Original Article

Perspectives of Iranian Clinical Interns on the Future of AI in Healthcare

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Abstract

This qualitative study examined the perspectives of Iranian clinical interns on the future of artificial intelligence in healthcare, with a focus on perceived opportunities, challenges, and the readiness of medical professionals for AI integration. A total of 64 clinical interns were recruited through snowball sampling from teaching hospitals across Tehran. Data were collected through semi-structured interviews and analyzed using thematic analysis to identify key insights regarding the participants' views on AI technologies in clinical practice. The findings revealed a general optimism about the potential of AI to enhance diagnostic accuracy, streamline workflows, and improve patient outcomes. However, participants expressed concerns about ethical dilemmas, such as the impact of AI on clinical decision-making autonomy and patient privacy. Many interns highlighted the need for AI to complement rather than replace human judgment in medicine. Additionally, most participants identified significant gaps in their training regarding AI, emphasizing the necessity for curriculum reforms to better prepare future clinicians for working alongside advanced technologies.

Key words: artificial intelligence, clinical interns, healthcare, medical education, qualitative study.

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Introduction

The Deloitte Center for Health Solutions (2024) highlights the growing adoption and optimism surrounding Generative AI in healthcare. Key insights include that 75% of leading healthcare organizations are actively exploring or planning to scale Generative AI, while 82% are focusing on establishing governance and oversight for its implementation. Leaders emphasize the technology's potential to enhance operational efficiency (92%) and accelerate decision-making processes (65%), signaling its transformative role in shaping the future of medicine. The promise of AI lies in its ability to analyze vast datasets, uncover complex patterns, and provide insights that augment human decision-making. However, this potential is accompanied by ethical, technical, and practical challenges (Zamani et al., 2021) that complicate its adoption. In exploring these dynamics, the perspectives of healthcare professionals become a pivotal factor in understanding the readiness and implications of AI integration.

Medical interns, as future leaders in healthcare, are particularly significant in this discourse. Their attitudes, experiences, and preparedness to work alongside AI technologies provide a unique lens into the opportunities and barriers to implementation. While optimism about the ability of AI to enhance diagnostic precision, streamline administrative workflows, and improve healthcare equity is widespread, apprehensions about the erosion of clinical autonomy, ethical accountability, and the human touch in medicine persist. Furthermore, gaps in medical education regarding AI knowledge and skills exacerbate the complexity of these challenges.

AI holds immense potential to transform healthcare delivery through its capacity for data-driven insights. Diagnostic algorithms powered by AI have demonstrated unprecedented accuracy in detecting diseases such as cancer, cardiovascular conditions, and rare genetic disorders. These tools analyze imaging studies, patient histories, and laboratory results with speed and precision, enabling earlier interventions that could save lives. Beyond diagnostics, AI is revolutionizing patient care by enabling real-time monitoring of chronic conditions, optimizing treatment regimens, and fostering personalized medicine. By tailoring therapies to individual patient profiles, AI enhances treatment efficacy while minimizing risks.

Another notable advantage of AI is its potential to mitigate disparities in healthcare access. AI-powered mobile diagnostic tools can extend specialist-level expertise to remote and underserved areas, addressing inequities in resource distribution. Research shows that social inequality and injustice are significant obstacles in society that not only prevent equitable systems but also create broader societal challenges (Maleki

Borujeni et al., 2022). Ensuring individual rights and freedoms is essential to overcoming these barriers and fostering inclusive solutions in social systems like healthcare. Furthermore, AI's ability to automate administrative tasks, such as appointment scheduling and documentation, relieves healthcare professionals of routine burdens, allowing them to focus on direct patient care. These benefits underline AI's role as a complementary force in advancing healthcare quality, efficiency, and equity.

Despite its promises, the integration of AI into healthcare systems is fraught with challenges. One of the most pressing concerns among healthcare professionals is the erosion of clinical autonomy. The reliance on AI-generated recommendations raises questions about the balance of decision-making authority between physicians and machines. If clinicians defer excessively to AI, the essence of personalized care and the physician-patient relationship may be compromised. Furthermore, accountability becomes a contentious issue when AI systems produce errors or adverse outcomes. Determining liability—whether it lies with the developer, the healthcare institution, or the physician—remains a complex and unresolved ethical dilemma. These challenges highlight a broader issue: ethical awareness is not inherent and must be actively cultivated. Research highlights that even highly educated individuals often lack sufficient understanding of ethical rules, particularly in complex contexts (Sabbar et al., 2019). This underscores the need for robust ethical education and frameworks to guide the responsible use of AI in healthcare.

Another critical issue is data privacy and security. AI systems require vast amounts of patient data for training and operation, raising concerns about the potential misuse of sensitive information (Sarfi et al., 2021). In regions with limited regulatory frameworks or inadequate cybersecurity measures, these risks are exacerbated. Additionally, the potential for algorithmic bias, stemming from flawed or unrepresentative training datasets, poses significant threats to equitable healthcare delivery. Such biases can lead to disparities in diagnosis and treatment, undermining trust in AI systems.

