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The Next Generation of Healthcare: A Review of Emerging Artificial Intelligence Technologies

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***Abstract*—**
Recent years have witnessed an unprecedented surge in artificial intelligence (AI) applications in healthcare, unlocking vast potential for improved diagnosis, clinical decision support, personalized treatment, and enhanced public health. This research explores the latest emerging AI technologies, including big language models, deep learning, and generative models, and analyzes their application in medical image analysis, telemedicine, precision nutrition, and combating famine. The research also addresses key challenges associated with AI use, such as data privacy, algorithmic bias, technology over-reliance, and the need for robust regulatory and ethical frameworks. Conversely, it points to future trends in smart, integrated, and personalized healthcare, capable of improving prevention, diagnosis, and the more efficient and sustainable management of healthcare resources. The study concludes that AI is a strategic pillar for the next generation of healthcare, combining technological innovation, precision care, and public health, thus opening new horizons for enhancing the quality of medical services globally.

Keywords*— *Public Health ; Emerging AI ; AI Challenges ; Future Trends , Precision Care.

1. INTRODUCTION

Over the past two decades, the world has witnessed unprecedented advancements in artificial intelligence (AI) technologies. These technologies are no longer confined to theoretical research or laboratory experiments but have become an essential component in many vital sectors, most notably healthcare [1]. AI has unlocked vast potential for improving the quality of medical services, enhancing the operational efficiency of healthcare institutions, and providing advanced, personalized care based on the independent and accurate analysis of each patient's data [2].

Applications of AI in the medical field range from early medical diagnosis and medical image analysis to predicting chronic diseases and managing electronic medical records, as well as designing customized treatment plans for each patient based on multiple health, genetic, and behavioral variables. It has become possible to handle massive amounts of medical data quickly and efficiently, with the potential to uncover hidden patterns and information that might be overlooked by traditional practices [3].

What distinguishes the current era is the emergence of a new generation of artificial intelligence (AI) technologies, such as Large Language Models (LLMs), Deep Learning algorithms, and Advanced Computer Vision (ACVs). These technologies are characterized by their ability to process massive amounts of data with efficiency and speed that surpasses human capabilities in some areas. They are no longer merely tools for assistance; they are now capable of providing accurate treatment recommendations, predicting disease progression,

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and contributing to complex clinical decisions, thereby enhancing the quality and effectiveness of healthcare [5 ,4].

With this significant progress, the healthcare sector faces important challenges related to the ethics of AI use, ensuring the privacy and confidentiality of medical data [6], addressing algorithmic bias that could lead to unfair or biased outcomes, and the need to seamlessly and safely integrate these technologies with traditional medical practices. Furthermore, vital questions arise regarding legal and ethical responsibility when relying on AI systems to make critical decisions affecting patients' lives.

This study aims to provide a comprehensive review of the latest emerging AI technologies in healthcare, focusing on their practical applications in medical diagnosis, preventative care, public health, and health resource management. The study also examines the challenges and limitations associated with applying artificial intelligence in medical practices and explores future trends expected to shape the next generation of smart and integrated healthcare, enabling the provision of accurate, safe, and sustainable healthcare for all segments of society. In short, this study represents an attempt to provide a comprehensive and integrated vision of artificial intelligence in healthcare, combining modern technological advancements, practical applications, ethical and regulatory challenges, and future trends. This will enable researchers, policymakers, and medical practitioners to understand the true potential of these technologies and leverage them optimally to improve public health and the quality of medical care globally.

2. Artificial Intelligence in Healthcare: Concept and Development

Artificial intelligence (AI) is defined as the ability of computer systems to mimic human cognitive abilities, such as learning, decision-making, and problem-solving [7, 8]. With the advancement of computing power and the availability of big data, AI has become a fundamental element in building intelligent systems capable of processing and analyzing medical data quickly and accurately [9].

The introduction of AI to the medical field began in the mid-20th century with early programs like MYCIN in the 1970s, which relied on rule-based systems to diagnose bacterial infections [10]. However, the machine learning revolution, followed by deep learning, revived interest in this field like never before, as systems became capable of learning autonomously from data without the need for explicit programming [11].

In the last decade, artificial intelligence (AI) has become a cornerstone in the development of precision medicine and predictive diagnosis [12]. We have witnessed the emergence of numerous commercial and medical applications officially approved by bodies such as the FDA, most notably algorithms for analyzing X-ray and MRI images, and models for predicting the risk of heart disease and cancer [13]. Recent studies indicate that AI contributes to reducing medical , improving the speed of diagnosis in emergency departments, supporting clinical decision-making for physicians through intelligent assistance systems, and lowering operational costs in healthcare institutions [14].

