Volume 22, Issue 1: KUS: 1239: 146-158: 15072024: 2025

KHULNA UNIVERSITY
STUDIES

journal homepage: www.kus.ku.ac.bd

Research article

Exploring AI Integration among Healthcare Professionals in Bangladesh: Opportunities, Challenges, and Ethical Concerns

Md. Rayhan Kabir*

Mass Communication and Journalism Discipline, Khulna University, Khulna-9208, Bangladesh

ABSTRACT

Artificial intelligence (AI) is significantly revolutionizing global healthcare systems by increasing diagnostic accuracy, optimizing treatment methods and improving patient outcomes. However, its effective integration in resource-constrained settings like Bangladesh presents challenges related to infrastructure, ethics, and professional preparedness. This research aimed to explore the perceptions of healthcare professionals in Bangladesh regarding the integration of AI in healthcare services, with a focus on identifying its opportunities, barriers, and ethical concerns. A qualitative research design was employed using semi-structured, in-depth interviews with 20 healthcare professionals conducted between January 1, 2023, and January 10, 2025. Participants included doctors, nurses, hospital administrators, and technology developers from five public and private medical institutions in Bangladesh based on specific inclusion criteria. The study involved participants who had limited knowledge about AI and healthcare professionals with at least two years of experience. These data were thematically analyzed using NVivo 14 software. The study identified five key themes and various subthemes. These themes are (I) AI and communication in a healthcare context, (II) Transformative potential of AI, (III) Barriers to AI adoption in healthcare, (IV) Ethical and legal considerations, and (V) Need for training & skill development. However, despite their limited knowledge of AI, participants expressed positive views regarding its potential to address challenges in Bangladesh's healthcare sector, highlighting its capacity to enhance healthcare providers' efficiency, improve workflow, save time, and reduce medical errors.

ARTICLE INFO

Article timeline:
Date of Submission:
15 July, 2024
Date of Acceptance:
27 May, 2025
Article available online:
26 June, 2025

***Keywords*:**
Artificial intelligence
Healthcare professionals
AI and health communication
Bangladesh in healthcare
AI implication in healthcare

Introduction

AI Advancements in healthcare

In recent years, artificial intelligence (AI) has emerged as a revolutionary force across various healthcare fields (Sun et al., 2022; Lenz & Reichert, 2007; Murphy et al., 2021). Healthcare is one of the most promising domains for emerging AI applications and is also among the fastest-growing industries (Ramadan et al., 2024). AI-powered tools have the potential to improve diagnosis, accuracy, and patient outcomes in the healthcare sector (Albahri et al., 2023; Kumar et al., 2023). Moreover, AI technologies—such as machine learning, natural language processing, robotics (Ellahham et al., 2020), and predictive analytics—are transforming healthcare delivery, presenting both opportunities and challenges (Davenport & Kalakota, 2019; Dwivedi et al., 2019; Rong et al., 2020). Artificial intelligence (AI) is described as a machine learning program capable of performing tasks and cognitive functions that typically require human intelligence (Aung et al., 2021; Sheikh et al., 2023). AI plays a fundamental role in enhancing various healthcare functions, including information management (Slevin et al., 2019), pattern recognition, and overall system performance (Xue et al., 2023; Ye et al., 2025). Advances in database transmission and computer systems have significantly improved diagnostic capabilities (Martinez, 2019; Briganti & Le Moine, 2020). However, military forces and certain organizations have also adopted modern tools and sophisticated AI technologies for various applications (Khan, 2019). The acceptance and implementation of AI in healthcare largely depend on the experiences and perceptions of healthcare providers, who play a crucial role in determining its effectiveness in the field (Bashshur et al., 2020).

Barriers and ethical concerns in AI-driven healthcare

The integration of AI in healthcare raises ethical concerns, including legal considerations, patient security

*Corresponding author: <rayhankabir.mcj@gmail.com>
DOI: https://doi.org/10.53808/KUS.2025.22.01.1239-ss

(Richardson et al., 2021), data privacy (Naik et al., 2022), and procedural analysis (Yuliana, 2023). Fairness and transparency are essential in addressing these ethical challenges, ensuring that healthcare professionals play a crucial role in mitigating potential risks (Radanliev & De Roure, 2022; Gupta et al., 2023). Additionally, resolving complex legal and ethical issues necessitates engagement from policymakers, healthcare providers, and patients (Prakash et al., 2022). By fostering a deeper understanding of AI ethics and incorporating societal values into technology, the healthcare system can build greater trust among patients (Gerke et al., 2020; Konidena et al., 2024; Belfrage et al., 2022). Healthcare professionals require adequate training and hands-on experience to effectively use AI in disease diagnosis and treatment (Frenk et al., 2022; Chen & Ryoo, 2025). Expanding their role in AI implementation is essential (Abdullah & Fakieh, 2020), as it involves not only technical proficiency but also an understanding of the patient's environment and the establishment of a strong doctor-patient relationship (Yang et al., 2025; Marwaha et al., 2022; Eijkelboom et al., 2023). To advance in the healthcare sector, professionals must undergo rigorous AI training to acquire new skills and adapt to evolving technologies (Shinde et al., 2023; Li & Qin, 2023). According to Adil et al. (2024), AI-powered applications can enhance the security of healthcare IT systems and improve communication within the healthcare sector. These developments highlight AI's potential for future integration and expansion in healthcare. Furthermore, AI can assist doctors in diagnosing diseases (Thakur et al., 2024), predicting illness progression, and tailoring treatment plans (Waymel et al., 2019; Maskara et al., 2017). However, effectively utilizing AI for data-intensive analysis and knowledge management requires expertise and a strong understanding of data quality (Secinaro et al., 2021a; Aradhya et al., 2023).

Infrastructure and human interaction

AI in healthcare presents several difficulties even if its many advantages are clear. Reliable implementation of artificial intelligence depends on addressing issues with fairness, bias, data privacy, and ethical conundrums (Eshwar, 2023; Karimian et al., 2022; Nash et al., 2023). Furthermore, the deployment of artificial intelligence calls for major infrastructure improvements; therefore, its integration might affect patient-provider contacts (Lee & Yoon, 2021a). The hazards connected with artificial intelligence-driven treatment call for a mixed strategy combining personal control with technical advancement (Khalid et al., 2024). AI in healthcare has conceptual, ethical, and transparency challenges that need meticulous consideration by innovators, lawmakers, and governments to maximize benefits and mitigate adverse impacts (Morley et al., 2020a). In healthcare, artificial intelligence calls for moral principles like equitable treatment and openness. Among the difficulties are economic incentives and societal shifts (F. Li et al., 2022). However, taking advantage of these chances could result in a morally decent year to come (Esmaeilzadeh, 2024). By tackling these concerns and grabbing possibilities, one may guarantee a culture change and a harmonious relationship between health care and financial benefits (Islam, 2025).

Practical applications and future directions of AI in healthcare

In healthcare, AI has significant and extensive transformative consequences. It provides consistent information on precise diagnosis, real-time monitoring, and proactive illness prevention, improving healthcare workflows (Harry, 2023). Healthcare professionals are able to delve deeper into these issues as they seek to integrate healthcare AI to alleviate healthcare concerns (Mohanty & Mishra, 2022). Numerous studies have investigated progress in AI in the medical field, emphasizing software, connection issues, and the importance of initial phases (Vimbi et al., 2024; He et al., 2018; Triantafyllidis & Tsanas, 2019). These studies look at possible ways to get people to accept AI in healthcare settings and give information about automated medical businesses around the world and how they work with healthcare services (Zahlan et al., 2023; Topol, 2018). Furthermore, intelligent AI uses are carried out in actual healthcare environments (Dangi et al., 2024). It assesses the accuracy and effect on healthcare results of many artificial intelligence techniques applied to risk determination, diagnosis, screening rates, and medical treatment (Yin et al., 2021; Zhongqi and Jia, 2022; Stinson & Vlaad, 2024). Artificial intelligence (AI) is incorporated in healthcare, talking about developments in quick illness diagnosis (Secinaro et al., 2021b), client evaluation (Fernandes et al., 2019), process efficiency, and professional instruction (Martinez-Ortigosa et al., 2023; Mirbabaie et al., 2021).

