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Unveiling ChatGPT's Potential across Biomedicine and Patient Care: From Text to Treatment

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Abstract: Nowadays, cutting-edge Artificial intelligence systems demonstrate exceptional capabilities in comprehending, generating, and manipulate human language, ushering in a new era of understanding, collaboration, and innovation. This systematic review explores the varied applications of ChatGPT within the realm of biomedicine and patient care, aiming to uncover its potential in transforming textual information into actionable insights for improved healthcare outcomes. To conduct this study, we followed PRISMA guidelines that specifically pertain to systematic reviews by targeting two dataset sources "Google Scholar" and "PubMed" and by using the keywords "Chatgpt, Biomedicine, and Health care". According to our literature surveys conducted from January 2021 to January 2024, we introduce ChatGPT, as a powerful language model, implicated in various tasks, such as interpreting medical literature, extracting meaningful patterns from vast datasets, and enhancing communication between healthcare professionals. It also investigates the model's ability to assist in clinical decision-making, generating hypotheses, and facilitating personalized treatment plans. However, the integration of ChatGPT into healthcare frameworks may bridge ethical concerns, and potential obstacles such as data privacy, bias, hallucination, and interpretability, emphasizing the need for responsible implementation to ensure patient safety and data security.

Keywords: ChatGPT; AI; Language; Model; Biomedicine, Prisma.

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Graphical Abstract

1. Introduction

Over the past few years, the landscape of biomedicine and healthcare has experienced a profound and dynamic transformation, driven by the rapid emergence and integration of cutting-edge technologies. Among this wave of innovations, several Large Language Models like ChatGPT have benefited from considerable attention and acclaim. These AI-powered marvels have swiftly asserted their indispensability in reshaping numerous facets of biomedicine and healthcare, transcending traditional boundaries to encompass realms as diverse as research, diagnostics, patient care, and education(Chakrabarti, 2000; Potapenko et al., 2023).

Unveiling the Boundless Potential of Language Models in Biomedicine, with an extraordinary ability to comprehend and generate human-like text. ChatGPT and its counterparts have unveiled unparalleled versatility within the domain of biomedicine(Ray, 2023). These models undergo rigorous training on extensive repositories of medical literature, research documents, clinical annotations, and patient records, endowing them with the capacity to offer invaluable support to researchers and medical practitioners across an expansive spectrum of tasks(Potapenko et al., 2023).

The exponential proliferation of biomedical data, spanning from intricate clinical notes, and research literature to the extensive drug databases, has catalyzed an urgent demand for more sophisticated and efficient methodologies of information extraction, synthesis, and interpretation. In this context, the ascendancy of substantial language models, meticulously trained on extensive textual datasets, emerges as a promising solution, empowering automated text analysis, nuanced semantic comprehension, and contextually driven reasoning. Harnessing the potent capabilities inherent to these models, researchers and healthcare providers stand poised to unlock novel avenues for knowledge discovery, evidence-based decision support, and elevated standards of patient care(Manasi, Pranav, & Prakash, 2023).

The Fusion of Large Language Models with the biomedical domain augurs a transformative odyssey that traverses a wide spectrum of applications. From offering invaluable assistance to researchers engaged in literature reviews to augmenting diagnostic precision and elevating the quality of patient

care, these AI-powered tools are actively recalibrating the contours of the healthcare panorama (Yang et al., 2023). As technological advancements surge forward and ethical frameworks continue to evolve, the synergistic collaboration between AI and medical professionals portends the potential to revolutionize the quick delivery of healthcare, ultimately culminating in enhanced global patient outcomes. It is against this backdrop that our systematic review embarks on a comprehensive expedition, meticulously navigating the contemporary of integrating ChatGPT and its analogous large language models within the intricate tapestry of biomedicine and health contexts (from diagnosis to scientific research). Through a meticulous synthesis of existing research and a critical evaluation of the implications, this review seeks to shed light on the multifaceted implications, potentials, and challenges that underlie this transformative symbiosis.