The infrastructural and educational readiness of healthcare systems further compounds these challenges (Sakhaei et al., 2024). Many institutions, particularly in resource-limited settings, lack the technical infrastructure and financial resources necessary for implementing AI solutions effectively. Mohammadi and Kharazmi (2021) highlight the critical role of technological infrastructure, especially in underdeveloped societies, where deficiencies in resources and preparedness can hinder accessibility and continuity in essential systems like education and healthcare. This underscores the need for significant investments in infrastructure and training to support the adoption of AI technologies.

Moreover, the current medical curriculum often fails to equip healthcare professionals with the skills and knowledge required to understand and utilize AI technologies. These gaps hinder the ability of clinicians to critically assess and integrate AI tools into their practice.

This study focuses on Iranian clinical interns, examining their perspectives on the future of AI in healthcare. Iran presents an intriguing context for such research due to its rapidly evolving healthcare landscape, characterized by high patient loads and varying levels of technological infrastructure. By exploring the views of these young professionals, this study aims to illuminate critical factors influencing the adoption of AI in clinical practice and identify strategies to address existing barriers. The perspectives of Iranian clinical interns provide a microcosm of the global discourse on AI in healthcare. In this study, participants expressed a nuanced understanding of both the opportunities and challenges associated with AI integration. One important aspect of AI is its ability in data analysis (Hosseini et al., 2021). Many interns were optimistic about the potential of AI to revolutionize healthcare delivery, citing its ability to enhance diagnostic accuracy, personalize treatment plans, and address inequalities in access to care. For example, interns highlighted the role of AI in identifying subtle patterns in patient data that might elude human analysis, thereby improving clinical outcomes.

However, this optimism was tempered by concerns about ethical and practical implications. Participants voiced apprehensions about the reliability of AI systems, particularly in critical decision-making scenarios. Questions of accountability and the potential for bias in AI algorithms were frequently raised. Additionally, the interns emphasized the importance of maintaining the human touch in medicine, cautioning against over-reliance on technology at the expense of empathetic patient care. Psychological factors, such as personality traits, play a significant role in shaping behavior and addressing social challenges. Research shows that understanding these traits can help identify and mitigate risks, emphasizing the importance of preventive measures and interventions to foster healthier integration in societal systems (Jamali et al., 2022). This highlights the need for a balanced approach that integrates technological advancements while preserving the human elements of care.

Educational preparedness emerged as a recurring theme in the discussions. Most interns acknowledged significant gaps in their training regarding AI concepts and applications. They advocated for the inclusion of AI-focused modules in medical curricula, encompassing theoretical foundations, practical exercises, and ethical considerations. Hands-on experiences with AI tools, through workshops or simulation exercises, were identified as essential for building confidence and competence.

This emphasis on virtual and interdisciplinary learning resonates with broader educational movements that advocate for the integration of virtual education as a means to bridge systemic educational gaps and promote holistic awareness, particularly in culturally specific contexts like Iran (Dastyar et al., 2023).

Addressing the challenges of AI integration requires a multifaceted approach. First, the development of robust regulatory frameworks is essential to ensure accountability, data security, and ethical usage of AI systems. Research shows that comprehensive legislative frameworks and preventive strategies are essential to address widespread societal challenges, as fragmented policies often lead to inefficiency and ambiguity (Taheri et al., 2022). In the context of healthcare, this highlights the need for well-designed regulatory frameworks to ensure the effective and ethical implementation of AI systems. Policymakers and healthcare institutions must collaborate to establish clear guidelines that delineate the roles and responsibilities of all stakeholders involved in AI implementation.

Second, investments in infrastructure and training are imperative. Healthcare institutions must prioritize the development of technical capacities, such as reliable data storage and processing systems, to support AI applications. In the age of AI, education is very important for most businesses (Zamani et al., 2024). Concurrently, medical education must undergo significant reforms to prepare future clinicians for the realities of AI-enhanced practice. This includes early and consistent exposure to AI technologies, interdisciplinary collaboration with computer scientists and engineers, and ethical training to navigate the complexities of AI-driven care.

Third, creating a culture of trust and collaboration is crucial. AI should be positioned as a tool to augment, rather than replace, human expertise. By emphasizing the human-in-the-loop approach, healthcare systems can ensure that clinicians retain ultimate authority in decision-making while benefiting from AI's analytical strengths. In this context, it is important to recognize the role of media in shaping public perception, particularly during times of uncertainty or rapid technological change. Research shows that media have the power to significantly influence how people perceive societal issues, especially in unusual circumstances or special situations (Kharazmi & Mohammadi, 2020). Media framing, as a powerful tool, can shape public understanding and beliefs, making it essential to leverage this influence positively. Transparent communication and public engagement can ensure that AI systems are perceived as supportive tools rather than threats to cultural or professional identity. This aligns with research showing that increased access to global communication tools can elevate public awareness and engagement with complex societal issues, including environmental and

technological developments (Mousavi & Dariush, 2019). Building trust among patients and healthcare providers through transparent communication and explainable AI systems is equally important.