This study addresses the existing knowledge gap in the integration of AI in the healthcare system in Bangladesh through a qualitative investigation. It will examine the opportunities AI offers to enhance healthcare delivery and identify the ethical, professional, and technical challenges healthcare professionals encounter in this emerging context. By focusing on Bangladesh, a country where AI adoption in healthcare is still in its primary stage, this research aims to contribute valuable insights into the unique dynamics of implementing AI in a developing healthcare environment, with implications that may be applicable to similar settings worldwide.

Research question

How do healthcare professionals perceive the integration of AI into healthcare services in terms of its potential opportunities, challenges, and ethical implications?

Methods

Research design

This study utilized a qualitative research design under an interpretivist paradigm to explore healthcare professionals' perceptions of artificial intelligence (AI) integration in healthcare services. Semi-structured, in-depth interviews were conducted with participants from five public and private medical institutions, along with healthcare providers in Bangladesh. The researcher used Braun and Clarke's (2006) framework for thematic analysis to identify recurring patterns and key themes. The study adhered to the Consolidated Criteria for Reporting Qualitative Research (COREQ) to ensure methodological rigor and transparency (Kiger & Varpio, 2020). A semi-structured questionnaire was developed to guide the in-

depth interviews. Participants were selected through purposive sampling, contacted via phone and email, and provided informed consent prior to participation in the interviews.

Participant selection

The study involved a rigorous selection process for AI in healthcare professionals in Bangladesh, ensuring diversity by including doctors, nurses, hospital administrators, technology developers, and academic experts. To maintain a balanced selection, inclusion and exclusion criteria were carefully implemented for individual participants. Prospective participants were required to have a graduate degree and at least two years of professional experience in the field. Additionally, this research focused on the opportunities, challenges, and ethical concerns associated with the use of artificial intelligence in healthcare, aiming to provide a multidimensional perspective. Participants were assessed for eligibility based on the defined inclusion and exclusion criteria during the selection process Figure 1.

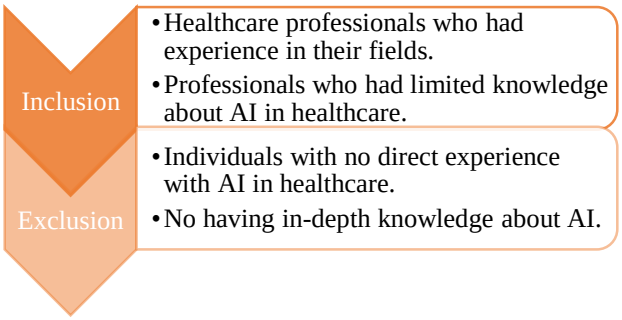

Figure 1: Eligibility criteria of participants.

Sample size

This Table 1 provides an overview of the various viewpoints expressed by participants about the use of AI in healthcare. These perspectives include demographics, professional backgrounds, and years of experience.

Table 1: Demographic information.

ID	Age	Gender	Educational background	Profession	Years of working
P 1	30	Male	Masters of Public Health	Assistant professor	6
P 2	35	Female	Doctor of Nursing Practice	Senior staff nurse	11
P 3	42	Male	Bachelor Degree in CSE	Professor	14
P 4	36	Male	Bachelor of Science	Hospital administrator	12
P 5	28	Female	Bachelor of Science in Nursing	Pediatric	4
P 6	31	Male	Bachelor of Medicine	Medicine specialist	8
P 7	29	Female	Doctor of Medicine	Medicine specialist	5
P 8	33	Male	Masters of Science	Technology developer	9
P 9	27	Male	Master's in Public Health	Charge nurse	3
P 10	32	Male	Master's in Public Health	Assistant professor	6
P 11	39	Female	Master of Science	Radiologist	13
P 12	32	Female	Bachelor in Pharmacy	Pharmacist	8
P 13	31	Male	Bachelor of Science	Medical technician	7
P 14	37	Male	Doctor of Medicine	Radiologist	12
P 15	26	Female	Bachelor of Science in Nursing	Nurse	2
P 16	28	Male	Master of Science in Nursing	Nurse manager	4
P 17	34	Female	Masters in Nutrition	Senior staff nurse	9
P 18	31	Male	Masters of Science	Technology developer	6
P 19	29	Male	Bachelor Degree in CSE	Technology developer	3
P 20	27	Female	Doctor of Nursing Practice	Lecturer	2

Data collection

The study conducted interviews with 20 healthcare professionals between January 1, 2023, and January 10, 2025. The selected sample size carefully gathered valuable insights and perspectives from healthcare professionals relative to integrating the potential opportunities, challenges, and ethical concerns related to AI integration in healthcare. Recruitment was carried out through phone calls, emails, and direct communication. A structured interview protocol was developed to ensure consistency across all sessions, incorporating a series of open-ended questions aligned with the research objectives. The researcher conducted face-to-face interviews, each lasting approximately 45–60 minutes. Data saturation was achieved with 18 interviews, ensuring participants' informed consent for ethical compliance and safety. Additionally, the interview transcripts were translated from Bengali to English to facilitate analysis.

Data analysis

Analytical Approach: This research used an inductive thematic technique to examine the data, according to the framework established by Braun and Clarke (2006). A comprehensive thematic analysis was performed, first with transparent coding to find emergent patterns, followed by targeted coding to improve principal topics about AI in healthcare professionals. The organizing and coding of data were conducted using NVivo 14 software, providing a systematic and thorough analysis approach. Furthermore, Microsoft's Excel program was used for data visualization and table creation, improving the readability of the results.

Ensuring validity and reliability

This research used various evaluation approaches to ensure the study's reliability and integrity. Participants can confirm their thoughts and give feedback through preliminary findings shared among them, which makes it easier to identify each person. Collaborative discussion sessions with healthcare professionals and AI specialists significantly improved the accuracy and coherence of the study, therefore ensuring a comprehensive and balanced presentation of the results. These strategies enhanced the rigor and reliability of the study approach.

Results

This study conducted a comprehensive qualitative analysis, revealing that the use of AI among healthcare professionals in Bangladesh is accompanied by both optimism and caution regarding various aspects of digitalization readiness. The integration of AI has both advantages and disadvantages for healthcare professionals. Specifically, the findings categorized five themes that emerged from in-depth interviews Figure 2.

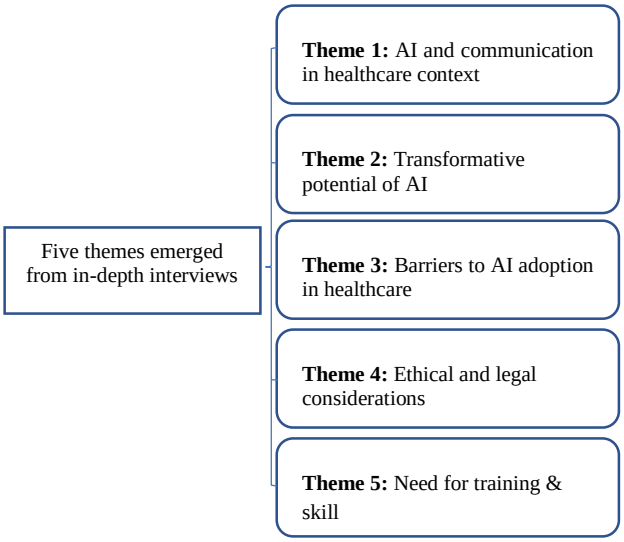

Figure 2: Five themes emerged from in-depth interviews.

Note: This figure illustrates five key themes identified through in-depth interviews, highlighting recurring patterns and insights.

