

Physicians' perceptions of artificial intelligence in clinical and academic practice: a mixed-methods study from Erbil City

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ABSTRACT

Background and objective: Integration of artificial intelligence (AI) in healthcare and medical research represents significant potential; however, it also introduces practical and ethical challenges. This study analyzes physicians' perceptions of AI implementation in clinical and academic settings, exploring their awareness, perceptions, barriers, concerns, and insights into ethical and regulatory considerations.

Methods: A mixed-methods approach was used. The quantitative component involved standardized surveys completed by 390 physicians (241 clinical, 149 academic) in Erbil City from November 2024 to June 2025. Participants were selected using systematic sampling, and surveys were self-administered. The qualitative component included two focus group discussions, involving 6 clinical physicians and 8 academic physicians, to explore in-depth perceptions and concerns regarding AI in healthcare and research.

Results: Of 390 physicians, the majority of participants were male (69.2%). Mean age was 46.7 ± 7 years. Familiarity with AI was higher among younger, male, and academic physicians, with age showing a negative association ($p < 0.001$). Clinical physicians reported more concerns regarding privacy in healthcare ($p = 0.003$) and research ($p = 0.041$), as well as algorithmic bias ($p = 0.030$). Despite these concerns, most physicians valued AI in healthcare and academic research and demonstrated strong interest in training and collaboration. Qualitative findings showed optimism and frequent use of AI tools such as ChatGPT and DeepSeek, often described as "Google replacements." However, physicians also highlighted ethical issues and the need for local training and infrastructure improvement.

Conclusion: Physicians generally welcome the use of AI in healthcare and research but emphasize the necessity of ethical guidelines, peer collaboration, and formal education. To ensure responsible adoption, addressing infrastructural and trust barriers will be essential for guaranteeing that AI technologies improve rather than undermine patient care and research integrity.

Keywords: Artificial intelligence, Physicians' perception, Ethical concerns, Adoption barriers, Healthcare technology

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INTRODUCTION

Recently, artificial intelligence (AI) has played a transformative role in modern healthcare and research by improving patient outcomes, enhancing diagnostic accuracy, and streamlining workflows (1).

The application of AI in healthcare has demonstrated remarkable capabilities, particularly in the interpretation of diagnostic images. As healthcare systems worldwide increase the need for precision and efficiency, AI technologies such as natural language processing, machine learning, and deep learning are being used across different medical specialties (2). However, successful integration of these technologies depends on physicians' levels of acceptance, and adoption factors remain poorly understood in many clinical contexts (3).

Studies have shown that AI systems can detect malignancy in radiology and pathology with accuracy comparable to human expertise (4-6). Beyond diagnostic capabilities, machine learning is being used to optimize treatment planning and improve patient outcomes (7). The COVID-19 outbreak accelerated adoption of these technologies, with AI deployed for screening, prediction, tracking, and bedside decision-making during the epidemic (8). This rapid deployment highlighted the necessity for broad AI training in medical education to prepare healthcare professionals for efficient deployment (9). Furthermore, AI is increasingly incorporated into literature reviews, assisting with issue formulation, search screening, data extraction, and analysis; this capability is essential in fields like information systems, enabling academics to concentrate more on developing theories and interpreting results (10). AI-assisted tools such as ChatGPT also raise

significant concerns about academic integrity, scientific contribution, and accountability (11).

Studies worldwide show that physicians are generally optimistic about AI's future. In a Bahraini study, physicians of different specialties agreed that AI would reduce diagnosis time (13). In Southern California, 76.6% of respondents expressed optimism about AI, although concerns remained about safety, accuracy, bias, workflow disruption, and the physician–patient relationship (14). A Japanese study noted general optimism but less desire to use AI tools personally, reflecting regulatory concerns (15). Other studies suggest that although many physicians understand AI conceptually, most lack formal training (16, 17), and the “black box” nature of AI undermines trust.

Despite global advances, a gap remains in understanding how physicians in the Kurdistan Region of Iraq perceive and use AI. This study therefore aimed to examine physicians' awareness, perceptions, barriers, and ethical considerations related to AI adoption in both clinical and academic settings.

