THE REVOLUTIONARY IMPACT OF ARTIFICIAL INTELLIGENCE ON MEDICATION ADHERENCE

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ARTICLE INFO	ABSTRACT
Article history Received 25/11/2023 Available online 05/12/2023 **Keywords** Medication adherence, Artificial intelligence, Health care, Drug resistance, Machine learning, Patient empowerment, Self-management.	Artificial intelligence (AI) has the potential to significantly improve medication adherence, leading to better health outcomes and lower healthcare costs. AI can create personalized medication plans, send notifications and reminders, identify obstacles to adherence, and track prescription usage. AI-powered solutions can help patients take their medications more consistently, reducing the risk of missed doses, taking medication when it shouldn't be taken, or stopping treatment early. AI can also provide personalized care, early intervention, patient empowerment, data-driven decision-making, reduced transmission rates, and accessible healthcare. AI smartphone applications have been used to monitor and promote medication adherence, while reminder programs and intelligent patient assistance have been implemented to encourage adherence. Despite the potential benefits, there are challenges and ethical considerations to consider, such as algorithm bias, data privacy, and the need for ethical AI development and implementation. Ensuring that AI tools are available and affordable to all patients is crucial to prevent healthcare disparities and ensure the availability of AI tools to all patients.

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INTRODUCTION

Medication adherence, or how closely patients follow physician recommendations and take their prescribed drugs as instructed, is essential for obtaining favorable health results. Unfortunately, non-adherence to pharmaceutical regimens continues to be a major problem in healthcare, contributing to deteriorating health, rising healthcare expenses, and avoidable hospitalizations. Though exciting new opportunities for enhancing drug adherence have emerged with the development of artificial intelligence (AI)[1]. In this essay, we will examine the substantial contribution that AI makes to improving drug adherence as well as how it has the potential to transform healthcare.[2]

Artificial intelligence, is based on the idea that human intelligence can be described in a way that makes it simple for a computer to duplicate it and carry out activities of any complexity. Artificial intelligence aims to emulate cognitive processes in humans. When it comes to concretely defining processes like learning, reasoning, and perception, researchers and developers in the field are making unexpectedly quick progress. Some people think that soon inventors might be able to create systems that are better than what humans are currently capable of learning or understanding. Others, however, continue to hold this view because all cognitive processes involve value judgments that are influenced by human experience.[1]

The degree to which a patient adheres to a recommended drug regimen is known as medication adherence. Although it can be difficult to obtain, especially for individuals with chronic diseases, it is essential to the success of many medical therapies.

The science of artificial intelligence (AI), which is currently undergoing rapid development, has the potential to completely transform many facets of healthcare, including drug adherence. AI can help patients take their medications as prescribed by creating individualized medication plans, sending out notifications and reminders, finding and removing any obstacles to adherence, and keeping track of patients' prescription usage. Though they are still in the early stages of research, AI-powered solutions have the potential to drastically increase drug adherence rates. Better health outcomes and lower healthcare expenditures might result from this.[3]

In this article, we will talk about how AI can help patients take their medications more consistently and look at some concrete examples of how AI is being applied to better patient outcomes.

Medication guides are detailed and complex and contain important interactions and negative effects. The extensive information causes patients to forget important drug information, which can lead to hospitalizations and nonadherence to medicine. There is a knowledge gap about how patients manage complex drug information. However, developments in technology and artificial intelligence (AI) enable us to comprehend patient cognitive processes to construct an app that will more effectively notify patients about critical prescription information.

Medicare beneficiaries can compare the quality of treatment provided by different Medicare Advantage prescription drug (MA-PD) plans and stand-alone prescription drug plans (PDPs) through the Centers for Medicare Medicaid Services (CMS) Plan Quality and Performance Program, also known as the Star Ratings Program. In order to boost member medication adherence and subsequently the Part D star rating performance, health plans have intensified intervention efforts and leveraged existing care management infrastructure.[4]

AI in healthcare

Over the past five decades, Artificial intelligence in Medicine has undergone significant change. Applications of AI Medicine have grown since the introduction of MachineLearning and Deep Learming, opening the door to individualized treatment rather than medicine solely based on algorithms. Future preventative medicine may use predictive models for illness diagnosis, therapy response prediction, and other purposes.7 AI may enhance clinical operations and workflow efficiency, provide better disease and treatment monitoring, enhance procedure accuracy, and enhance patient outcomes overall.[1] The following is a chronology of the ongoing growth and development of the AI platform in medicine, structured according to key historical junctures.

