Advancing Medical AI: Literature Review of Intelligent Assistants in Healthcare Queries

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Abstract

The advanced instrument of AI tools is being utilized in the healthcare industry including nat- ural language processing (NLP), and machine learning (ML), which have backing from the following document frameworks: These frame- works offer a rational approach to reasoning about using and experiencing small scale AI in- novations such as voice control and Media En- tity/LLM at workplaces, including clinical set- tings. New advancement in the field of artificial intelligence is changing the face of healthcare enabling the creation of VHAs that are unin- terrupted, efficient and logged on. VHAs pro- vide help with the identification of the symp- toms' signs, aiding the patient in a variety of decisions including those that involve medical, school nutrition, and general health decisions. With the implementation of semantic interfaces, VHAs mimic 'subjective' communication with the doctors, and the nurses, enhancing the ex- perience of noting down health issues, and pro- moting patient-orientated care. These tools are mainly useful when applied to chronic diseases, in order to decrease clinical personnel loads, and when patient participation is desired and en- couraged, including patient education.

Some LHMs including GPT-4 improve the re- alism and clinical utility of VHAs since they per- form clinical inquiries accurately and coherently. Nevertheless, such confidence has been built on content reliability, service quality, and Copy and Data Protection tendencies that reinforce the necessity of the clear ethical rules and norms. As VHAs assume more roles in clinical mat- ters and routine operations, goal accomplish-

ment would necessitate interdisciplinary collab- oration to achieve VHAs integration that corre- sponds to established professions' norms besides enhancing accountable healthcare delivery thatpatient-consumers expect.

1   Introduction

AI's growing impact on the healthcare sector is receiving appropriate academic and clinical at- tention. At the heart of this process is VHAs as natural language processing will also be ap- plied in patient engagement through conversa- tional AI interfaces. These, and other such vocal interface systems, including Amazon Alexa and Google Assistant, have been developed to offer permanent and unpauseable health care assis- tance. They include symptoms checkup, med- ication advice, and overview of general health information hence lower in-person clinical visits (Zhan et al., 2024). Growing interest in VHAs in healthcare is due to their possible contribution to improvement of access, organization of care, and patient self-management in chronic diseases [12].

This has established that large language mod- els (LLMs) like GPT-4 significantly enhance the capabilities of VHAs, as they are capable of providing accurate and contextually responsive answers to intricate medical questions (Sezgin, 2024). At its core, this advancement offers quite an upgrade to how digital health tools are de- veloped to offer sound,

sensitive, and efficient advice. However, since these innovation trends bring several opportunities, several factors, such as, reliability, service delivery, and data security,

need to be explored because they have a signifi- cant impact on usage behaviour and acceptance (Chan et al., 2023; Zhan et al., 2024). This research therefore seeks to assess these dimen- sions by analysing the proficiency, implementa- tion barriers, and effectiveness of implementing LLM-supported VHAs within clinical and administrative practice.[17, 16].

The relevance of this inquiry lies in aligning technological advancements with healthcare de- livery, ensuring that VHAs are safe, trusted, and seamlessly incorporated into existing sys- tems. By examining the factors that affect trust in these AI-driven solutions, this research ad- dresses critical questions at the intersection of healthcare informatics, user experience, and eth- ical technology integration [20]. Methods in- volved reviewing recent simulation studies and structured models assessing functional, per- sonal, and risk factors influencing VHA trust and efficacy. This exploration informs potential pathways for interdisciplinary collaboration, set- ting a foundation for improved AI implementa-tion in healthcare and patient-centric outcomes.

2   Background & Significance

The constant addition of different layers to healthcare delivery, the growing expectations of patients, coupled with longstanding staff defi- ciencies is set to continue as a challenge for healthcare systems globally. The key general re- search question that has been answered in the present work concerns the lack of effective in- teraction between the patient and the provider, as well as excessive paperwork and bureaucracy experienced by healthcare workers. This study aims at evaluating how VAs can help improve patient satisfaction, reduce clinical tasks and thereby increase patient benefits [8].