2. Methodology

2.1. Research protocol according PRISMA models

To carry on this investigation, adherence to meticulous rules and transparent reporting standards was ensured, following the protocol of Preferred Reporting Standards for Systematic Reviews or PRISMA. Employing the PRISMA framework guarantees the highest level of quality and transparency in reporting. This research methodology is described and illustrated in the flowchart (Figure 1). For this systematic review centered on the utilization of ChatGPT and large language models in the biomedicine domain, a rigorous and systematic search approach was adopted to comprehensively cover pertinent literature. The search was carried out by using "Google Scholar" as a unique source of this study, utilizing a combination of carefully selected keywords and controlled vocabulary terms. The search criteria encompassed variations of terms relating to "ChatGPT," "large language models," "biomedicine," "healthcare," and "medical applications."

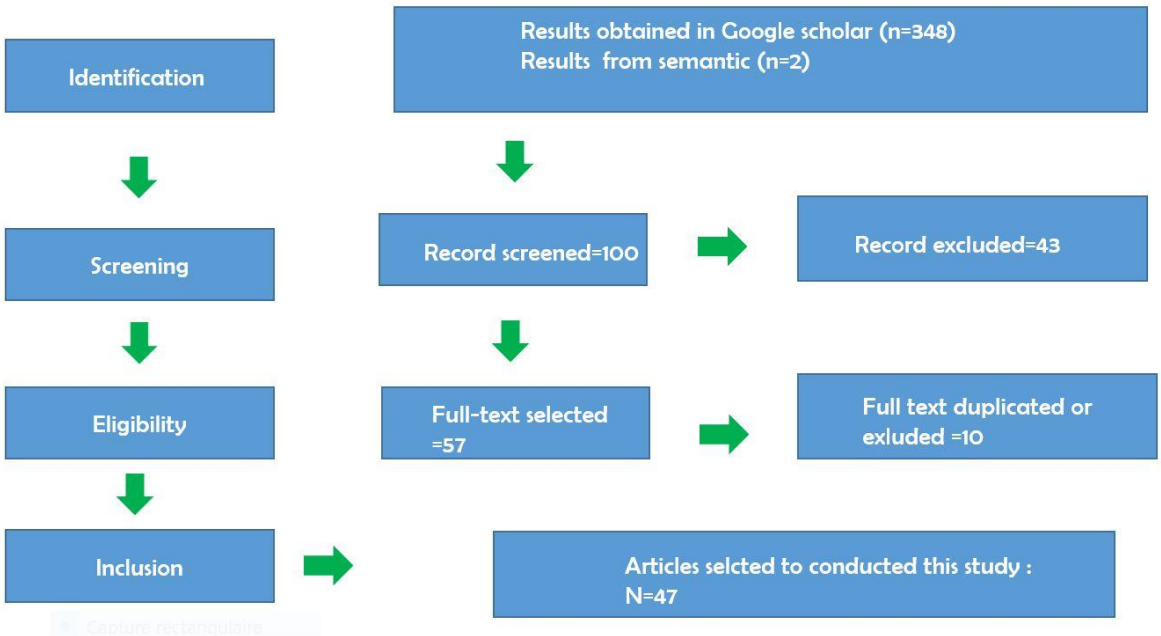

Figure 1. Flowchart of the record selection process based on PRIMSA guidelines.

2.2. Selection *criteria*

As mentioned above, we used the Preferred Reporting Items devoted to work on Systematic Reviews [6, 7]. The database Google Scholar is considered the sole origin for identifying potential publications. When searching Google Scholar, filters were applied to narrow down results to articles ordered by relevance and published from January 2022 to March 2024. Our search explored the applications of ChatGPT within different medical domains (such as surgery, research, nuclear medicine, radiology, healthcare, education, etc.), to achieve our goal we used the keywords "chatgpt applications in biomedicine". We reviewed just indexed articles and wrote in English, our screening included all categories: original, review, mini-review, systematic review, and letters to the editor .