The study revealed several subthemes Figure 3, including AI-powered chatbots, virtual assistants for scheduling, AI in telemedicine for remote consultations, doctor-patient interaction, and AI in health information dissemination. In addition to these, AI chatbots for patient inquiries and AI in health information dissemination were the most frequently mentioned by respondents, which underlines the significance of AI in providing timely, customized health updates and interaction with patient management. In contrast, the least discussed subtheme was AI in health information dissemination, indicating that it is still an emerging idea in the regional medical landscape.

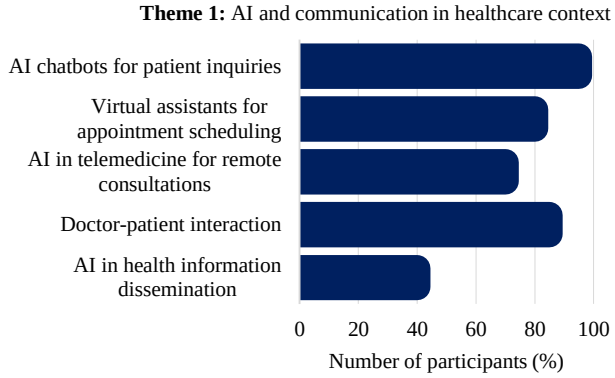

Figure 3: AI and communication in healthcare context.

Note: The figure showed AI communication tools in healthcare, based on participant responses (N=20); percentages reflect frequency of mentions.

Table 2: Summary of results, including sub-themes and associated codes under the theme of AI and communication in healthcare context.

Sub-themes	Codes
AI chatbots for patient inquiries	P4: 24/7 chatbot availability for medical queries; P14: Multilingual support for patient communication; P18: Personalized chat; P7: Mental health and emotional support
Virtual assistants for appointment scheduling	P15: Automated scheduling and reminders; P8: Voice assistants for appointments; P2: Follow-up reminders and rescheduling
AI in telemedicine for remote consultations	P11: Video consultations with translation; P12: Voice recognition for medical transcription; P19: Personalized post-consultation recommendations
Doctor-patient interaction	P13: Reducing miscommunication; P10: Trust building through consistency; P19: Time and accessibility optimization
AI in health information dissemination	P3: Misinformation detection; P20: Social media monitoring

Note: This table highlights sub-themes and codes derived from participants' interviews, showcasing key patterns and applications of AI in healthcare. (P= Participant).

AI chatbots for patient inquiries

Many participants noted that AI chatbots had markedly enhanced responsiveness in patient care. Artificial intelligence (AI) chatbots provide patients with health-related services by providing typical replies to inquiries about medications, scheduling appointments, and more relevant topics. AI chatbots have the potential to significantly transform the health industry, particularly for both patients and healthcare providers. These apps provide primary health treatment answers to basic questions any time of day or night, e nsuring patients always have access to information, even when the clinic is closed. A single participant emphasized the significance of this access to information, stating:

"I contend that AI chatbots may efficiently provide health information via applications, so obviating the need for patients to await medical visits or make repeated inquiries for responses. The chatbot is always accessible, delivering immediate replies to prevalent health inquiries." (Participant 2)

Another participant mentioned that:

"Before, getting a doctor's advice took hours or even days. Now, AI chatbots answer my basic health concerns instantly, making me feel more informed and prepared before seeing a doctor." (Participant 11)

Virtual assistants for appointment scheduling

In the past, many people had to wait for their medical appointments; however, modern technology now offers novel opportunities in healthcare via virtual assistants, while AI technologies enhance ease and efficiency. The interview disclosed that automated methods alleviate administrative burdens on medical facilities while also offering clients freedom and satisfaction. This transition guarantees rapid, seamless patient access to therapy and enhances operational efficiency. One participant shared their experience:

"Previously, I had to call the hospital's operations several times just to request a scheduled time. The queue was sometimes crowded; hence, I had to wait. Currently, I simply type a message to the online assistant, who confirms my appointment in a matter of seconds." (Participant 18)

AI in telemedicine for remote consultations

Applying AI in telemedicine has opened fresh opportunities for many patients to get health treatments in rural and less developed locations. By assessing patient data during online consultations, AI applications help medical professionals by providing information about diagnostic concepts as well as therapy recommendations. This accelerates the procedure and increases the accuracy of distant diagnosis and treatment. A user of telemedicine services explained:

"One evening I had a high fever and was not sure what to do. Before my doctor's appointment, the artificial intelligence system asked questions and suggested first steps. It gave me peace and prepared me for the visit." (Participant 1)

Doctor-patient interaction

Strong interaction between users and clinicians is essential for optimal treatment. Nonetheless, miscommunication may emerge owing to reasons such as medical terminology, time limitations, geographical disparities, and health awareness levels. Telemedicine provides creative methods to address these disparities, improving clarity and comprehension in patient-physician interactions. Online conversations, including video conferences, safe messaging platforms, and real-time conversations, allow clients to engage with medical professionals from their residences, providing trustworthy and readily available contact. This consistency cultivates confidence and fortifies the connection between doctors and their patients, mitigating misconceptions and adverse health consequences.

"AI can suggest treatments based on patient history via online platforms, but I make the final decision. It's like having an assistant that helps me give better care, as well as communication that will enhance a positive relationship between patient and doctor." (Participant 15)

AI in health information dissemination

Artificial intelligence is revolutionizing the distribution of health information by enhancing accessibility, precision, and efficiency. It improves patient care via chatbots, tailored health insights, and public health communication. AI-driven solutions, such as electronic health records, automated monitoring, and predictive analytics, optimize healthcare operations. Nonetheless, issues like disinformation, ethical dilemmas, and data privacy need resolution. One participant said:

"AI has the potential to transform health communication; however, stringent guidelines are necessary to guarantee accuracy and security. Collaboration among healthcare professionals, policymakers, and AI developers is essential for the appropriate integration of AI, which enhances the inclusivity, accuracy, and impact of health information." (Participant 7)

Numerous participants discussed that AI in healthcare offers transformative potential in enhanced diagnostics and personalized treatment plans. It promises to revolutionize diagnostic processes, enabling more accurate identification of diseases, particularly in complex fields like oncology. Besides, AI facilitates the development of personalized treatment plans based on patients' genetic, lifestyle, and medical histories. This approach can boost treatment efficacy Figure 4.

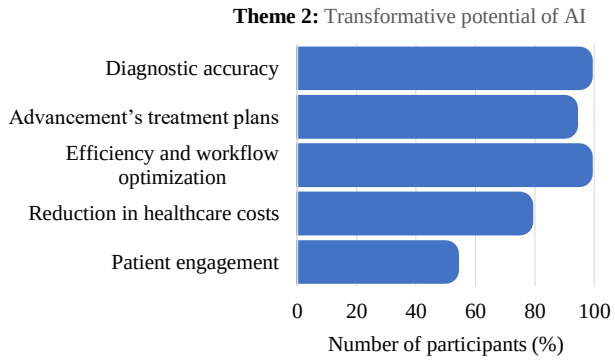

Figure 4: Transformative potential of AI.

Table 3: Summary of results, including sub-themes and associated codes under the theme of transformative potential of AI.