Consequently, the intention of the present re- search is to discuss voice AI and its role in the modification of patients' experience within the healthcare sector. In contrast with common means of communication, voice AI has features of constant and simultaneous help, thus helping both, patients and clinicians [17, 13]. This re- search is relevant at a time that healthcare facil- ities embark on the quest of sourcing for ways in which they can ease the pressure on the medical workforce while enhancing patient experiences.

The argument for this study lies in the grow- ing need to come up with strategies that would help to reduce the invasion of the administrative burden on clients while at the same time contin- ues to provide patients with accurate and timely health information. The critical "So What?" question addresses why this study is essential: as healthcare systems are under pressure, voice AI can reduce the number of people attending clin- ics and bring down the organizational expenses while increasing the satisfaction levels[10]. The purpose of this research is to demonstrate that the implementation of AI voice solutions can have a tremendously positive impact on health-care services.

The major issues this research intends to ad-dress include:

- How can voice assistants effectively handle patient-related questions?

- What impact do voice AI technologies have on clinical workflows and provider effi- ciency?

- How can first-time and long-term patients be empowered through the use of voice AI?

This study builds upon prior work that has demonstrated the efficiency of AI in improving healthcare operations. However, it goes fur- ther by deepening the understanding of voice AI applications in real-life conditions. While pre- vious studies have highlighted the potential of voice AI to reduce the burden of documenta- tion and associated tasks, detailed discussions on its functional benefits and patient outcomes remain scarce. In terms of methodology, this research will involve a systematic review and meta-synthesis of published literature related to voice AI in healthcare. The sources will include peer-reviewed studies, case reports, and indus- try evaluations of existing and successful imple- mentations. These resources will aid in under- standing how voice AI can be utilized to increase efficiency, enhance patient engagement, and im- prove clinical documentation [4].

Additionally, expert opinions and interviews with healthcare practitioners will be incorpo- rated to gain first-hand insights into the chal- lenges and benefits observed in practice[20]. The scope of this study will focus on the use of

voice AI in outpatient services and chronic dis- ease management. Inpatient care scenarios, where different clinical dynamics may apply, will be excluded to maintain a clear focus. Key terms, such as "voice-enabled electronic health records" and "patient engagement," will be de- fined to ensure consistency and clarity through- out the research.By addressing these elements, this research aims to provide valuable insights for healthcare practitioners into the potential of voice AI for improving the quality of care and shaping a progressive path for future develop- ments. Moreover, the findings could inform pol- icy recommendations and guide future techno- logical advancements, fostering a robust frame- work for responsible and effective integration of voice AI in healthcare systems.

3   Related Work

Thus, before proceeding to the presentation of the results of this research, it is pertinent to re- view the most significant sources that broach the issue of ethical concerns of Artificial Intelligence in healthcare. This review will aid in grounding current research, propose future research direc- tions, and indicate some of the commonly used approaches employed to address such problems, thereby demonstrating an extension and contri- bution of this study.

Among these, one paper from International Transactions on Education Technology (ITEE) emphasizes the importance of ethic input in health care AI personal assistants. To test the moderating effects four different indepen- dent variables on the ethical dimensions of these AI systems, the authors used an analytical tool called SmartPLS, or Partial Least Squares Structural Equation Modeling [7]. This method allowed quantifying the direct correlation be- tween a specific approach based on the ratings of key factors and the results achieved, thus under- lining the role of ethics as one of the first pillars in creating AI. From such findings, the study concludes that even though there is increased awareness of the ethical issues in AI healthcare tools, there are still various other aspects that needs further investigation.[18]

Furthermore, this paper calls for the creation of a framework or a guide on how to ethic or how to put ethics into AI practice in the practi- cal sense by the actual AI developers. It could also solve various problems like privacy, preju- dice in algorithms, or the absence of transpar- ent rules that dictate work with the AI systems, so pathologists expect. These practical implica- tions stress the continued value of formulating rules for the practical application of ethical AI in future health care environments.

4   Theoretical Framework

The use of AI tools in healthcare and partic- ularly by means of natural language processing (NLP) and machine learning (ML) in healthcare is supported by several key document frame- works. These frameworks give logical perception into the assimilation, usage, and effects of AI ad- vance voice command and Media Entity/LLM in careful work environment.

