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RESEARCH ARTICLE

SCOPE OF AI IN HEALTHCARE SYSTEM - REDUCE MEDICATION ERROR AND DOSE ERROR, IN PERSONALISED MEDICATION MANAGEMENT AND EARLY DIAGNOSIS OF FUTURE DISEASE

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ABSTRACT

Errors in medication and dose selection are a major concern in the field of healthcare systems, they can have an impact on the patient's safety and care. More precisely dose errors represent a particular type of medication error, as they can lead to adverse events like adverse drug reaction (ADR), birth defect, disability, unexpected adverse events (UAE) etc. In an effort to reduce medication errors and dose errors and also to improve personalized medication management, artificial intelligence (AI) has been taken into consideration. The purpose of the study is to throw some light on the scopes of AI to help with the above-mentioned problems. By using various algorithms and models A.I development could give more accurate and precise results. Some of the events like screening a prescription, providing real time alerts to the health care personnel about the possible medication interactions, dose related issues can be more specified and ethically modified using AI algorithms. Also, by using and developing A.I models and algorithms prediction of an upcoming disease can be possible from the early stages. As an example, by using different parameters like age, height, weight, patient medical history, genetic history, lifestyle there is a great possibility to predict the upcoming possible diseases.

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INTRODUCTION

AI is like a most auspicious and obligatorily knowledgeable and encouraging prospect that actually helps build the prosperous medical environment in a very positive way so human beings get their benefits (though there are some negatives too which we are going to discuss). AI can be seen in our everyday life, from waking up from the shut eye, to going into the nutshell again, AI is being the most prolific and handy standby of us. In every good deed prospect, there are also some loopholes which can cause smooth defeatist and gloom ridden paths in modern days. Few other contradictory and dissension ways are also there. In utterly circumstances like some dangerous disease that has come along our ways, can be tackled with AI to get an easy and healthy life. Bringing out solutions for big radical problems can cause huge relief in our lives (where ai can be easier life friendly), at the same time can relief us from our daily tantrums like helping in our everyday schedule so we can at least feel a bit less hectic in this hidden traumatised generation. So, in this paper we are generally working on a theoretical model to understand and bring a new light to the development of A.I in the modern pharmaceutical era. In today's generation the maximum healthcare system partially relies on some manual processes which can cause some kind of errors, delays, misleads and inaccuracy (2).

To evaluate the system from a side of personalised medicine and disease prediction, it is very much important to study and provide an elaborate knowledge about the A.I in Personalized medication management, disease detection, drug-drug interaction (DDI), drug-food interaction (DFI), chronic disease management, evaluation parameters and individual patient centred care. Additionally, as the A.I is being implemented in healthcare systems, it should be considered and planned with precaution and in a maintained confidential environment. Otherwise, it may become a threat for human beings. A.I will be very versatile about personalised medical suggestions to provide 24/7 support . In this populated growing world, it is very important to implement the power of A.I for better advancement of healthcare and managing the medication for patients faster and more accurately. Also A.I can be more beneficial for reducing workload of healthcare providers (2). For example, DeepDDI2 - a drug-drug interaction (DDI) model for identifying and predicting ADR. The model is able to compute and identify a total of 113 types of DDI, more than the types of 86 DDIs covered by the existing DeepDDI. They used a deep learning method for the improvement of the A.I. (5). Either for dose detection or disease detection, the database is very much important; it's the backbone of A.I.

For evaluating such databases there are various kinds of parameters that need to be considered for providing commands to the A.I model. So that it runs with a great efficacy and provides us reliable and errorless results and thus enhances the patient compliance. Till now there have been many advancements in A.I models for predicting diseases on the basis of signs and symptoms. Here, in this article, we propose another approach that is the prediction of diseases that are most likely to occur in the future based on the current disease condition of a patient.

This article highlights the probable scopes of A.I in the following:

- Reduction of medication error and dosing error by analysing patient data, including electronic health records, genomic data, and lifestyle information, to identify individual risk factors and treatment options.
- Development of personalised medication plans that take into account the patient's individual needs, such as their age, weight, brain age, bone age and other health conditions.
- Suggestions of drugs for combined drug therapy in multiple disease conditions.
- To predict diseases that are most likely to occur in the future based on the current disease condition of a patient.
- To predict adverse events based on DDIs and DFIs.

MEDICATION ERROR AND DOSE ERROR REDUCTION

Every year, new medicines are introduced into the market and also many medicines are withdrawn according to their post market surveillance report. Healthcare professionals need to get updated before prescribing any medication. For multiple disease conditions of a patient, when prescribing, the practitioner needs to evaluate every possible effect and side effects of drugs for each disease, like drug-drug interaction (DDI), drug-food interaction (DFI), patient's medical history and so on. All these complexities can be solved if we implement AI for such evaluations to help practitioners prescribe errorlessly with accurate medication and dose recommendation. Dosage errors are a common problem in healthcare, and can result in serious consequences for patients. AI can be used to analyse a patient's medical history, lab results, and other data to determine the correct dosage of a medication. AI can also be used to generate alerts if a dosage is outside of the recommended range (9). To decrease dosing errors, a variety of innovative AI-powered technologies are now being created or applied. For instance, the business PillDrill employs AI to assist physicians and pharmacists in determining the appropriate dosage of medications for patients. It has been demonstrated that the company's AI-powered tool can cut dose errors by as much as 50% (10)(13).