Sub-themes	Codes
Diagnostic accuracy	P1: Enhancing accuracy in radiology and pathology; P2: Early disease detection; P8: Lab testing; P18: Real-time analysis; P14: Patient monitoring.
Advancement's treatment plans	P3: Customizing treatments based on genetic data; P8: Tailored medication prescriptions; P18: AI-assisted therapy customization; P15: Personalized diet planning for health improvement
Efficiency and workflow optimization	P6: Enhance admin work; P9: Auto records; P1: Smart scheduling; P4: Reducing patient wait times and no-shows; P13: Workflow optimization; P5: Robotic surgery
Reduction in healthcare costs	P9: Lower treatment costs; P11: AI telehealth saves; P15: Smart billing
Patient engagement	P12: AI health tips; P14: Personalized advice; P18: Treatment tracking; P2: Well-being tools

Diagnostic accuracy

Developed nations benefit from advanced technologies, such as AI, which facilitate earlier disease detection and enhance the accuracy of patient health information through real-time analysis. In contrast, Bangladesh lacks sufficient advanced technology in the medical sector, many times resulting in the provision of inaccurate health information. If used correctly, this technology will precisely diagnose therapy. Artificial intelligence has many potential advantages in the healthcare industry. It could make hospitals more efficient, help and guide doctors who treat patients, and most importantly, it could diagnose patients. The participants highlighted the potential of artificial intelligence in improving healthcare efficiency, particularly in cancer-related issues. Meanwhile, according to the participant:

"I think artificial intelligence has the potential to revolutionize healthcare, improve diagnoses, streamline hospital operations, and provide tools to make sound decisions." (Participant 16)

Additionally, participants mentioned how AI can aid in diagnosing treatment areas for chemotherapy by acquiring blood samples, diagnostic imaging, and other tests. This data is then uploaded into a system, which generates a proper diagnosis, treatment, and management plan, ultimately improving patient outcomes.

"Healthcare AI is essentially a game-changer; it can quickly provide results for patient diagnosis through systematic data analysis, a process that is not easily achievable for humans." (Participant 4)

Advancement's treatment plans

Today, the healthcare industry is widely using AI in the world, particularly to identify patterns and anomalies in medical imaging and pathology. AI is leading to more accurate disease detection and personalized treatment opportunities. There is no doubt that AI can help with many parts of healthcare.

"I think AI-powered robotic surgery will help us perform delicate procedures with unmatched precision, reducing recovery time for patients." (Participant 17)

Participants assert that AI has brought several transformations to the healthcare industry. Artificial intelligence (AI) yields accurate outcomes for eye, blood, and urine tests with a success rate of 95-99%. The participant expressed his opinion on the matter as follows:

"I believe AI holds enormous promise as a new tool for patients today, but it requires an organization in healthcare to objectively assess its potential benefits and drawbacks, as well as its boundaries and limitations, and provide proper guidance on its appropriate use." (Participant 12)

Reduction in healthcare costs

The healthcare profession's statements revolve around a future outlook and an adaptive stance towards AI integration. According to the participants, AI has several advantages in healthcare, including improved patient outcomes, efficient diagnosis, and the ability to mitigate healthcare costs. The use of AI without ethics and caution can cause harm. The potential for maleficence or harm due to AI misuse or unintended consequences is a significant ethical concern. One participant expressed his opinions:

"I can ensure that AI will serve the entire population equally, leading to a future where healthcare will play a role in making patient care cost-effective, personalized, efficient, and effective." (Participant 5)

Efficiency and workflow optimization

Many participants believe that AI's potential in healthcare is immense. However, to harness this potential fully, we need to address the challenges head-on. The task involves establishing a new regulatory workflow in collaboration with AI developers, healthcare practitioners, policy advisers, and patients. Several participants expressed their perspectives on the cooperative approach to healthcare information. These are followed by:

"AI can help reduce patient wait times and no-shows, making the whole system work more smoothly and efficiently." (Participant 14)

"If we want AI to really work in healthcare, we need to bring everyone together – doctors, patients, and tech developers – to create the right rules and make sure it's helping everyone." (Participant 6)

Patient engagement

Most of the participants highlighted that artificial intelligence will facilitate precision medicine by analyzing vast datasets to identify patient outcomes, predict individual responses to treatment, and provide easy access to health information for improved patient care. However, for widespread adoption in Bangladesh, we must address challenges such as digital literacy, accessibility, and trust in AI-driven healthcare. This will help create highly customized treatment plans tailored to each patient's genetic, environmental, and lifestyle characteristics.

"I believe AI will help us predict diseases before they even start. Imagine getting a health alert on your phone telling you to see a doctor before you even feel sick. That's the future we are moving toward." (Participant 10)

Clinical workflow integration and weak technological infrastructure can hinder AI adoption in healthcare. To maximize AI's potential, developers, healthcare providers, policymakers, and patients must renovate technological infrastructure, especially in the rural areas. Moreover, senior healthcare professionals may become skeptical of new technology. This situation makes healthcare AI adoption difficult Figure 5.

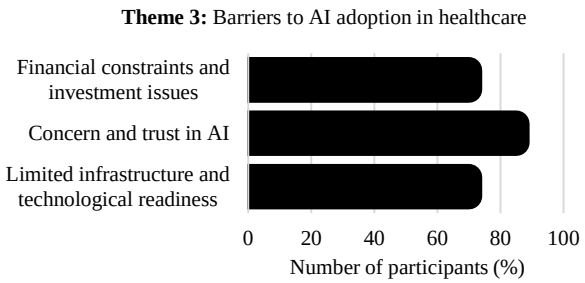

Figure 5: Barriers to AI adoption in healthcare.

Table 4: Summary of results, including sub-themes and associated codes under the theme of barriers to AI adoption in healthcare.

Sub-themes	Codes
Financial constraints and investment issues	P9: High costs of software and implementation; P13: Lack of funding for AI projects; P16: Expensive maintenance and training; P1: Limited AI research budgets; P3: Costly infrastructure upgrades
Concern and trust in AI	P5: Lack of patient confidence; P1: Misinformation in healthcare; P4: Dehumanization of patient care; P3: Fear of critical errors; P13: Lack of public education; P7: Need for transparent decisions
Limited infrastructure and technological readiness	P19: High integration costs; P11: Limited computing facilities; P7: Poor connectivity in rural areas;

Financial constraints and investment issues

Many of those interviewed thought that financial capability would be a major obstacle in implementing artificial intelligence, as bringing modern technology driven by AI would put a strain on the economic system, especially in nations such as Bangladesh, which could find it difficult to finance.

"Currently, Bangladesh is seeing increased financial difficulties, particularly in the healthcare sector. Clients need to confront the constant lack of essential and life-saving medications at public medical facilities on a daily basis." (Participant 9)

Concern and trust in AI

When discussing the potential of AI to replace healthcare professionals, several participants said that, particularly in Bangladesh, AI cannot replace humans, but it can in many other nations worldwide.

"Although many countries in the world are using it to perform complex treatments like surgery. I think it is not yet possible in our country. However, it will take more time for Bangladesh to adopt this technology." (Participant 12)

Some participants articulated an opposing perspective, anticipating that healthcare professionals may improve cognitive logical abilities and foster credibility via the suitable application of AI.

"If we explain AI in simple words and show how it helps, more people will trust it. So, it can be appreciated for the next phase." (Participant 3)

Limited infrastructure and technological readiness

The use of artificial intelligence in healthcare in Bangladesh may encounter obstacles owing to inadequate infrastructure and technological readiness. Remote facilities contend with old equipment, limited computing capacity, and insufficient internet connectivity. Modest services have elevated expenses and significant technical and financial challenges. The lack of suitable technologies may further impede AI implementation. Consequently, governments, medical organizations, and technology firms must collaborate to guarantee efficient connectivity. Improvement in digital networks, enhanced internet access in rural regions, and adaptable AI solutions tailored for resource-constrained settings are essential for effective AI integration.

"AI has enormous potential in healthcare, but many hospitals, especially in rural areas, face big challenges like poor internet, outdated systems, and high costs. Without proper infrastructure, regular updates, and financial support, AI remains an idea that's difficult to use rather than a real solution for improving patient care." (Participant 17)

Participants revealed that AI comes with data privacy and legal concerns. Often, healthcare information is very sensitive and considered private, like sexual disease histories. How AI will ensure data privacy and security is a significant concern to address. Besides, senior healthcare professionals who are technologically lagging behind may unintentionally misuse AI technologies, which may bring legal threats. Hence, they suggested

being very cautious in the initial stage of AI adaptation Figure 6.