2.3. Extraction and analysis of data

The selection process comprised two distinct phases. Initially, three reviewers (A.B., S.F, and D.H.) analyzed the titles and abstracts of screened papers. Subsequently, another set of three reviewers (B.L, C.I, and El.A) conducted a comprehensive examination of the entire texts of the selected articles to investigate their eligibility. The third author (El.M) addressed all inconsistencies between the two groups of reviewers.. Following this strategy, three reviewers (A.B., S.F, and D.H.) evaluated the content of the included publications to gauge their suitability for inclusion in the study. Any disagreements between these reviewers were resolved through consensus. In cases where disagreements persisted, a third reviewer (El.M) was consulted for resolution.

Duplicate records were managed using the Zotero web tool, with two independent reviewers (A.B and S.S). Any challenges encountered throughout this procedure were addressed through dialogue with an additional reviewer (D.R). The quantity of records obtained and evaluated at every phase was recorded in a PRISMA flow chart, which was prepared to illustrate the progression of the selection process. It is noteworthy that all reviewers involved in this endeavor possess adequate training and expertise in systematic review methodologies. Finally,

Data analysis was done by three reviewers (A.B, El. A,C.I, and B.L) and reported in the results part of this paper. However, ChatGPT a pivotal part in the examination of the selected records and the composition of this manuscript. The title of this paper and our research highlighted have been also proposed by chatGPT. Each article's detailed summary reported in Table 1, was crafted with the complementary software "ChatPDF" (developed by OpenAI, California, USA, accessible at https://www.chatpdf.com/).

2.4. Methodology Limits

Our systematic review of ChatGPT is subject to limitations, including language biases, as our search may exclude relevant articles published in languages other than English; incorporating multilingual search terms could have mitigated this limitation. Additionally, variations such as "OpenAI’s language model" or "GPT-4" might have captured a more diverse range of studies. Moreover, Our research excludes articles pertaining to other fields such as "education". Furthermore, the assessment of quality assessment has not been proceeded.

3. Results and Discussion

3.1. Literature screening

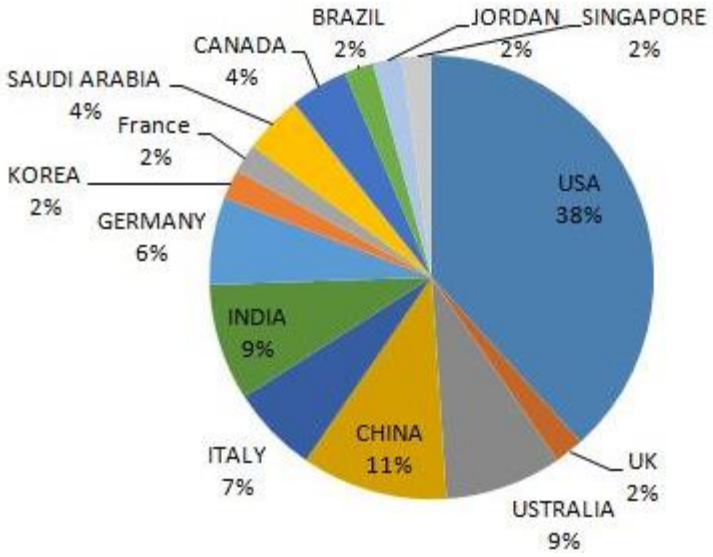

Figure 2. The main Classification of the studied papers

Figure 2 illustrates that most of the articles analyzed were authored by researchers based in the United States (38%), with China (11%), Australia (9%), India (9%), Italy (7%), and Germany (7%) following suit. Conversely, Figure 4 depicts that 45 out of 47 articles (96.29%) were published in indexed journals, while two were released as eBooks (3.7%).

The search criteria encompassed variations of terms relating to "ChatGPT," "large language models," "biomedicine," "healthcare," and "medical applications."

Only English-language studies were considered. This research strategy aimed to uncover a comprehensive array of studies shedding light on the present landscape, potential advantages, challenges, and ethical considerations tied to integrating ChatGPT language in the realm of biomedicine area.

