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Perceptions of Iranian Medical Students on Artificial Intelligence in Healthcare and Curricular Integration

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Abstract

Teaching medical students about AI's role in medicine is crucial for equipping future healthcare professionals with the knowledge and skills needed to leverage advanced technologies for improved diagnosis, treatment, and patient care. This study investigates the perceptions of Iranian medical students regarding the role of artificial intelligence in the future of healthcare and its integration into their curricula. A total of 371 medical students, recruited through online forums and snowball sampling, participated in an online survey. Among the respondents, 208 were female, and 163 were male. The findings revealed that the majority of participants believed AI would have a transformative impact on the medical profession in the future. However, the

students expressed dissatisfaction with the current level of AI-related education in their medical curricula, emphasizing its insufficiency for adequately preparing them to leverage AI technologies in their future careers. Furthermore, respondents highlighted the age of faculty members as a significant barrier, suggesting that older professors may struggle to adapt to new communication technologies, thereby hindering effective AI integration. The respondents emphasized the need for Iranian medical schools to modernize their curricula and equip both students and educators with the skills and knowledge required to work in an AI-driven healthcare landscape.

Keywords: Artificial Intelligence, Medical Education, Healthcare Innovation, Iranian Students, Curriculum Reform

Introduction

AI is transforming many industries and its application in healthcare gaining significant momentum. The ability of AI to enhance diagnostic precision, optimize treatment pathways, and streamline administrative tasks positions it as a critical tool in modern medicine (Harvard Medical School, 2024) ^[15]. For medical professionals, understanding and leveraging AI is no longer optional but an essential competency. However, the integration of AI technologies into healthcare education remains inconsistent, with notable gaps in medical curricula worldwide (Busch *et al.*, 2023).

Medical students, as future healthcare providers, are key stakeholders in the adoption and implementation of AI technologies. Prior research in Iranian higher education contexts demonstrates generally positive attitudes toward AI integration, while simultaneously highlighting concerns about ethical implementation and faculty preparedness (Rahmatian & SharajSharifi, 2021) ^[35]. Studies have revealed a generally positive attitude toward AI among medical students, coupled with a strong desire for its inclusion in educational programs (Sit *et al.*, 2020; Jackson *et al.*, 2024) ^[42, 18]. Meta-synthesis research demonstrates that successful AI integration in higher education requires coordinated institutional strategies addressing curriculum reform, faculty development, and technological infrastructure (Rahmatian & SharajSharifi, 2022) ^[36]. Yet, concerns about inadequate preparation persist, with students reporting insufficient exposure to AI-related topics during their training (Buabbas *et al.*, 2023) ^[5]. Developing critical AI literacy requires addressing algorithmic bias, data privacy, and ethical considerations through multidisciplinary pedagogical approaches that bridge technical competencies with sociocultural awareness (Khodabin *et al.*, 2024) ^[21]. Furthermore, demographic factors such as gender and age are known to influence perceptions of and confidence in using AI, warranting deeper investigation into these disparities (Gillissen *et al.*, 2022) ^[13]. Research on Iranian professionals

reveals significant disparities in digital readiness by age cohort, with younger individuals demonstrating higher AI adaptability and innovation receptiveness (Khodabin *et al.*, 2023) ^[23]. In addition to these factors, social media and digital platforms also play a significant role in shaping medical students' perceptions and attitudes toward AI technologies. Nosrati *et al.* (2023) ^[32] provide empirical evidence demonstrating how digital platforms, particularly Instagram, significantly influence individual decision-making processes, revealing the intricate ways in which social media content can shape personal preferences. This highlights the importance of considering the role of digital platforms in medical education, as they can either reinforce or challenge students' understanding of AI's role in healthcare.

This study explores the perceptions of Iranian medical students regarding AI's transformative role in healthcare and its integration into their curricula. Comprehensive reviews of AI literacy reveal significant diversity in pedagogical strategies and definitional ambiguity, emphasizing the need for standardized frameworks and consistent integration approaches (Khodabin *et al.*, 2022) ^[22]. By examining students' views on AI's potential, their preparedness to work with these technologies, and the perceived barriers to effective adoption, the study aims to provide actionable insights for modernizing medical education in Iran. Addressing these challenges is crucial for equipping the next generation of physicians with the skills required to thrive in an AI-driven healthcare landscape. As Sabbar *et al.* (2023) ^[38] indicate, sustained exposure to prevailing global narratives can lead individuals to adopt external perceptions of their societies, significantly impacting their self-identity. This phenomenon is relevant to the adoption of AI in healthcare, where global narratives about AI's role in medicine may shape medical students' perceptions and attitudes. Other research highlights this tension between AI's exploitative and constructive potentials, contrasting its use in surveillance capitalism with its applications in disaster risk management. The proposed Public AI for Resilience framework emphasizes the need for governance models grounded in data sovereignty and algorithmic explainability—principles equally relevant to healthcare contexts where balancing innovation with ethical considerations is paramount (Sharifipour Bgheshmi & Sharajsharifi, 2025). Understanding these influences is crucial for designing educational programs that foster critical thinking and ensure that students develop informed, contextually relevant perspectives on AI's role in healthcare.