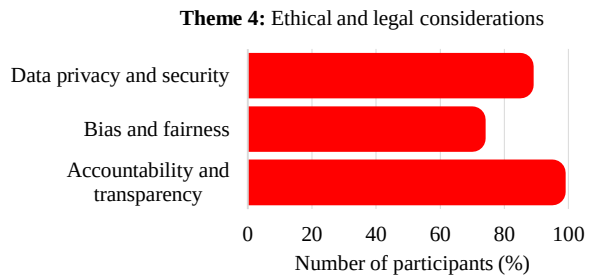

Figure 6: Ethical and legal considerations.

Table 5: Summary of results, including sub-themes and associated codes under the theme of ethical and legal considerations.

Sub-themes	Codes
Data privacy and security	P7: Patient data protection; P1: AI encryption; P1: Cyber threats; P17: Patient consent and control; P4: Anonymization challenges
Bias and fairness	P13: Algorithmic bias; P6: Disparities in access to care; P11: Fairness in medical diagnosis; P17: Technology and healthcare inequalities; P15: Bias in medical data training
Accountability and transparency	P8: Liability for errors in automation; P14: Need for explainability in technology; P3: Accountability in malpractice cases; P5: Legal risks of automation in care

Data privacy and security

Despite ongoing concerns around data security and privacy, the use of artificial intelligence in healthcare presents significant benefits. Prior to artificial intelligence being able to fully predict outcomes, we must consider the associated risks. Ethical and secure artificial intelligence necessitates collaboration among researchers, regulatory bodies, and healthcare institutions. Robust oversight and stringent protocols will be needed in the future to address these challenges and ensure the proper incorporation of artificial intelligence into healthcare.

"Before AI can make all the decisions in healthcare, we need to look at the risks carefully and make sure patient privacy is protected." (Participant 8)

Bias and fairness

Most of the participants said that one major concern with AI is that it may perpetuate or even amplify existing biases and discrimination in healthcare. This is because AI's fairness is dependent on the data it learns from and the programming techniques used. Since humans who create these programs have their own implicit data biases, the AI will replicate them and maybe even amplify them with its efficiency.

"As a healthcare professional and digital health leader, I suggest that until those aspects are established from a medico-legal, liability, data bias, education, and socio-technical perspective for clinicians, we should be rigorously challenging the message of simplicity put forward here so that AI can be a trustworthy tool." (Participant 1)

Accountability and transparency

Although artificial intelligence has considerable potential in medicine, its successful use relies on accountability and transparency. The decision-making processes of AI must be comprehensible and reliable, grounded on explicit standards and transparency. Transparency ensures the ethical and equitable operation of artificial intelligence systems, addresses issues or concerns, and cultivates trust among customers and experts. Healthcare institutions must prioritize responsible use as artificial intelligence advances, ensuring they understand its limitations and capabilities. Ensuring accountability and openness will enable artificial intelligence to safeguard patient rights and trust while improving healthcare outcomes.

"AI should help, but we must always make sure it's being used in the right way and protecting patient trust." (Participant 6)

Several participants expressed that integrating AI into healthcare requires continuous training and skill development to address existing gaps in AI literacy. Integrating it demands introducing training programs to address this new technology so that technologically laggard and skeptical healthcare professionals can overcome their deficiencies and fear Figure 7.

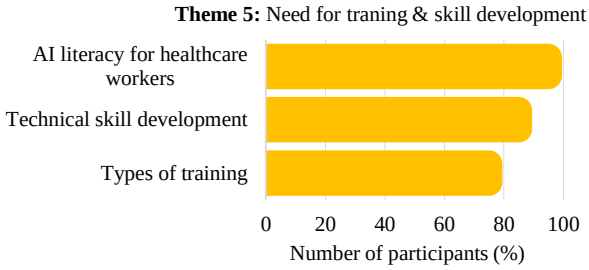

Figure 7: Need for training & skill development.

Table 6: Summary of results, including sub-themes and associated codes under the theme of need for training & skill development.

Sub-themes	Codes
AI literacy for healthcare workers	P4: Basic AI training; P9: Hands-on workshops; P12: AI integration courses; P18: Continuous learning
Technical skill development	P6: AI programming for clinicians; P11: Machine learning basics; P14: Data interpretation training
Types of training	P5: Online lecture and teamwork; P10: Research-based learning; P15: Workshops and Short courses

AI literacy for healthcare workers

Bangladesh, a South Asian country that is still in the early stages of developing its digital health system, needs to start planning a more advanced training program for healthcare professionals because the country lacks the necessary healthcare knowledge and skills, such as hands-on experience, education, and training in emerging technologies, which results in insufficient use of equipment. Another participant identified his opinion:

"In our medical curriculum, AI is barely mentioned. If AI is the future of healthcare, we should start learning about it now, but there's no structured program to teach us how to use AI in real medical settings." (Participant 13)

Technical skill development

Several participants observed that a significant barrier to the incorporation of AI into Bangladesh's healthcare system is the lack of training programs. Healthcare staff lack the essential knowledge and technical skills required to operate advanced technology. Most hospitals in Bangladesh use outdated equipment for health services, which is incompatible with the latest software. Power supply issues and a lack of internet access hinder the integration of AI technology.

"To be honest, our nation has a significant issue with equipment for AI technology training as well as a lack of instruction in healthcare; however, I believe we will overcome this issue quickly." (Participant 4)

Types of training

To effectively incorporate AI into the healthcare sector, organized workshops, readily available online lectures or self-directed studies, and medical education are beneficial for acquiring knowledge about AI. Medical graduates emphasized the need to integrate AI training into academic programs. A final-year medical student proposed:

"I recommend online programs, teamwork, and seminars for healthcare training. Social media has significantly increased knowledge about emerging technology, providing more videos for effective learning in healthcare." (Participant 7)

Discussion

This research aimed to explore healthcare professionals' perspectives about the integration of artificial intelligence (AI) inside Bangladesh's healthcare system, emphasizing its potential advantages, current obstacles, and ethical considerations. The study provides context-specific insights by qualitatively analyzing these aspects, thereby informing policy, education, and technology design in resource-limited environments. The study's findings revealed a contrast between desire and preparedness: healthcare providers exhibit considerable belief about AI's potential to enhance diagnostics, minimize medical errors, and streamline workflows, while concurrently emphasizing systemic deficiencies in infrastructure, training, and ethical oversight. This highlights a significant issue common in several Global South situations—the want to rapidly develop technologically, hindered by few resources and institutional stagnation. A core insight from this study is the significant communication gap between AI systems and healthcare practitioners, particularly in clinical decision-making processes. Participants recognized AI's capacity to enhance operational efficiency but expressed apprehensions over the diminishment of personalized treatment. This corresponds with recent work indicating that AI may unintentionally diminish the emotional and empathic dimensions of patient-provider interactions if not carefully executed (Lee & Yoon, 2021b; Morley et al., 2020b). Involving AI helps make healthcare better by supporting doctors in taking care of patients, correctly diagnosing illnesses, especially cancer, offering personalized treatment, and making choices that match earlier studies. In addition, healthcare professionals are eager to incorporate artificial intelligence into healthcare, acknowledging its ability to enhance patient outcomes and optimize treatment procedures. This aligns with prior research, indicating a shared commitment to exploring AI's potential contributions to healthcare practice (Barrera et al., 2020; Petersson et al., 2022). Participants expressed significant concerns about the use of AI in healthcare, including access, use, and control of patient data in private hands, as well as the external risk of privacy breaches through an AI-driven approach (Murdoch, 2021). In addition, their emphasis on insufficient internet connectivity and outdated IT infrastructure, especially in rural areas, hinders AI deployment (Olugboja & Agbakwuru, 2024). In terms of this, AI's potential in healthcare is vast, but challenges require new regulatory frameworks, collaboration, and constant monitoring for ethical and practical use (Goirand et al., 2021; Saraswat et

