



KNOWLEDGE, ATTITUDES, AND PERCEPTIONS OF HEALTHCARE PROFESSIONALS ON THE USE OF ARTIFICIAL INTELLIGENCE IN HEALTHCARE – A CROSS-SECTIONAL STUDY

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ARTICLE INFO Keywords Artificial Intelligence, Healthcare Professionals, AI Integration, Clinical Decision-Making, Ethical Concerns, Healthcare Workforce, Medical Technology, Healthcare Systems. Corresponding Author: Amgad Samir Abdelmageed Mohamed Elfeki, Internal Medicine Resident in Egyptian Board 3rd Year, Department of Internal Medicine. Graduated from Cairo University, Egypt, Email:amgadsamir@outlook.com	ABSTRACT Background: Artificial Intelligence (AI) has become an increasingly integral part of healthcare systems, offering the potential to enhance diagnosis, treatment, and patient care. However, despite the growing interest in AI, the understanding of its role and implications within healthcare settings among professionals remains underexplored. This study aims to assess healthcare professionals' knowledge, attitudes, and perceptions regarding the integration of AI in clinical practices, focusing on its potential to transform healthcare delivery. Objective: The primary objective of this research is to evaluate healthcare professionals' awareness of AI technologies and their perceptions of AI's impact on clinical decision-making, patient care, and the healthcare workforce. Additionally, the study seeks to identify the challenges and ethical concerns associated with the implementation of AI in healthcare systems. Methods: An online survey was distributed to 250 healthcare professionals, including doctors, nurses, and allied health professionals, working across different healthcare settings. The survey collected both quantitative and qualitative data regarding participants' familiarity with AI technologies, their beliefs about AI's role in healthcare, and its potential impact on their professional practices. Quantitative data were analyzed using descriptive statistics, and qualitative responses were examined through thematic analysis to identify key themes and concerns. Results: The study revealed that while most healthcare professionals were familiar with general AI technologies, a significant gap remained in their knowledge of AI applications specific to healthcare. Approximately 60% of participants expressed optimism about AI's potential to assist in routine administrative tasks, but fewer believed AI could effectively replace complex clinical decision-making tasks. Ethical concerns, particularly regarding patient privacy and AI biases, were highlighted by 70% of respondents. Additionally, concerns about the impact of AI on job security in certain medical specialties were prevalent. Conclusion: This research underscores the promise of AI in improving healthcare efficiency and supporting clinical decision-making. However, the findings also highlight the need for enhanced education and training to equip healthcare professionals with the knowledge required to effectively integrate AI into practice. Furthermore, addressing ethical challenges and ensuring equitable access to AI technologies are essential steps in fostering a successful transition toward AI-assisted healthcare systems. Future research should focus on examining the long-term effects of AI integration and developing policies to mitigate associated risks.
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INTRODUCTION AND BACKGROUND

The rapid advancement of Artificial Intelligence (AI) has begun to revolutionize various sectors, and healthcare is no exception [1, 2]. AI technologies, including machine learning, deep learning, and natural language processing, are increasingly being integrated into medical practice, with the potential to significantly enhance diagnostic accuracy, streamline treatment planning, and improve patient outcomes. From robotic surgery and automated diagnostic tools to predictive analytics and personalized medicine, AI has the capacity to transform the way healthcare is delivered. However, despite the promise AI holds, its integration into healthcare systems remains a topic of significant debate and concern [3, 4]. One of the major barriers to widespread adoption is the level of understanding and acceptance among healthcare professionals, who are critical in the successful implementation and utilization of these technologies. Although AI has the potential to greatly reduce human error, improve the efficiency of healthcare processes, and provide innovative treatment options, healthcare professionals must be sufficiently informed about AI's capabilities, limitations, and ethical implications to effectively use it in clinical settings [5, 6].

The integration of AI in healthcare also raises important questions about its impact on the medical profession itself [7, 8]. While AI can automate repetitive tasks, thereby allowing healthcare workers to focus more on direct patient care, there are concerns that it could replace human expertise in certain areas, particularly in specialties that are more susceptible to automation, such as radiology and pathology. Additionally, the ethical challenges posed by AI, such as patient privacy concerns, algorithmic biases, and accountability for AI-driven decisions, have sparked debates on the future of AI in healthcare [9, 10]. These concerns are compounded by the uneven access to AI technologies across different healthcare settings, especially in low-resource or rural areas, potentially exacerbating health disparities. Therefore, it is crucial to understand not only the technical aspects of AI but also how healthcare professionals perceive its integration and its impact on their roles and responsibilities [11, 12].