❖ **Understanding Medication Adherence**

It's important to understand the scope of the drug adherence issue before diving into the effects of AI. Missing doses, taking medication when it shouldn't be taken, or stopping treatment early are all examples of non-adherence. According to research estimates, up to 50% of patients fail to take their prescribed drugs, with serious ramifications for both personal health and the healthcare system.[5]

❖ **The Role of Artificial Intelligence**

Artificial intelligence, a subfield of computer science that enables machines to carry out operations that ordinarily demand for human intelligence, has proven to be a game-changer in the fight against medicine non-adherence. Here are a few examples of the huge impacts AI is having:

1. **Personalized Medication Management:** AI algorithms examine patient information, such as medical history, way of life, and prescription schedule, to provide tailored adherence programs. These programs offer personalized reminders and support while taking into account each patient's preferences and any potential barriers to adherence, like side effects.

2. **Smart Medication Dispensing:** AI-powered medicine delivery devices, such as smart pillboxes or blister packs, assist patients in managing their medications by giving auditory or visual cues when it's time to take a dose. If a patient misses a medication, these gadgets can also alert caretakers or medical experts.

3.   **Predictive Analytics:** AI can examine patient data to forecast when a patient may be at risk of non-adherence. High-risk patients can be identified using elements including appointment attendance, refill trends, and social determinants of health. Then, healthcare professionals can take action early to alleviate adherence-related obstacles.

4.   **Chatbots and Virtual Assistants:** Artificial intelligence (AI)-powered chatbots and virtual assistants can converse with patients about their drugs, respond to inquiries, and provide support. To help patients better comprehend their treatment, they can also send prescription reminders and instructional materials.

5.   **Adverse Event Detection:** Artificial intelligence (AI) systems can keep track of adverse drug reactions and symptoms reported by patients. The chance of non-adherence owing to discomfort or side effects is decreased by fast treatment plan modification enabled by early diagnosis of adverse effects by healthcare professionals.

6.   **Data Integration and EHRs:** To give a complete picture of a patient's medical history, AI can connect with electronic health records (EHRs). Informed judgments concerning pharmaceutical regimens and the identification of potential interactions or contraindications can then be made by healthcare professionals.[6]

❖   **Challenges and Ethical Considerations**
     While AI shows great potential in enhancing medicine adherence, there are obstacles to overcome and ethical issues to take into account. These include issues with algorithm bias, data privacy, and the necessity for ethical AI development and implementation. Another essential step in preventing the escalation of healthcare disparities is to guarantee that AI tools are available and inexpensive to all patients.[7]

Artificial Intelligence Solutions to Increase Medication Adherence in Patients With communicable Diseases
Communicable Diseases:
     A contagious or infectious disease, sometimes referred to as a communicable disease, is a sickness that can be passed from one person or organism to another.This includes HIV/AIDS, tuberculosis (TB), malaria, viral hepatitis, sexually transmitted infections.[8]
1. **Improved Public Health**: To stop the transmission of infections and lessen the total burden of disease on public health systems, it is essential to improve treatment adherence in communicable diseases.
2. **Reduced Drug Resistance:** By ensuring that patients finish their prescribed medication regimens, AI can assist prevent the emergence of pathogen strains that are resistant to drugs as a result of partial treatment.
3. **Improved Treatment Outcomes:** Patients' health and wellbeing are ultimately benefited by better treatment outcomes, which include quicker recovery times and fewer problems.
4. **Savings in expenses:** Successful AI-driven interventions can result in fewer hospitalizations and medical problems, lowering the costs of healthcare related to communicable diseases.
5. **Personalized Care:** AI algorithms can modify treatment plans to suit particular patient requirements, taking into account elements like heredity, lifestyle, and medication tolerance, resulting in more efficient and individualized care.
6. **Early Intervention:** AI's predictive abilities can spot patients who are at danger of non-adherence, giving healthcare professionals the opportunity to act quickly and give more assistance as necessary.
7. **Patient Empowerment:** AI-powered mobile apps and virtual assistants provide information, reminders, and resources to empower patients to actively participate in their own care, improving adherence. Data-Driven Decision-Making: AI can incorporate patient information into public health surveillance, giving authorities crucial information to successfully influence public health programs and interventions.
8. **Reduced Transmission Rates:** Better adherence lowers the risk of affected people spreading the illness to others, helping to manage communicable diseases more broadly.
9. **Accessible Healthcare:** AI technologies can improve medication adherence support's accessibility, ensuring that patients from a variety of socioeconomic backgrounds and geographic locations receive the treatment they require.[9]