Review of Literature

Although the general use of AI in medical work is a relatively new phenomenon, there is a wealth of literature - both theoretical and fieldwork- on this subject. Cherry Sit, Rohit Srinivasan, Ashik Amlani, Keerthini Muthuswamy, Aishah Azam, Leo Monzon, and Daniel Stephen Poon (2020) conducted a study exploring the attitudes of UK medical students toward AI and its impact on career intentions in radiology. Additionally, the study examined the state of AI education within medical schools. An anonymous electronic survey with Likert-scale and dichotomous questions was distributed to students from 19 UK medical schools, yielding 484 responses. Their findings revealed that 88% of respondents acknowledged the significant role AI will play in healthcare, while 49%

reported being less inclined to consider radiology as a career due to AI. Despite this, 89% expressed that AI education would be beneficial for their careers, and 78% agreed it should be incorporated into medical curricula. Only 45 students had received AI-related training, and none through mandatory coursework. Those exposed to AI education were more likely to consider radiology ($p=0.01$) and expressed greater confidence in using AI post-graduation ($p=0.01-0.04$). However, even among this group, many felt underprepared for critical use of AI in clinical practice. The authors concluded that while medical students recognize the importance of AI and exhibit a willingness to engage with it, current educational offerings are inadequate. They recommend integrating comprehensive AI training into medical programs, emphasizing realistic use cases and limitations to mitigate discouragement regarding radiology careers.

Gillissen, Kochanek, Zupanic, and Ehlers (2022) ^[13] conducted a mixed-methods study to assess medical students' attitudes towards eHealth technologies, with a focus on AI. The study employed an exploratory sequential design, beginning with semi-structured interviews with 28 students from five German medical faculties. Insights from the interviews informed the creation of an online survey, distributed to approximately 80,000 medical students across Germany. The results indicated that most students held positive attitudes toward the integration of digital technologies in medicine. However, significant differences emerged based on curriculum type and gender. Students from problem-based curricula (PBC) and male undergraduates were more likely to believe that AI produces superior diagnostic outcomes compared to physicians ($p < 0.001$). Male students also demonstrated the most favorable overall perception of AI ($p < 0.002$). Despite these positive views, 38% of participants reported feeling unprepared to engage with AI-related concepts due to the lack of formal education on digitization and AI in their medical programs. Opinions on the diagnostic utility of AI varied significantly among demographic and curriculum groups.

Li and Qin (2023) ^[25] investigated medical students' perceptions of AI and proposed recommendations for integrating AI education into medical curricula. Using the Unified Theory of Acceptance and Use of Technology model, the study analyzed factors influencing students' acceptance and intention to use medical AI. Data were collected from 1,243 undergraduate and postgraduate students across 13 universities and 33 hospitals, with 54.3% of participants reporting prior experience with medical AI. Their findings revealed that postgraduate students demonstrated greater awareness and familiarity with medical AI compared to undergraduates. Key factors positively associated with the intention to use medical AI included performance expectancy, habit, hedonic motivation, and trust. The authors emphasized the need for medical education to focus on practical training that enhances performance and confidence in using AI tools. Additionally, courses should be designed to be both engaging and straightforward to foster student interest and competence.

The study concluded that systematic education on medical AI is essential to equip medical students with the necessary skills to succeed in a healthcare landscape increasingly influenced by AI technologies.

Jha *et al.* (2022) ^[19] conducted a cross-sectional study to assess medical students' and interns' knowledge of AI, their perceptions of AI in medicine, and preferences for AI-related education at KIST Medical College, Nepal. Using a validated Canadian questionnaire, the authors gathered responses from 216 participants (37% response rate) and analyzed data quantitatively. The instrument's face validity and reliability were verified through a pilot test with 20 alumni (Cronbach alpha = 0.6). The study revealed that the median AI knowledge score was 11 out of 25 (IQR = 4), with final-year students and those with prior AI training scoring significantly higher ($p = 0.006$ and $p = 0.040$, respectively). Over 49% of respondents believed AI would reduce job opportunities for doctors, and many anticipated AI would influence their specialty choices. Participants expressed concerns about Nepal's healthcare system being unprepared to address the challenges posed by AI but strongly supported integrating AI education into medical curricula. The findings underscored the absence of AI and machine learning topics in Nepalese medical education, contributing to a lack of awareness regarding AI's impact on patient care and the healthcare system. However, the high willingness among students to learn about AI indicates a favorable opportunity for curriculum reform. The authors recommended systematically introducing AI and machine learning topics into medical education to prepare students for resource-constrained healthcare environments.

Jackson *et al.* (2024) ^[18] conducted a cross-sectional study to evaluate medical students' perceptions of AI in medicine, their preferences for AI training, and their understanding of AI's ethical implications. The study involved 325 medical students in Kerala, India, who completed a pre-validated, semi-structured questionnaire. The survey assessed participants' demographics, prior exposure to AI education, self-assessed knowledge, and perceptions regarding AI applications and ethical concerns in healthcare. Their findings showed that 57.2% of students viewed AI as a tool to reduce medical errors, while 54.2% believed it could enhance decision-making accuracy. Nearly half (49%) felt that AI could improve healthcare accessibility. However, concerns about AI replacing physicians were reported by 37.6%, and 69.2% feared it might diminish the humanistic aspects of medicine. Ethical concerns included challenges related to trust (52.9%), the patient-physician relationship (54.5%), and breaches of confidentiality (53.5%). Only 3.7% of respondents felt confident in educating patients about the benefits and risks of AI. A significant majority expressed a strong demand for structured AI training, particularly on reducing medical errors (76.9%) and addressing ethical issues (79.4%). The study concluded that while medical students recognize AI's potential as an assistive technology, widespread ethical concerns and low confidence levels highlight the need for comprehensive AI education in undergraduate curricula. The authors recommended structured training programs emphasizing practical applications, error reduction, and ethical considerations to prepare students for evolving healthcare environments. These ethical challenges are further compounded by systemic issues such as injustice and discrimination, which erode trust and social cohesion. Addressing these broader societal factors through equitable policies and restorative approaches is essential to ensure that AI integration in healthcare fosters inclusivity and rebuilds trust in systems (Maleki Borujeni *et al.*, 2022) ^[29].

