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Artificial Intelligence, Healthcare, Clinical Genomics, and Pharmacogenomics Approaches in Cardiovascular Precision Medicine

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Abstract

Due to the complexity of medical decisions, the use of information systems to support these decisions has increased. Meanwhile, the development of intelligent systems in helping doctors is outstanding. In this article, the capabilities of these systems in the field of cardiovascular medicine have been investigated. In this research, the main English and Farsi articles were searched in PubMed, Scopus Cochrane Library, Google Scholar Direct Science, and in Iran database including SID and IranMedex. To find articles in the Medical Subject Search Database (MeSH), the words: "artificial intelligence", "genomics", "pharmacogenomics", "cardiology" and their English equivalents were used together with the prepositions AND and OR. Artificial intelligence has a lot of potential to improve medical decision-making, but the successful implementation of these types of systems in medicine, in addition to paying attention to the principles required for any other information system, including attention to organizational, behavioral, cultural, managerial, economic, educational and technical factors, It requires other things.

Keywords: *Artificial intelligence , Genomics, Pharmacogenomics, Cardiology*

Introduction

Today, due to the expansion of knowledge and the complexity of decision-making, the use of information systems, especially artificial intelligence systems, has become more important in supporting decision-making. (1) Artificial intelligence refers to systems that can behave and react similar to intelligent behaviors Human beings, including understanding complex conditions, simulating human thought processes and reasoning methods, and successfully responding to them, learning and having the ability to acquire reasoning to solve problems (1-3), expanding knowledge in the field of medicine and the complexity of decisions related to diagnosis and treatment. The expression of human life has drawn the attention of experts to the use of decision support systems in medical affairs, in the meantime, the use of different types of intelligent systems in medicine

is increasing (5) (4); so that today the effect of various types of intelligent systems in Medicine has been studied (6-11) The continuous development of the technological sector of industry has enabled it to integrate with medicine in order to create new reliable and efficient integrated methods for providing quality health care. One current trend is the proposed use of artificial intelligence. Artificial intelligence (AI) is increasing and expanding the effectiveness of cardiologists. Cardiology is a broad field that deals with a large number of diseases, specifically with the heart, the circulatory system and its functions, so similar symptoms and diagnostic features may exist in the same person, making it easy to identify the real problem. It makes it difficult for the doctor to visit the heart. As a result, the use of artificial intelligence is aimed at freeing doctors from this obstacle and extending better quality to patients.The results of screening tests such as echocardiogram, MRI or CT scan have long been proposed for analysis using more advanced techniques in the field of technology, thus while artificial intelligence is not yet widely used in clinical practice as the future. Health care is considered. This is because artificial intelligence or machine learning enables accurate measurement of patient performance and diagnosis from the beginning to the end of the treatment process. Specifically, the use of artificial intelligence in cardiology aims to focus on research and development, clinical practice and population health. Artificial intelligence technologies that have been developed as a comprehensive mechanism in cardiac health care incorporate complex algorithms in determining the relevant steps required for successful diagnosis and treatment. The role of artificial intelligence specifically extends to the identification of new drug treatments, classification or statistics of diseases, remote, continuous monitoring and diagnosis, integration of multi-omic data, and expansion of physician effectiveness and efficiency. Engineer researchers and medical scientists are apparently evaluating the use of artificial intelligence in genomic and environmental analysis, particularly for cardiac patients.The researchers used algorithms based on cardiac MRI combined with a 3D heart systolic motion pattern to accurately predict the health outcomes of patients with pulmonary hypertension. . With the success of the aforementioned study, as well as the promise of other research in the field of artificial intelligence, it seems that cardiovascular surgery is moving towards a more technological practice. Genetics is a term that refers to the study of genes and their role in heredity, in other words, the way some traits or conditions are passed from generation to generation. Other genetics includes the scientific study of genes and their effects. Genes are the units of heredity, instructions for making proteins that They direct the activity of cells and body functions.Genomics is a newer term that describes the study of all the genes in an individual's genome, including how those genes interact with each other and with the environment. Genomics includes the scientific study of complex diseases such as heart disease, asthma, diabetes, and cancer because these diseases are usually caused by a combination of From genetic and environmental factors to just genes, genomics offers new possibilities for treatment and treatment of some complex diseases as well as new diagnostic methods. Both genetics and genomics play a role in our health and disease. Genetics helps people learn about how genetic diseases are inherited and available treatments.Genomics helps researchers to understand why some people get sick due to certain infections, environmental factors and lifestyle behaviors and others respond differently to these things. The reason for the difference in drug reactions in different people is (a) genetic cause, genotype, sex and background (racial, environmental cause of the disease) and previous treatments of substances in the environment, so pharmacogenetics is the study of the genetic basis of people's abilities to respond to therapeutic agents. Medicines usually enter the body as prodrugs and are therefore inactive. Prodrugs undergo changes in order to be activated. Mutations in genes that are somehow related to the metabolism of drugs change the fate of the drug in the body. The response of people to a special treatment is the result of gene-drug interaction of genes involved in drug metabolism. In fact, if the diagnosis of the disease is done correctly, due to different genetics, the response of different people to the same drug can be different.