Specific Objectives

1. To assess medical professionals' awareness of AI technologies in healthcare and research.
2. To explore medical professionals' perceptions of the benefits and challenges associated with AI implementation.
3. To identify factors influencing medical professionals' acceptance and adoption of AI technologies.
4. To gather insights into the ethical and regulatory considerations perceived by medical professionals regarding AI use in healthcare and research.

METHODS

A mixed-methods design integrating quantitative surveys and qualitative focus groups was used to explore physicians' awareness, perceptions, and concerns regarding AI in clinical and academic practice.

Study Setting and Population

The study was conducted in Erbil City, Kurdistan Region, Iraq, across several healthcare institutions, including Rizgary Teaching Hospital, Hawler Teaching Hospital, Rozhawa Emergency Hospital, Maternity Hospital, Rapareen Hospital, Erbil Cardiac Center Hospital, Nanakali Hospital, and Eye Hospital. The academic institutions included Hawler Medical University (HMU) and the Kurdistan Higher Council of Medical Specialties (KHCMS). Data collection and analysis were conducted over nine months, from September 2024 to June 2025.

Eligible participants included specialist physicians employed in healthcare or medical academic institutions in Erbil, who were actively involved in clinical care or research practice and willing to provide informed consent. Physicians who were residents, medical students, retired, on leave, or non-physician healthcare providers, or those practicing outside academic settings, were excluded.

Sampling Procedure

For the clinical group, an official list of specialist physicians was obtained from the General Directorate of Health–Erbil. The total population consisted of 651 eligible physicians. Using an online sample size calculator, the required sample size was determined to be 242, based on a 95% confidence level, 5% margin of error, and an expected frequency of 50%. Systematic sampling was applied by selecting every second physician from the list, and a total of 241 physicians participated.

For the academic group, faculty lists and contact information were obtained from Hawler Medical University and the Kurdistan Board for Medical Specialties. The total population included 255 eligible academic physicians. Using the same parameters, the calculated sample size was 154. All eligible physicians were invited to participate, and a total of 149 faculty members participated. The total sample included 390 physicians (241 clinical and 149 academic).

For qualitative data, purposive sampling was used. Two focus groups were conducted: one with six physicians from clinical settings and another with eight physicians from academic institutions, selected based on their relevant experience and interest in AI-related topics.

Study Protocol

Quantitative data were collected using a self-administered structured questionnaire developed based on the study objectives and expert feedback, distributed in paper-based format. A pilot study was conducted with 24 physicians, yielding a Cronbach's alpha of 0.82, indicating good internal consistency. For the qualitative study, group discussions were arranged at convenient locations and times. Participation in both study phases was voluntary, and verbal informed consent was obtained before data collection.

Ethical Considerations

Ethical approval was obtained from the College of Medicine, Hawler Medical University (Ref. 3, 4 February 2025). Participation was voluntary, and informed verbal consent was obtained.

Data Analysis

For the quantitative section, IBM SPSS Statistics (version 27) was used. Descriptive statistics summarized participant demographics; frequencies and percentages were displayed for categorical

variables. The Shapiro-Wilk test revealed that the data were not normally distributed ($p < 0.05$), so nonparametric tests were used. The Mann-Whitney U test was used to analyze Likert scale items and compare ordinal responses among groups. Chi-square tests were used to assess relationships between categorical variables (e.g., yes/no responses). Binary logistic regression was used to identify predictors of AI familiarity, with independent variables including age group, gender, and practice setting.

For the qualitative section, thematic analysis followed Braun and Clarke's six-phase methodology⁽¹⁸⁾, chosen for its flexibility in identifying, analyzing, and reporting patterns (themes) within the data. Both focus group discussions were audio-recorded, then transcribed and translated into English by a professional translator. Manual data coding was applied without qualitative-analysis software. The steps included: [1] familiarization with the data, by reading and rereading transcripts; [2] generating initial codes by systematically coding interesting features; [3] searching for themes by grouping codes into potential themes; [4] reviewing themes to ensure coherence and accuracy; [5] defining and naming themes by determining the essence of each; and [6] producing the report, combining themes and participant quotes into a coherent narrative.