al., 2022). Participants acknowledged the obstacles to AI adoption and the need for collaborative efforts, which aligned with research on AI implementation challenges and supporting a creative corporate culture (Al Kuwaiti et al., 2023). In this study, healthcare information focuses on the ethical and legal issues related to using AI, emphasizing the importance of protecting patient privacy and data while also considering innovation alongside patient rights and confidentiality. The impact of digital technologies on healthcare delivery participants addresses existing healthcare biases and inequalities by providing an epistemological framework for ethical concern, transparency, and accountability (Radanliev & De Roure, 2021; Radanliev et al., 2021). Based on their observations, they mentioned concern about patient privacy with AI in healthcare, emphasizing its ethical awareness and significance in alignment with research on AI in healthcare (van der Gaag et al., 2023). The participants emphasized the importance of AI integration in healthcare for exceptional patient care and the need for continuous training and investment in AI. This is consistent with research that seeks to evaluate viewpoints on health information, specialized AI training and technology for the purpose of enhancing healthcare (Sapci & Sapci, 2020). However, the participants recognized the importance of focusing on educational programs, such as rules and guidelines, teamwork in redesigning services, future AI training, and improving communication between patients and doctors, to make sure they gain the skills needed for the best patient care. The healthcare profession is integrating AI with research that underscores AI's ability to enhance patient outcomes, diagnose accuracy, and reduce costs (Chaurasia, 2023; Racine et al., 2019). However, ethical concerns about the use or consequences of AI in shaping potential practice trajectories in healthcare may lead to a personalized, future-improving, and efficient healthcare system (Trocin et al., 2023). The participants' idealistic ideas were in line with AI's transformative discourse, which includes problem-solving in clinical settings, ethical use to protect patients, scheduling appointments, real-time treatment guidance, and health tracking that led to future improvements in healthcare (Yu et al., 2020).

Strengths and limitations

The principal strength of the study consists of its diverse composition of healthcare professionals sourced from the five largest hospitals in Bangladesh. This variation provided a unique opportunity to analyze the collected data and understand the use of AI in the local healthcare sector. This effort facilitated the resolution of challenges associated with AI integration. Nevertheless, the study has several limitations. The study was conducted in a specific region of Bangladesh, which limits the generalizability of the results to the entire country. Convenience sampling may not fully reflect the broader perspective, leading to the overrepresentation of certain viewpoints and thus introducing bias. The perspectives of healthcare professionals at private institutions may significantly differ, since the data were collected from public sector hospitals that may not possess the advanced medical resources available in private facilities.

Conclusion

The study examines the integration of artificial intelligence into Bangladeshi healthcare, considering technological limitations. Bangladeshi healthcare professionals see AI positively and are prepared to use technology to improve outcomes in their area. The integration of artificial intelligence necessitates awareness, suitable training, increased funding allocation, and the promotion of AI research challenges. The research recommends that technological companies, private healthcare organizations, and government authorities collaborate to ensure the integration of artificial intelligence into Bangladesh's healthcare system. Efforts should commence both in megacities and nationwide.

Declaration of competing interest

The authors declare that there is no conflict of interest regarding this paper.

Acknowledgements

The author expresses gratitude to those who answered all the questions and contributed to this study.

Funding

Not applicable.

Data availability statement

The data that support the findings of this study are available from the corresponding author upon reasonable request. Due to privacy and ethical restrictions related to interview-based qualitative data involving human participants, the data are not publicly available.

Transparency statement

The lead author Md. Rayhan Kabir affirms that this manuscript is an honest, accurate, and transparent account of the study being reported; that no important aspects of the study have been omitted; and that any discrepancies from the study as planned (and, if relevant, registered) have been explained.

References

Abdullah, R., & Fakieh, B. (2020). Health care employees' perceptions of the use of artificial intelligence applications: survey study. *Journal of Medical Internet Research, 22*(5), e17620.

Adil, M., Khan, M. K., Farouk, A., Jan, M. A., Anwar, A., & Jin, Z. (2024). AI-driven EEC for healthcare IoT: Security challenges and future research directions. *IEEE Consumer Electronics Magazine, 13*(1), 39-47.

Al Kuwaiti, A., Nazer, K., Al-Reedy, A., Al-Shehri, S., Al-Muhanna, A., Subbarayalu, A. V., Al Muhanna, D., & Al-Muhanna, F. A. (2023). A Review of the Role of Artificial Intelligence in Healthcare. *Journal of Personalized Medicine, 13(6),* Article 6.

Albahri, A., Duhaim, A. M., Fadhel, M. A., Alnoor, A., Baqer, N. S., Alzubaidi, L., Albahri, O., Alamoodi, A., Bai, J., Salhi, A., Santamaría, J., Ouyang, C., Gupta, A., Gu, Y., & Deveci, M. (2023). A systematic review of trustworthy and explainable artificial intelligence in healthcare: Assessment of quality, bias risk, and data fusion. *Information Fusion*, *96*, 156–191.

Aradhya, S., Facio, F. M., Metz, H., Manders, T., Colavin, A., Kobayashi, Y., Nykamp, K., Johnson, B., & Nussbaum, R. L. (2023). Applications of artificial intelligence in clinical laboratory genomics. *American Journal of Medical Genetics Part C Seminars in Medical Genetics*, *193*(3).

Aung, Y. Y., Wong, D. C., & Ting, D. S. (2021). The promise of artificial intelligence: A review of the opportunities and challenges of artificial intelligence in healthcare. *British Medical Bulletin*, *139*(1), 4-15.

Barrera, A., Gee, C., Wood, A., Gibson, O., Bayley, D., & Geddes, J. (2020). Introducing artificial intelligence in acute psychiatric inpatient care: Qualitative study of its use to conduct nursing observations. *Evidence-Based Mental Health, 23(1),* 34–38.

Bashshur, R., Doarn, C. R., Frenk, J. M., Kvedar, J. C., & Woolliscroft, J. O. (2020). Telemedicine and the COVID-19 Pandemic, lessons for the future. *Telemedicine Journal and e-Health*, *26*(5), 571–573.

Belfrage, S., Helgesson, G., & Lynøe, N. (2022). Trust and digital privacy in healthcare: a cross-sectional descriptive study of trust and attitudes towards uses of electronic health data among the general public in Sweden. *BMC Medical Ethics*, *23*(1).

Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology*, *3*(2), 77–101.

Briganti, G., & Moine, O. L. (2020). Artificial intelligence in Medicine: Today and tomorrow. *Frontiers in Medicine, 7*.

Chaurasia, A. (2023). Algorithmic Precision Medicine: Harnessing Artificial Intelligence for Healthcare Optimization. *Asian Journal of Biotechnology and Bioresource Technology, 9(4),* Article 4.

Chen, X., & Ryoo, J. (2025). Advancing AI in Healthcare through Professional Training: Insights from Chinese Practitioners. *Scientia. Technology, Science and Society.*, *2*(1), 95–110.

Dangi, R. R., Sharma, A., & Vageriya, V. (2024). Transforming healthcare in Low-Resource settings with Artificial intelligence: recent developments and outcomes. *Public Health Nursing*.

Davenport, T., & Kalakota, R. (2019). The potential for artificial intelligence in healthcare. *Future Healthcare Journal*, *6*(2), 94–98.

Dwivedi, Y. K., Hughes, L., Ismagilova, E., Aarts, G., Coombs, C., Crick, T., Duan, Y., Dwivedi, R., Edwards, J., Eirug, A., Galanos, V., Ilavarasan, P. V., Janssen, M., Jones, P., Kar, A. K., Kizgin, H., Kronemann, B., Lal, B., Lucini, B., . . . Williams, M. D. (2019). Artificial Intelligence (AI): Multidisciplinary perspectives on emerging challenges, opportunities, and agenda for research, practice and policy. *International Journal of Information Management, 57,* 101994.

Eijkelboom, C., Brouwers, M., Frenkel, J., van Gurp, P., Jaarsma, D., de Jonge, R., Koksma, J., Mulder, D., Schaafsma, E., Sehlbach, C., Warmenhoven, F., Willemen, A., & de la Croix, A. (2023). *Twelve tips for patient involvement in health professions education. Patient Education and Counseling, 106,* 92–97.