Enlitic, a different business, analyses medical photos using AI to find probable dose problems. The company's AI-powered technology has demonstrated success in detecting dosage problems in patients using the blood thinner warfarin (14). Although it is currently in its early stages, using AI to eliminate dose errors could have major advantages. The amount of dose errors could be greatly decreased with the use of AI-powered technologies, which could save lives and improve patient outcomes (11)(12). Prescribing the proper medication and its accurate dosage depends on various factors that need to be considered.

Important parameters to be considered:

To get a more precise and accurate result, the key is to provide perfect parameters to set some of the important parameters to the database. Such parameters are:

- **Patient demographics:** The patient's age, sex, race, ethnicity, and other demographic details are included in this.
- **Medical history:** Details on the patient's ongoing drugs as well as their current and previous medical conditions are included.
- **Genetic history:** This includes the patient's family and genetic history of diseases.
- **Lifestyle factors:** It includes the patient's diets, exercise habits, smoking status, and other lifestyle factors like consuming alcohol that can affect their body.
- **Laboratory results:** This includes the patient's blood tests, urine tests, etc. and can provide information about their health.
- **Genomic data:** This includes the patient's genetic data, which can be used to pinpoint genes linked to particular illnesses.

AI databases need to be updated with every possible data on drug-drug interaction, drug food interaction, dose calculating formulas and other data like how lifestyle factors like smoking or alcohol consumption, may affect the working of medicine or medicines and its dose. These databases are required by the AI, for it can evaluate all the risk factors and give us the errorless result.

PERSONALISED MEDICATION MANAGEMENT

When making drug recommendations, it's crucial to take into account the patient's unique preferences and goals in addition to these factors. For instance, while some patients may choose to use drugs with fewer side effects, others could be more concerned about drug costs.(15)(16) It is feasible to create more precise predictions about which treatments are likely to be helpful for people with multiple medical conditions by taking into account all of these criteria. By doing so, the likelihood of adverse medication events can be decreased and patient outcomes can be improved.(16)(17)

Additional factors that may be significant in determining medication for various medical situations include the following:

- **The severity of the patient's conditions:** The likelihood that a patient may require many medications increases with the severity of their diseases.
- **The patient's tolerance for medications:** Since some people may be more sensitive to side effects than others, it's critical to take into account each patient's unique tolerance when recommending medicine.
- **Adherence to drug schedules by the patient:** Patients are more likely to benefit from treatment if they follow their prescription schedules.
- The accessibility of medicines When making suggestions, it is crucial to take the patient's access to medication into account because some medications may not be available in all nations or locations.
- It is feasible to make more informed decisions regarding whether medications are likely to be safe and beneficial for patients with various medical conditions by taking into account all of these criteria.

PREDICTION OF DISEASES THAT ARE MOST LIKELY TO OCCUR IN THE FUTURE BASED ON CURRENT HEALTH CONDITION OF A PATIENT

A.I. applications for disease detection based on symptoms, genetic history, diagnosis reports, etc. have made significant strides recently. Numerous methods can be utilised to forecast future disease detection using artificial intelligence (AI). Among the most popular techniques are:

- **Computer learning:** Large datasets of patient data can be used to train machine learning algorithms to find patterns that can be utilised to forecast future illness risk. For instance, depending on a patient's age, weight, family history, and other indicators, an algorithm may be developed to identify those who are at a high risk of acquiring diabetes.
- Machine learning algorithms that can discover complicated patterns from data are known as "deep learning" algorithms. They are therefore ideally suited for jobs like disease prediction, which frequently requires finding tiny patterns in patient data.
- **Natural language processing:** Text-based patient data, like posts on social media or electronic health records, can be analysed using natural language processing (NLP) algorithms.

Based on their linguistic patterns, this can be used to identify people who are likely to get a disease. Additionally, AI can also predict future diseases by the following:

AI can evaluate patients' genetic data, and find if they are at risk of having particular disease or diseases. This is because many diseases are influenced by hereditary factors. Environmental factors that can raise the chance of contracting certain diseases, such as air pollution or chemical exposure, can be tracked using artificial intelligence (AI). Some wearable technologies, such as fitness trackers or smartwatches, can be used to identify people who are at risk of specific diseases by using AI algorithms. The future disease risk can be predicted using data from a person's physical activity, heart rate, and other characteristics collected by wearable devices. (18)(19)(20)(21)