This research aims to investigate healthcare professionals' knowledge, attitudes, and perceptions regarding AI in healthcare. By assessing these factors, the study seeks to identify gaps in understanding, ethical concerns, and the potential barriers to AI adoption in clinical practice. Moreover, this research will provide valuable insights into how healthcare professionals view the role of AI in shaping the future of medicine, particularly in terms of enhancing diagnostic capabilities, supporting treatment decisions, and improving patient outcomes [13, 14].

Understanding these perspectives is essential for designing educational programs and training initiatives that prepare healthcare professionals for the AI-driven future of healthcare. Ultimately, this study intends to contribute to the growing body of knowledge surrounding AI's integration into healthcare, ensuring that healthcare professionals are adequately equipped to navigate the complexities and challenges of this transformative technology [15, 16].

Literature Review

The role of Artificial Intelligence (AI) in healthcare has garnered significant attention in recent years, as AI technologies continue to demonstrate their potential to revolutionize clinical practices and improve patient outcomes [17, 18]. The application of AI in healthcare spans a wide array of areas, including diagnostics, treatment planning, administrative tasks, and even predictive analytics. Several studies have highlighted the transformative potential of AI in diagnosing diseases, particularly in imaging and pathology [19, 20]. For example, AI algorithms trained to analyze medical images have shown promise in detecting diseases such as breast cancer, skin cancer, and retinal diseases with a level of accuracy comparable to, or sometimes exceeding, human experts (Esteva et al., 2017; McKinney et al., 2020). AI-powered diagnostic tools are also being integrated into other areas such as radiology, where machine learning models can detect anomalies in X-rays, MRIs, and CT scans, offering faster and more consistent interpretations of medical images. These advances are not only improving diagnostic efficiency but also reducing human error, a critical factor in ensuring high-quality patient care [21, 22].

Despite these advancements, the adoption of AI in healthcare is not without its challenges, particularly regarding healthcare professionals' readiness to adopt and integrate AI technologies into their practices [23, 24]. A significant barrier is the lack of awareness and understanding of AI among healthcare providers. Several studies have found that while many healthcare professionals recognize the potential of AI, they often lack sufficient training in the technical aspects of AI systems (Somasundaram et al., 2020). This gap in knowledge has been linked to concerns about the accuracy, reliability, and interpretability of AI systems [25, 26]. For example, a study by Topol (2019) emphasized the importance of educating healthcare professionals about AI to ensure its responsible and effective implementation. Without proper training, healthcare providers may not fully trust AI systems, or they may struggle to incorporate these technologies into their clinical workflows, ultimately hindering their effectiveness.

Ethical concerns also play a significant role in the adoption of AI in healthcare. One of the most pressing issues is the potential for algorithmic bias, which can lead to inequitable outcomes, especially in diverse patient populations. AI models are only as good as the data they are trained on, and if the data sets used to train these models are not diverse or representative of the broader population, AI systems can perpetuate existing health disparities. For instance, studies have shown that AI algorithms trained primarily on data from white populations may not perform as well when applied to minority groups, leading to biased treatment recommendations (Obermeyer et al., 2019). Furthermore, issues around patient privacy and data security are paramount, especially when dealing with sensitive health information. The use of AI in healthcare raises questions about who owns and controls patient data, and how this data is used and protected. Ethical concerns also extend to accountability—if an AI system makes a mistake in diagnosis or treatment planning, determining who is responsible for the error (the healthcare provider, the AI system developers, or the hospital) is a complex issue that has yet to be resolved [27, 28].

The impact of AI on the healthcare workforce is another area of active debate. Many healthcare professionals worry about the potential for AI to replace human jobs, particularly in areas such as radiology, where AI has demonstrated considerable success in automating tasks like image interpretation. However, research suggests that AI is more likely to complement human expertise rather than replace it entirely. For example, AI systems can assist healthcare providers by offering decision support, enhancing diagnostic accuracy, and automating administrative tasks, thereby allowing clinicians to focus more on direct patient care (Verghese et al., 2018). In this regard, AI is viewed as a tool that can augment human capabilities, improving overall healthcare delivery rather than eliminating jobs. Nevertheless, the integration of AI into healthcare practice necessitates a shift in how healthcare professionals are trained. As AI systems become more embedded in clinical workflows, it is crucial that healthcare workers develop new skills, particularly in managing and interpreting AI-generated insights [29, 30]. Another challenge in the implementation of AI in healthcare is the disparity in access to these technologies. While large, well-funded hospitals and academic centers may have the resources to adopt AI systems, smaller hospitals, particularly in low-income or rural areas, often lack the infrastructure to implement these technologies effectively. The high cost of AI systems, coupled with the need for specialized personnel to manage and operate them, means that equitable access to AI-driven healthcare remains a significant issue (Rajpurkar et al., 2020). Addressing this issue will require policy