Furthermore, the integration of technologies such as natural language processing (NLP) has enabled systems to analyze and understand textual medical records, contributing to the development of medical digital assistants capable of interacting with physicians and patients in natural language [15]. However, the development of AI in healthcare is not without its challenges, most notably the limited availability of high-quality data, the lack of unified ethical standards, and the lack of complete trust in the decisions made by intelligent systems [16]. However, the global trend today is moving towards integrating artificial intelligence as an integrative, not a replacement, element for medical personnel, paving the way for a new era of human-machine collaboration medicine [17].

3. Emerging AI Technologies in Healthcare

The last few years (2020–2025) have witnessed a significant leap in artificial intelligence (AI) technologies employed in healthcare, driven by advancements in generative models, improved computing capabilities, and the availability of vast amounts of medical and statistical data. These technologies range from deep learning-based diagnostic algorithms and large linguistic models to integrated predictive and analytical systems for clinical and genetic data [18].

3.1 Generative AI

Generative AI models are among the most prominent recent developments that have begun to have a direct impact on the fields of diagnosis and medical decision support [19]. According to Reddy's 2024 study, "Generative AI in Healthcare: An Implementation Science-Informed Translational Path on Application, Integration, and Governance," the use of generative models such as ChatGPT and Med-PaLM demonstrates significant potential in transforming textual medical knowledge into intelligent recommendations, provided that this is managed within rigorous governance frameworks to protect the patient and ensure the reliability of the outcomes. The study indicates that integrating generative AI into hospitals requires a scientific and regulatory framework that guarantees safety and facilitates the transition from experimental models to real-world application, thus paving the way for what is known as the next generation of "interactive AI-assisted medicine" [20].

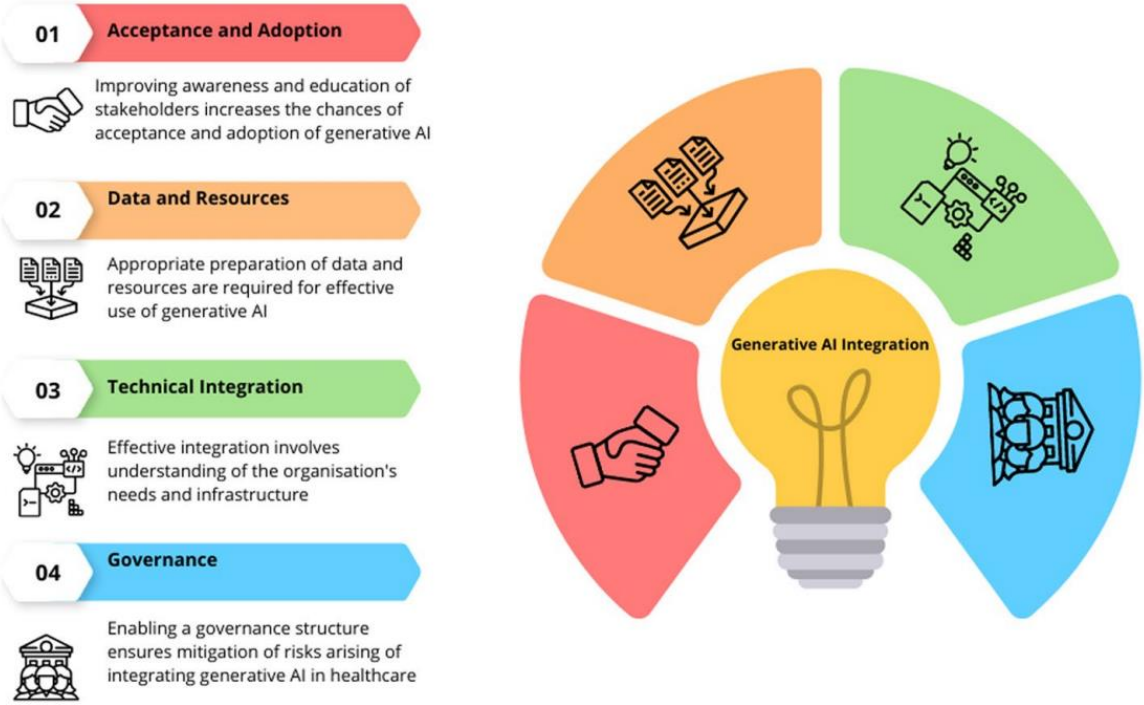

Figure. 1 Translational path for generative AI in healthcare [20].