The designated timeframe for publication extended from March 2023 to March 2024. Despite using various databases, only a few articles were initially found. Therefore, a targeted search for titles containing "ChatGPT" was carried out using Google Scholar within the same timeframe mentioned in the document. This method helped uncover additional articles that had been overlooked in the initial database search.

3.2. How ChatGPT Performs Across Various Fields?

Examining ChatGPT's performance across diverse biomedical and health domains is pivotal to understanding its capabilities in addressing complex medical queries and assisting healthcare professionals. By compiling outcomes from numerous up-to-date research endeavors, we aim to provide the findings in a summarized format, which can be found in Table 1. This table encapsulates the review of existing literature surveys.

Table 1. The main domains used ChatGPT : from health care to Research area

Author(s)/Year	Title	Domaine Application of ChatGPT	Objectif

Ray 2023	ChatGPT: A comprehensive review of background, applications, key challenges, bias, ethics, limitations, and future scope	Ethics	This review covers ChatGPT's evolution, applications in industries like customer service and healthcare, and challenges such as ethics and biases. Future directions include integration with other technologies and addressing societal disparities. Despite facing controversies, ChatGPT has rapidly garnered attention in both academia and industry, demonstrating its substantial influence and promising potential. (Ray, 2023)
Meyer et al 2023	ChatGPT and large language models in academia: opportunities and challenges	Education	ChatGPT offers academic efficiency improvements by assisting researchers and students in different tasks such as writing, literature review, creating ideas, answering questions, as well as supplying educational materials. But demands ethical scrutiny for bias, and plagiarism prevention(Meyer et al., 2023)
Santandreu-Calonge et al 2023	Can ChatGPT improve communication in hospitals?	Health care	ChatGPT can improve communication in hospitals by aiding in the translation of medical jargon, facilitating clearer explanations for patients, standardizing communication protocols, enhancing coordination among healthcare teams, and potentially offering personalized patient education and support(King, 2023)
Wang et al 2023	Can ChatGPT Write a Good Boolean Query for Systematic Review Literature Search?	Boolean Query	ChatGPT generates precise Boolean searches for systematic reviews by processing user-provided instructions on research questions, inclusion/exclusion criteria, and specific terms, then formulating a query that effectively retrieves relevant literature from databases(S. Wang, Scells, Koopman, & Zuccon, 2023)
Wang et al 2023	Accelerating the integration of ChatGPT and other large-scale AI models into biomedical research and healthcare	Biomedical Research and Healthcare	The integration of ChatGPT and analogous extensive AI models into biomedical research and healthcare through advancements in performance, specialized algorithm creation, efficacy validation, and promotion of collaborations between AI specialists and healthcare practitioners (D.-Q. Wang, Feng, Ye, Zou, & Zheng, 2023)
Parray et al 2023	ChatGPT and global public health: Applications, challenges, ethical considerations, and mitigation strategies	Public health	ChatGPT, designed for healthcare and education, aids in research and material generation, but its potential is tempered by biases, data quality concerns, and the need for critical evaluation, caution in real-time interactions, and adherence to academic integrity standards (Parray et al., 2023)
Sallam et al 2023	The Utility of ChatGPT as an Example of Large Language Models in Healthcare Education, Research and Practice: Systematic Review on the Future Perspectives and Potential Limitations	Education, Research and Healthcare	The aim of the study is to highlight the usefulness, advantages, drawbacks, and considerations associated with implementing ChatGPT in the field of medical and clinical research, emphasizing the need for caution in its adoption and proposing the establishment of ethical code (Sallam, 2023)
Anghelescu et al 2023	PRISMA Systematic Literature Review, including Meta-Analysis vs. Chatbot/GPT (AI) regarding Current Scientific Data on the Main Effects of the Calf Blood Deproteinized Hemoderivative Medicine (Actovegin) in Ischemic Stroke	Biomedicine	This research aims to evaluate the efficacy of Actovegin®/AODEJIN in ischemic stroke treatment by conducting a comprehensive review of recent literature. It employs both traditional and AI-driven search methods, emphasizing the necessity for additional clinical research to confirm its claimed neuroprotective effects(Anghelescu et al., 2023).
Dave et al 2023	ChatGPT in medicine: an overview of its applications, advantages, limitations, prospects, and ethical considerations	Medicine	This work undertakes a thorough investigation of ChatGPT's capabilities in understanding and generating human-like responses, and discusses its diverse medical applications from research assistance to patient support, while also addressing ethical concerns such as copyright issues and the need for transparency in content generated by AI (Dave, Athaluri, & Singh, 2023)