Review of literature

Since AI technology has been on the rise for the past decade or so, the issue of physicians' perspective on using AI in healthcare has been well studied. Martinho et al. (2021) explored the ethical perspectives of medical doctors regarding the implementation of AI in healthcare. Conducted among physicians in the Netherlands, Portugal, and the United States with diverse medical specializations, the study aimed to understand varying viewpoints on the ethical challenges of Health AI. The researchers identified four distinct perspectives. The first, "AI as a helpful tool", highlighted that automation could enhance efficiency, enabling doctors to focus on advancing their expertise. The second, "Rules and regulations are crucial", underscored skepticism toward private tech companies and advocated for stringent regulatory oversight. In contrast, the third perspective, "Ethics is enough", reflected trust in private companies, positing that adherence to ethical principles suffices to ensure responsible AI use. The fourth perspective, "Explainable AI tools", emphasized the necessity of transparent and interpretable AI systems to facilitate doctors' active involvement in technological progress. These findings suggest a spectrum of opinions among healthcare professionals, ranging from optimism about AI's potential to apprehensions about corporate motives and the ethical implications of its deployment. The study emphasizes the importance of aligning Health AI with bioethical principles and involving medical professionals in its design to address these varied concerns effectively.

Ganapathi and Duggal (2023) conducted a qualitative study to explore the experiences and perspectives of doctors involved in developing and working with AI in the National Health Service (NHS) in England. Through semi-structured interviews with eleven doctor-developers, the researchers aimed to understand their roles in medical AI discourse, their views on broader implementation, and strategies to enhance engagement among medical professionals with AI technologies. The data were analyzed thematically.

The findings revealed an unstructured pathway for doctors entering the AI field, with participants reporting various challenges related to navigating the intersection of clinical, commercial, and technological domains. Doctors highlighted significant barriers to frontline engagement with AI, including the hype surrounding its capabilities and a lack of protected time for learning and development. The participants emphasized the importance of increasing awareness and engagement to advance both AI development and its practical adoption within the NHS.

The study concluded that while AI has substantial potential in healthcare, its integration within the NHS remains in its early stages. To harness its benefits, the NHS must prioritize education and engagement efforts. This includes incorporating AI-focused education into the medical curriculum, allocating time for professional development, and creating flexible opportunities for doctors to explore AI.

Samhammer et al. (2022) investigated the perspectives of experienced nephrologists on the use of artificial intelligence-driven decision support systems (AI-DSS) in clinical decision-making. Through a qualitative content analysis of expert interviews conducted after testing an AI-DSS in a straightforward clinical scenario, the study aimed to explore the needs, challenges, and reflections on the integration of these systems into medical practice.

The findings underscored the critical importance of explainability in AI-DSS, which must be tailored to specific clinical contexts to ensure practical utility. Physicians highlighted the necessity of maintaining the traditional strengths of the medical profession, such as intuition and judgment, even as AI technologies are adopted. Furthermore, the study pointed to the need for AI-DSS to support shared decision-making processes, fostering collaborative interactions between physicians, patients, and the technology. Challenges such as limited control over AI systems and the broader clinical implications of integrating AI into workflows were also noted. The authors concluded that successful implementation of AI-DSS requires systems designed to accommodate the complexities of clinical environments, emphasizing meaningful interaction and trustworthiness.

Laï, Brian and Mamzer (2020) conducted a qualitative survey study to explore perceptions of AI in healthcare among diverse stakeholders in France. Using the grounded theory method, the researchers analyzed interviews with 40 participants, including healthcare professionals, industrial partners, institutional players, external observers, and AI-focused health researchers, conducted between October 2017 and June 2018. The study aimed to gain a comprehensive understanding of the attitudes and concerns surrounding the integration of AI into healthcare practices. The findings revealed that AI in healthcare is often viewed as a myth requiring demystification, though perspectives varied among stakeholders. Healthcare professionals prioritized patient safety and care quality but noted limited application of AI tools in their practice. Industrial partners highlighted AI's transformative potential but pointed to legal challenges, particularly regarding access to individual health data. Institutional actors emphasized their regulatory role in ensuring proper AI tool utilization. External observers expressed concerns about balancing health equity, social justice, and personal freedoms. Meanwhile, health researchers adopted a pragmatic stance, focusing on

improving the transition of AI from research to practical application. The study concluded that while AI holds significant promise for healthcare, its successful development and adoption require collaborative efforts among stakeholders, including patients, to address ethical, legal, and practical challenges. In this regard, it is crucial to consider how external factors shape public attitudes toward emerging technologies. As Sabbar et al. (2023) highlight, people's perceptions can be significantly influenced by external sources, such as political and societal narratives, as well as media consumption. These influences can broadly shape how individuals and groups perceive new technologies like AI, underscoring the need for inclusive and culturally sensitive approaches to foster trust and acceptance.