AI IN PREDICTION OF DRUG-DRUG INTERACTION AND DRUG-FOOD INTERACTION

Adverse drug events (ADEs), which result in toxicity or a diminished treatment efficacy, may inevitably occur during the treatment of multiple diseases. Patients may experience higher morbidity and mortality rates as a result of them. Additionally, wet-lab tests for DDI verification might be time- and money-consuming for researchers and challenging for frequent and widespread adoptions. Therefore, it is helpful to use artificial intelligence (AI) models to predict DDIs in order to save time and costs. These models have been regularly researched and developed as part of numerous AI development programs, along with the extension and saturation of drug-database resources to support clinical judgments (6). This method may employ deep learning technology to precisely predict drug-drug interactions (DDIs), and it is anticipated that this will play a significant role in the pharmaceutical, precision medicine, and digital healthcare industries by offering helpful information during the development of new medications and prescription writing (5).

It is speculated that research into genetic factors impacting pharmacokinetics, pharmacodynamics, and drug-drug, drug-food interactions would increase drug safety and enable individualised combined drug therapies. Only when medications are taken in the right amounts, with the right combinations of medications and foods, and at the right times, can they demonstrate their effectiveness. Contrary to information on drug-drug interactions, which is readily available, information about food-drug interactions is not necessarily so easily accessible. Accurately predicting the effects of food and nutrition on a given medicine is a challenging and complex challenge. By utilising AI algorithms that analyse extensive data, prediction of the drug food interactions with potential drug candidates is possible (8).

DISCUSSION

Artificial intelligence (AI) integration into the healthcare system has the potential to lower costs and burdens associated with providing healthcare while also increasing the quality and safety of patient treatment. By minimising medication error and dose error, offering individualised medication management, and aiding early disease diagnosis, AI can significantly improve the quality and safety of the healthcare system.The accuracy of the result is based on the algorithm and the procedures. Finding the loopholes are the important tasks to sort out problems. Before AI may be fully incorporated into healthcare practice, there are still several obstacles to be overcome. These include ethical, legal, social, and technical concerns.

Some of the challenges are

- **Data size:** One of the most common challenges faced by most of the trials was insufficient data to train the model. A small sample size implies a smaller training set which does not authenticate the efficiency of the proposed approaches. On the other hand, a good sample size can train the model better and accurate than the limited one
- **High dimensionality:** High dimensionality is another data-related problem cancer research faces. There are many more characteristics than cases, which is referred to as high dimensionality. However, there are methods for dealing with numerous dimensions that can be used to solve this problem.
- **Efficient feature selection technique:** Numerous research have shown outstanding prediction results. However, to eliminate the data cleaning processes and produce high disease prediction accuracy, a computationally efficient feature selection method is needed.
- **Model Generalizability:** It is necessary to refocus research on enhancing the model's generalizability. The majority of studies have suggested a prediction model that has been tested on just one location. Multiple locations must be used to validate the models in order to increase their generalizability.
- **Clinical Implementation:** AI-based models have established their superiority in medical research, but they have not yet been used in actual clinical settings. To help the doctor confirm the diagnosis decisions, these models must be evaluated in a clinical situation.(22)(23)(24)(25)(26)(27)

CONCLUSION

Artificial intelligence is a very powerful tool that can be used to reduce medication error and dose error. It has high potential to accurately identify the probable medication error and dose error and to prescribe the correct medication and dose. Though the implementation of AI in this area is in a very early stage, it can be seen that there is growing evidence that supports its probable potential. There is a wide scope of artificial intelligence in every sector of healthcare systems. Some of these scopes such as its implementation in reducing medication error, dose error, personalised medication management, as every patient's need is unique, and also in prediction of any potential disease based on current condition of the patient, are highlighted in this article. AI technology is evolving at a very fast pace, providing us with more innovative and effective ways to improve the healthcare system. However, AI is not completely reliable. So, it may reduce the above-mentioned errors but cannot totally eliminate them. It is therefore suggested to use AI in association with other safety measures like double checking and medication reconciliation.

FUTURE ASPECTS

Artificial intelligence (AI) is rapidly transforming the healthcare industry, with the potential to revolutionise the way diseases are diagnosed, treated, and managed. Here are some of the future aspects of AI for improvement of the healthcare system:

Virtual care: AI can be used to provide virtual care to patients, such as through remote monitoring and diagnosis. This could make healthcare more accessible to patients who live in rural areas or who have difficulty travelling to see a doctor. For example, AI is being used to develop virtual care platforms that allow patients to connect with doctors and nurses from anywhere in the world.

Drug discovery: AI can be implemented to shorten the drug discovery process by identifying new drug targets and designing new drugs. This could accelerate the process of development of new treatments for diseases that are currently difficult to treat. For example, AI is being used to develop new drugs for Alzheimer's disease and cancer.

ABBREVIATION

AI	Artificial Intelligence
ADR	Adverse Drug Reaction
UAE	Unexpected Adverse Events
DDI	Drug-Drug Interaction
DFI	Drug-Food Interaction

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