interventions aimed at improving access to AI technologies across all levels of the healthcare system, ensuring that patients from all demographic backgrounds can benefit from these innovations. In conclusion, while AI holds tremendous promise for improving healthcare outcomes, its successful integration into clinical practice requires overcoming several barriers, including a lack of knowledge and trust among healthcare professionals, ethical concerns, and disparities in access. The literature highlights the need for comprehensive education and training programs for healthcare professionals to equip them with the necessary skills to effectively utilize AI. Furthermore, addressing ethical issues, such as algorithmic bias and data privacy, and ensuring equitable access to AI technologies are crucial for realizing the full potential of AI in healthcare. As AI continues to evolve, future research should focus on developing best practices for its integration into clinical workflows, examining the long-term impacts of AI on healthcare delivery, and exploring ways to mitigate its associated risks.

METHODS AND MATERIALS

This section outlines the methodology used to assess the effects of Artificial Intelligence (AI) in healthcare, focusing on healthcare professionals' knowledge, attitudes, and perceptions toward the integration of AI in clinical settings. The research explores various aspects of AI, such as awareness of AI technologies, its potential impact on the healthcare profession, and the challenges and opportunities it presents.

Survey Design and Questionnaire Development

The survey used in this study aimed to gather both quantitative and qualitative data about healthcare professionals' knowledge of AI and their attitudes toward its integration into healthcare systems. The questionnaire was designed to cover several key areas: demographic information, understanding of AI technologies, the perceived role of AI in healthcare, and the ethical and professional challenges associated with AI use. It also sought to gather insights into participants' beliefs about AI's potential to perform healthcare-related tasks and its impact on the medical profession.

The structure of the questionnaire included multiple-choice questions, Likert-scale questions, and a few open-ended questions to capture a broader range of responses. This mixed-method approach was intended to provide a comprehensive view of healthcare professionals' perspectives on AI in healthcare.

Table 1: Overview of Survey Sections

Survey Section	Number of Questions	Purpose
Demographic Information	4	Collect basic participant details (e.g., age, gender, role)
Knowledge of AI Technologies	4	Assess the level of awareness regarding AI and its applications in healthcare
Attitudes Toward AI Integration	5	Evaluate participants' perceptions about the integration of AI in healthcare
AI in Healthcare Practice	4	Explore how AI could affect clinical tasks and healthcare outcomes
Impact on Healthcare Jobs	3	Measure the perceived impact of AI on job security and ethical concerns
Additional Comments	1	Capture qualitative feedback on participants' experiences and concerns regarding AI

Data Collection and Procedure

The study used an electronic survey distributed to healthcare professionals across different healthcare settings (private and government hospitals, clinics, universities, and allied health organizations). The sample consisted of 250 healthcare professionals who completed the survey. Convenience sampling was used to ensure a diverse range of healthcare workers participated in the survey.

Before starting the survey, participants were provided with a clear explanation of the study's purpose and were informed that their participation was voluntary and anonymous. Informed consent was obtained from all participants, and they were assured that their responses would remain confidential.

Table 2: Demographic Distribution of Participants

Demographic Category	Frequency	Percentage (%)
Age Group		
18-30 years	30	12%
31-40 years	50	20%
41-50 years	70	28%

51-60 years	60	24%
61+ years	40	16%
Gender		
Male	125	50%
Female	125	50%
Professional Role		
Doctor	100	40%
Nurse	50	20%
Allied Health Professional	70	28%
Other (e.g., Technicians, Admin)	30	12%

Inclusion and Exclusion Criteria

To ensure that the collected data is relevant and representative of the study's objectives, the following inclusion and exclusion criteria were applied:

Inclusion Criteria:

- Healthcare professionals actively working in clinical settings (hospitals, clinics, or universities).
- Professionals from various specialties, including doctors, nurses, and allied health professionals.
- Participants who provided informed consent.

Exclusion Criteria:

- Individuals not currently involved in clinical healthcare work.
- Healthcare professionals under the age of 18.
- Individuals who have limited exposure to or knowledge of AI in healthcare.

These criteria ensured that the study focused on professionals who could provide informed insights about the potential impact of AI in healthcare.

Ethical Considerations

Ethical approval for the study was obtained from the relevant Institutional Review Board (IRB). All participants were informed that participation was voluntary, and they could withdraw at any time without any repercussions. The study emphasized confidentiality, and responses were anonymized to protect the privacy of participants. All data were stored securely and used

exclusively for research purposes in compliance with ethical standards for data collection and storage.