Materials and methods

In this research, the main English and Farsi articles in PubMed and Scopus databases Cochrane Library, Google Scholar Direct Science and in Iran's database SID and IranMedex were searched. To find articles in the medical title search database (MeSH), From the words: "artificial intelligence", "genomics", "pharmacogenomics", "cardiovascular" their English equivalents are It was used with the prepositions AND and OR.

Discussion

Intelligent systems (expert system) and neural network have the structure of components and capabilities that They improve the total decision-making ability (12); for this reason, they are used in many cases in medicine

Used. Many studies on the ability of artificial intelligence systems to support decisions Medicine has shown. One of the advantages of these systems is to consider more diverse solutions (1). Artificial intelligence helps the doctor to consider more and more diverse variables at the time of disease diagnosis Or consider treatment options. In other words, according to the limitation of the mind's recollection, the doctor is possible Consider all variables necessary to make decisions for example symptoms or test results at once Don't take or forget them or don't seek information about it, but because the relationship between this Variables are considered during system design, so the possibility of ignoring some of these Factors or consideration of their influence are reduced more than reasonable. So according to the quality The definition of these relationships can be expected to make doctors' decisions more accurate. The existence of many variables and Unknown means more complexity of decision-making. With the help of these systems, more variables can be used Involved in decision making.It is also possible to consider unknown variables, unknown relationships between the neural network of the variables, and also variables with an unknown effect on the outcome variable . By using these systems, one can expect more accuracy in more complex decisions (2) 3) For example, to decide to refer a patient with a heart attack to other hospitals, Many variables (such as the patient's general condition, distance tolerance, etc.) should be taken into consideration. It makes the decision very complicated. But it is possible to consider all these variables in intelligent systems The doctor helped in making the right decision (7). Due to the abundance and interference of variables in decisions Medical doctors can make faster and more consistent decisions by using artificial intelligence systems and spend more time on decision evaluation (1) (2). Finally, with these systems, speed Analysis and access to recommendations increases at any time and place (3) regarding decisions Medicine is very important. For example, predicting whether a lesion is benign or malignant Performing a biopsy, or correctly predicting the recurrence or metastasis of cancer (18), allows doctors to be able to do it faster Treat or prevent. Despite the many advantages of using artificial intelligence systems in Medicine is facing many serious obstacles and challenges. Among these limitations can be. The limitation of technology and the cost of the system pointed out. On the other hand, their performance requires updating It is continuous (2). Some believe that dependence on the intelligent system may increase in the long term (2) Also, the use of these systems requires entering the patient's data into the system In order to receive diagnostic or treatment recommendations. This means that the doctor should Enter the patient's information once in this system and again in the patient file (manually or electronically). Repetition of entering information in different systems can be an obstacle to using these systems; Unless the patient's data is available electronically in the patient's file and it can be done from this. Systems used together with the electronic file integrated. The main issue about the use From artificial intelligence in cardiology or in any medical field for that matter, there are ethical issues that to It exists. In addition, since the machines may have problems, the safety of the patients as well Always on the . Thus, while doctors see the promise of artificial technology, in Its use, safety and appropriateness in medical practice are also severely limited. Issues and challenges that. Technological innovations in cardiology are faced by current research that aims to access Easy and accessible to everyone has overcome artificial intelligence. With this in mind Various projects are currently under study. For example, the use of intelligence technology. A wearable prosthesis aims to create a mechanism by which patients and doctors can easily Access and monitor cardiac activities remotely. An ideal tool for Wearable artificial intelligence technology monitoring ensures real-time monitoring and assessment updates he does. Another direction of cardiology in artificial intelligence technology is the use of technology to register and Validation of experimental data for further analysis of biomarker symptoms and treatment efficacy Is. Using artificial intelligence technology, cardiovascular researchers seek to simplify and expand the scope Knowledge in this field is for better patient care and treatment results.

Result

Artificial intelligence has great potential to improve medical decision-making, but successful implementation. These types of systems in medicine, in addition to paying attention to the principles required for any other information system. Paying attention to organizational, behavioral, cultural, managerial, economic, educational and technical factors requires. Another is in this article, the most important challenges and questions ahead in the field of artificial intelligence application. Medicine was discussed, which is necessary by the thinkers, experts and researchers of the case. Be examined and suitable solutions or answers are provided for them; To be able to expect that. The use of these types of systems in the medical profession will increase.

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