King 2023	The Future of AI in Medicine: A Perspective from a Chatbot	Medicine	This paper is to investigate the feasibility of utilizing an AI-driven chatbot, exemplified by ChatGPT, to co-write or write articles. Also, prospects of IA can play a key role in healthcare, by adopting advanced algorithms and deep learning techniques to analyze medical images for improved diagnosis and treatment planning, as well as by assisting surgeons during complex procedures By advancing the creation of smart surgical robots outfitted with equipped with machine learning algorithms and sensors (King, 2023)
Laudicella et al 2023	ChatGPT in nuclear medicine and radiology: lights and shadows in the AI bionetwork	Nuclear Medicine	ChatGPT could potentially assist in tasks such as interpreting imaging data, summarizing medical literature, educating patients, providing decision support, analyzing data, and generating reports in nuclear medicine(Laudicella et al., 2023).
Jeblick et al 2023	ChatGPT Makes Medicine Easy to Swallow: An Exploratory Case Study on Simplified Radiology Reports	Medicine	ChatGPT start to play a considerable role in the radiology domain by streamlining intricate medical reports, rendering them more comprehensible for patients and enhancing communication within the healthcare sector. Despite its capacity to advance patient-centric care, additional validation is essential to guarantee the precision and dependability of the simplified reports it generates (Jeblick et al., 2023)
Tustumi et al 2023	Future of the language models in healthcare: the role of chatgpt	Healthcare	The objective of this work is to utilize artificial intelligence, particularly through the development of chatbots like ChatGPT, to facilitate the development of evidence-informed clinical practice guidelines while emphasizing their role as supportive tools to enhance, rather than replace, the expertise of healthcare professionals (Tustumi, Andreollo, & Aguilar-Nascimento, 2023)
Lyu et al 2023	Translating radiology reports into plain language using ChatGPT and GPT-4 with prompt learning: results, limitations, and potential	Radiology	The authors collected radiology reports from lung cancer and brain metastase screenings and evaluated ChatGPT's performance based on criteria such as accuracy, completeness, and relevance of suggestions provided. The findings suggest that ChatGPT generally succeeds in this task, achieving high scores and offering relevant suggestions for patient care. However, the model occasionally produces oversimplified or incomplete responses, which can be addressed by providing more detailed prompts (Lyu et al., 2023)
Baumgartner et al 2023	The potential impact of ChatGPT in clinical and translational medicine	Translational medicine	The objective of the paper is to assess the prospective influence of employing ChatGPT in clinical and translational medicine, highlighting its advantages, obstacles, drawbacks, and outlook for the future, within the context of ongoing discussions about AI's role in healthcare (Baumgartner, 2023)
Cascella et al 2023	Evaluating the Feasibility of ChatGPT in Healthcare: An Analysis of Multiple Clinical and Research Scenarios	Healthcare	ChatGPT involves generating medical notes for ICU patients, condensing information from medical research papers, engaging in discussions on public health matters offering precise definitions, and drawing conclusions for abstracts (Cascella, Montomoli, Bellini, & Bignami, 2023)
Ruksakulpiwat et al 2023	Using ChatGPT in Medical Research: Current Status and Future Directions	Medical Research	ChatGPT serves as a valuable resource in the treatment procedure, offering medical guidance, fostering patient-provider communication, and potentially revolutionizing personalized medicine through data-driven treatment strategies. While it may not possess full comprehension of human biology, the strength of ChatGPT rests in its capacity for analysis data, interpret findings, and generate tailored treatment plans to enhance patient outcomes.(Ruksakulpiwat, Kumar, & Ajibade, 2023)
Sakib Shahriar et al 2023	Let's Have a Chat! A Conversation with ChatGPT: Technology,	Application and limits of Chatgpt	In clinical decision support for breast cancer screening, ChatGPT offers text prompts to assess diagnostic responses. ChatGPT received prompts