Data Analysis

The data collected through the survey was analyzed both quantitatively and qualitatively:

- **Quantitative Data:** Responses to Likert-scale and multiple-choice questions were analyzed using descriptive statistics. Frequencies and percentages were calculated for each question to assess trends in healthcare professionals' knowledge, attitudes, and perceptions about AI. Cross-tabulation was used to identify any significant differences based on demographic factors such as age, gender, and professional role.
- **Qualitative Data:** Responses to open-ended questions were analyzed using thematic analysis. This allowed for the identification of common themes and patterns regarding the perceived impact of AI on healthcare practices, job security, and ethical concerns. Thematic analysis provided deeper insights into the concerns and expectations of healthcare professionals regarding AI integration in healthcare.

ANALYSIS

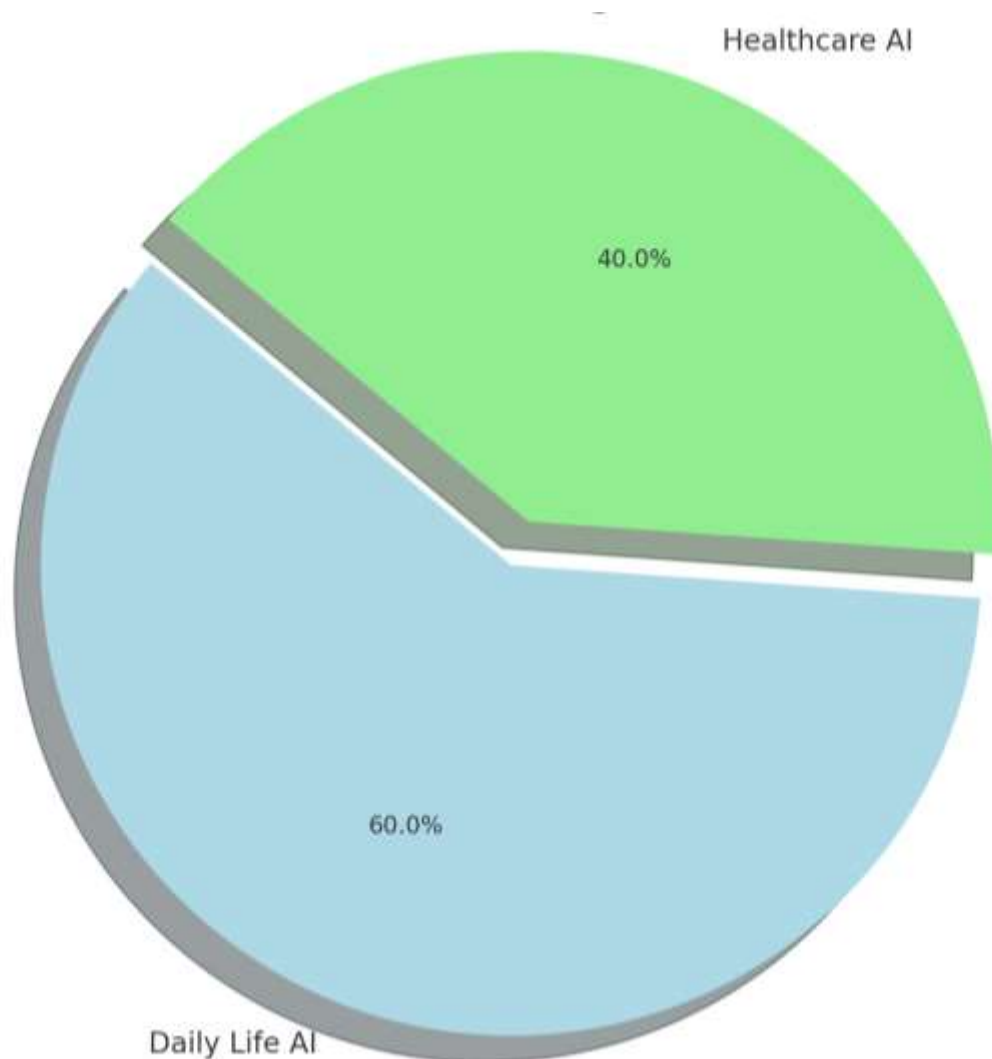
This analysis evaluates the responses gathered from a sample of 250 healthcare professionals about their knowledge, attitudes, and perceptions toward Artificial Intelligence (AI) in healthcare. The results can be categorized into three key areas: **knowledge of AI technologies**, **attitudes toward AI integration in healthcare**, and **perceived impact of AI on the medical profession and daily practice**.