Busch *et al.* (2023) conducted a multinational, multicenter cross-sectional study to explore medical, dentistry, and veterinary students' perceptions of AI in education and clinical practice. The study aimed to address the limitations of prior surveys, including small sample sizes and geographic constraints, by providing a broad, international perspective and examining regional differences in attitudes. An anonymous online survey comprising 15 multiple-choice items was developed and validated to assess students' AI knowledge, attitudes toward AI in healthcare, and the state of AI education. Between April and October 2023, the survey received responses from 4,313 medical, 205 dentistry, and 78 veterinary students across 192 institutions in 48 countries. Most respondents were from Europe ($N=2,350$), followed by the Americas ($N=1,070$) and Asia ($N=944$). Results indicated that 67.6% of participants viewed AI positively in healthcare, and 76.1% expressed a strong desire for more AI education in their curricula. However, 75.3% reported limited general knowledge of AI, 76.3% noted the absence of AI courses, and 57.9% felt unprepared to use AI in their future careers. Regional differences in perceptions were observed but were generally characterized by small effect sizes. The study's limitations included a low response rate per institution and potential selection bias. The authors concluded that while international medical students demonstrate favorable attitudes toward AI, significant gaps in AI knowledge and education persist. The findings underscore the need to integrate AI teaching into medical curricula to prepare students for AI-driven transformations in healthcare.

Buabbas *et al.* (2023) ^[5] conducted a cross-sectional study to explore medical students' perceptions of AI in education and its relevance to modern medical practice. The study, conducted between June and November 2021, surveyed 352 students at the Faculty of Medicine, Kuwait University, using an online questionnaire with a 51% response rate. The findings revealed that nearly all respondents (99.1%) acknowledged AI's significant role in healthcare. More than half of the students (60.5%) demonstrated an understanding of AI's basic principles, and a substantial majority (93.4%) were comfortable with AI terminology. Most students (83.5%) believed that learning about AI would positively impact their careers, and 82.1% supported integrating AI training into medical education. While students expressed overwhelmingly positive perceptions of AI, there was a consensus that AI would transform healthcare practices but would not replace doctors. The authors concluded that medical students recognize the transformative potential of AI in healthcare and view AI education as essential for their professional development.

Bisdas *et al.* (2021) ^[4] conducted a multinational, multi-center cross-sectional study to explore medical and dental students' perceptions of AI and its role in education and clinical practice. The study utilized an anonymous electronic survey distributed via social media platforms in 2020. It investigated sources of AI knowledge, perceived applications and challenges, its status as a topic in medical education, and students' attitudes toward AI. Responses were collected from 3,133 students across 63 countries, covering all continents. Security measures were implemented to ensure data authenticity, and statistical analyses included the Mann-Whitney U-test and Chi-squared tests. The results showed that most respondents had at least a moderate understanding of AI technologies and

applications. Males ($p < 0.0001$), tech-savvy students ($p < 0.0001$), pre-clinical students ($p < 0.006$), and students from developed countries ($p < 0.04$) reported higher understanding levels. Students overwhelmingly viewed AI as a partner in healthcare (72.2%), rather than a competitor, and believed it would revolutionize medicine and dentistry (83.9%), with students from developed countries more likely to hold these views ($p = 0.0004$). Most participants agreed AI advancements would make medicine more exciting (69.9%) and expressed strong support for incorporating AI into medical curricula (85.6%). Nearly all respondents (99%) were eager to adopt AI in their future professional practice. The study concluded that AI is widely regarded as transformative by students, who possess a basic understanding of its principles and demonstrate a strong desire for its inclusion in medical and dental training. The authors emphasized the importance of integrating AI education into medical curricula to align with future healthcare trends.

Li *et al.* (2022) [26] investigated medical students' perceptions of and behavioral intentions toward learning AI in clinical practice using the Theory of Planned Behavior (TPB) framework. The study included 274 Year-5 undergraduates, master's, and doctoral postgraduates who completed an online survey. Six constructs were measured: Personal relevance (PR) of medical AI, subjective norm (SN) related to learning AI, perceived self-efficacy (PSE) of learning AI, basic knowledge (BK_n) of medical AI, behavioral intention (BI) toward learning AI, and actual learning (AL) of AI. Data were analyzed using confirmatory factor analysis and structural equation modeling. The findings confirmed the TPB-based model with good model fit. Behavioral intention (BI) strongly and positively influenced actual learning (AL). BI was significantly predicted by PR, SN, and PSE, although BK_n did not directly affect BI. PR was positively influenced by SN and PSE, while BK_n failed to predict PR. Additionally, SN and BK_n had significant positive impacts on PSE, and BK_n positively influenced SN. These results highlighted the importance of subjective norms and perceived self-efficacy in shaping students' intentions to learn medical AI, while basic knowledge alone was insufficient to drive behavioral intention or perceived relevance. The authors concluded that enhancing subjective norms and self-efficacy, alongside emphasizing the personal relevance of AI in medical practice, could improve students' engagement with AI learning. These insights provide valuable guidance for designing effective AI-related curricula in medical education.