Pedro et al. (2023) conducted a comprehensive survey to assess the perspectives of Portuguese medical doctors on AI in clinical practice. This observational, descriptive, cross-sectional study utilized a quantitative approach, gathering data through an online survey. The survey explored the perceived impact of AI on healthcare quality, its integration into clinical procedures, advantages and disadvantages of AI in medicine, and physicians' readiness to adopt AI. The study also included demographic, professional, and digital proficiency data to contextualize findings. A total of 1,013 valid responses were obtained, ensuring a representative sample of the medical community in Portugal (99% representativeness, $P< 0.01$). The results indicated widespread optimism among Portuguese doctors about AI's potential in medicine, with most respondents expressing a willingness to adopt AI in their professional activities. Participants acknowledged AI's strengths, such as its ability to enhance data extraction and processing, while also recognizing challenges, including risks associated with delegation of clinical tasks and gaps in digital health training within medical education. Respondents strongly supported the inclusion of AI in medical curricula to address these shortcomings. The study highlights the need for targeted educational reforms and strategies to facilitate the seamless integration of AI into clinical workflows. These findings are relevant not only to Portugal but also to healthcare systems in other jurisdictions, particularly within the European Union, where similar professional contexts exist.

Givanoudi et al. (2024) evaluated the reliability of machine learning (ML) applications, as a subset of AI, in healthcare from the perspective of medical professionals in Northern Greece. The study aimed to assess the trustworthiness of clinical AI systems and to identify factors influencing medical staff's acceptance and use of such tools. A survey was conducted with 35 doctors using a structured questionnaire to capture their opinions on the role and challenges of AI in clinical settings. The findings highlighted nine key factors that affect the adoption of AI in healthcare,

including cost, complexity, and trust issues. Despite these concerns, respondents largely viewed AI as a valuable and supportive tool for medical decision-making, particularly in enhancing diagnostic accuracy and efficiency. However, a subset of doctors expressed reservations, citing a lack of full trust in AI systems due to perceived limitations in explainability and reliability. The study concluded that while AI systems are positively received for their potential to improve clinical workflows, addressing concerns related to cost, usability, and trust is essential for broader adoption.

Banerjee et al. (2024) explored the perceptions of medical doctors regarding the use of AI in healthcare, focusing on familiarity with AI, educational needs, and implementation challenges. A web-based questionnaire was distributed to physicians from diverse fields, addressing demographics, concepts of AI, AI-related education, and challenges in implementation. Of the 142 participants, 52.12% completed the survey. The results revealed limited familiarity with AI among respondents, with a notable emphasis on the challenges associated with integrating AI into clinical practice. The primary concern was the degree of autonomy in AI systems, which scored 3.56 on a Likert scale, highlighting apprehensions about fully automated decision-making processes. Furthermore, 67.61% of respondents identified the lack of human supervision as a critical barrier to AI implementation in therapeutic settings. Despite these concerns, there was significant interest among physicians in gaining a deeper understanding of AI concepts and applications. Similar to findings in other educational contexts, students' motivation to learn and engage with advanced technologies like AI often persists regardless of socioeconomic background, though access to opportunities may vary significantly (Dariush et al., 2017). The study concluded that the low familiarity with AI underscores the urgent need for specialized education and training programs in medical schools and healthcare institutions. By equipping physicians with knowledge and skills related to AI, these initiatives could improve the integration of AI into clinical workflows and enhance patient outcomes.

Ursuleanu et al. (2024) examined the evolving doctor-AI relationship in medical practice, focusing on the interplay between physicians' emotional and attitudinal dispositions and their receptivity to AI technologies. The study emphasized the novelty of exploring how introverted (emotional) and extroverted (attitudinal) components of doctors' personalities impact their interactions with AI, aiming to provide an aesthetic and ethical framework for this dynamic. Using a holistic approach, the researchers analyzed the challenges and prospects of AI adoption in medicine. They emphasized the need for integrating AI as a supportive tool in clinical practice rather than as a replacement for

human expertise. The findings suggested that fostering emotional and attitudinal engagement among physicians enhances their receptivity to AI technologies. This approach aligns with efforts to optimize the doctor-patient-AI relationship, ultimately aiming to improve patient outcomes and quality of care. The authors concluded that AI's role in medical practice is best framed as a complement to human decision-making, capable of handling large datasets and complex tasks such as image analysis but lacking semantic understanding of medical concepts. Addressing the emotional and ethical dimensions of the doctor-AI relationship was identified as critical for successful integration, enabling high-performance AI tools to be effectively used in clinical workflows while maintaining human-centric care.

Sezgin (2023) examined the evolving role of AI in healthcare, emphasizing its capacity to complement rather than replace medical professionals. The article addressed concerns about whether AI could supplant doctors or create disparities between AI-adopting and non-adopting physicians. Through a focus on human-AI collaboration, the study argued that AI's primary function is to enhance clinical practice by augmenting diagnostic accuracy, optimizing treatment plans, and improving patient outcomes. Central to the discussion is the human-in-the-loop (HITL) approach, which integrates human oversight into AI-driven processes to ensure safety and quality in healthcare delivery. By combining the analytical capabilities of AI with the cognitive and empathetic strengths of healthcare providers, this model supports a collaborative framework that enhances decision-making while maintaining the human touch in patient care. The article further suggested that organizational adoption of AI should be guided by HITL principles to foster multidisciplinary teamwork and ensure the responsible use of AI tools.