Ellahham, S., Ellahham, N., & Simsekler, M. C. E. (2020). Application of artificial intelligence in the health care safety context: opportunities and challenges. *American Journal of Medical Quality*, *35*(4), 341–348.

Eshwar, M. S. (2023). Exploring the potential of artificial intelligence in healthcare: Possibilities and challenges. *International Scientific Journal of Engineering and Management,* 02(04).

Esmaeilzadeh, P. (2024). Challenges and strategies for wide-scale artificial intelligence (AI) deployment in healthcare practices: A perspective for healthcare organizations. *Artificial Intelligence in Medicine, 151,* 102861.

Fernandes, M., Vieira, S. M., Leite, F., Palos, C., Finkelstein, S., & Sousa, J. M. (2019). Clinical Decision Support Systems for Triage in the Emergency Department using Intelligent Systems: a Review. *Artificial Intelligence in Medicine, 102*, 101762.

Frenk, J., Chen, L. C., Chandran, L., Groff, E. O. H., King, R., Meleis, A., & Fineberg, H. V. (2022). Challenges and opportunities for educating health professionals after the COVID-19 pandemic. *The Lancet, 400(10362),* 1539–1556.

Gerke, S., Minssen, T., & Cohen, G. (2020). Chapter 12—Ethical and legal challenges of artificial intelligence-driven healthcare. *In A. Bohr & K. Memarzadeh (Eds.), Artificial Intelligence in Healthcare* (pp. 295–336). Academic Press.

Goirand, M., Austin, E., & Clay-Williams, R. (2021). Implementing Ethics in Healthcare AI-Based Applications: *A Scoping Review. Science and Engineering Ethics, 27(5),* 61.

Gupta, P., Maharaj, T., Weiss, M., Rahaman, N., Alsdurf, H., Minoyan, N., Harnois-Leblanc, S., Merckx, J., Williams, A., Schmidt, V., St-Charles, P., Patel, A., Zhang, Y., Buckeridge, D. L., Pal, C., Schölkopf, B., & Bengio, Y. (2023). Proactive contact tracing. *PLOS Digital Health*, *2*(3), e0000199.

Harry, A. (2023). The future of medicine: Harnessing the power of AI for revolutionizing healthcare. *International Journal of Multidisciplinary Sciences and Arts, 2(1),* 36-47.

He, J., Baxter, S. L., Xu, J., Xu, J., Zhou, X., & Zhang, K. (2018). The practical implementation of artificial intelligence technologies in medicine. *Nature Medicine*, *25*(1), 30–36.

Islam, A. (2025). Ethical challenges and opportunities in AI-Driven healthcare. *Journal of AI-powered Medical Innovations.*, *3*(1), 102–114.

Karimian, G., Petelos, E., & Evers, S. M. A. A. (2022). The ethical issues of the application of artificial intelligence in healthcare: A systematic scoping review. *AI and Ethics, 2(4),* 539–551.

Khalid, J., Chuanmin, M., Altaf, F., Shafqat, M. M., Khan, S. K., & Ashraf, M. U. (2024). AI-Driven Risk Management and Sustainable Decision-Making: Role of perceived environmental responsibility. *Sustainability*, *16*(16), 6799.

Khan, S. A. (2019). Situation analysis of health care system of Pakistan: Post 18 Amendments. *Health Care Current Reviews*, *07*(03).

Kiger, M. E., & Varpio, L. (2020). Thematic analysis of qualitative data: *AMEE Guide No. 131. Medical Teacher, 42(8),* 846–854.

Konidena, B. K., Malaiyappan, J. N. A., & Tadimarri, A. (2024). Ethical Considerations in the Development and Deployment of AI Systems. *European Journal of Technology, 8(2),* Article 2.

Kumar, A., Mani, V., Jain, V., Gupta, H., & Venkatesh, V. G. (2023). Managing healthcare supply chain through artificial intelligence (AI): *A study of critical success factors. Computers & Industrial Engineering, 175,* 108815.

Lee, D., & Yoon, S. N. (2021). Application of Artificial Intelligence-Based Technologies in the Healthcare Industry: Opportunities and Challenges. *International Journal of Environmental Research and Public Health, 18(1),* Article 1.

Lenz, R., & Reichert, M. (2007). IT support for healthcare processes – premises, challenges, perspectives. *Data & Knowledge Engineering*, *61*(1), 39–58.

Li, F., Ruijs, N., & Lu, Y. (2022). Ethics & AI: A Systematic Review on Ethical Concerns and Related Strategies for Designing with AI in Healthcare. *AI*, *4*(1), 28–53.

Li, Q., & Qin, Y. (2023). AI in medical education: medical student perception, curriculum recommendations and design suggestions. *BMC Medical Education*, *23*(1).

Martinez, R. (2019). Artificial intelligence: Distinguishing between types & definitions. *Nevada Law Journal*, *19*(3), 9. https://scholars.law.unlv.edu/cgi/viewcontent.cgi?article=1799&context=nlj

Martinez-Ortigosa, A., Martinez-Granados, A., Gil-Hernández, E., Rodriguez-Arrastia, M., Ropero-Padilla, C., & Roman, P. (2023). Applications of Artificial Intelligence in Nursing Care: A Systematic review. *Journal of Nursing Management*, *2023*, 1–12.

Marwaha, J. S., Landman, A. B., Brat, G. A., Dunn, T., & Gordon, W. J. (2022). Deploying digital health tools within large, complex health systems: Key considerations for adoption and implementation. *npj Digital Medicine*, *5*(1).

Maskara, R., Bhootra, V., Thakkar, D., & Nishkalank, N. (2017). A study on the perception of medical professionals towards artificial intelligence. *International Journal of Multidisciplinary Research and Development*, *4*(4), 34–39.

Mirbabaie, M., Stieglitz, S., & Frick, N. R. J. (2021). Artificial intelligence in disease diagnostics: A critical review and classification on the current state of research guiding future direction. *Health and Technology*, *11*(4), 693–731.

Mohanty, A., & Mishra, S. (2022). A Comprehensive Study of Explainable Artificial Intelligence in Healthcare. In S. Mishra, H. K. Tripathy, P. Mallick, & K. Shaalan (Eds.), *Augmented Intelligence in Healthcare: A Pragmatic and Integrated Analysis*, (pp. 475–502). Springer Nature.

Morley, J., Machado, C. C., Burr, C., Cowls, J., Joshi, I., Taddeo, M., & Floridi, L. (2020). The ethics of AI in health care: A mapping review. *Social Science & Medicine*, *260*, 113172.

Murdoch, B. (2021). Privacy and artificial intelligence: Challenges for protecting health information in a new era. *BMC Medical Ethics, 22(1),* 122.

Murphy, K., Di Ruggiero, E., Upshur, R., Willison, D. J., Malhotra, N., Cai, J. C., Malhotra, N., Lui, V., & Gibson, J. (2021). Artificial intelligence for good health: A scoping review of the ethics literature. *BMC Medical Ethics*, *22*(1).

Naik, N., Hameed, B. M. Z., Shetty, D. K., Swain, D., Shah, M., Paul, R., Aggarwal, K., Ibrahim, S., Patil, V., Smriti, K., Shetty, S., Rai, B. P., Chlosta, P., & Somani, B. K. (2022). Legal and ethical consideration in artificial intelligence in healthcare: Who takes responsibility? *Frontiers in Surgery*, *9*.

Nash, D. M., Thorpe, C., Brown, J. B., Kueper, J. K., Rayner, J., Lizotte, D. J., Terry, A. L., & Zwarenstein, M. (2023). Perceptions of Artificial Intelligence Use in Primary Care: A Qualitative Study with Providers and Staff of Ontario Community Health Centres. *The Journal of the American Board of Family Medicine, 36(2),* 221–228.