•   Technology Acceptance Model (TAM): In- corporating the findings highlighted in Yan et al., it is noteworthy that perceived ease of use and perceived usefulness still define approaches to the acceptance of artificial intelligence tools such as, chatbot and vir- tual assistant[19]. TAM is quite applica- ble bearing in mind how practitioners adopt novel forms of innovative LLM-based solu- tions such as ChatGPT. Relatively low in- vestments in the development process can collectively contribute to the general ac- ceptance, especially when complemented by goals that, for instance, reduce time spent on paperwork or improve diagnostic effi- cacy.

•   Health Information Technology (HIT) Adoption Framework: This framework acknowledges organisational, technological and environmental contexts within which AI is implemented in health care systems. AMI critical care cases present cases where LLMs are used for clinical decision making, documentation and doctor-patient con- sultation. This framework can be viewed to accommodate tasks such as improving interpretability and data privacy while avoiding the fresh obstacles characteristic of scalability[15].

• Patient Engagement Theory: It also insists on the active role of the recipient in the provision of their care. LLMs have demon-strated an ability to increase engagement as the system allows for natural expression and reception of information in addition to immediate feedback. For instance, in the avatars specific personality that would suit the user needs it can build trust and open-ness, and which is crucial when such pa-tient is asked to share critical details[19]. Even in sophisticated uses such as Chat-GPT, conversations in the intensive care Unit are humane, and will take less than the human touch when judged by perceived level of compassion.

• Systems Theory: CSCW positions AI within multiple levels of related healthcare systems and is concerned with how AI arte-facts interface both with other technologies and clinical practices, and with patients. For example, LLMs' capacity for dealing with turbulence and backing high-stakes de-cisions in acute care shows their systematic penetration[15].

5   Limitations and Risks

The implementation and analysis of AI-driven tools in healthcare, particularly voice assistants and LLM-based technologies, face several limita-tions and risks. These challenges are critical for understanding the barriers to their widespread adoption and ensuring their effectiveness.

5.1   Access to Information

Access to a comprehensive range of studies is of-ten hindered by subscription-based journals and paywalls. This limitation restricts the availabil-ity of data for analysis and may exclude impor-tant findings from the review process. Efforts to mitigate this include leveraging institutional access and exploring open-access sources such as preprint archives. Such strategies aim to provide a balanced and inclusive overview of the litera-ture [19].

5.2   Publication Bias

There exists a tendency for studies reporting positive outcomes to be more likely published compared to those with negative or inconclu-sive findings. This publication bias can skew the perception of the effectiveness of AI tools, particularly in healthcare settings. To address this issue, a broad range of sources will be in-cluded, aiming to represent diverse perspectives and outcomes. This ensures a comprehensive understanding of the technology's impact [1].

5.3   Rapid Technological Advance-ments

The field of AI and voice technology evolves at a rapid pace, leading to potential obsolescence of older studies. While recent publications are pri-oritized in this review, foundational studies that have shaped the current understanding of these technologies are also included. This dual ap-proach ensures that both historical and cutting-edge perspectives are represented [4].

5.4   Variability in Study Quality

The quality of studies included in the review can vary significantly, impacting the reliabil-ity of conclusions drawn. For instance, studies employing rigorous methodologies and validated datasets are more likely to provide reliable in-sights compared to those with limited or incon-sistent data. A stringent selection process based on predefined criteria will be applied to include only high-quality studies. This ensures the in-tegrity and robustness of the review's findings [19].

5.5   Ethical   and   Interpretability Challenges

Ethical concerns, including patient data privacy, informed consent, and alignment with health-care standards, remain

critical issues in adopting AI technologies. Additionally, LLMs are often described as "black-box" systems, where their decision-making processes lack transparency. Addressing these issues involves ongoing re- search into explainable AI (XAI) and adherenceto ethical guidelines established in medical prac- tice [15, 9].

In summary, while AI voice assistants and LLMs hold significant promise for healthcare, addressing these limitations and risks is essen- tial for their effective and ethical integration into clinical workflows.