The study concluded that AI has the potential to transform healthcare by complementing the expertise of medical professionals. By focusing on collaboration rather than substitution, authors say, the integration of AI can lead to better service quality, improved patient outcomes, and a more efficient healthcare system.

The review of literature in the document explores diverse perspectives on AI in healthcare, focusing on ethical, practical, and educational aspects, as well as its integration into clinical workflows. Martinho et al. (2021) identified varied ethical perspectives among doctors, ranging from optimism about AI as a helpful tool to skepticism about private companies' motives and the necessity for explainable AI systems. These perspectives highlight the importance of aligning AI tools with bioethical principles and involving healthcare professionals in their design.

Ganapathi and Duggal (2023) examined the experiences of doctors

working with AI in the NHS, emphasizing challenges such as the lack of structured pathways for AI adoption and limited engagement due to time constraints. They advocated for education and training programs to enhance understanding and integration of AI in clinical practice. Similarly, Samhammer et al. (2022) underscored the importance of explainability and maintaining traditional medical strengths in decision-making. They emphasized AI's role in fostering shared decision-making and the need for meaningful human interaction with AI systems.

Laï et al. (2020) presented diverse viewpoints from French healthcare stakeholders, highlighting the need for collaborative efforts to address ethical and practical challenges. Pedro et al. (2023) found optimism among Portuguese doctors about AI's potential while identifying educational gaps and advocating for curriculum reforms. Givanoudi et al. (2024) focused on trust issues and factors influencing AI adoption in Northern Greece, emphasizing the necessity of addressing cost, complexity, and usability concerns.

Banerjee et al. (2024) identified low familiarity with AI among physicians, pointing to an urgent need for education and training to bridge knowledge gaps and improve AI integration. Ursuleanu et al. (2024) examined the interplay between physicians' emotional and attitudinal dispositions and their receptivity to AI, concluding that addressing these dimensions fosters better AI adoption. Sezgin (2023) highlighted the importance of human-AI collaboration and the human-in-the-loop approach to ensure safety, quality, and enhanced patient outcomes.

Methodology

This is a qualitative study. Qualitative research is an approach aimed at exploring and understanding complex phenomena, often focusing on subjective experiences, meanings, and social processes. Unlike quantitative research, which emphasizes numerical data and statistical analysis, qualitative research seeks to provide rich, detailed descriptions and interpretations of human behavior and thought processes. This approach is particularly valuable in fields such as social sciences, healthcare, and education, where understanding context, lived experiences, and underlying motivations is essential. By prioritizing depth over breadth, qualitative studies allow researchers to uncover nuances and intricacies that might be overlooked in quantitative methodologies.

One of the most commonly used methods in qualitative research is the interview. Interviews are a versatile and effective way to gather in-depth information about participants' thoughts, feelings, and experiences. They provide a platform for participants to articulate their perspectives in their own words, thereby offering unique insights that structured

surveys or observational methods may not capture. Interviews can take various forms, including structured, semi-structured, and unstructured formats, depending on the research objectives. Structured interviews follow a predetermined set of questions, ensuring consistency across participants, while unstructured interviews allow for open-ended exploration of topics. Semi-structured interviews, a widely used approach, strike a balance between these two by providing a flexible framework that enables researchers to probe deeply into areas of interest while maintaining comparability across responses.

The strength of interviews as a qualitative method lies in their adaptability and capacity to elicit rich, context-specific data. Through thoughtful question design and active listening, researchers can explore participants' beliefs, attitudes, and experiences in detail. This method also allows for clarification of responses and the opportunity to delve into unexpected topics that emerge during the conversation. Moreover, interviews are particularly effective for exploring sensitive or complex issues, as the one-on-one setting can create a safe and confidential environment for participants to share their thoughts. However, the success of interviews depends heavily on the interviewer's skill, including their ability to establish rapport, avoid bias, and facilitate open and honest dialogue.

Despite their advantages, interviews also come with challenges and limitations. They are time-consuming, both in terms of conducting the interviews and analyzing the data. The analysis process, which often involves transcribing, coding, and thematically interpreting responses, requires significant effort and expertise. Additionally, the subjective nature of interviews means that findings are influenced by the interaction between the interviewer and the participant. This introduces potential biases, such as social desirability bias, where participants provide responses, they believe the interviewer wants to hear. To mitigate such biases, we ensured that our interview techniques and data analysis were rigorous and reflective.

Participants

The participants in this study comprised 64 clinical interns recruited from various teaching hospitals in Tehran, Iran. The sample included 47 males and 17 females, reflecting the broader gender distribution often seen in medical education in Iran. The age range of the participants was between 22 and 38 years, spanning early to late stages of clinical training. This age distribution allowed the study to capture a wide spectrum of perspectives, from younger interns newly introduced to clinical settings to more experienced individuals nearing the completion of their training. The recruitment strategy, which utilized snowball

sampling, facilitated access to participants across different institutions, adding depth to the dataset by encompassing varied experiences and exposures to AI-related concepts in healthcare.