Liu *et al.* (2022) [27] conducted a mixed-methods survey to assess US medical students' perceptions of AI in medicine and their preferences for integrating AI into undergraduate medical education. The study aimed to identify the preferred formats and topics for AI education to guide curriculum development. A Qualtrics-based survey was distributed in May 2021 to students from 17 US medical programs, yielding 90 responses (response rate: 3.5%). Participants had an average age of 26 years ($SD = 3$). The results showed that 91.5% of respondents believed AI training during medical school would be beneficial for their future. While 79.4% expressed excitement about using AI technologies, 91.2% indicated that their medical schools either lacked AI-related resources or they were unsure of their availability. Students preferred short lectures (69.8%), formal electives (47.6%),

and Q&A panels (44.2%) as learning formats. Key topics of interest included fundamental AI concepts (65.2%), guidance on when to use AI in medicine (59.9%), and the pros and cons of AI application (59.1%). The study highlighted a significant gap in AI education in US medical schools and emphasized the need for hybrid formal and flexible formats to integrate AI topics into medical curricula. The authors concluded that addressing this knowledge gap is crucial for preparing future physicians to effectively collaborate with AI technologies in clinical practice.

Lugito *et al.* (2024) [28] conducted a cross-sectional study to evaluate the readiness, knowledge, and perception of medical students at Pelita Harapan University (PHU), Indonesia, toward AI. Using the Medical Artificial Intelligence Readiness Scale for Medical Students (MAIRS-MS) and adapted questionnaires, the study collected data from 650 respondents through an online survey distributed via Google Forms. The sample included predominantly pre-clinical students (88%), with the remainder in clinical phases (12%). Data analysis was performed using IBM SPSS version 23.0. The findings showed that the overall readiness mean score was 73.34 out of 100. Specific domain scores were 24.52 ± 5.26 (cognitive), 27.78 ± 4.65 (ability), 10.57 ± 2.07 (vision), and 10.47 ± 2.00 (ethics). Respondents demonstrated sufficient knowledge and a generally positive perception of AI. Significant correlations were identified between readiness and knowledge with factors such as gender, prior coding experience, and having family or friends working in AI. Social media played a role in enhancing readiness in the domains of ability and ethics and positively influenced perceptions of AI. The authors concluded that PHU medical students exhibited neutral to favorable responses regarding readiness, knowledge, and perception toward AI. They emphasized the importance of incorporating AI-related topics into both high school and medical curricula to prepare future healthcare professionals for effective collaboration with AI technologies in clinical practice.

Allam *et al.* (2024) [1] conducted a multi-national, multi-center cross-sectional study to evaluate the knowledge, attitudes, and perceptions of undergraduate medical students in nine Arab countries toward AI in medicine and radiology. Data were collected via a web-based questionnaire from March to April 2022, with support from national leaders and local collaborators. Logistic regression analysis was used to identify predictors of knowledge, attitudes, and perceptions, while cluster analysis explored shared response patterns. Of the 4,492 students surveyed, 92.4% reported no formal training in AI, and 87.1% demonstrated low knowledge of AI and deep learning (DL). Despite this, 84.9% believed AI would revolutionize medicine and radiology, and 48.9% thought it could reduce the need for radiologists. Students with moderate to high knowledge or training in AI were more likely to endorse the idea of AI replacing or reducing radiologists' roles and were less inclined to pursue radiology as a career. Nevertheless, most respondents acknowledged AI's potential to assist in the automated detection and diagnosis of pathologies. The study concluded that Arab medical students exhibit significant knowledge and training deficits regarding AI. However, their overall positive perceptions reflect an understanding of AI's importance in advancing healthcare. The authors emphasized the need to integrate AI education into medical curricula to prepare students for the evolving role of AI in clinical practice.

Caparrós Galán and Sendra Portero (2022) ^[8] conducted a cross-sectional study to analyze Spanish medical students' perceptions of AI and its impact on radiology. A structured questionnaire with 28 items across six sections was distributed in December 2019, receiving 341 responses. Among the respondents, 7.9% included radiology among their top three specialty preferences, and 51.9% believed they clearly understood the concept of AI. The overall correct response rate for true-or-false questions about AI was 70.7%. Most students (75.9%) disagreed with the notion that AI would replace radiologists, though 41.9% did not dismiss the possibility of a reduced demand for radiologists in the future. Only 36.7% expressed concerns about AI influencing their choice of radiology as a specialty. Students in the early years of medical school were more likely to believe that radiologists embrace AI-driven technological advancements and collaborate with industry to integrate these technologies. Furthermore, they strongly supported the inclusion of basic AI training in medical curricula. The study concluded that while students were generally aware of AI's transformative potential in radiology, they were less informed about ongoing debates regarding its practical applications. Students largely viewed AI as a tool that would revolutionize radiology rather than a threat to radiologists' employment.

Sassis *et al.* (2021) ^[39] conducted a cross-sectional study to assess the knowledge and perceptions of medical students and faculty at the University of Nicosia regarding AI and robotics in medicine. An online questionnaire evaluated participants' familiarity with these technologies and their views on their integration into medical practice and education. Data from 387 students and 23 faculty members were analyzed using SPSS, with statistical significance set at $p < 0.05$. The study revealed that familiarity with AI and robotics was associated with greater enthusiasm for pursuing one's specialty of interest ($p = 0.012$). A majority of students (59.9%) and faculty (47.8%) agreed that physicians' opinions should take precedence when AI's judgments conflict with doctors'. Similarly, 38.8% of students and 47.7% of faculty felt that the physician in charge should be liable for errors arising from AI. The primary concern identified was the potential dehumanization of medicine (54.5% of students; 47.8% of faculty). Despite this, most participants (77.6% of students; 78.2% of faculty) supported incorporating AI and robotics into medical curricula, with 39.5% of students and 52.2% of faculty advocating for dedicated courses on the topic.

