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AI in Pharma: Accelerating Drug Development and Personalizing Healthcare

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Abstract
Artificial Intelligence (AI) and machine learning are useful in drug discovery, pharmaceutical formulation and dosage form testing. By analyzing biological data like preteomics and genomics. Researchers can indentify disease related target and predicts how they will interact with treatment. AI is rapidly becoming a powerful tool that help solve complex problems more quickly and efficiently. This improve drug approval success and helps focus drug research efforts. AI also lower the process and expense of development. The pharmacokinetics and toxicity of possible drugs are predicted by machine learning algorithms, which also aid in study design. Artificial Intelligence (AI) systems evaluate real patients data and assists with medical plan to improve treatment results. AI and drug discovery have many uses including design, testing, and pharmacokinetics and pharmacodynamic analysis. The ongoing research into AI by the pharmaceutical industry today presents numerous chances to improve patient care and the medication development process.

Keywords: Artificial Intelligence, Drug Delivery Design, Pharmacokinetics, Pharmacodynamic, Machine Learning

1. Introduction

Artificial intelligence (AI) is the capacity of algorithms and technologically coded systems to learn from data in order to execute automated tasks without requiring human intervention to explicitly program each step. WHO acknowledges that artificial intelligence (AI) has enormous potential to improve human health and achieve universal health care, but it also poses risks and ethical issues that must be resolved if society, support systems, and individuals are to fully benefit from it.

The speed at which technology is developing and AI is being used, together with its rapid acceptance and updating for a variety of often unpredictable applications, has made the development and implementation of relevant principles, standards, and regulations more critical The discovery, clinical development, and delivery of pharmaceutical goods have seen a sharp increase in the usage of AI. This discussion paper offers a concise synopsis of the constantly growing use of AI in all stages of research and implementation. While the document does not specifically address the increasing usage of AI-based devices, such as diagnostic technology, many of the concepts and issues covered are applicable to that field, which has released guidelines on the development, validation, and training of AI for cervical cancer screening **(2).**

The pharmaceutical industry's current application of AI is not the first time computational methods have been used for this goal. For many years, computing has been essential. Computer-aided medication design began in the 1970s, **(3)** and the "next industrial revolution" was heralded in the early 1980s when pharmaceuticals created entirely on computers were introduced **(4)** For instance, screening compound libraries is another common application for computational methods **(5)**