	Applications, and Limitations		concerning breast cancer screening and was tasked with identifying the optimal imaging procedure for average-risk women. The findings indicated that ChatGPT demonstrated promising performance in this capacity, with an accuracy rate of 88.9% in delivering accurate responses for breast cancer screening (Shahriar & Hayawi, 2023)
Biswas et al 2023	Role of Chat GPT in Public Health	Public Health	ChatGPT supports individuals and communities by furnishing insights into public health matters such as infectious diseases and lifestyle decisions, while elucidating the responsibilities of community health workers. Additionally, it delves into the influence of social and environmental factors on health and provides details about community health programs and services (Biswas, 2023)
Marchandot et al 2023	ChatGPT: the next frontier in academic writing for cardiologists or a pandora's box of ethical dilemmas	Cardiology	This article aimed to explore the wid spread of ChatGPT in varied field, including academic research. It delves into the diverse ways these models can aid researchers, spanning from data analysis and literature reviews to the composition of research papers and the revision of manuscripts. Furthermore, it acknowledges potential drawbacks associated with their use in academic settings, such as concerns regarding accuracy, bias, and ethical issues like plagiarism. Additionally, the article engages with the ongoing discourse among those in charge of journal editing, and publishing regarding the proper acknowledgment of AI tools like ChatGPT in scholarly works, advocating for their inclusion as co-authors or even primary authors in instances where they have significantly contributed to the manuscript's development (Marchandot, Matsushita, Carmona, Trimaille, & Morel, 2023)
Deiana et al 2023	Artificial Intelligence and Public Health: Evaluating ChatGPT Responses to Vaccination Myths and Misconceptions	Public Health: vaccination	The study aimed to determine how ChatGPT could combat misinformation about vaccination provide accurate and pertinent information on vaccination adherence, which has the potential to enhance health literacy and diminish vaccine hesitancy. (Deiana et al., 2023)
Huang et al 2023	Evaluate the accuracy of ChatGPT's responses to diabetes questions and misconceptions	Diabetes and misconceptions diseases	In this study, researchers used internet searches to find common questions and misunderstandings about diabetes. They then presented these questions to ChatGPT, an AI model, and recorded its responses. Professionals in endocrinology independently evaluated the accuracy of these responses on a scale from 0 to 10. This approach aimed to measure ChatGPT's ability to provide accurate information on diabetes-related topics (C. Huang et al., 2023)
Tian et al 2023	Opportunities and Challenges for ChatGPT and Large Language Models in Biomedicine and Health	Biomedicine	This study explores the potential of large language models, like ChatGPT, in biomedicine and health applications, investigating their capacity to revolutionize tasks like biomedical information retrieval and medical education. WhileConsiderable advancement has been achieved in in text generation, challenges remain, including concerns about fabricated information and privacy issues, highlighting the necessity of thoughtful deliberation when incorporating these models into healthcare environments these models into healthcare settings (Tian et al., 2024)
Thapa et al 2023	ChatGPT, Bard, and Large Language Models for Biomedical Research: Opportunities and Pitfalls.	Biomedical Research	This study sought to highlight the influence of Large Language Models such as ChatGPT and Bard on biomedical research., highlighting both their opportunities and challenges, and providing insights into strategies for responsible implementation(Thapa & Adhikari, 2023)
Gala et al 2023	The Utility of Language Models in Cardiology: A Narrative Review of the	Cardiology	Language models present a multitude of advantages within cardiology, covering areas such as medical diagnosis, patient interaction, educational purposes, and