Olugboja, A., & Agbakwuru, E. M. (2024). Bridging Healthcare Disparities in Rural Areas of Developing Countries: Leveraging Artificial Intelligence for Equitable Access. *2024 International Conference on Artificial Intelligence, Computer, Data Sciences and Applications (ACDSA),* 1–6.

Petersson, L., Larsson, I., Nygren, J. M., Nilsen, P., Neher, M., Reed, J. E., Tyskbo, D., & Svedberg, P. (2022). Challenges to implementing artificial intelligence in healthcare: A qualitative interview study with healthcare leaders in Sweden. *BMC Health Services Research, 22(1),* 850.

Prakash, S., Balaji, J. N., Joshi, A., & Surapaneni, K. M. (2022). Ethical conundrums in the application of artificial intelligence (AI) in healthcare—A scoping review of reviews. *Journal of Personalized Medicine, 12(11),* 1914.

Racine, E., Boehlen, W., & Sample, M. (2019). Healthcare uses of artificial intelligence: Challenges and opportunities for growth. *Healthcare Management Forum, 32(5),* 272–275.

Radanliev, P., & De Roure, D. (2021). Epistemological and Bibliometric Analysis of Ethics and Shared Responsibility—Health Policy and IoT Systems. *Sustainability, 13(15),* Article 15.

Radanliev, P., & De Roure, D. (2022). Advancing the cybersecurity of the healthcare system with self-optimising and self-adaptative artificial intelligence (part 2). *Health and Technology*, *12*(5), 923–929.

Radanliev, P., De Roure, D., Ani, U., & Carvalho, G. (2021). The ethics of shared Covid-19 risks: An epistemological framework for ethical health technology assessment of risk in vaccine supply chain infrastructures. *Health and Technology, 11(5),* 1083–1091.

Ramadan, O. M. E., Alruwaili, M. M., Alruwaili, A. N., Elsehrawy, M. G., & Alanazi, S. (2024). Facilitators and barriers to AI adoption in nursing practice: a qualitative study of registered nurses' perspectives. *BMC Nursing*, *23*(1).

Richardson, J. P., Smith, C., Curtis, S., Watson, S., Zhu, X., Barry, B., & Sharp, R. R. (2021). Patient apprehensions about the use of artificial intelligence in healthcare. *Npj Digital Medicine*, *4*(1).

Rong, G., Mendez, A., Bou Assi, E., Zhao, B., & Sawan, M. (2020). Artificial Intelligence in Healthcare: *Review and Prediction Case Studies. Engineering, 6(3),* 291–301.

Sapci, A. H., & Sapci, H. A. (2020). Artificial Intelligence Education and Tools for Medical and Health Informatics Students: Systematic Review. JMIR Medical Education, 6(1), e19285.

Saraswat, D., Bhattacharya, P., Verma, A., Prasad, V. K., Tanwar, S., Sharma, G., Bokoro, P. N., & Sharma, R. (2022). Explainable AI for Healthcare 5.0: Opportunities and Challenges. IEEE Access, 10, 84486–84517. IEEE Access.

Secinaro, S., Calandra, D., Secinaro, A., Muthurangu, V., & Biancone, P. (2021a). The role of artificial intelligence in healthcare: A structured literature review. BMC Medical Informatics and Decision Making, 21(1), 125.

Secinaro, S., Calandra, D., Secinaro, A., Muthurangu, V., & Biancone, P. (2021). The role of artificial intelligence in healthcare: a structured literature review. *BMC Medical Informatics and Decision Making*, *21*(1).

Sheikh, H., Prins, C., & Schrijvers, E. (2023). Artificial intelligence: definition and background. In *Research for policy* (pp. 15–41).

Shinde, S. V., Medhane, D. V., & Castillo, O. (2023). Applied Computer Vision and Soft Computing with Interpretable AI. CRC Press.

Slevin, P., Kessie, T., Cullen, J., Butler, M. W., Donnelly, S. C., & Caulfield, B. (2019). A qualitative study of chronic obstructive pulmonary disease patient perceptions of the barriers and facilitators to adopting digital health technology. *Digital Health*, *5*, 205520761987172.

Stinson, C., & Vlaad, S. (2024). A feeling for the algorithm: Diversity, expertise, and artificial intelligence. *Big Data & Society*, *11*(1).

Sun, L., Gupta, R. K., & Sharma, A. (2022). Review and potential for artificial intelligence in healthcare. *International Journal of System Assurance Engineering and Management, 13(1),* 54–62.

Thakur, G. K., Thakur, A., Kulkarni, S., Khan, N., & Khan, S. (2024). Deep learning approaches for medical image analysis and diagnosis. *Cureus*.

Topol, E. J. (2018). High-performance medicine: the convergence of human and artificial intelligence. *Nature Medicine*, *25*(1), 44–56.

Triantafyllidis, A. K., & Tsanas, A. (2019). Applications of Machine Learning in Real-Life Digital Health Interventions: Review of the Literature. *Journal of Medical Internet Research*, *21*(4), e12286.

Trocin, C., Mikalef, P., Papamitsiou, Z., & Conboy, K. (2023). Responsible AI for Digital Health: A Synthesis and a Research Agenda. *Information Systems Frontiers, 25(6),* 2139–2157.

van der Gaag, A., Jago, R., Gallagher, A., Stathis, K., Webster, M., & Austin, Z. (2023). Artificial Intelligence in Health Professions Regulation: An Exploratory Qualitative Study of Nurse Regulators in Three Jurisdictions. *Journal of Nursing Regulation, 14(2),* 10–17.

Vimbi, V., Shaffi, N., & Mahmud, M. (2024). Interpreting artificial intelligence models: a systematic review on the application of LIME and SHAP in Alzheimer's disease detection. *Brain Informatics*, *11*(1).

Waymel, Q., Badr, S., Demondion, X., Cotten, A., & Jacques, T. (2019). Impact of the rise of artificial intelligence in radiology: What do radiologists think? *Diagnostic and Interventional Imaging*, *100*(6), 327–336.

Xue, V. W., Lei, P., & Cho, W. C. (2023). The potential impact of ChatGPT in clinical and translational medicine. *Clinical and Translational Medicine, 13*(3).

Yang, X., Xiao, Y., Liu, D., Zhang, Y., Deng, H., Huang, J., Shi, H., Liu, D., Liang, M., Jin, X., Sun, Y., Yao, J., Zhou, X., Guo, W., He, Y., Tang, W., & Xu, C. (2025). Enhancing doctor-patient communication using large language models for pathology report interpretation. *BMC Medical Informatics and Decision Making*, *25*(1).

Ye, Y., Pandey, A., Bawden, C., Sumsuzzman, D. M., Rajput, R., Shoukat, A., Singer, B. H., Moghadas, S. M., & Galvani, A. P. (2025). Integrating artificial intelligence with mechanistic epidemiological modeling: a scoping review of opportunities and challenges. *Nature Communications*, *16*(1).

Yin, J., Ngiam, K. Y., & Teo, H. H. (2021). Role of Artificial Intelligence Applications in Real-Life Clinical Practice: Systematic review. *Journal of Medical Internet Research*, *23*(4), e25759.

Yu, S., Kulkarni, V. G., & Deshpande, V. (2020). Appointment Scheduling for a Health Care Facility with Series Patients. *Production and Operations Management, 29(2),* 388–409.

Yuliana, Y. (2023). Legal Consideration in Implementing Artificial Intelligence when Dealing with Patients in Healthcare Services. *SAPIENTIA ET VIRTUS, 8(1),* Article 1.

Zahlan, A., Ranjan, R. P., & Hayes, D. (2023). Artificial intelligence innovation in healthcare: Literature review, exploratory analysis, and future research. *Technology in Society*, *74*, 102321.

Zhongqi, H., & Jia, Z. C. (2022). Development and application of software testing under artificial intelligence, 21ks. Available at: https://www.21ks.net/lunwen/rgznlw/180797.html (Accessed March 24, 2024).