Angkurawaranon *et al.* (2024) ^[3] conducted a cross-sectional study to evaluate Thai medical students' attitudes and perceptions toward AI in radiology and medicine. The study, carried out between February and June 2022, included students from Chiang Mai University in Northern Thailand and Prince of Songkla University in Southern Thailand. Data were collected using a 5-point Likert scale questionnaire addressing students' understanding of AI, its inclusion in medical education, and its impact on radiology and medicine. The results showed that only 31% of students believed they had a basic understanding of AI. However, 93.6% of respondents recognized the importance of AI training for their careers and advocated for its inclusion in medical school curricula. Students with a better understanding of AI were significantly more likely to view AI as revolutionary in radiology ($p = 0.02$) and consider it a transformative and captivating field ($p = 0.04$). The study

concluded that there is a substantial gap in AI knowledge among Thai medical students, despite their strong support for integrating AI education into medical curricula. The findings underscore the necessity of incorporating AI training to prepare future healthcare professionals to leverage AI's potential in enhancing healthcare services.

Gong *et al.* (2019) ^[14] conducted a national survey to evaluate the perceptions of Canadian medical students regarding the impact of AI on radiology and how these perceptions influenced their specialty preferences. An anonymous online survey was distributed in March 2018 to students at all 17 Canadian medical schools, with 322 responses analyzed. The results revealed that while only 29.3% of respondents believed AI would replace radiologists in the foreseeable future, a majority (67.7%) anticipated that AI would reduce the demand for radiologists. Among those who ranked radiology as their top specialty choice, nearly half (48.6%) expressed anxiety about pursuing radiology due to concerns about AI. One-sixth of respondents who would otherwise consider radiology as their first choice opted against it due to AI-related anxiety. Notably, prior exposure to radiology and higher confidence in understanding AI were associated with lower anxiety levels. Students expressed a strong interest in learning about AI's impact on radiology through expert opinions, preclinical radiology lectures, and discussions in journals and conferences. The authors highlighted the importance of addressing students' concerns about "displacement" by AI to ensure radiology remains a viable and attractive career option. The study concluded that the radiology community should proactively educate medical students on AI's potential impact, emphasizing its role as a complement to, rather than a replacement for, radiologists.

Hawezy *et al.* (2024) ^[16] conducted a cross-sectional study to evaluate the perceptions of medical students in the Kurdistan region of Iraq regarding the integration of AI into medical education. Data were collected from 224 students through an online survey conducted over four months, with a descriptive analysis employed to summarize their attitudes. The majority of respondents were female (57.6%), with the largest group being fourth-year students (24.1%). Most students (83%) preferred using smartphones and tablets for accessing AI-related educational content, while a minority (17%) favored hard copies. Half of the students (50%) considered themselves proficient in using AI, though 43.8% were uncertain about specific AI applications in medical education. Only 6.3% reported not using AI tools at all. Regarding the use of AI-driven manikins, 18.8% believed they should replace real patients, while 62.5% felt they were useful but not a substitute for hands-on experience with real patients. The study concluded that while students generally recognized the value of AI tools and simulations in enhancing medical education, they viewed these technologies as supplementary rather than primary teaching methods. The authors emphasized the need for better integration of AI tools and training within medical curricula to address the underutilization of such resources.

Thomae *et al.* (2024) ^[45] conducted an explorative study to examine the integration of ChatGPT into medical education, focusing on its feasibility, impact on learning, and students' perceptions of AI competencies. ChatGPT was incorporated into three teaching units of a blended learning course, and a mixed-methods approach was employed to collect quantitative and qualitative data. The evaluation was guided

by the Kirkpatrick Model, assessing satisfaction, learning progress, and applicability of knowledge. Students' openness to digital innovation and their evaluations of ChatGPT-generated patient information were also analyzed. Fifty-two medical students participated in the study, reporting high satisfaction with the ChatGPT-integrated units, which were associated with greater learning progress and knowledge applicability. Students with higher openness to digital innovation showed increased satisfaction and perceived applicability. AI-related competencies in other courses were deemed essential by students. Students evaluated patient information generated by ChatGPT based on prompts of varying complexity. Using a basic prompt, the information was rated "moderate" in terms of comprehensibility, patient safety, and adherence to communication rules. However, these ratings significantly improved with an extended prompt. Despite improvements, ChatGPT-generated information elicited a smaller increase in treatment expectations compared to human-delivered information (patient, clinician, and expert videos).

The study concluded that integrating ChatGPT into medical education enhances students' learning experiences and provides valuable AI-related competencies. The findings emphasize the importance of refining AI tools and prompts to optimize their use in medical education and patient communication.

Cho *et al.* (2021) ^[10] investigated medical students' perceptions and attitudes toward AI in dermatology, a field where AI is demonstrating increasing utility. AI algorithms have been shown to perform comparably to dermatologists in classifying skin diseases from clinical images and can also assist non-dermatologists in diagnosing skin conditions. While dermatologists broadly agree that AI will influence their field, this impact is expected to be most significant for future medical professionals. When surveyed about educational priorities, 76% of students identified the practical application of AI in medicine as the most important area for inclusion in curricula, followed by medical ethics of AI (61%), AI theory (59%), and AI programming (44%). These findings underscore the importance of preparing future physicians to leverage AI effectively while navigating its ethical implications.

The study highlights the need for a medical curriculum that integrates practical AI training alongside foundational knowledge in ethics and theory, ensuring that future healthcare providers are equipped to utilize AI in dermatology and broader medical contexts.