	Benefits and Concerns of ChatGPT-4		research. These benefits have the potential to improve patient results and enrich medical learning. Nevertheless, it's crucial to thoughtfully assess their constraints to guarantee their secure and efficient integration into cardiology practices. (Gala & Makaryus, 2023)
Reddy et al 2023	Evaluating large language models for use in healthcare: A framework for translational value assessment	Healthcare	ChatGPT fulfills a crucial function by providing patients with precise details regarding their medical conditions, available treatments, and suggestions for lifestyle adjustments, thereby enhancing their healthcare experience. For instance, a patient consulting a healthcare chatbot powered by ChatGPT receives personalized and reliable guidance based on their symptoms and medical history (Reddy, 2023)

As reported in Table 1, the integration of ChatGPT into various medical domains has unveiled a multitude of opportunities to transform healthcare practices. ChatGPT's potential applications are vast and promising.

Among the diverse areas where ChatGPT finds application, it plays a significant role in pediatrics by providing parents and caregivers with reliable information regarding child health and development, albeit with concerns about the accuracy of medical advice generated (Lee & Choi, 2023). In radiology and endoscopy, ChatGPT aids in image analysis and report generation, although discussions persist regarding the need for validation by medical professionals (Jeblick et al., 2023; Li et al., 2023; Lyu et al., 2023). Its integration into anesthesiology involves predicting patient responses to anesthesia, potentially leading to safer administration during surgical procedures, yet emphasizing the ongoing importance of human monitoring (Lee & Choi, 2023). In medical education and research, ChatGPT facilitates interactive learning experiences and assists in information retrieval and synthesis (Sallam, 2023; D.-Q. Wang et al., 2023), while caution is advised to ensure critical evaluation of its outputs. Within healthcare administration, ChatGPT streamlines administrative tasks, but concerns linger about depersonalization and maintaining a balance between automation and personalized care. In oncology (Deiana et al., 2023), particularly in glioma treatment, ChatGPT contributes to personalized medicine by aiding in disease prediction and treatment recommendations (Haemmerli et al., 2023), although validation through clinical trials remains crucial (Deiana et al., 2023). Moreover, its effectiveness in providing information on urological cancers underscores the necessity of assessing its precision and reliability as reliance on AI-driven healthcare data increases (Ozgor et al., 2024).

Virtual doctor services facilitated by ChatGPT extend healthcare access but acknowledge limitations in physical examinations (Iftikhar, Iftikhar, & Hanif, 2023), requiring follow-up in-person visits. Ethical considerations arise with AI integration, emphasizing the importance of patient privacy, and data security, and addressing misinformation through continuous monitoring (Dave et al., 2023). In clinical decision-making, ChatGPT offers insights based on medical literature and patient data to improve diagnostic accuracy and treatment planning, yet human expertise remains indispensable. AI-powered tools assist in managing infectious diseases by tracking outbreaks and disseminating preventive measures aligned with public health guidelines (Jeblick et al., 2023). In diabetes care, ChatGPT provides personalized advice, necessitating collaboration with medical professionals for patient safety (C. Huang et al., 2023). In translational medicine, ChatGPT accelerates the translation of research findings (Baumgartner, 2023) but faces challenges in accurately capturing nuanced research conclusions. Lastly, in vaccination strategies, ChatGPT combats misinformation, promoting awareness and education, while emphasizing the importance of tailored responses and open conversations to build trust (Deiana et al., 2023).

3.3. Advantages vs Limitations of ChatGPT

Powered by the impressive GPT-3.5 architecture, ChatGPT introduces a spectrum of advantages and constraints within the realm of AI-driven conversational technology. On the positive front, its capacity To generate text that mimics human language facilitates natural and captivating exchanges, enabling