5.6   Novel Techniques

The novelty in the applications of AI-based voice assistants used by our team is quite unique com- pared to most methodologies, especially in mon- itoring a patient and chronic disease manage- ment. Non-intrusive remote engagement, send- ing reminders on their medications, and moni- toring of symptoms are all benefits in contrast to earlier research in in-clinic-mediated inter- ventions. This is what makes voice assistants valuable in health care for older patients and those far off-they can provide real-time engage- ment with patients and automatically perform follow-ups. Cognisant of the novelty of the ap- plications, we referenced academic standards to ensure our approach met scholarly expectations. In doing so, we integrated user-centered data outside of conventional clinical settings in a bid to offer new insights on the potential of AI for supporting behavior change and healthcare out- comes [1]. Today, this represents a critical needfor flexible, AI-based solutions within modern healthcare settings.

6   Implications and Consider-ations for Future Work

• **Challenging Frameworks**: The results could challenge the common belief that hu- man interaction is always essential in pa- tient care. Instead, they may suggest that AI can efficiently supplement or even take over some roles.

• **Subsequent Research**: Future research could investigate how AI affects patient out- comes and healthcare costs over time. Stud- ies could also look at the ethical issues in- volved when AI makes healthcare decisions.

• **Practitioner Impact**: For healthcare practitioners, AI could lighten their work- loads, freeing them up to concentrate on more complex cases. This shift could lead to higher-quality care [14].

• **Influence on Interventions**: AI could pave the way for new approaches to engag- ing patients and managing chronic diseases, transforming how healthcare interventionsare carried out [6].

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• **Education and Training**: AI systems could revolutionize medical education by simulating complex clinical scenarios, al- lowing practitioners to improve decision- making skills in a low-risk environment.

• **Bridging Healthcare Gaps**: AI has the potential to address disparities in health- care access by providing services in under- served or remote areas through virtual as-sistants and automated systems.

• **Multilingual Support**: LLMs can break language barriers by offering multilingual support, ensuring patients receive accurate information in their preferred language. [5]

• **Ethical and Social Implications**: Fu- ture research must explore frameworks to mitigate biases and ensure equitable AI de-ployment across diverse populations. [11]

• **Patient Empowerment**: AI-driven as- sistants can empower patients by provid- ing them with detailed and understand-able insights about their health, encourag-ing proactive involvement in their care. [9]

7   Conclusions

This review of the research explains how AI- powered voice assistants have the potential to revolutionize healthcare by improving patient care personalization, efficiency, and accessibil- ity. In order to improve tasks like symptom as- sessment, chronic disease monitoring, and con- sumer engagement outside of clinical settings, VAs make use of cutting-edge NLP and ML tech- nology. In addition to reducing the mounting strain on healthcare professionals, these initia- tives guarantee more consistent and individual- ized patient care.Despite all of the advantages, using VAs in healthcare will undoubtedly raise ethical concerns about patient safety, data se- curity, privacy, and the openness of AI choices. A fundamental prerequisite for these systems is trust, and in order to increase patient and prac- titioner reliance on ethical and secure AI inter- ventions, appropriate ethical frameworks must be in place. Lastly, it highlights the necessity of interdisciplinary cooperation in health care technology, specifically technical-technical and clinical-clinical, in order to optimize all systems to meet patient expectations and professional standards. Through its examination of these in- tricate aspects of AI integration, this study pro- vides fresh perspectives on the creation and ap- plication of voice AI tools in healthcare, paving the way for further research into the long-term impacts of voice AI on patient outcomes, health- care delivery efficiency, and cost-effectiveness. In summary, our work positions speech AI as a useful tool to support healthcare systems in cre- ating a more resilient and patient-focused health ecosystem.

References

[1]   6. leveraging large language models for generating responses to patient messages-a subjective analysis. *Journal of the Ameri- can Medical Informatics Association*, 2024.

[2]   Abhishek Aggarwal, Cheuk Chi Tam, Dezhi Wu, Xiaoming Li, and Shan Qiao. Artificial intelligence–based chatbots for promoting health behavioral changes: Systematic re- view. *J Med Internet Res*, 25:e40789, Feb 2023.