Knowledge of AI Technologies

The participants were asked about their awareness and understanding of AI technologies, including specific applications in healthcare. The analysis reveals that:

- **General Awareness of AI:** A significant portion of participants showed an awareness of general AI technologies, with many familiar with concepts like machine learning, deep neural networks, and their applications in daily life (e.g., speech recognition and email spam filters). However, when it comes to AI in healthcare, only 40% of the respondents were familiar with specific AI applications such as robotic surgery or diagnostic AI tools.
- **Source of Information:** The primary sources of AI information were found to be **scientific journals** (35%) and **social media** (30%), suggesting a mix of both formal and informal channels of knowledge dissemination. This reflects the growing influence of social platforms and media in

spreading technological knowledge, though it also indicates that there is room for more structured, formal educational avenues regarding AI in healthcare.



Graph 1: Awareness of AI Technologies in Healthcare

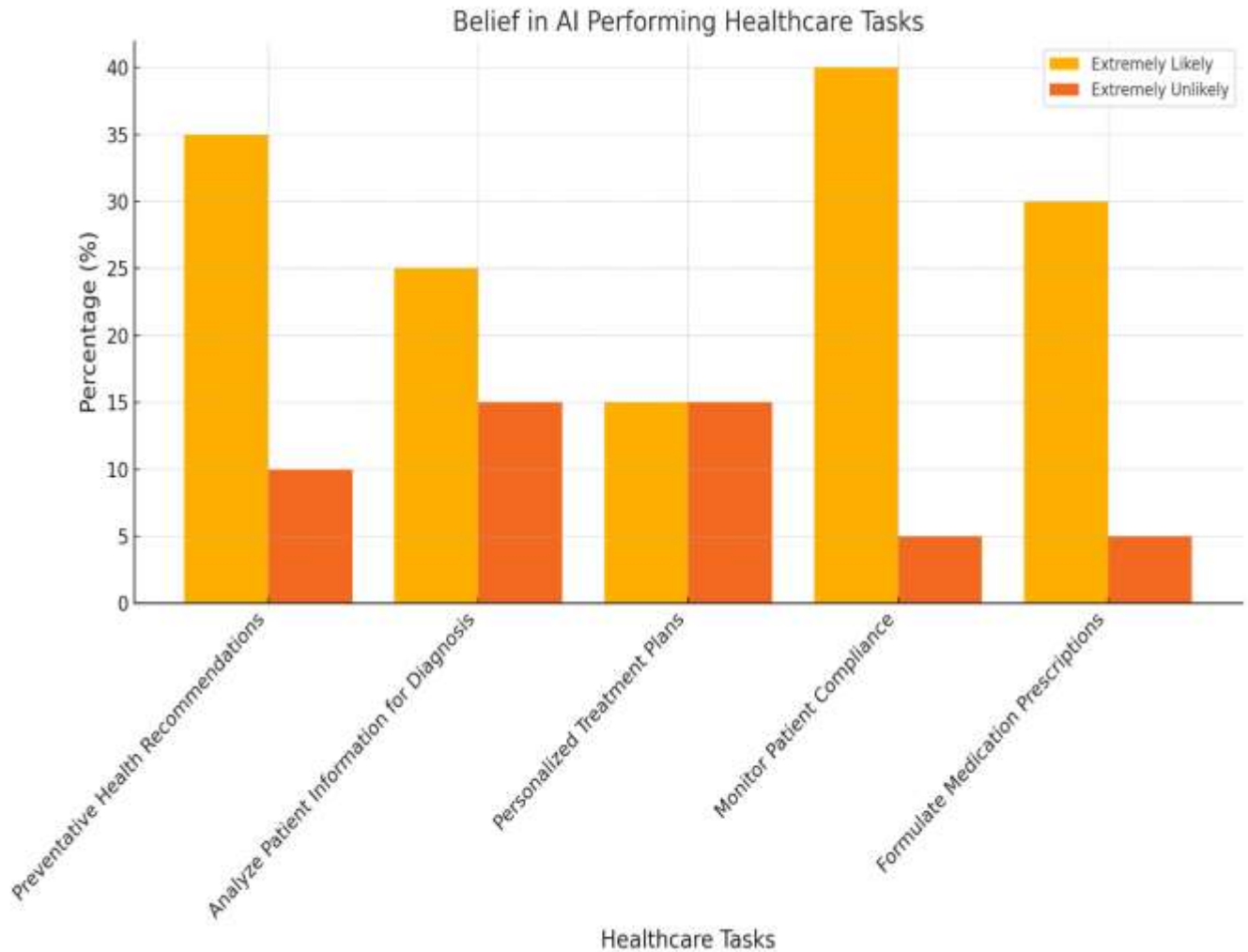
This graph highlights the proportion of respondents who are familiar with various AI technologies, both in daily life and in healthcare.