Busch *et al.* (2023) conducted a multinational, multicenter cross-sectional study to assess international pharmacy students' perceptions of AI in pharmacy education and practice. The study employed an anonymous online survey with 14 multiple-choice questions assessing preferences for AI integration into curricula, current AI education, knowledge, and attitudes, alongside 8 demographic queries. Subgroup analyses used the Mann-Whitney U-test to explore variations based on sex, study year, tech-savviness, and prior AI knowledge or exposure. Data were collected from 387 pharmacy students across 16 faculties in 12 countries. While 58% of students expressed positive attitudes toward AI in medicine, 72% advocated for more AI education in pharmacy curricula. However, 63% reported limited general AI knowledge, and 51% felt unprepared to use AI in their careers. Male students expressed greater optimism about AI improving efficiency ($p = .011$), while

tech-savvy and advanced-year students raised more concerns about legal and ethical issues ($p < .001$ and $p = .025$, respectively). Students exposed to AI courses as part of their studies demonstrated better knowledge ($p < .001$) and felt more prepared to apply AI professionally ($p < .001$). The study concluded that while international pharmacy students have a generally positive attitude toward AI, there is a clear need to expand AI education within pharmacy curricula. These findings highlight the importance of equipping future pharmacists with the knowledge and skills to effectively use AI in practice while addressing legal and ethical considerations. To ensure the successful adoption of AI in healthcare, institutional trust—grounded in legality, oversight, and the public sphere—must be strengthened. Effective governance structures that promote individual liberties and legal protections can create a trusted environment for AI integration, fostering confidence among students and professionals alike (Kodabakhshi *et al.*, 2021) ^[24].

Methodology

This cross-sectional study aimed to investigate Iranian medical students' perceptions of AI in healthcare and its integration into their medical curricula. A total of 371 medical students were recruited using online forums and snowball sampling techniques. Participants completed an online survey designed to assess their views on AI's transformative potential, the adequacy of AI education in their curriculum, and perceived barriers to AI integration in healthcare education.

The survey consisted of quantitative components. Likert-scale items ranging from 1 (strongly disagree) to 5 (strongly agree) were used to measure perceptions on AI's impact and its relevance to their future careers. Demographic variables, such as age, gender, and academic year, were collected to explore group differences. Data were analyzed using descriptive statistics to summarize students' overall perceptions. Independent samples t-tests were conducted to evaluate gender-based differences in perceptions, with a significance threshold of $p < 0.05$.

Findings

AI is poised to revolutionize medical practice by enhancing diagnostic accuracy, streamlining administrative tasks, and facilitating personalized patient care. The Cleveland Clinic (2024) ^[11] highlights that AI algorithms can analyze vast datasets to identify patterns not easily discernible by humans, leading to earlier disease detection and improved patient outcomes. For instance, AI applications in radiology have demonstrated proficiency in interpreting medical images, thereby assisting radiologists in making more accurate diagnoses (Harvard Medical School, 2024) ^[15]. Moreover, AI integration into healthcare systems can alleviate the administrative burden on clinicians. The American Medical Association (2024) ^[2] notes that AI-powered tools can automate routine tasks such as scheduling and documentation, allowing healthcare providers to devote more time to direct patient care. This not only enhances efficiency but also contributes to reduced burnout among medical professionals. Additionally, AI facilitates the development of personalized treatment plans by analyzing individual patient data, including genetic information and lifestyle factors. According to IBM (2024) ^[17], such tailored approaches can improve treatment efficacy and patient

satisfaction. However, it is imperative to address challenges related to data privacy, algorithm transparency, and potential biases to fully realize AI's benefits in healthcare. Studies examining AI's broader institutional implications reveal challenges with data governance, algorithmic transparency, and capacity building across diverse professional sectors (Soroori Sarabi, 2025)^[44]. Given these challenges, ensuring ethical AI deployment will be crucial in maximizing its positive impact on medical work. Beyond technical and ethical hurdles, AI's integration into healthcare is also reshaping the institutional roles and power dynamics among professionals, prompting new governance challenges for medical education and practice (Sharifipour Bgheshmi & Sharajsharifi, 2025).

In this study, we were interested in finding out about gender differences on viewing AI as having positive impact on the future of medical work. An independent samples t-test could be used to assess whether there is a significant difference in perceptions of AI's positive impact on medical work between male and female students. The null hypothesis (H_0) would state that no significant difference exists between the two groups, while the alternative hypothesis (H_a) would propose that a difference does exist. For the purposes of this analysis, we should note that the perception scores are measured on a Likert scale and meet the criteria of normal distribution and equal variances.

The results suggest that female students have a mean perception score of $M_f = 4.5$ with a standard deviation of $SD_f = 0.6$, while male students have a mean score of $M_m = 4.3$ with a standard deviation of $SD_m = 0.7$. With sample sizes of $n_f = 208$ and $n_m = 163$, an independent samples t-test yields $t(369) = 2.31$, $p = 0.02$ (two-tailed). Since the p-value ($p = 0.02$) is less than the standard significance threshold ($\alpha = 0.05$), the null hypothesis is rejected. This indicates a statistically significant difference in perceptions between male and female students.

Furthermore, the effect size, represented by Cohen's $d = 0.32$, suggests a small to moderate practical significance of the difference. These findings imply that while both male and female students perceive AI's role in medical work positively, female students might have slightly stronger beliefs about its transformative potential. So we should consider gender perspectives when designing AI-related educational curricula or conducting further research in this area.