RESULTS

Demographic Characteristics of Physicians

A total of 390 physicians participated: 241 working in clinical practice and 149 in academic settings. Table 1 shows the demographic characteristics of participants. Male physicians formed the majority across both groups (69.2%). The mean age of clinical physicians was 45.2 years ($SD=5.9$), while academic physicians were older on average, with a mean age of 49.2 years ($SD=7.9$). In terms of professional experience, clinical physicians reported a mean of

11.2 years ($SD=5.6$), compared with 13.1 years ($SD=8.3$) among academic physicians.

A variety of medical specializations was represented. The predominant specialties included radiology, general surgery, gynecology, pediatrics, cardiology, and internal medicine. Other specialties included neurology, ophthalmology, emergency medicine, rheumatology, hematology, oncology, community medicine, psychiatry, gastroenterology, and clinical nutrition, with less than 5% "Other."

Influence of Age, Gender, and Practice Setting on AI Familiarity

We examined the impact of age, gender, and practice setting on physicians' familiarity with AI in both clinical and academic settings using binary logistic regression. The codes for familiarity were 1 (moderately/very/extremely familiar) and 0 (not at all/slightly familiar). As shown in Table 2, age was negatively correlated with AI familiarity in both healthcare and research settings; older physicians were less likely to be familiar with AI in healthcare ($p < 0.001$, $OR=0.595$) and in research ($p=0.005$, $OR=0.708$), suggesting that AI familiarity decreases with increasing age across both settings.

Gender was a significant predictor only in clinical practice ($p=0.010$), with male physicians being 1.9 times more likely to report familiarity with AI than female physicians ($OR=1.902$). In the academic setting, gender was not a significant predictor ($p=0.648$), indicating no significant difference in AI familiarity between females and males in research contexts. Practice setting was a strong positive predictor in both settings; physicians involved in academic roles were significantly more likely to report familiarity with AI in clinical practice ($p < 0.001$, $OR=2.468$) and in academic research ($p < 0.001$, $OR=2.653$), suggesting that academic exposure may positively influence AI awareness.

Table 1. Demographic characteristics of the participating physicians (N=390)

Variable	Category	Clinical (n=241)	Academic (n=149)	Total (n=390)
Gender	Female	87 (36.1%)	33 (22.1%)	120 (30.8%)
	Male	154 (63.9%)	116 (77.9%)	270 (69.2%)
Age (years)	Mean±SD	45.24±5.95	49.22±7.96	46.76±7.05
Experience (years)	Mean±SD	11.24±5.68	13.12±8.38	12.96±7.02
Specialty	Radiology	23 (9.5%)	8 (5.4%)	31 (7.9%)
	General surgery	15 (6.2%)	14 (9.4%)	29 (7.4%)
	Gynecology	23 (9.5%)	5 (3.4%)	28 (7.2%)
	Pediatrics	14 (5.8%)	13 (8.7%)	27 (6.9%)
	Cardiology	19 (7.9%)	6 (4.0%)	25 (6.4%)
	Urology	15 (6.2%)	9 (6.0%)	24 (6.2%)
	Internal medicine	12 (5.0%)	11 (7.4%)	23 (5.9%)
	ENT	17 (7.1%)	5 (3.4%)	22 (5.6%)
	Orthopedic surgery	13 (5.4%)	8 (5.4%)	21 (5.4%)
	Dermatology	12 (5.0%)	8 (5.4%)	20 (5.1%)
	Others	78 (32.4%)	62 (41.6%)	140 (35.9%)

Table 2. Binary logistic regression analysis of predictors of physicians' familiarity with AI in clinical and academic research

Predictor	B (clinical)	p (clinical)	OR (clinical)	B (academic)	p (academic)	OR (academic)
Age (groups)*	-0.520	<0.001	0.595	-0.345	0.005	0.708
Gender (1=F, 2=M)	0.643	0.010	1.902	-0.115	0.648	0.891
Practice setting**	0.904	<0.001	2.468	0.976	<0.001	2.653
Constant	-1.534	0.004	0.216	-1.205	0.024	0.300

*1=33-39 (early career), 2=40-46 (mid-career), 3=47-53 (late-mid), 4=54-68 (senior). **1=clinical physicians, 2=academic physicians; reference=clinical physicians. OR=odds ratio.

