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EDITORIAL

USE OF ARTIFICAL INTELLIGENCE IN PUBLIC HEALTH

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Artificial Intelligence (AI) denotes a software program, which is capable of simulating either a context-sensitive response or a conversation with a human user in natural language through mobile applications (apps), websites or messaging services.[1]

HISTORY OF AI IN PUBLIC HEALTH

In 1960, the first signs of artificial intelligence (AI) research appeared. Originally, the goal was to develop machines that could simulate human intelligence.[2] AI applications in healthcare, in the initial days, were mostly focused on expert systems, which used human specialists' knowledge to aid in making decisions about medical diagnosis and treatment planning.

During the 1980s and 1990s, the primary focus of AI research in the healthcare industry were the expert systems. Nonetheless, research was also being done on natural language processing and machine learning.[3] Around that time, researchers were able to begin investigating the possibilities of artificial intelligence (AI) in a variety of fields, including drug development, medical diagnosis, public health surveillance, and more, thanks to the availability of a sizable collection of medical data and advanced computer systems.

Natural language processing, computer vision and machine learning all made significant strides in the 2000s. This subsequently helped researchers to build highly complex artificial intelligence (AI) systems that could analyze enormous volumes of data and forecast future events. [4] This led to the development of AI-based diagnostic tools, such as those that assist in the diagnosis of diseases like cancer by analyzing medical images. Furthermore, advances in text mining and natural language processing techniques made it possible for researchers to employ AI to analyze enormous volumes of unstructured data, including electronic health records, and draw insightful conclusions. [5]

The use of AI in public health has garnered more attention in recent years, particularly in the areas of predictive modeling and public health surveillance. By using AI algorithms, we are able to predict the spread of infectious diseases such as influenza or COVID-19, which has allowed public health officials to take preventive measures.[6] AI has additionally been used to monitor the spread of diseases by analyzing huge volumes of data from various sources to predict possible outbreaks. Because of the advanced computational resources available, AI in public health has also extended to new areas such as tailored treatment plans and medication development. [7]

As a result, the history of artificial intelligence in public health has greatly expanded, moving from simple expert systems to more sophisticated systems that can analyze enormous amounts of data and generate predictions.

COMPONENTS AND SUBFIELDS OF AI IN PUBLIC HEALTH

•**Machine learning:** This is the process of using "learning algorithms" with training data. A set of rules will be produced by the algorithm based on patterns found in the data. These guidelines can then be applied to categorize fresh data or forecast data in the future. Furthermore, the same learning process might be useful in generating alternative models (e.g., disease prediction) by using different training data. [8]

•**Cognitive search**: This is the process of incorporating and understanding digital content from a variety of sources, including text, photos, video, and machine data, using AI tools like machine learning and natural language processing (NLP). The purpose of this is to increase the relevance and importance of the results that a user search yields. [8]

•**Natural language processing, or NLP:** This automates the comprehension, reading, and interpretation of human language. [8]

•**Two NLP subfields of particular interest exist.** Natural language understanding (NLU): These algorithms use a coded comprehension of grammar, semantics, and syntax to interpret works written by humans. [8] Natural language generation (NLG): These algorithms are made to convert structured data into simple language automatically. For this reason, it is thought of as NLU's opposite. [8]

•**Robotics:** This is an interdisciplinary field of study that lies at the intersection of engineering and computer science. The main objective of robotics is to develop intelligent machines

that will eventually support human activity.[8]

•**Virtual agents (chatbots):** "Conversational agents" is another term for these. These are software programs that imitate written or spoken human speech in order to simulate a dialogue or other interaction with an actual person.[8]

•**Computer vision:** This is the process of teaching computers to perceive and comprehend the visual environment. These devices are able to precisely detect and categorize items through the use of deep learning techniques and digital images captured by cameras and movies.[8]

•**Deep learning:** This branch of machine learning makes use of algorithms—which are essentially networks of decisions—to extract knowledge from data. Neural networks are the common name for these networks. When a network has numerous layers, it is referred to as a deep neural network or deep learning network. Deep learning is able to predict health status from electronic health records and detect diseases based on imaging. [8]

•**Speech analytics:** This is the process of understanding and deriving meaning from speech, either live or recorded. [8]

GUIDING PRINCIPLES FOR USING AI

It is imperative that patient safety and quality of treatment remain the primary priorities in the development, implementation, and application of AI for public health, with evidence behind every decision.

The following eight guiding principles, which are intended to reduce ethical risk in public health and related policy initiatives, should be used as a mandatory framework for the use of artificial intelligence (AI) in public health. These concerns are technical and ethical in nature.

•**People-centered:** People must be the focus of all actions and solutions, and they cannot be applied in isolation. AI is just one of several technologies that can improve public health while upholding individual rights. [8]

•**Ethically grounded:** It must be recognized that the universally accepted ethical precepts of justice, human dignity, beneficence, and nonmaleficence should serve as the foundation for all conversations, developments, and actions. [8]

•**Transparent:** It is imperative to consistently employ and disclose transparent methodologies while constructing AI algorithms. [8]

•**Data protected:** Every advancement in AI must start with privacy, confidentiality, and data use security. [8]

•**Demonstrates scientific integrity:** The best practices in science should be adhered to by all AI initiatives. The interventions need to be trustworthy, reproducible, accountable, impartial, and truthful. [8]

•**Open and sharable:** Everything needs to be as shareable and transparent as feasible. Any AI development must include the tools and the fundamental idea of openness as a feature and success element. [8]