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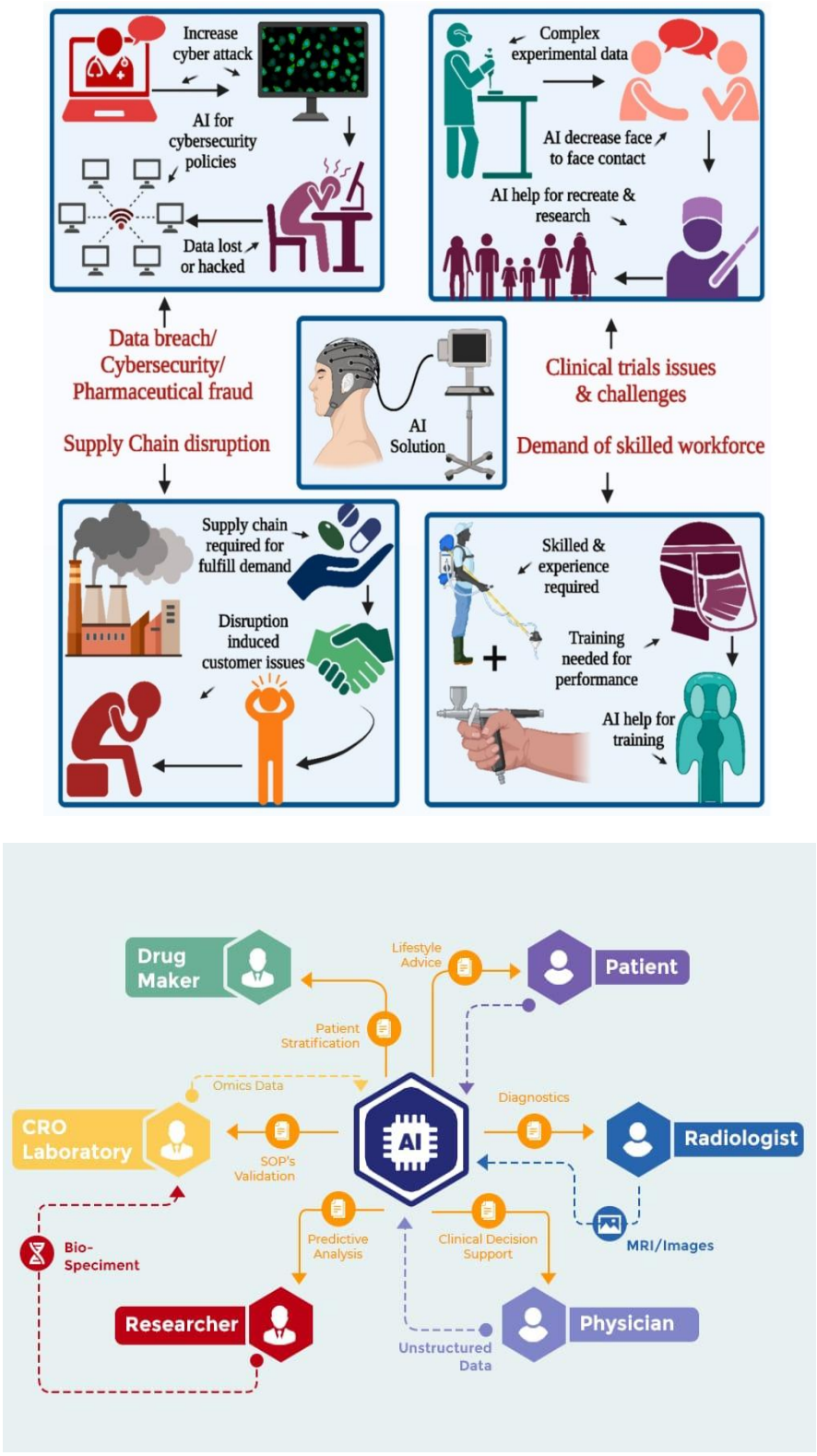

Figure 1. AI in Pharma

Types of Artificial Intelligence:
(A) Based on the caliber and their presence
1. Artificial narrow intelligence or weak AI
2. Artificial general intelligence or strong AI
3. Artificial super Intelligence

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(B) Based on Presence
1. Reactive Machine
2. Limited Memory System
3. Theory of Mind
4. Self-awareness

1. Uses of AI in Pharmaceutical Development & Delivery

Finding and testing medications or vaccines in order to get regulatory permission for their clinical usage is known as pharmaceutical research and development. Over time, advancements in AI have expanded the range of tasks that AI can perform for pharmaceutical businesses and scientists. It is currently utilized for marketing, registration, and medication delivery, as well as in all phases of the pharmaceutical development cycle. The following lists the existing and planned applications of AI in the pharmaceutical development cycle:

1.1 Uses of AI in Diagnosis

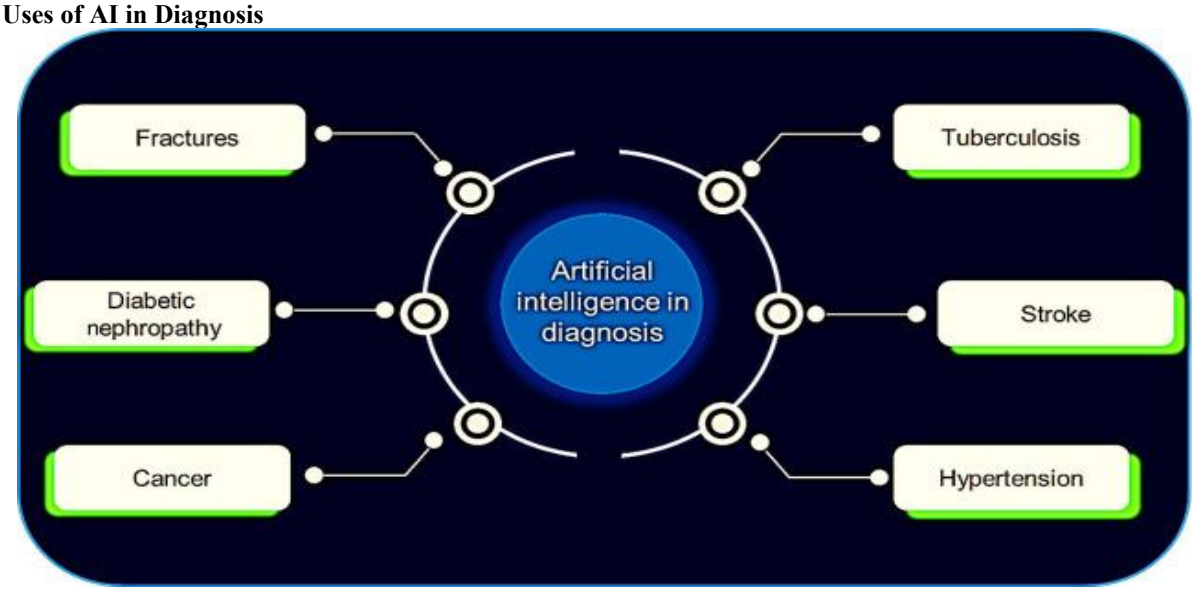

Figure 2. Uses of AI in Pharma

1.2 Basic Scientific Research

Pharmaceutical discovery typically depends on fundamental scientific studies or a thorough comprehension of human disease at the molecular level**(6)**. Pharmaceutical discovery research also makes use of AI. The application of AI to resolve the "protein folding problem," or the query of how one amino acid in a protein forms its three-dimensional atomic structure, was one notable breakthrough**(7)**. Additionally, AI is used to choose, plan, and design studies as well as enhance measurements and observations. For example, it may transform low-resolution photos of mitochondria into high-resolution, noise-free images**(8)**.

1.3 Pharmaceutical Discovery & Design

Numerous applications of AI have been used for decades, including pharmaceutical design and discovery. By analyzing vast amounts of biological data, artificial intelligence (AI) can be utilized to find novel pharmacological targets by discovering specific biomarkers or mutations linked to disease**(9)**.

2. Are Commercial Use of AI Beneficial for Public Health

AI is being used for drug development by pharmaceutical and tech corporations mainly to boost their earnings. However, neither individual patients nor the general public's health may benefit from such AI use. Additionally, such uses could raise moral questions and result in consequences that compromise fundamental rights

2.1 Precision Medicine & Personalised Medicine: More Specific But More Exclusionary

It is widely believed that artificial intelligence (AI) would enable the pharmaceutical industry to shift drug research toward personalized and precision medicine. The "average patient" is the target of most medical treatments; nevertheless, precision medicine customizes care to fit various genetic profiles, surroundings, and lifestyles **(10)**

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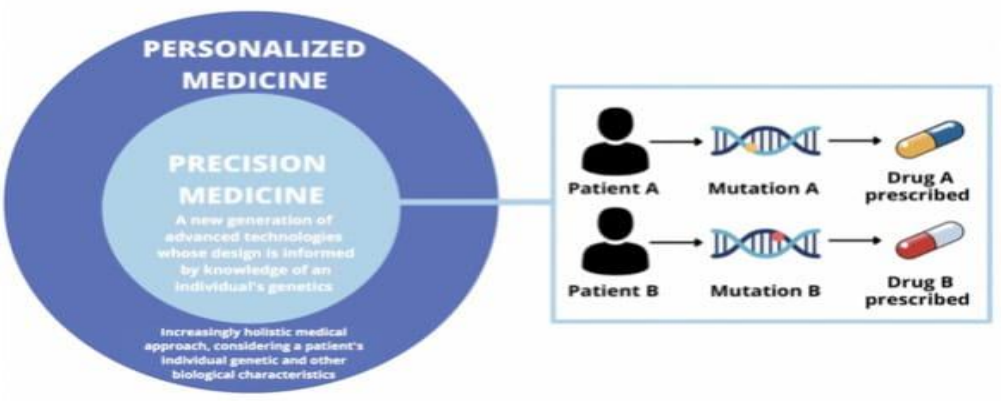

Figure 3. Precision Medicine & Personalised Medicine

2.2 Improving Drug Discovery Rates and Clinical Trial Success ; reducing overall cost, but for whom

The application of AI is also anticipated to drastically accelerate drug development, from the current anemic, slow rate to much shorter lines with a 20–50% success rate **(11**) It is anticipated that the increased success rate will save pharmaceutical corporations billions of dollars in drug development expenses **(12)** . Since the expensive cost of research and development and the high failure rate are the primary justifications offered by businesses for charging exorbitant prices for pharmaceuticals, any savings from the application of AI could enable pharmaceutical corporations to lower the cost of medications and vaccines. The amount of money pharmaceutical companies invest in research and development is unrelated to the prices they charge for medications, whether or not they are patented **(13)**

2.3 Identifying the public health benefits of AI for development and delivery of pharmaceutical products

AI has the potential to deliver larger benefits to public and global health. This would necessitate the deployment of AI on a global scale to solve unmet needs or aspects of drug development or access that are underserved by the current pharmaceutical system.