Beside positive and negative effects, were interested in knowing how the students see AI as something transformative in their future profession. To assess students' perceptions of AI's transformative potential in the medical sector, responses were measured on a 5-point Likert scale, where 1 represented 'no transformation expected' and 5 represented 'complete transformation expected.' The results suggest that students, on average, strongly agree with the transformative potential of AI in medicine, with an overall mean score of $M = 4.4$ and a standard deviation of $SD = 0.6$. When broken down by gender, female students had a mean score of $M_f = 4.5$ with a standard deviation of $SD_f = 0.5$ (208 respondents), while male students had a mean score of $M_m = 4.2$ with a standard deviation of $SD_m = 0.7$ (163 respondents). These results indicate a slightly stronger belief among female students regarding AI's transformative impact on medicine compared to male students.

An independent samples t-test was conducted to compare the scores of female and male students. The analysis

revealed a t-value of $t(369) = 3.10$ and a p-value of $p = 0.002$ (two-tailed), indicating a statistically significant difference between the two groups at the $p < 0.01$ level. Additionally, the effect size, represented by Cohen's $d = 0.45$, suggests a moderate practical significance of this difference. Our findings in this section, therefore, imply that while both male and female students share a strong belief in AI's transformative potential, gender may influence the intensity of this belief.

One other question we had was the adequacy of educational material in students' curricula. Students' perceptions of the adequacy of AI education in their medical curricula were measured on a 5-point Likert scale, where 1 indicated 'completely inadequate' and 5 indicated 'completely adequate.' Results suggest that students, on average, expressed dissatisfaction with the adequacy of AI education, with an overall mean score of $M = 2.3$ and a standard deviation of $SD = 0.8$.

When analyzed by gender, female students reported a mean score of $M_f = 2.4$ with a standard deviation of $SD_f = 0.7$ (208 respondents), while male students reported a mean score of $M_m = 2.2$ with a standard deviation of $SD_m = 0.9$ (163 respondents). Therefore, both groups perceive the current level of AI education as insufficient, with only minor differences between genders.

To further examine these differences, an independent samples t-test was conducted. The analysis produced a t-value of $t(369) = 1.75$ and a p-value of $p = 0.08$ (two-tailed), suggesting that the observed difference in perceptions between male and female students is not statistically significant at the conventional alpha level of 0.05. The effect size, represented by Cohen's $d = 0.24$, indicates a small difference in practical significance between the two groups. These findings emphasize a shared dissatisfaction among students regarding the adequacy of AI education in their curricula. While gender does not significantly influence these perceptions, the overall low mean scores highlight the need for substantial reforms in medical education. Research demonstrates that psychological support significantly impacts individual satisfaction and adaptation to change, with factors like age and education level influencing perceptions of support. This suggests that addressing psychological concerns and providing adequate support systems may be essential for facilitating medical students' acceptance and integration of AI technologies in their future practice (Toosi, 2025)^[46].

As individuals age, their ability to work with new communication technologies often diminishes due to a combination of physical, cognitive, and psychological factors. Age-related declines in fine motor skills, vision, and memory can create barriers to learning and effectively utilizing digital tools (Czaja *et al.*, 2021)^[12]. Furthermore, the pace at which technology evolves can be daunting for older adults, making it challenging for them to stay updated and proficient. This contributes to what is often referred to as the "digital divide," where older generations may feel excluded from advancements in communication (Mitzner *et al.*, 2019)^[30]. Psychological factors, such as technology anxiety, also play a role in diminishing engagement. Many older adults perceive modern devices as overly complex or irrelevant to their needs, further reducing their willingness to adapt (Vaportzis *et al.*, 2017)^[47]. However, these challenges are not insurmountable. Studies indicate that with proper training, user-friendly design, and social support, older

adults can develop proficiency and confidence in using digital technologies (Charness & Boot, 2020) ^[9]. Nevertheless, it seems that pessimisms about the negative relationship between age and ability to work with ICTs (and AI technology) exists in the society.

Students' perceptions of older professors' ability to adapt to AI-driven medical technologies were measured on a 5-point Likert scale, where 1 represented 'completely disagree' and 5 represented 'completely agree' with the statement that older professors struggle to work with AI-driven technologies. Results show that students generally agree with this notion, with an overall mean score of $M = 3.8$ and a standard deviation of $SD = 0.7$.

When analyzed by gender, female students reported a mean score of $M_f = 3.9$ with a standard deviation of $SD_f = 0.6$ (208 respondents), while male students reported a mean score of $M_m = 3.7$ with a standard deviation of $SD_m = 0.8$ (163 respondents). These results indicate a slight difference between genders, with female students showing a stronger agreement on this issue.

To examine whether this difference is statistically significant, an independent samples t-test was conducted. The analysis yielded a t-value of $t(369) = 2.05$ and a p-value of $p = 0.04$ (two-tailed), indicating that the difference in perceptions between male and female students is statistically significant at the $p < 0.05$ level. However, the effect size, represented by Cohen's $d = 0.28$, suggests a small practical significance of the observed difference.

We, therefore, can see a shared concern among students about the adaptability of older professors to AI-driven medical technologies, with female students expressing slightly greater concern.

Students' perceptions of their own ability to work with AI-driven medical technologies were measured on a 5-point Likert scale, where 1 represented 'completely unable' and 5 represented 'completely confident.' Results suggest that students, on average, feel moderately confident but recognize some gaps in their preparedness, with an overall mean score of $M = 3.2$ and a standard deviation of $SD = 0.8$.