•**Non-discriminatory:** Fairness, equality, and inclusivity in impact and design should always be the cornerstones of any AI endeavor for public health.[8]

•**Human-controlled technology:** Formal procedures for human oversight and evaluation of automated judgments are required.[8]

USE OF AI IN PUBLIC HEALTH

Through the provision of easily accessible, reasonably priced, and engaging solutions, AI-based applications can enhance health education and promotion initiatives.[9] AIs can help people manage their chronic conditions, such as asthma, diabetes, and hypertension, on their own.[10] AI technologies can facilitate people's access to automated or remote medical screenings, diagnosis, and treatment. AI can also assist in tracking and monitoring health data, symptoms, and therapies in a semi-automated manner. The provision of emotional support for individuals with mental health concerns has demonstrated the utility of AI.[11]

Personalization that is tailored to a user's medical history, lifestyle, and preferences, as well as reminders to get vaccines and health exams, could all be helpful. Artificial intelligence (AI) models offer context-sensitive health education materials, such as tailored advice on exercise, nutrition, and healthy lifestyle practices.[12] AI is also capable of reminding people to repeatedly finish the recommended health exams. These technologies facilitate the availability of health information to consumers, empowering them to make more informed decisions regarding their health.[13]

By automating data analysis, finding patterns, and making predictions, artificial intelligence (AI) has the potential to improve research skills.[14] AI can help with information retrieval and data processing as well. AI can aid in the creation of new research tools and methodologies.[15]

AI-based epidemiological surveillance use AI technology to evaluate data from various sources, including social media, news articles, and electronic health records, offering a promising method for identifying, tracking, and forecasting the spread of diseases.[16] These tools enable public health professionals to respond to disease outbreaks quickly and effectively by detecting patterns in real time and providing pertinent insights. Because AI can anticipate future outbreaks, it has a substantial edge over traditional disease surveillance approaches. Public health professionals can therefore act pro-actively and preventively at an early stage as a result. AI-based systems continuously improve their predicted accuracy by learning from new data, which increases the effectiveness of disease surveillance.[17] Artificial intelligence (AI) technologies are better than traditional approaches because of their

adaptive learning potential. Traditional methods are more static and lack the sensitivity needed to accurately predict outbreaks and recognize new diseases.

The Indian government created "Arogya Setu" to provide people with self-assessment and real-time contact tracing information, enabling them to stay informed during emergencies like the COVID-19 pandemic.[18]

Canadian experts in data science and epidemiology created the AI-powered platform "BlueDot." It analyzes a variety of data sources, such as news articles and other indications, using machine-learning techniques. Cues and information about case counts, attributes of disease, assessments of healthcare capacity, risk alert warning, epidemic preparedness, and environmental suitability have been helpfully provided by this AI-driven software. The global reaction to the pandemic was influenced by BlueDot's early warnings to public health personnel about the COVID-19 outbreak that occurred in Wuhan, China, towards the end of 2019.[19]

Another AI-driven epidemiological information surveillance system in the United States is called "HealthMap." Based on time, geographic location , and infectious pathogens, it monitors, organizes, and visualizes disease outbreaks. Data from a variety of sources, such as news articles, social media, official health reports, etc., are analyzed in order to do this. AI-based epidemiological surveillance has been implemented by the US Centers for Disease Control and Prevention (CDC) to track the transmission of infectious diseases. Their "BioSense" system analyzes data from electronic health records, emergency department visits, and other sources using machine learning algorithms to pinpoint infectious disease epidemics.[20]

Popularly known as "precision public health," AI can help determine when and how to focus the appropriate intervention at the correct population. [21] Sentiment analysis of Twitter data, for instance, has made it possible to identify the group of people who have conflicting views regarding hookah smoking, which has helped with public health initiatives that are aimed at the most responsive individuals. [22] To determine who is at suicidal risk, similar data and natural language processing techniques have also been applied. [23, 24] AI-powered interactive web tools and apps have made it possible for us to perform individualized risk assessments and offer suggestions for risk mitigation. It has been discovered that these AI methods are more motivating and engaging than traditional approaches, for instance, when it comes to managing and preventing chronic diseases or promoting behavioral change. [25, 26] Florence, a "digital health care assistant," was just made available by the World Health Organization as part of their AI for Quitting Tobacco initiative (www.who.int/campaigns/ Florence). Florence helps people give up smoking by using AI, animation, and computer-generated graphics.[27]

CONCLUSION:

AI methods and tools are still in their early stages. Despite a number of drawbacks, AI technologies and methods are useful for predicting population health risks and for obtaining comprehensive health information about an individual. In the near future, there will likely be a major increase in the application of AI for public health.

It is crucial that public health organizations carefully consider their AI implementation plans. Analytical governance and infrastructure, as well as the review and modernization of existing organizational data, are critically needed. The skills gap in data science and AI needs to be addressed concurrently, and we also need to concentrate on building strategic alliances for collaboration. We must use AI best practices with caution, taking equity into clear consideration.[28]

It is crucial to realize that the human rights perspective must be applied to ensure ownership, confidentiality, data security and informed consent. It will also be necessary to comprehend the local epidemiological, social, political, and health system contexts in order to apply AI in public health effectively. If artificial intelligence (AI) technologies are applied correctly, ethically, and effectively, they will significantly contribute to reaching the Sustainable Development Goals (SDGs) linked to health and inch us closer to achieving Universal Health Coverage (UHC).

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