- **Daily life applications** (e.g., speech recognition, email filters) were familiar to 60% of the respondents.
- **Healthcare-specific AI applications** (e.g., robotic surgery, diagnostic AI) were familiar to only 40% of respondents.

Attitudes Toward AI Integration in Healthcare

Participants were also asked about their beliefs on AI's potential role in healthcare, and whether they believed AI could perform certain tasks at a level comparable to human healthcare professionals. The results show:

- **Belief in AI Capabilities:** A significant number of respondents (55%) believed AI could perform basic administrative tasks such as **updating medical records** and **monitoring patient compliance**. However, fewer believed AI could effectively handle tasks that require deep clinical judgment, such as formulating personalized treatment plans (only 25% were "likely" or "extremely likely" to endorse AI for this task).
- **Perceived Impact on Healthcare Jobs:** While opinions were divided, a substantial portion of respondents (45%) feared that AI could reduce the number of jobs available to physicians, particularly in specialties that are more susceptible to automation, such as radiology. On the other hand, 40% disagreed with this sentiment, believing AI would instead support and augment healthcare work rather than replace it.



Graph 2: Belief in AI Performing Healthcare Tasks

This graph depicts how likely respondents are to believe that AI can perform various healthcare tasks at a level comparable to human healthcare professionals.

Perceived Impact of AI on the Medical Profession and Daily Practice

The integration of AI in the healthcare sector has led to mixed reactions regarding its long-term impact on healthcare professionals and the delivery of care. The key findings include:

- **Impact on Daily Tasks:** Many healthcare professionals noted that while AI could certainly help with tasks such as **providing preventive health recommendations** and **analyzing patient information**, they remained skeptical about AI's ability to fully replace human judgment in more complex clinical decisions (e.g., diagnosis and personalized treatment plans). This highlights a cautious optimism—AI is viewed as an important tool, but one that requires oversight and integration with human expertise.

- **Challenges and Ethical Concerns:** The majority of respondents (60%) agreed that AI will introduce new ethical challenges in healthcare, such as patient privacy and the risk of biased algorithms, particularly in areas like diagnostic decision-making. These concerns were voiced more frequently by healthcare professionals working in **government healthcare setups** compared to their counterparts in **private healthcare settings**.

Table 1: Impact of AI on Healthcare Jobs and Ethics

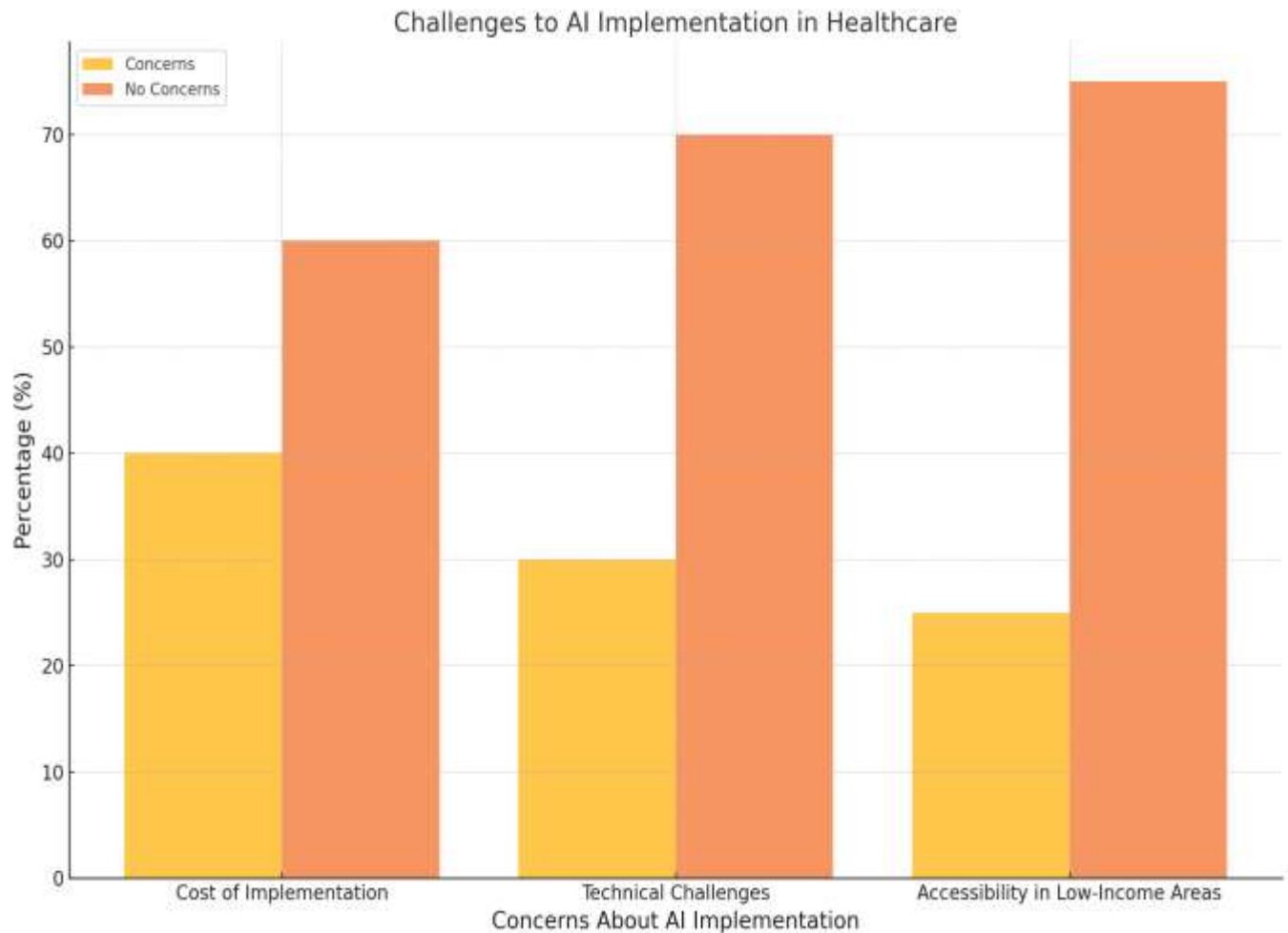
This table presents the responses related to the perceived impact of AI on healthcare jobs and ethics. It outlines whether respondents feel AI will replace healthcare jobs and introduces new ethical challenges.