3.2 Large Language Models in Medical Assessment

Waldock et al.'s 2024 study, "The Accuracy and Capability of Artificial Intelligence Solutions in Health Care Examinations and Certificates," examined the performance of Large Language Models (LLMs) in medical examinations and clinical practice. The results showed that modern models like ChatGPT achieved an average accuracy of 64% in standardized medical tests, indicating their ability to absorb theoretical medical knowledge. However, they remain

limited in complex clinical reasoning. The study introduced a new framework called RUBRICC, which aims to regulate the integration of artificial intelligence (AI) into medical training through six criteria: organization, ease of use, bias, reliability, integration, and patient engagement [21].

3.3 AI in Medical Imaging

Medical image processing is one of the fields that has benefited most from the rapid development of deep learning algorithms. Convolutional neural networks (CNNs) have proven effective in diagnosing cancer, lung, and brain diseases. A recent study supporting this trend is Global Distribution and Patterns of the Most Common Cancers (2025), which analyzed the geographic distribution of the most common cancers worldwide. The importance of this study lies in providing up-to-date, high-resolution data that can be used to feed AI algorithms in the field of epidemiological analysis and geographic disease prediction. Intelligent models can build upon this data to identify high-risk areas and direct medical resources and preventive programs more effectively [22].

3.4 Artificial Intelligence in Precision Nutrition and Malnutrition Control

he nutrition transition presents a complex public health challenge marked by the coexistence of undernutrition, micronutrient deficiencies, and a rising burden of diet-related non-communicable disease [23]. Artificial intelligence applications are expanding to include nutrition and food security, particularly in countries experiencing famine or chronic malnutrition. In Mehta S.'s (2025) study, intelligent algorithms are used to analyze dietary and genetic patterns to provide personalized nutritional recommendations. This trend represents a significant leap forward in preventive medicine, as AI can identify groups at risk of malnutrition before clinical symptoms appear, thus contributing to reducing the burden of resulting chronic diseases. Similarly, recent research reports indicate the potential for using AI to predict food crises and monitor famine-stricken areas by analyzing satellite imagery and agricultural and climate data. These efforts indicate that artificial intelligence (AI) is no longer confined to hospitals and clinics, but has become a strategic tool in public health and combating famine and malnutrition, thus reinforcing the concept of comprehensive healthcare based on intelligent data [24].

3.5 AI for Healthcare Administration and Efficiency

The study "Generative Artificial Intelligence Use in Healthcare: Opportunities for Clinical Excellence and Administrative Efficiency" (2025) addressed the importance of using generative models to automate administrative processes, reduce the paperwork burden on doctors and nurses, and improve communication among medical staff. The study demonstrated that AI applications can reduce the time spent on record-keeping by more than 40%, allowing doctors to focus more on clinical aspects and enhancing the operational efficiency of healthcare institutions. These studies show that AI now covers a wide range of healthcare applications—from clinical analysis and medical imaging to nutrition and food security, and smart health management. It can be said that the prevailing trend towards integrated artificial intelligence (AI), which links clinical medicine, prevention, and management, represents the cornerstone of the next generation of smart healthcare [25].

4. Current Applications of AI in Healthcare

Recent years have witnessed a significant expansion in the application of artificial intelligence (AI) across various healthcare sectors, not only in hospitals and clinics but also in public health,

prevention, and medical management [26]. Emerging evidence demonstrates that AI has become a pivotal element in improving diagnostic accuracy, increasing operational efficiency, and intelligently allocating healthcare resources [27]. Medical image analysis is one of the most prominent areas that has benefited from AI, particularly deep learning and convolutional neural networks (CNNs) [28]. The study "Global Distribution and Patterns of the Most Common Cancers" (2025) highlighted the importance of up-to-date data on the most common cancers globally [22], which is used to train AI systems to improve the accuracy of early diagnosis and treatment guidance. Furthermore, the study "Waldock et al." (2024) demonstrated the ability of large language models to analyze medical image records and text related to laboratory analyses, facilitating faster and more accurate medical decisions [21]. AI systems are used to support clinicians in making medical decisions by analyzing clinical data, electronic medical records, and laboratory test results [29]. A Reddy study (2024) highlighted the role of generative models in providing treatment recommendations based on vast amounts of medical knowledge and reducing potential medical errors [20]. These systems also facilitate personalized medicine based on each patient's characteristics, such as genetics, age, and medical history, thus enhancing treatment accuracy and efficiency.