Artificial Intelligence Solutions to Increase Medication Adherence in Patients With Non communicable Diseases
Non communicable Diseases:
     Non-communicable diseases (NCDs) are ailments or illnesses that aren't brought on by contagious organisms. These are long-lasting chronic diseases that often proceed slowly and are caused by a confluence of genetic, physiological, environmental, and behavioral factors.This includes mainly cardiovascular diseases, diabetes, cancers and chronic respiratory diseases.[8]
1. **Applications for smartphones:** In a small number of studies, AI smartphone applications (or "apps") have been assessed as instruments for monitoring and promoting medication adherence. An AI smartphone app was created by Labovitz et al. to track medication compliance in stroke patients receiving direct oral anticoagulant treatment. The AI program employed the smartphone camera and a neural network computer vision algorithm to visually recognize the patient, the drug, and the confirmed consumption.

2. **Reminder Programs**: AI has also been applied to health communication to promote adherence, such as automated systems that send out reminders to take drugs. In elderly patients with NCDs, Brar Prayaga et al. evaluated the "mPulse Mobile," an SMS-based refill reminder system using conversational AI. When compared to the control group, which did not get SMS reminders, the intervention group's rate of medicine refills was much greater. Intelligent Patient Assistance.

3. **Through patient support and empowerment**: AI has also demonstrated indirect benefits for drug adherence. "Vik" is a chatbot created to empower breast cancer sufferers and their loved ones through tailored SMS messaging. It included pertinent, carefully reviewed medical information regarding breast cancer, its epidemiology, therapies, and side effects, as well as data on fertility, lifestyles, payment policies, patients' rights, and other topics. Incorporated Care Using AI.

4. **In order to improve clinical results and patient experiences:** integrated care programs—also known as care systems—seek to create coordination both inside and across healthcare organizations and healthcare practitioners. For difficult patients, such as those with multimorbidity (defined as the presence of more than one concurrent NCD), these programs help improve the care and treatment of patients with NCDs.[2]

AI Advantages for Better Medication Adherence
Evaluation of Adherence Levels

As mentioned, AI has demonstrated promise in detecting drug adherence levels and enhancing medication adherence. For doctors and academics, determining drug adherence and the factors that influence it can be difficult at the moment. There are numerous direct and indirect, objective and subjective methods available for measuring these; at the moment, patient self-report, electronic measures, pharmacy refill and claims data, routine practice, epidemiological and intervention studies are the most frequently used measures.[10]

Adherence is raised

In contrast to conventional therapy, patients using AI-assisted technologies have higher adherence rates than those using the latter, as shown in the aforementioned examples from multiple trials evaluating these technologies . Patients with NCDs who take their medications more consistently have better clinical results. For instance, taking statins and beta-blockers as prescribed has been linked to a lower risk of long-term mortality (median of 2.4 years) in patients with acute myocardial infarction and ischemic heart disease , and patients with diabetes and ischemic heart disease have also been shown to have lower all-cause mortality when taking cardioprotective medications. Additionally, a comprehensive study found that hospital admissions linked to pharmaceutical non-adherence are a widespread issue, especially in regard to cardiovascular medications.

Saving time

Patients' subjective assessments of adherence in clinical practice may not be correct, and doctors may not have enough time to investigate and address the underlying causes of non-adherence, especially given the wide variety of complicated factors that might affect it . Therefore, utilizing AI-assisted technology may help free up time for healthcare professionals to engage in crucial clinical tasks and more in-depth patient communication about their diseases and treatments. It has been proposed that AI could enable a more precise knowledge of a patient's prescription adherence so that doctors can devote more time to judgment and emotional intelligence for devising tailored tactics to maximize adherence.[2]

CONCLUSION

The role of Artificial Intelligence in medication adherence cannot be overstated. AI-driven solutions have the potential to revolutionize healthcare by enhancing patient engagement, personalizing treatment plans, and improving overall health outcomes. As technology continues to advance and ethical concerns are addressed, we can expect AI to play an increasingly significant role in tackling the pervasive issue of medication non-adherence, ultimately leading to better patient health and reduced healthcare costs.

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