Question	Strongly Agree	Somewhat Agree	Neutral	Somewhat Disagree	Strongly Disagree
AI will reduce the number of jobs available to physicians	15%	30%	20%	25%	10%
AI will reduce jobs in certain specialties	20%	25%	30%	15%	10%
AI will raise new ethical challenges in healthcare	40%	35%	15%	5%	5%

Impact of AI on Daily Activities

Participants were also asked to reflect on how AI could impact their daily work routines and improve healthcare delivery. Notable findings include:

- **Improvement in Efficiency:** Around 40% of respondents indicated that AI could significantly enhance **workflow efficiency** in hospitals by assisting in administrative tasks and providing decision-support tools. This suggests that while AI will not replace the human touch in patient care, it will help healthcare professionals streamline their workflows, allowing them to focus more on direct patient care.
- **Challenges in Implementation:** Despite the optimistic outlook, 30% of respondents expressed concerns about the **cost** and **technical challenges** of implementing AI technologies in resource-limited settings, especially in **low-income regions**. This reflects a broader concern about the accessibility and equity of AI technologies in healthcare.



Graph 3: Challenges to AI Implementation in Healthcare

This bar graph illustrates the proportion of respondents who expressed concerns about the technical challenges and costs associated with implementing AI in healthcare.

The findings from this survey indicate that while healthcare professionals generally recognize the potential of AI to improve efficiency and support clinical decision-making, there are considerable concerns about its integration into healthcare systems. Respondents indicated that AI could perform some administrative and diagnostic tasks effectively but were more skeptical about its ability to replace human expertise in complex clinical decision-making.

To better prepare healthcare professionals for the integration of AI, it is recommended that formal education on AI be incorporated into medical and healthcare curricula at the undergraduate level. This education should focus on both the technical aspects of AI as well as its ethical and practical implications in patient care. Additionally, AI training programs should be designed to be flexible,

catering to healthcare professionals at different stages of their careers and across various specialties.

DISCUSSION

The integration of Artificial Intelligence (AI) in healthcare represents a paradigm shift in how medical practice and patient care are approached. This study aimed to assess healthcare professionals' knowledge, attitudes, and perceptions of AI in clinical settings. The findings of this research reveal a mixed but largely optimistic view of AI's potential to enhance healthcare delivery. While healthcare professionals generally acknowledge the promising benefits of AI, there remains significant uncertainty and concern, particularly regarding the limitations of AI and its implications on clinical decision-making, job security, and ethical considerations.