The global pandemic has accelerated the use of AI in telemedicine, both in diagnosis and patient follow-up [30]. AI technologies are used to analyze patient symptoms via smartphone applications, assess vital signs, and even provide initial consultations before hospital admission [31]. Mehta S.'s study (2025) discussed how artificial intelligence (AI) can monitor the nutritional status of individuals with malnutrition or chronic illness, particularly in resource-limited countries, integrating remote care with public health and prevention. AI can improve the management of big data, including automating data entry and medical reporting, and identifying hidden patterns in health data to improve disease prediction [32]. It also enhances operational efficiency and reduces administrative errors [2]. The study "Generative AI Use in Healthcare: Opportunities for Clinical Excellence and Administrative Efficiency" (2025) highlighted that generative AI applications can reduce the time spent on medical records by up to 40%, allowing medical staff to focus more on clinical care. Artificial intelligence (AI) extends its role to public health, such as combating malnutrition and famine in low-resource countries [33]. This includes analyzing agricultural, nutritional, and satellite data to predict potential famine zones and monitoring children's growth and weight indicators to identify those most vulnerable to malnutrition. A study published in the journal Nutrients (MDPI, 2024) discussed the development of a machine learning model that integrates climate and economic data to predict food crises [34]. AI is used to accelerate drug discovery and analyze clinical trial results. This includes predicting new active molecules based on molecular databases, more accurately identifying suitable patients for clinical trials, and reducing the time and cost required to develop new drugs while improving safety [35]. These examples demonstrate that artificial intelligence is now present in all aspects of healthcare, from diagnosis to prevention, from management to public health, and even food security. It is not only supporting medical staff, but also improving access to care in low-resource countries and reducing global health disparities.

5. Challenges and Risks

Despite significant advancements in artificial intelligence (AI) applications in healthcare, this technology faces several challenges and risks that impact its reliability and effectiveness, requiring integrated regulatory and technical solutions [36]. Most AI technologies rely on massive amounts of medical data, including patient records, medical images, and nutritional and genetic data [37]. This data is highly sensitive, raising concerns about its potential for leakage or misuse. Recent studies indicate the need for a robust governance framework to ensure data protection, such as the study on integrating generative AI in hospitals (Reddy, 2024). AI models can reflect biases present in training data, leading to unfair decisions affecting

certain population groups [38]. For example, models for predicting malnutrition or distributing food resources in low-resource countries may marginalize certain communities if the data is incomplete or biased. While some algorithms may be accurate, the final medical decision should remain with the physician. Recent studies, such as Waldock et al., highlight this point. (2024) showed that large language models perform well in theoretical exams but are limited in complex clinical reasoning. AI technologies require powerful computing, large data storage, and advanced digital infrastructure [39]. In low-resource countries, this presents a significant obstacle to AI applications in healthcare, nutrition, and famine prevention [40]. The emergence of AI in medical decision-making raises ethical questions: Who is responsible for errors? How can fairness and equality be ensured? Clear regulatory policies and internationally standardized ethical guidelines are needed to ensure the safe and effective use of AI in medicine. Despite the challenges, the future of AI in healthcare points to broad prospects for innovation and improvement, with a focus on integrating different technologies and expanding preventative applications. There is a growing need for AI decisions to be transparent and understandable to both clinicians and patients [41]. Explanatory systems help build trust and reduce errors resulting from misinterpretation of results. Integrating AI with genetic, nutritional, and behavioral data enables the design of personalized treatments for each patient, with more accurate predictions of therapeutic response [42]. For example, Mehta's 2025 study on micronutrition using AI demonstrates how malnutrition risks can be predicted and prevention plans improved. AI is also being used to monitor food crises and famines by analyzing data on agriculture, climate, poverty, and public health. These models can predict risk areas, allocate resources, and mitigate the impact of famines on the most vulnerable populations [43]. MDPI's 2024 study highlighted the role of AI in predicting malnutrition and improving food resource distribution. Hybrid systems that combine deep learning, generative models, and predictive analytics to deliver comprehensive and intelligent healthcare are the scientific cornerstone of today's world. These systems can operate at all levels—diagnosis, treatment, management, prevention, and nutrition—thus promoting the concept of integrated, AI-powered healthcare.

6. Conclusion

This research highlights the growing role of artificial intelligence (AI) as a pivotal element in reshaping healthcare across all levels, from medical diagnosis and image analysis to clinical decision support, and extending to public health and the fight against malnutrition and famine. Recent evidence demonstrates that integrating technologies such as big language models, deep learning, and generative models offers significant potential for improving diagnostic accuracy, personalized treatment, and enhanced efficiency in healthcare institutions. However, a balanced approach to AI and human medical expertise, along with ensuring data privacy, addressing bias, and developing clear regulatory and ethical policies, remains crucial for the safe and effective use of these technologies. Looking ahead, current trends suggest that smart healthcare will become more integrated, proactive, and personalized, with greater capacity to predict diseases, improve prevention, and sustainably manage healthcare resources. Therefore, AI is not merely a technological tool, but a strategic pillar for building an advanced healthcare system capable of addressing global health challenges and delivering high-quality healthcare services for all.

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