Barriers and Ethical Concerns to AI Adoption

As shown in Table 3, clinical and academic physicians reported similar concerns regarding AI, although some differences were statistically significant. Academic physicians were more likely to identify technical barriers (45.6% vs. 31.5%, $p=0.007$) and financial barriers (38.3% vs. 28.2%, $p=0.045$). Concerns about privacy in healthcare

applications of AI were higher among clinical physicians (86.3% vs. 73.8%, $p=0.003$), as were concerns about privacy in medical research (82.6% vs. 73.8%, $p=0.041$). Awareness of algorithmic bias was also greater among clinical physicians (90.0% vs. 81.9%, $p=0.030$). Other issues, such as regulatory barriers, accountability, data security, and ethical bias in decision-making, did not differ significantly between the two groups.

Table 3. Barriers and ethical concerns related to AI adoption among physicians, by practice setting

Item	Clinical Yes	Academic Yes	p
	No. (%)	No. (%)	
Technical barriers	76 (31.5)	68 (45.6)	0.007
Regulatory barriers	32 (13.3)	28 (18.8)	0.151
Financial barriers	68 (28.2)	57 (38.3)	0.045
Privacy — AI in healthcare	208 (86.3)	110 (73.8)	0.003
Privacy — AI in research	199 (82.6)	110 (73.8)	0.041
Accountability of AI	197 (81.7)	112 (75.2)	0.125
Bias in AI algorithms	217 (90.0)	122 (81.9)	0.030
Data security	215 (89.2)	124 (83.2)	0.092
Ethical bias in decision-making	203 (84.2)	122 (81.9)	0.577

“No” counts for each item are the complement of the “Yes” counts shown (out of $n=241$ clinical, $n=149$ academic).

Perception of Physicians Across Various Settings

As shown in Table 4, there was no statistically significant difference between the two groups regarding agreement that AI is integral to healthcare delivery, research writing, and data analysis. Both groups reported high levels of agreement regarding AI's importance in these domains. The median score for all three items was 4, with an interquartile range of 1 for most items, and no variation (IQR=0) for AI in research data analysis among clinical physicians, suggesting strong consensus.

Physicians' Interest in AI-Related Education and Collaboration

As shown in Table 5, physicians reported high levels of interest in AI-related training opportunities. The most frequently preferred formats were hands-on training (84.2% clinical, 82.6% academic) and educational workshops (80.9% clinical, 84.6% academic). Regarding collaboration, a majority favored peer collaboration in healthcare practice (83.8% vs. 84.6%) as well as in research projects (81.3% vs. 85.9%). There were no statistically significant differences between clinical and academic physicians across any training or collaboration domain.

Table 4. Physicians' agreement on the role of AI in healthcare and research, by practice setting

Item	Group	N	Mean (SD)	Median (IQR)	Mean rank	p
Healthcare delivery	Clinical	241	3.45 (.80)	4 (1)	194.29	0.767
	Academic	149	3.44 (.88)	4 (1)	197.46	
Research writing	Clinical	241	3.78 (.83)	4 (1)	199.43	0.325
	Academic	149	3.67 (.93)	4 (1)	189.14	
Data analysis	Clinical	241	3.89 (.84)	4 (0)	198.60	0.444
	Academic	149	3.82 (.90)	4 (1)	190.48	

Table 5. Interest in AI-related educational and collaborative activities, by practice setting

Item	Clinical Yes No. (%)	Academic Yes No. (%)	p
Educational workshops	195 (80.9)	126 (84.6)	0.413
Online courses	181 (75.1)	114 (76.5)	0.809
Hands-on training	203 (84.2)	123 (82.6)	0.675
Peer collaboration — healthcare	202 (83.8)	126 (84.6)	0.887
Peer collaboration — research	196 (81.3)	128 (85.9)	0.268

Demographic Characteristics of Focus Group Participants

Sociodemographic characteristics of the qualitative sample are summarized in Table 6, comprising two focus groups. Focus Group A comprised six physicians working in clinical healthcare settings across ophthalmology, general surgery, urology, orthopedic surgery, pediatric surgery, and dermatology. Focus Group B included eight physicians in academic settings, representing internal medicine, general surgery, gynecology,

psychology, medical education, pathology, community medicine, and neurology.