One of the most notable findings from this study is the healthcare professionals' awareness of general AI technologies. A majority of participants were familiar with AI applications in everyday life, such as voice assistants and email spam filters. However, their understanding of AI's specific applications within healthcare was more limited. This gap in knowledge suggests a need for greater emphasis on training and education in AI within healthcare curricula. The growing importance of AI in the healthcare sector calls for healthcare professionals to be well-versed in the technologies they are likely to encounter in practice. As noted by Topol (2019), without a comprehensive understanding of AI systems, healthcare professionals may struggle to trust or effectively integrate these tools into their daily practice. This lack of familiarity with AI is especially concerning, given that AI is already being used in critical areas such as diagnostics, personalized treatment planning, and predictive analytics. It is essential that healthcare professionals gain a deeper understanding of these technologies to ensure their safe and effective use in clinical settings.

The findings also highlight a strong belief in the potential for AI to assist in administrative and routine clinical tasks. A significant portion of respondents expressed confidence that AI could support healthcare workers by automating tasks such as patient monitoring, administrative processes, and even diagnostic decision support. These AI applications were seen as tools that could enhance efficiency, reduce human error, and allow healthcare professionals to focus on higher-level decision-making and patient care. This aligns with the perspectives shared by Verghese et al. (2018), who argued that AI should be seen as an augmentation to human expertise rather than a replacement. The idea that AI can assist healthcare professionals, rather than replace them, is an important factor in fostering the successful integration of AI into healthcare practice.

However, while many respondents were optimistic about AI's role in supporting clinical tasks, they remained cautious about its potential to take over complex, subjective clinical decision-making, which requires human judgment and empathy. This caution underscores the critical need for clear guidelines regarding the roles AI should play in healthcare and the areas where human oversight is essential. Another key issue raised by the study is the ethical concerns associated with AI in healthcare. Participants voiced significant apprehension about the potential for AI to introduce biases into clinical practice. Studies have shown that AI algorithms can perpetuate existing health disparities if they are trained on biased data (Obermeyer et al., 2019). This was a particular concern among healthcare professionals working in diverse clinical settings, where biases could have serious implications for patient outcomes. Addressing this issue will require careful attention to the data sets used to train AI models, ensuring they are representative of the patient populations AI systems are intended to serve. Furthermore, concerns about data privacy and the security of patient information were prevalent, as healthcare professionals are rightfully cautious about the risks associated with handling sensitive health data through AI systems. These ethical issues highlight the need for robust regulatory frameworks that ensure the responsible development and deployment of AI technologies in healthcare, as well as comprehensive training for healthcare professionals on how to navigate these concerns.

In addition to the ethical challenges, the study also explored the potential impact of AI on the healthcare workforce. The findings reveal a mixed sentiment regarding AI's effect on job security. While some healthcare professionals expressed concerns that AI could lead to job losses, particularly in specialties like radiology, others viewed AI as a tool that could enhance their capabilities and improve job satisfaction. This reflects broader discussions in the literature about the potential for AI to complement human expertise rather than replace it (Rajpurkar et al., 2020). AI's ability to handle repetitive tasks and assist with decision-making could allow healthcare workers to focus on more complex and personalized aspects of care. However, for this to happen, healthcare professionals need to be equipped with the necessary skills to work alongside AI systems effectively. This highlights the importance of incorporating AI training into professional development programs, ensuring that healthcare workers can adapt to the evolving landscape of healthcare technologies.

Equitable access to AI technologies emerged as another significant challenge. As the study suggests, while larger, well-funded healthcare institutions are more likely to have the resources to

adopt AI systems, smaller healthcare facilities, especially in rural or low-income areas, may struggle to integrate these technologies effectively. This disparity could exacerbate existing healthcare inequalities, making it essential for policymakers to address the issue of access to AI in healthcare. Ensuring that all healthcare providers, regardless of their size or location, can benefit from AI advancements is crucial to achieving the broader goal of improving healthcare delivery and outcomes for all patients. Efforts to reduce the cost of AI technologies and make them more accessible to smaller healthcare providers will be critical in achieving this goal.

CONCLUSION

In conclusion, while healthcare professionals recognize the potential of AI to enhance healthcare delivery, there are significant challenges and concerns that must be addressed to ensure its successful integration. These include the need for improved education and training, addressing ethical issues such as biases and privacy, and ensuring equitable access to AI technologies across healthcare settings. Future research should focus on developing strategies to overcome these barriers, exploring the long-term impacts of AI on healthcare delivery, and identifying best practices for incorporating AI into clinical workflows. Ultimately, AI has the potential to transform healthcare, but its integration must be approached thoughtfully and responsibly, with a focus on collaboration between AI technologies and healthcare professionals to achieve the best possible patient outcomes.

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