Table 1 shows the details of names, ages and genders of our participants. Upon the request of some participants, we chose a pseudonym for them so their full anonymity was guaranteed. For all participants, the informed consent was obtained before the interview. Interviews took 20 to 75 minutes, depending on each interviews responses.

Table 1. The demographics of the participants

First name	Age	Gender
Ali	24	Male
Mojtaba	28	Male
Sara	25	Female
Reza	30	Male
Fatemeh	22	Female
Hassan	25	Male
Nasrin	29	Female
Hossein	24	Male
Zahra Sadat	26	Female
Ehsan	31	Male
Leila	27	Female
Mohammad Taha	23	Male
Afsaneh	23	Female
Ali Reza	28	Male
Narges	28	Female
Amir	26	Male
Roya	24	Female
Moahmmad Saeed	23	Male
Parviz	25	Male
Mahsa	26	Female
Navid	27	Male
Mehdi	29	Male
Saman	25	Male
Alireza	30	Male
Zhinous	24	Female
Babak	37	Male
Mojtaba	28	Male
Farzaneh	32	Female
Kaveh	31	Male
Pegah	22	Female
Omid	33	Male
Ashkan	26	Male
Niloofar	25	Female

First name	Age	Gender
Behnam	25	Male
Hamid	38	Male
Mitra	29	Female
Javad	30	Male
Arash	26	Male
Hadi	28	Male
Yalda	24	Female
Peyman	27	Male
Elham	27	Female
Kamran	26	Male
Amin	23	Male
Shirin	23	Female
Vahid	31	Male
Shayan	23	Male
Simin	26	Female
Parsa	28	Male
Kian	25	Male
Roya	29	Female
Ebrahim	27	Male
Amir Bahman	30	Male
Atefeh	25	Female
Yousef	34	Male
Keyvan	26	Male
Leila	22	Female
Arman	28	Male
Darya	27	Female
Pooya	31	Male
Amirhossein	23	Male
Nazanin	24	Female

As was mentioned, we put our data to qualitative analysis and the results were categorized into 5 main categories: Perceived Benefits of AI in Healthcare; Challenges and Concerns; Educational Needs and Readiness; Integration of AI in Clinical Practice; Personal Attitudes Toward AI.

Results

As we saw above, our participants were young medical interns and therefore they had a clear idea of the current -and perhaps future- role of AI in the healthcare industry. Some of the participants viewed some aspects of an AI-driven healthcare service as beneficial. Their responses were categorized as “Perceived Benefits of AI in Healthcare.”

Perceived benefits of AI in healthcare

The integration of AI in healthcare presents a range of transformative opportunities, as highlighted by the perspectives of clinical interns. Central to these benefits is AI's capacity to enhance diagnostic accuracy and efficiency through the rapid analysis of complex datasets, including imaging studies and patient histories, facilitating early detection of critical conditions such as cancer and cardiovascular diseases. Participants in the study emphasized the potential of AI to streamline workflows by automating routine administrative tasks, allowing healthcare professionals to devote more time to direct patient care. Furthermore, AI's ability to personalize treatment plans based on data from wearables and electronic health records aligns with goals of improving patient outcomes and satisfaction. The potential for AI to reduce healthcare disparities was also noted, particularly in underserved regions where access to specialized care is limited.

Amin, 23:
"I think AI can revolutionize the way we approach diagnosis and treatment in healthcare. For example, AI algorithms can analyze imaging studies, lab results, and patient histories far more quickly and comprehensively than a human can. This can lead to earlier detection of conditions like cancer or cardiovascular diseases, which are often missed in the early stages. Moreover, our professors told us, AI can identify subtle patterns and correlations in large datasets that might be imperceptible to the human eye, providing insights that could improve treatment plans. Beyond diagnostics, AI can assist in managing chronic diseases by tracking patient data in real-time and suggesting adjustments to treatment regimens. This is why I see AI as a powerful tool to enhance efficiency, and personalization in patient care."

Hadi, 28:
"AI has the potential to streamline our workflows. By automating routine tasks such as scheduling appointments or transcribing notes, AI can free up more time for us to focus on direct patient care. This would not only improve efficiency but also reduce burnout among healthcare professionals."

Shirin, 23:
"One of the most exciting aspects of AI is its ability to personalize patient care. Analyzing data from wearables or electronic health records can help tailor treatment plans to individual patients, improving outcomes and patient satisfaction."

Keyvan, 26:
"AI has immense potential to transform patient care by providing support in areas where human capabilities have limitations. For instance, in

diagnostics, AI-powered tools can rapidly analyze complex imaging scans like MRIs or CT scans and flag abnormalities with high precision. This could significantly reduce diagnostic errors, which are a major challenge in healthcare. Additionally, AI can optimize treatment by integrating data from a patient's medical history, genetic information, and lifestyle factors to create tailored therapy plans. Such personalized care could lead to better patient outcomes and reduced healthcare costs. I also see AI as an asset in research, as it can process large datasets in minutes, uncovering patterns that would take humans years to find. The possibilities are truly promising."

Darya, 27:
"New technologies like AI could address inequalities in healthcare by bringing expertise to underserved areas. Imagine AI-powered mobile clinics diagnosing diseases in remote regions where specialists are not readily available. It could be a step toward global health equity."