Qualitative Summary — Clinical Healthcare Physicians (Focus Group A)

Table 7 summarizes the qualitative themes regarding the application of AI in clinical healthcare settings. Despite data and infrastructure constraints, physicians expressed optimism that AI will improve diagnosis and workflow. Strong themes also surfaced regarding ethical issues and the necessity of local adaptation and training.

Table 6. Demographic characteristics of focus group participants

ID	Clinical setting (Group A)	Academic setting (Group B)
P1	Ophthalmology	Internal medicine
P2	General surgery	General surgery
P3	Urology	Gynecology
P4	Orthopedic surgery	Psychology
P5	Pediatric surgery	Medical education
P6	Dermatology	Pathology
P7	—	Community medicine
P8	—	Neurology

Table 7. Qualitative summary — Group A: physicians in clinical healthcare settings

Theme	Subtheme	Illustrative quote
Optimism about AI in diagnosis	AI enhances diagnosis accuracy, esp. image-based specialties	“I think... AI, if it entered eye devices, can help you in at least giving you differential diagnoses or suggestions on the diagnosis.” (Ophthalmologist, P1)
Awareness and current uses of AI	General awareness but limited direct experience; use of ChatGPT for research	“Usually, if I search for a topic of our specialty and don't find anything in Google Scholar or PubMed, I use ChatGPT.” (Urologist, P3)
Data issues and restricted infrastructure	Lack of data collection, recording, and clinical guidelines locally	“We are very limited in data collection... apart from some data of the intraoperative surgery written on the file.” (Urologist, P3)
Ethical and legal concerns	Patient privacy, accountability, legal variation across countries	“You blame who? You cannot blame AI... The end decision is by the doctor.” (Ophthalmologist, P1)
Need for training and local customization	Importance of local training; initial resistance	“Training courses were resisted at first, but with time, like any other new technology, we adapted to it.” (Dermatologist, P6)

**Qualitative Summary — Academic Physicians
(Focus Group B)**

Table 8 summarizes the qualitative themes regarding AI use among academic physicians, who

are highly aware of and utilize AI tools, especially ChatGPT, DeepSeek, and other language-based models. Although they expressed concerns regarding AI's clinical reliability and judgment, they valued it for research and academic workflow.

Table 8. Qualitative summary — Group B: physicians in academic settings

Theme	Subtheme	Illustrative quote
Awareness and current use of AI	Use of language-based AI tools (ChatGPT, DeepSeek); AI replacing traditional sources	“Google has been replaced now by AI. So, AI has now replaced Google.” (Medical education, P5)
Perceived benefits of AI	Facilitates academic tasks; supports research and workflow	“I think it is useful in research... But on clinical decisions, it is weak.” (Internal medicine, P1)
Challenges and limitations	Concerns about accuracy, reliability, inconsistency, lack of human judgment	“AI is not genuine intelligence... There is no alternative to the brain.” (Internal medicine, P1)
Impacts on patients and misinformation risk	Patients may receive conflicting AI advice, causing confusion and distress	“She gave the information of the MRI to the AI, and she got upset, and she was crying... she doesn't know what the significance is.” (Neurologist, P8)
Ethical and privacy concerns	Privacy risks from account sharing and data transparency	“People share one account... the information of each one will be shared by those people.” (Histopathologist, speaker 6)
Need for training and guidance	Importance of learning prompt writing; lack of local guidelines	“The prompt. How to write prompts. They have to learn how to write prompts.” (Medical education, P5)

DISCUSSION

This mixed-methods study provides comprehensive insight into physicians' perspectives on AI use across clinical and academic healthcare settings in Erbil City. Our findings reveal that clinical and academic physicians demonstrate significant variation in AI familiarity, ethical concerns, and implementation barriers, contributing valuable evidence to the growing literature on healthcare AI adoption.

Our quantitative analysis demonstrated that academic physicians were significantly more familiar with AI tools, as shown by logistic regression findings identifying practice setting as a predictor of AI familiarity. In qualitative data, several academic physicians described using tools such as ChatGPT and DeepSeek in their scholarly workflows, often characterizing them as “Google replacements.” A likely explanation lies in the nature of their professional roles. In contrast, clinical physicians primarily used AI for general information queries, with limited hands-on interaction in clinical decision-making. This finding aligns with global data reporting that only 7% of physicians use generative AI for clinical decisions (19), suggesting that AI adoption in healthcare is still in its early phases. The analysis showed important associations between AI familiarity in healthcare and gender ($p=0.010$), with males being more familiar, and that younger physicians were more familiar with AI than older ones. These findings contrast with research from Bahrain showing no demographic associations (13), potentially reflecting differences in sample size, healthcare system, or digital infrastructure between regions.

