patients to trials based on specific criteria. By quickly analysing patients from broad pools and identifying the best patients for a given trial, AI helps ensure uptake by providing trial opportunities to the most suitable candidates.

#### **B. Optimising Trial Design**

By constantly analysing workflows in granular detail, machine learning is helping pharmaceutical companies identify and iron out inefficiencies in their clinical trial processes – making them faster and more cost-effective.

#### **C. Trial Output Optimization**

By offering pharmaceutical team’s deeper insight into the patients involved in their clinical trials, AI is also helping to solve some of the oldest and most persistent challenges in clinical trial administration. AI is helping teams proactively identify when a patient may be about to stop engaging with a trial and drop out, and act on that insight before the validity of the trial is put in jeopardy. (8)

## **IV. AI USED FOR THE TREATMENT OF DISEASE**

Chronic diseases are the leading causes of death and disability. Conditions like diabetes, cancer, and kidney disease take a massive toll on healthcare spending and patient outcomes. From chronic diseases and cancer to radiology and risk assessment.

### **4.1 Advancing the Use of Immunotherapy for Cancer Treatment**

Immunotherapy is one of the most promising avenues for treating cancer. By using the body’s own immune system to attack malignancies, patients may be able to beat stubborn tumors. However, only a small number of patients respond to current immunotherapy options, and oncologists still do not have a precise and reliable method for identifying which patients will benefit from this option.

Machine learning algorithms and their ability to synthesize highly complex datasets may be able to illuminate new options for targeting therapies to an individual’s unique genetic makeup.(9)

“Recently, the most exciting development has been checkpoint inhibitors, which block some of the proteins made by some times of immune cells,” explained Long Le, MD, PhD, Director of Computational Pathology and Technology Development at the MGH Center for Integrated Diagnostics. “But we still don’t understand all of the disease biology. This is a very complex problem.”

“We definitely need more patient data. The therapies are relatively new, so not a lot of patients have actually been put on these drugs. So whether we need to integrate data within one institution or across multiple institutions is going to be a key factor in terms of augmenting the patient population to drive the modeling process.” (10)

### **4.2 Artificial Intelligence in Kidney Disease**

Kidney disease is a major Health problem in part because of it’s common etiology caused by diabetics, hypertension, obesity & aging the incidence of these condition is increasing. AI is a science of computer simulated thinking processes & human behaviors, which involves computer science, psychology, philosophy & linguistics.

Electronic medical records which is the basis for developing AI technology in the clinic. (11)

#### **4.3 Artificial Intelligence for COVID-19**

COVID-19, caused by SARS-CoV-2, was first discovered in December 2019 and has since become a global pandemic. An emerging viral pandemic like COVID-19 exerts significant.

Digital methods such as artificial intelligence (AI) hold the potential to greatly enhance medical care. AI implies the use of a computer to model intelligent behavior without human intervention. It has been applied to many areas of medicine, especially to aid the detection and prevention of disease. AI techniques being used in medicine are broad, ranging from computer vision to deep learning techniques. (12)

An example of how AI has been applied to COVID-19 is demonstrated by BlueDot, a Canadian company specializing in infectious disease forecasting. Using an AI engine that continuously gathers data for a multitude of diseases from a range of different sources globally, BlueDot was able to predict the COVID-19 outbreak and alert its users even before the World Health Organization did. Another example is an AI-powered chatbot named SGDormBot, which has been used for symptom-based mass screening of migrant workers for COVID-19 in Singapore.

Nonetheless, while AI has been promoted as a tool to help manage the COVID-19 pandemic, AI has both potential benefits and limitations. We therefore conducted a rapid review of AI applications for COVID-19. In our review, we sought to delineate the major categories of AI use, describe the limitations of AI, and identify areas for further development.(13)

#### **A. Containing the Risks of Antibiotic Resistance**

Antibiotic resistance is a growing threat to populations around the world as overuse of these critical drugs fosters the evolution of superbugs that no longer respond to treatments. Multi-drug resistant organisms can wreak havoc in the hospital setting, and claim thousands of lives every year.

Electronic health record data can help to identify infection patterns and highlight patients at risk before they begin to show symptoms. Leveraging machine learning and AI tools to drive these analytics can enhance their accuracy and create faster, more accurate alerts for healthcare providers.(10)

#### **4.4 AI Used in Education**

The study of artificial intelligence is to proceed on the basis of the conjecture that every aspect of learning or any other feature of intelligence can in principle be so precisely described that a machine can be made to simulate it. An attempt will be made to find how to make machines use language, form abstractions and concepts, solve kinds of problems now reserved for humans, and improve themselves.(1)

It defines AI as the use of computer systems to analyze large quantities of data, then applying the results of those analyses programmatically to better inform decisions. In this manner, AI can guide people to make the best possible use of medications, so they ultimately gain better health.(14)

AI is already being used to predict adverse drug events, including drug–drug interactions, as well as to power mobile platforms that aid patients in boosting medication adherence. (8)

#### **A. Purpose**

- To provide pharmacists and other clinicians with a basic understanding of the underlying principles and practical applications of artificial intelligence (AI) in the medication-use process.
- Pharmacists should use scientific approaches to determine the degree to which AI is used to automate specific medication-use tasks.
- To perform tasks that normally would require human cognition, such as perception, language understanding, reasoning, learning, planning, and problem solving.
- Understanding the vocabulary of and methods used in AI will help clinicians productively communicate with data scientists to collaborate on developing models that augment patient care. (15)

#### **4.5 Challenges to Adoption of AI in Pharma**

- The unfamiliarity of the technology – for many pharma companies, AI still seems like a “black box” owing to its newness and esoteric nature.

- Lack of proper IT infrastructure – that’s because most IT applications and infrastructure Currently in use weren’t developed or designed with artificial intelligence in mind. EvenWorse, pharma firms have to spend lots of money to upgrade their IT system.
- Much of the data is in a free text format – that means pharma companies have to go above And beyond to collate and put this data into a form that’s able to be analyzed. Despite allThese limitations, one thing is for certain: AI is already redefining biotech and pharma. And ten years from now, Pharma will simply look at artificial intelligence as a basic, Everyday, technology. (16)

#### V. CONCLUSION

The Companies are more flexible & adopt AI faster will likely gain a strategic advantages. AI is expected to be integrated in to most, if not all, pharma R & D Operations. There is a lot of hype about AI in the popular press. It is likely that AI, and particularly ML, will be used to find and learn patterns in pharmacy data that, when applied in practice, will have both positive and negative consequences. An understanding of the core concepts of AI is necessary to engage in collaboration with data scientists and critically evaluating its place in patient care, especially as clinical practice continues to evolve and develop. AI is not a new phenomenon and is becoming more common in healthcare as data sets and computing power continue to grow. Augmented intelligence in healthcare, Pharmacy needs to continue to build on education that will enable current and future generations of pharmacists and pharmacy technicians to shape the evolution of AI technology. Advances in technology through AI stand to substantially change how care is delivered to patients. Augmented intelligence in healthcare leverages the strengths of computers and the strengths of clinicians together to achieve improved outcomes for patients, making it faster and easier to perform clinical activities. The bigger the healthcare sector gets more sophisticated and more technologically advanced infrastructure it will need. Artificial intelligence is the design and application of algorithms for analysis of learning and interpretation of data.

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