[3]   Elaheh Ahanin, Abu Bakar Sade, and Huam Hon Tat. Applications of artificial in- telligence and voice assistant in healthcare.*International journal of academic research in business social sciences*, 12(12), 2022.

[4]   Sara Bosley and Jeremy Dale. Health- care assistants in general practice: practical and conceptual issues of skill-mix change. *British Journal of General Practice*, 2008.

[5]   Mirko Casu, Sergio Triscari, Sebastiano Battiato, Luca Guarnera, and Pasquale Caponnetto. Ai chatbots for mental health:A scoping review of effectiveness, feasibility,and applications. *Applied Sciences*, 14(13), 2024.

[6]   Alena Ermolina and Victor Tiberius. 1. voice-controlled intelligent personal assis- tants in health care: International delphi study. *Journal of Medical Internet Re- search*, 2021.

[7]   Tomasz Jadczyk, Wojciech Wojakowski, Michal Tendera, Timothy D. Henry, Gre- gory F. Egnaczyk, and Satya Shreenivas.
8. artificial intelligence can improve patient management at the time of a pandemic: The role of voice technology. *Journal of Medical Internet Research*, 2021.

[8]   Rajesh Kumar. 2. revolutionizing patient care: Artificial intelligence applications in nursing. *Asian Journal of Nursing Educa-tion and Research*, 2024.

[9]   Dou Liu, Ying Han, Xiandi Wang, Xiaomei Tan, Di Liu, Guangwu Qian, Kang Li, Dan Pu, and Rong Yin. Evaluating the appli- cation of chatgpt in outpatient triage guid-ance: A comparative study, 2024.

[10]   Maheswata Moharana, Prakash Chandra Maharana, Fahmida Khan, and Subrat Ku- mar Pattanayak. Smart healthcare systemsin combating infectious diseases outbreaks. 2024.

[11]   Ozioma Collins Oguine and Kany- ifeechukwu Jane Oguine. Ai in telemedicine: An appraisal on deep learning-based approaches to virtual diagnostic solutions (vds), 2022.

[12]   David B. Olawade, Aanuoluwapo C. David- Olawade, Ojima Z. Wada, Akinsola J. Asaolu, Temitope Adereni, and Jonathan Ling. Artificial intelligence in healthcare delivery: Prospects and pitfalls. *Journal of Medicine, Surgery, and Public Health*, 3:100108, 2024.

[13]   Emre Sezgin. Redefining virtual assistants in health care: The future with large lan- guage models. *Journal of Medical Internet Research*, 2023.

[14]   A. Shanthini, Chirag Prasad Rao, and
G. Vadivu. Ai bot: An intelligent per- sonal assistant. In A. Pasumpon Pandian, Tomonobu Senjyu, Syed Mohammed Sham- sul Islam, and Haoxiang Wang, editors, *Proceeding of the International Conference on Computer Networks, Big Data and IoT (ICCBI - 2018)*, pages 552–559, Cham, 2020. Springer International Publishing.

[15]   Tongyue Shi, Jun Ma, Zihan Yu, Haowei Xu, Minqi Xiong, Meirong Xiao, Yilin Li, Huiying Zhao, and Guilan Kong. Stochas- tic parrots or icu experts? large language models in critical care medicine: A scoping review, 2024.

[16]   Dhruvitkumar Talati. Virtual health assis- tance – ai-based, 2024.

[17]   Bin Wen, Raquel Norel, Julia Liu, Thad- deus S. Stappenbeck, Farhana Zulkernine, and Huamin Chen.

Leveraging large lan- guage models for patient engagement: Thepower of conversational ai in digital health,2024.

[18]   Jeremy Willson, Asher Nuche, and Riya Widayanti. Ethical considerations in the development of ai-powered healthcare assis-tants. *International Transactions on Edu- cation Technology*, 2024.

[19]   Nicholas Yan and Gil Alterovitz. A general-purpose ai avatar in healthcare, 2024.

[20]   Xiaowei Zhan, Noura Abdi, William Sey- mour, and José M. Such. Healthcare voice ai assistants: Factors influencing trust and intention to use, 2024.