Challenges and Concerns

Challenges associated with integrating AI into healthcare systems are multifaceted and warrant careful consideration. Among the primary concerns are ethical dilemmas such as the erosion of clinical autonomy and accountability in decision-making, as noted by participants who questioned the extent to which physicians retain control when AI-generated recommendations conflict with their clinical judgment. Issues of patient data privacy further complicate the scenario, particularly in regions with insufficient infrastructure to safeguard sensitive information against breaches or misuse. Concerns about the reliability and bias in AI systems were also prevalent, reflecting apprehensions about flawed training datasets potentially leading to adverse outcomes. Moreover, practical barriers such as the lack of necessary infrastructure and limited readiness of healthcare institutions exacerbate these challenges, raising doubts about the feasibility of widespread AI adoption in under-resourced areas. Our participants believe these obstacles reveal the need for comprehensive strategies, including regulatory frameworks, enhanced training programs, and robust infrastructure, to ensure AI's integration benefits patient care without compromising ethical or operational standards.

Leila, 22:
"I am worried about how AI might affect decision-making in medicine. If a machine makes a mistake, who is accountable—the doctor or the developers? This ethical gray area makes me hesitant about fully trusting AI in critical situations."

Ali, 24:
"One of my primary concerns about AI in healthcare is the potential erosion of clinical autonomy. For example, if an AI system recommends a certain treatment plan, how much freedom does the doctor have to override it, especially if the hospital or administrators favor AI-driven decisions for efficiency or cost-saving reasons? This could undermine the doctor-patient relationship, where trust is built on the physician's judgment and personalized care. Additionally, there's the ethical issue of accountability. If an AI system makes an incorrect diagnosis or treatment recommendation that leads to patient harm, who is held responsible? It's not just a legal question but a moral one that complicates the role of healthcare professionals in an AI-driven environment. These issues make me cautious about embracing AI without first addressing these critical concerns."

Zahra Sadat, 26:
"One major concern is the reliability of AI systems. How do we ensure the algorithms are unbiased and accurate? If the data used to train these systems is flawed, it could lead to dangerous outcomes in patient care."

Babak, 37:
"Patient data privacy is a big issue for me. With AI relying on vast amounts of data, how can we guarantee that sensitive patient information isn't misused or hacked?"

Saman, 25:
"Even if AI has great potential, I feel that most healthcare systems in our region lack the infrastructure to implement these technologies effectively. Without proper resources, AI might create more problems than it solves."

Educational needs and readiness

Current medical curricula often lack structured education on AI technologies, leaving many medical interns feeling underprepared to interact effectively with these tools in clinical settings. Participants in this study expressed a strong desire for practical and theoretical training on AI, encompassing fundamental concepts like machine learning, hands-on experiences with AI systems, and ethical considerations relevant to clinical practice. Structured workshops, case studies, and simulation exercises were identified as essential components to bridge this educational divide. Additionally, there was consensus on the importance of early and consistent exposure to AI, beginning in pre-clinical years, to build confidence and competence.

Shayan, 23:
"I believe AI has the potential to revolutionize healthcare, but I feel unprepared to work with these technologies."

Javad, 30:
"I've read a few articles about AI in medicine, but I don't feel confident about how to integrate it into clinical decision-making. It would be helpful if universities introduced AI modules, including practical sessions where we could interact with AI-based diagnostic tools. Without hands-on experience, I fear that we might misuse or underutilize these technologies."

Roya, 24:
"Our education hasn't kept up with the advancements in artificial intelligence, and this is a significant gap. For instance, we've never been formally introduced to how AI-based diagnostic systems work or how to interpret their recommendations in clinical practice. This leaves many of us uncertain about how to integrate such tools effectively into patient care. It's not just about knowing that AI exists; we need structured education that starts with basic concepts like machine learning and progresses to hands-on experience with AI tools in simulated or real-world settings. I think this could be achieved by incorporating AI into the curriculum as a mandatory subject, similar to pharmacology or pathology. Additionally, organizing workshops and seminars led by experts in the field could help us bridge this knowledge gap. Without this foundation, I worry that we might misinterpret AI outputs or fail to use these technologies to their full potential."

Fatemeh, 22:
"We hear a lot about AI replacing doctors, but no one teaches us how to collaborate with it. I'd like to see case studies or real-world examples in our training to understand where AI fits in our daily responsibilities as clinicians."

Peyman, 37:
"I think introducing basic concepts early, such as during pre-clinical years, could make us more confident and prepared by the time we graduate."

Integration of AI in clinical practice

AI tools, such as decision support systems and predictive analytics, have demonstrated potential to augment clinicians' capabilities by analyzing vast datasets and identifying subtle patterns beyond human recognition. However, the successful adoption of AI hinges on its ability to complement rather than supplant the nuanced judgment and empathy inherent in medical practice. This requires reliable infrastructure, robust training programs, and the development of human-AI collaborative frameworks to ensure safety, trust, and effectiveness. Ethical concerns, including accountability, patient privacy, and the maintenance of clinical autonomy, remain central to discussions on AI integration, necessitating a thoughtful and inclusive approach. By addressing these challenges, healthcare systems can position AI as an invaluable partner in advancing

the quality and equity of medical care.