2.4 Medicine and vaccines to address unmet needs

Deep mind has partnered with the Drugs for Neglected Diseases Initiative, a non-profit partnership for the development of new medicines and against neglected tropical diseases and other infectious diseases (like Hepatitis C and COVID-19). The partnership's initial focus has been on a protein on *Trypanosoma Cruzi*, the parasite that causes Chagas disease, to see if an investigational compound being developed by DNDi can go to the protein and eliminate the parasite. This may also point to additional substances that have the ability to attach to proteins (14)

2.5 Making Clinical Trial More Inclusive

86% of clinical trial participants were white, according to a 2014 study, while 79% of genetic data came from people of European descent, according to a 2019 study. Exclusion of individuals of childbearing age and pregnant and lactating individuals from clinical trials are examples of bias and its relationship to sex and gender in R&D (15).

2.6 Strengthening Pharmacovigilance

A monitoring technology called the Peak Platform, created by WHO, uses artificial intelligence (AI) to detect, identify, and categorize adverse events linked to COVID-19 vaccines that are discussed online (16)However, if the data is not gathered in a strong national and international regulatory context, there is a wider fear that the use of AI, whether by pharmaceutical corporations, the government, or international agencies, could compromise the right to privacy. In response, in February 2022, the Council for International Organization of Medical Sciences established a working group to advance guidelines and principles for the application of AI in pharmacovigilance (17)

3. Risk and Challenges

AI technology not only provide benefits for public health and drug development but also pose challenges and risk , WHO guidance on the ethics and governance of AI for health identifies 10 specific concern with the use of AI for health

3.1 Bias

AI technology utilized in healthcare frequently reproduces biases and discriminatory practices. Bias is most frequently seen in three areas: data sets used to train AI technologies, data sets pertaining to the development of AI technology, and data sets utilized in technology deployment (18)

Electronic health records and other health data also contain human biases and discriminatory biases in clinical care, as well as discrepancies in healthcare quality and access. The discriminatory patterns in the data will ultimately filter the trend of the AI model (19)

3.2 Safety

If algorithms employed in medication development are not examined for possible errors or whether they deliver, for instance, false positive or fault negative suggestions, patient safety may be in jeopardy. An algorithm has been demonstrated to be able to not only find or create novel, medicinally useful molecules, but also, in less than six hours, find 40,000 hazardous chemical compounds that might be employed as biological weapons. Consequently, in a researcher's perspective, "letting loose on the world of biology, AI could be dangerous" (20)

3.3 Explain ability and transparency

As for all uses of AI in health care and medicine, researchers, regulators and health-care providers may find ethical difficulty in relying on use of AI for the development of medicines when decisions are made based on “black-box” algorithms. The widely held convention is that many algorithms, such as those based on artificial neural networks and other complex models, are “black boxes” that make inferences and decisions that are not understood, even by their developers. There is a possible trade-off between full “explainability” of an algorithm (at the cost of accuracy and effectiveness) and accuracy and effectiveness (at the cost of explainability). WHO recommends that all algorithms be tested rigorously in the settings in which the technology will be used to ensure that they meet standards of safety and efficacy. The testing should include the assumptions, operational protocols, data properties.16)

3.4 Privacy and informed consent

Use of health data in AI-based drug development presents unique concerns. For example, in clinical trials, patients who are recruited through AI (by mining health records and other information, such as social media) must give informed consent that is meaningful for such uses of their data. They might have to be contacted proactively and additionalmeasureused to ensure that their informed consent is meaningful. Use of publiclyavailable data (such as from socialmedia) or combining health-care and non-health-care datasets is inherently risky unless high standards of protection for privacyand human rights are followed.(18)

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