Physicians in both settings acknowledged AI's potential to improve research efficiency, assist in diagnosis, and reduce workload. An ophthalmologist noted AI's role in providing differential diagnoses, echoing evidence supporting

AI's strength in imaging and pattern recognition²⁰. Academic physicians primarily valued AI for research tasks, including data analysis, literature searches, and manuscript preparation, consistent with documented large language model (LLM) integration in scholarly workflows (21).

Ethical issues were a predominant concern. Clinical physicians reported higher levels of concern about patient privacy and algorithmic bias. One participant stated, “You cannot blame AI,” highlighting the ambiguity of accountability in AI-driven decisions. These concerns reflect broader ethical debates in AI literature (22). Academic physicians stressed the need for policy guidance on authorship and responsible use in scholarly outputs. Patient misinformation risks were highlighted, with neurologists reporting cases where AI-generated interpretations caused unnecessary patient distress, reflecting broader concerns about AI's understanding of complex patient–physician relationships (23) and reinforcing concerns about patient safety and data bias.

Both clinical and academic physicians reported barriers to AI implementation, with academic physicians experiencing significantly higher rates of technical and financial barriers. This may reflect that greater involvement in academic activities exposes physicians to more complex AI-related challenges. Qualitative data further highlighted frustrations with inadequate data systems; a urologist commented, “We are very restricted in data collection.” Given AI's dependence on large, high-quality datasets, these concerns are well founded, as data incompleteness or bias may compromise AI performance and equity in healthcare delivery (24–26). In addition, concerns about legal liability and inadequate infrastructure were frequently mentioned. Lack of training was a recurrent theme, indicating the need for

education in ethical AI use and prompt engineering (27).

Physicians supported the inclusion of AI training in medical curricula, with strong interest in hands-on learning and peer collaboration across both settings, reinforcing the urgency of structured digital education. These findings align with the World Health Organization's recommendations on workforce digital preparedness, advocating for targeted investment in digital skills and retraining (28). Educating clinicians on AI use could reduce fear, improve trust, and promote safer adoption. Prior studies support this need, showing that physicians often welcome AI but lack practical experience (29). To address this gap, it is essential to integrate basic AI training into undergraduate education programs to keep pace with changing healthcare needs and address ethical issues (30).

Academic physicians expressed greater optimism and confidence in AI, consistent with a prior study in Saudi Arabia in which academic physicians thought AI would create new jobs instead of threatening them, and 87.5% favored specialized AI courses (31). By contrast, non-academic physicians were more skeptical, especially regarding AI's applicability in high-stakes, real-time clinical settings. Trust remains a major barrier, as emphasized in prior reviews identifying transparency and fairness as essential to acceptance (32). This gap indicates the need for interdisciplinary cooperation between developers, researchers, and frontline clinicians.

The study has several limitations. The research was conducted in Erbil City, which may limit generalizability. Senior consultants and junior doctors were not included, which could limit diversity. The cross-sectional design limits assessment of changes over time. Self-reported data also introduces bias, and purposive sampling in

the qualitative component could lead to overrepresentation of physicians who are more interested in technology.

CONCLUSION

This research highlights physicians' perceptions of AI across clinical and academic settings, disclosing a complex landscape of opportunity and difficulty. While physicians generally hold positive perceptions regarding AI's potential to enhance decision-making, improve workflow, and support academic research, successful implementation requires addressing ethical concerns, patient privacy, algorithmic bias, transparency, and accountability. Variation in familiarity across ages, genders, and settings of practice underscores the need for targeted training and support. Ultimately, successful adoption of AI in healthcare and research will depend not only on technological advancement but also on building trust through strong training, ethical safety, and inclusive policy creation. As AI continues to develop, collaboration among physicians, patients, developers, and policymakers will be essential to ensuring that these tools improve rather than harm patient care.

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COMPETING INTEREST

The authors declare that they have no competing interests.

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