seamless communication in diverse applications, ranging from customer support to content creation. The model adeptly comprehends context, resulting in consistent and contextually appropriate replies. Furthermore, gaining knowledge from a diverse range array of sources bolsters its knowledge base (Dave et al., 2023). Nevertheless, limitations persist. While ChatGPT shows potential for diverse and intriguing applications, users must be mindful of its current limitations. Although its ability to craft meaningful and conversational sentences is noteworthy, the model can sometimes 'hallucinate' responses, as evidenced by recent research (Alkaissi & McFarlane, 2023). Therefore, it is highly recommended to verify and fact-check responses provided by ChatGPT (S. S. Huang et al., 2023). The deficiencies of the model include mistakes in fundamental reasoning, logical processes, mathematical computations, and the delivery of factual data (Arkoudas, 2023). The GPT-4, anticipated in 2023, is expected to significantly enhance ChatGPT's performance. GPT-3 is made up of 175 billion parameters, howver GPT-4 is projected to have around 100 trillion parameters, suggesting a substantial leap in complexity (Corvalán et al., 2023). Currently, ChatGPT is confined to handle up to 5000 text tokens during processing as input. Although this is suitable for most tasks, it could pose challenges in endeavors like text summarization. Furthermore, the current ChatGPT interface lacks provisions for generating textual representations from visual images and audio files, although their artistic capabilities remain somewhat constrained (Corvalán et al., 2023). Researchers have introduced multi-modal language models capable of perceiving various modalities in response to these limitations offering applications such as image generation from textual prompts (Ray, 2023). ChatGPT has a propensity for verbose and detailed responses unless instructed otherwise. Additionally, it conveys fewer emotions than the average human, tending to maintain objectivity (Dwivedi et al., 2023). Consequently, ChatGPT is incapable of replacing the necessity for human interaction or fulfilling the role of a friend (Rahaman, 2023). Indeed, it is not suitable for personal therapy or counseling, where a real human connection is imperative(Corvalán et al., 2023). Despite its ability to provide information predating September 2021, ChatGPT is not a source for the latest news or as a references (Sanchez-Ramos, Lin, & Romero, 2023). When inquired about recent events, the model responds with a disclaimer about its knowledge limitations beyond September 2021(Guo et al., 2023).

It's crucial to acknowledge that the evolution of AI technologies is ongoing (Kim & Adlof, 2024), potentially altering the landscape of strengths, weaknesses, opportunities, and threats associated with ChatGPT (figure 3). Hence, regular evaluations and improvements are crucial to address its limitations and maximize its potential benefits(Nazir & Wang, 2023; Rice, Crouse, Winter, & Rice, 2024).

Figure 3. Summary of SWOT diagram of chatGpt: Advantages and benefits vs limitations of applications.

3.4. Future perspectives and research directions

ChatGPT's increasing presence across various medical fields brings about complex ethical challenges, highlighting the crucial need for accurate information dissemination. Collaboration between medical experts and technologists is essential to ensure the responsible and secure integration of ChatGPT in medical settings. This integration presents significant opportunities across medical disciplines, demanding a balanced approach that capitalizes on AI's strengths while recognizing its limitations. While AI models like ChatGPT have the potential to enhance efficiency, precision, and accessibility, the foundational principles of medical practice, human judgment, personalized care, and ethical considerations must remain central. Continuous cooperation between AI systems and healthcare professionals is essential to unlock the full potential of AI in medicine while prioritizing patient well-being and care quality.

Conclusion

Our systematic review highlights the significant impact of cutting-edge AI, particularly ChatGPT, on biomedicine and patient care. Using PRISMA guidelines and literature surveys from January 2021 to January 2024, we explore ChatGPT's role in transforming textual data into actionable healthcare insights. ChatGPT enhances medical literature interpretation, pattern recognition in datasets, and professional communication. It also aids clinical decision-making, hypothesis generation, and personalized treatment planning, promoting precision medicine. However, ethical issues like data privacy, bias, and interpretability require careful oversight. Despite its potential, adopting ChatGPT in healthcare necessitates a responsible approach to ensure patient safety and ethical standards.

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Each Author independently conceptualized, collected, and analyzed data, wrote, and reported on this article. ChatGPT was extensively employed, as outlined in the methodology part.

Data availability

Data will be provided upon request by the smart Health editor and reviewers.

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