Yalda, 24:
"Integrating AI into clinical practice has the potential to revolutionize how we deliver healthcare, but it also raises significant challenges that need to be addressed. For example, AI tools could be invaluable in reducing diagnostic errors by analyzing large datasets more efficiently than humans. However, there are practical issues to consider, such as the need for reliable infrastructure in hospitals and ensuring compatibility with existing systems. Additionally, clinicians must remain central to decision-making processes. While AI can suggest diagnoses or treatment plans, it cannot replace the nuanced judgment that comes from experience and understanding of a patient's unique circumstances. Training is another key factor; many of us feel unprepared to work with these technologies due to limited exposure during our education. Hospitals and universities need to prioritize integrating AI into medical training programs, focusing not only on the technical aspects but also on ethical considerations. Ultimately, for AI to be successfully integrated, it must enhance the work of clinicians without undermining their role or the trust patients place in them."

Sara, 25:
"I believe AI should be used as a supportive tool rather than a decision-maker. For instance, an AI system could suggest potential diagnoses based on patient symptoms, but the final decision must always rest with the clinician."

Amirhossein, 23:
"Hospitals need to prioritize workshops and hands-on sessions to familiarize medical teams with AI systems."

Ebrahim, 37:
"The idea of integrating AI into patient consultations is intriguing, such as using virtual assistants to gather patient history before they meet the doctor. This could save time, but we need to ensure the technology doesn't make the experience feel impersonal for patients."

Personal attitudes toward AI

Personal attitudes toward AI in healthcare are shaped by a dynamic interaction of optimism, apprehension, and openness to learning. Clinical interns, as future healthcare practitioners, recognize AI's transformative potential to enhance diagnostic accuracy, streamline workflows, and provide personalized care. However, concerns persist about the erosion of the human element in medicine, accountability in AI-driven decisions, and the ethical implications of integrating AI into clinical practice. For many interns, these apprehensions are coupled

with a readiness to embrace AI, provided adequate training and guidelines are in place.

Navid, 27:
"I believe AI has the potential to revolutionize healthcare. It can help us diagnose rare diseases more accurately and faster than ever before. While there may be challenges, I am optimistic that with proper guidelines and education, AI will become a trusted partner in our practice."

Babak, 26:
"I'm concerned that AI might undermine the human touch in medicine. Patients trust us as their caregivers, and if they start seeing machines making decisions, it might erode that trust. It's hard to imagine how this balance can be maintained."

Atefeh, 25:
"While I don't know much about how AI works, I'm open to learning. As clinicians, we've always adapted to new technologies, and AI is no different. If it helps us provide better care, I'm willing to embrace it."

Conclusion

The Internet has revolutionized access to information but has also contributed to health problems such as digital eye strain, sedentary lifestyles, and mental health issues (Nosraty et al., 2021) like anxiety and addiction to social media. Prolonged screen time and poor posture have led to physical ailments, while misinformation online has caused confusion about health practices. However, the rise of artificial intelligence offers promising solutions for a more efficient medical system. AI can analyze vast amounts of data to improve diagnostics, predict disease outbreaks, and personalize treatment plans. It streamlines administrative tasks, reducing wait times and costs. Telemedicine powered by AI enables remote consultations, making healthcare accessible to underserved areas. While the Internet has posed health challenges, AI is paving the way for a smarter, more responsive healthcare system.

The perspectives of Iranian clinical interns on the future of AI in healthcare reflect a mixture of optimism, caution, and the desire for structured preparation. This study reveals the significant potential of AI to enhance clinical outcomes through improved diagnostic accuracy, personalized treatment plans, and increased healthcare access, particularly in underserved regions. Simultaneously, concerns regarding ethical dilemmas, such as accountability, erosion of clinical autonomy, and data privacy, emphasize the need for robust regulatory frameworks and transparent governance.

Educational preparedness emerged as a critical theme, highlighting gaps in current medical training that leave many interns feeling unprepared to utilize AI technologies effectively (Soroori Sarabi et al., 2023). Participants advocated for integrating AI into medical curricula, emphasizing the need for theoretical knowledge, hands-on experience, and ethical training to navigate the complexities of AI-driven care. Addressing these gaps will be essential for ensuring that future healthcare professionals can engage confidently and competently with AI.

Practical challenges, including infrastructural limitations and algorithmic biases, further complicate AI integration. These barriers must be addressed through investments in healthcare infrastructure and the development of explainable and equitable AI systems. Moreover, fostering a collaborative culture that positions AI as a supportive tool rather than a replacement for human expertise is critical to maintaining trust and ensuring patient-centered care.

Ethical considerations

The author has completely considered ethical issues, including informed consent, plagiarism, data fabrication, misconduct, and/or falsification, double publication and/or redundancy, submission, etc.

Conflicts of interests

The author declares that there is no conflict of interests.

Data availability

The dataset generated and analyzed during the current study is available from the corresponding author on reasonable request.

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