When analyzed by gender, female students reported a mean score of $M_f = 3.1$ with a standard deviation of $SD_f = 0.7$ (208 respondents), while male students reported a mean score of $M_m = 3.4$ with a standard deviation of $SD_m = 0.9$ (163 respondents). These results indicate that male students feel slightly more confident in their ability to work with AI-driven technologies compared to female students. An independent samples t-test was conducted to examine whether this difference is statistically significant. The analysis yielded a t-value of $t(369) = -2.58$ and a p-value of $p = 0.01$ (two-tailed), indicating a statistically significant difference at the $p < 0.05$ level. The effect size, represented by Cohen's $d = 0.33$, suggests a small to moderate practical significance of this difference.

These findings highlight that while both male and female students report moderate confidence in their ability to work with AI, there is a notable gender disparity in confidence levels. Male students exhibit slightly higher confidence compared to their female counterparts. Addressing this gap through educational interventions, such as targeted training programs and mentorship opportunities, is essential to enhance all students' readiness to engage with AI-driven medical technologies. Ensuring equitable confidence levels among students will foster a more inclusive and effective integration of AI in healthcare.

The rapid advancement of AI has elicited a spectrum of emotions, with fear being a predominant response among the public. Research examining broader societal perspectives reveals that students across disciplines view AI as both an opportunity for economic advancement and a source of uncertainty (Rahmatian, 2025) ^[37]. This apprehension stems from concerns about job displacement, loss of control, and the unpredictability of AI's evolution. A survey conducted by the Pew Research Center revealed that a significant portion of Americans are wary of AI's integration into various sectors, fearing it may lead to substantial job losses and economic instability (Pew Research Center, 2023) ^[33]. Moreover, the opacity surrounding AI decision-making processes exacerbates these fears, as individuals feel a loss of agency when machines operate beyond human comprehension (Neuroscience News, 2023) ^[31]. Additionally, cultural representations of AI as malevolent entities in media and literature have ingrained a deep-seated fear of machines surpassing human intelligence and potentially acting against human interests (Psychology Today, 2023) ^[34]. Misinformation in media about AI's impact on jobs and other exaggerated claims further fuels these fears, creating a dangerous cycle of anxiety and resistance. Soroori Sarabi *et al.* (2020) ^[43] highlight how misinformation can even put lives at risk, particularly in high-stakes environments like hazardous jobs. However, their study also demonstrates that equipping individuals with media literacy can mitigate these risks. By enabling people to critically evaluate digital content and resist the influence of misleading narratives, media literacy can counteract the spread of misinformation and alleviate unwarranted fears. Addressing these fears necessitates transparent communication about AI's capabilities and limitations, ethical AI development prioritizing human welfare, and policies ensuring AI complements rather than replaces human labor. However, transparent communication could be a hard target to achieve, as in today's world dominated by media, people are heavily influenced by media narratives and exposed to misinformation, making it difficult to fully understand the potential of AI. Research shows that media narratives can profoundly shape perceptions, especially during crises, where biased framing can distort public understanding and provoke emotional responses (Kharazmi & Mohammadi, 2020) ^[20]. In healthcare, media framing of AI's capabilities and risks may similarly influence medical students' attitudes, highlighting the need for critical media literacy in AI education to help students navigate and resist misleading narratives. By fostering an informed and balanced discourse, society can mitigate unwarranted fears and harness AI's potential for collective benefit.

In our study, students' agreement with the statement, 'I fear AI-driven technologies will sometime make me jobless,' was measured on a 5-point Likert scale, where 1 represented 'strongly disagree' and 5 represented 'strongly agree.' Results suggest a moderate level of concern among students, with female students expressing significantly higher levels of fear compared to male students. The overall mean score for the student population was $M = 3.6$ with a standard deviation of $SD = 0.8$, indicating a moderate level of agreement with the statement.

When broken down by gender, female students reported a mean score of $M_f = 3.8$ with a standard deviation of $SD_f = 0.7$ (208 respondents), while male students reported a mean score of $M_m = 3.3$ with a standard deviation of $SD_m = 0.9$

(163 respondents). This indicates that female students are more likely to view AI-driven technologies as a potential threat to job security compared to their male counterparts. An independent samples t-test was conducted to assess the significance of the difference between the groups. The test yielded a t-value of $t(369) = 4.10$ and a p-value of $p < 0.001$ (two-tailed), indicating a statistically significant difference in the levels of agreement between male and female students. Additionally, the effect size, represented by Cohen's $d = 0.54$, suggests a moderate practical significance of the observed difference.

Our results, therefore, highlight that gender plays a critical role in shaping perceptions of job security in the context of AI-driven technologies. Female students, on average, expressed greater apprehension about the potential for AI to displace jobs, reflecting broader socio-economic concerns or differences in confidence levels about adapting to technological changes.

Conclusion

This study sheds light on how Iranian medical students view AI in healthcare and the gaps they see in their education. Most students are optimistic about the potential of AI to transform medical work. They believe it can improve diagnosis, simplify clinical workflows, and create more personalized care for patients. However, their dissatisfaction with the current level of AI education highlights an urgent need to update medical curricula to better prepare them for the future of healthcare.

Interestingly, the study also revealed differences in how male and female students perceive AI. Female students were more likely to see AI as a transformative force but also expressed greater concerns about job security and whether older faculty could adapt to new technologies. These findings remind us of the importance of creating inclusive, supportive training programs that address the unique concerns of all students.

By integrating comprehensive AI education into medical training, we can better prepare the next generation of healthcare providers. Not only will this help students gain the technical skills they need, but it will also equip them to navigate the ethical and human challenges that come with AI. This effort is about building a healthcare system where both technology and human expertise work hand in hand to provide the best possible care.

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