PHYSICIANS' PERCEPTIONS OF THE USE OF ARTIFICIAL INTELLIGENCE IN MEDICINE IN THE UNITED STATES

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Introduction

The use of artificial intelligence (AI) in medicine is continually increasing and has the potential to transform nearly all areas of healthcare. (Giavina-Bianchi et al., 2024). AI can be defined as a field of research that seeks to develop machines capable of reproducing human actions (Al-Medfa et al., 2023). While the origins of AI as an academic discipline go back to the 1950s (Haenlein & Kaplan, 2019), AI has garnered much attention in recent years due to advancements in Generative AI tools (Reddy, 2024).

The term "Artificial Intelligence" was officially coined in 1956 when Marvin Minsky and John McCarthy hosted the Dartmouth Summer Research Project on Artificial Intelligence at Dartmouth College, with the intention of uniting researchers to create a new research area focused on building machines capable of simulating human intelligence (Haenlein & Kaplan, 2019). However, the idea of machines mimicking human intelligence can be traced back even further to Alan Turing, who in 1950 proposed the Turing test – a measure of whether a machine is intelligent by judging if its responses are indistinguishable from those of humans (Brynjolfsson, 2022).

The application of AI to medicine has a long history, dating back at least to the early 1970s, when the world's first virtual medical consultant, INTERNIST-1, was developed (Hirani et al., 2024). This consultant used an algorithm to make diagnoses based on patient symptoms (Nelson et al., 2020). More recently, Generative AI has been in the spotlight for its ability to generate new data (Reddy, 2024), offering the potential to transform the healthcare landscape with its capacity for natural language processing (Zhang & Boulos, 2023).

The sociology of expectations recognizes the role of an individual's expectations in shaping technological change (Borup et al., 2006), suggesting that the successful diffusion of technologies heavily depends on people's expectations about their capabilities and potential (Amann et al., 2023). With this framework as guidance, this study theorizes that physician perceptions will play an integral role in guiding the success of AI tools in medical practice and seeks to understand physicians' feelings on the topic. While many studies have examined physician perceptions of AI internationally, few exist in the United States. This study seeks to help fill that gap.

The purpose of the study will be to survey physicians in the United States on their perceptions of, and concerns about, the use of artificial intelligence in medicine. The study will uncover which demographic factors are most influential in determining physicians' perceptions of AI in medicine. The study also seeks to uncover which demographic factors are most influential in determining physicians' level of concern about AI in medicine. The purpose of this research is to answer the following questions:

RQ1 – Is there a significant interaction effect between the predictor variables of age and gender regarding perception of AI?

RQ2 – Is there a significant interaction effect between the predictor variables of age and gender regarding concerns about AI?

RQ3 – Are there significant mean differences between years of medical practice regarding their perception of AI?

RQ4 – Are there significant mean differences between years of medical practice regarding their concerns about AI?

Review of the Literature

Positive attitude despite low level of familiarity with AI

In a survey of 301 Russian doctors and medical students, Orlova et al. (2023) found that only 35.6% stated they were familiar with AI technologies. Despite this lack of familiarity, 85% of those doctors questioned stated they believe AI has useful applications in medicine. While they believe that AI will become a valuable medical tool, they do not widely believe that it will replace physicians in the future. No significant gender differences were found, and older doctors tended to be more pessimistic about the possibility of AI use – the most optimistic group was novice doctors (residents or students). A substantial majority believed that doctors using AI will replace doctors who do not. Participants stated that the most likely advantages of AI use are the optimization of organizational decisions (74%), biopharmaceutical research (67%), and diagnosis of disease (52%). 56% believe it will be difficult for AI to make decisions in the case of missing or incomplete information.

A positive attitude toward AI despite a low level of familiarity was a common theme across several of the studies reviewed. In a cross-section study of medical students and doctors in Southeast England within the field of skeletal radiology, participants self-reported a generally low knowledge of artificial intelligence and an even lower understanding of the application of AI to healthcare (York et al., 2023). Despite this low knowledge about AI, a significant majority of those surveyed held favorable views of the role of AI in healthcare. Both students and practicing clinicians showed support for the development of AI technologies to assist in interpreting trauma radiographs. Similarly, Polesie et al. (2020) performed an international survey of pathologists working in dermatopathology. They found that among the 718 respondents, 81.5% were aware of AI as an emerging topic in their field. However, only 18.8% reported having good or excellent knowledge about AI. Attitudes were positive towards using AI in dermatopathology, with 72.3% of respondents agreeing or strongly agreeing that AI will improve the field. Polesie et al. did not find age impacting overall attitude towards AI use. Only 6% of the respondents agreed or strongly agreed that AI will replace pathologists in the future, and 84.1% believed AI should be a part of medical training. As a specialty, pathologists seemed to have a favorable view of the potential for AI tools to assist in their work. In an international survey of physicians working in pathology, respondents' attitudes toward integrating and using AI tools were positive, with only limited concerns about negative career impacts (Sarwar et al., 2023). A slight majority of the respondents (58%) felt that with appropriate training, AI tools could increase or dramatically increase the efficiency of diagnosis. Despite this positive attitude, most doctors surveyed believe diagnosis should remain a human task or be shared equally with an AI tool.

Following a similar trend of positive attitude despite low familiarity with AI, of 669 Korean physicians and medical students surveyed, Oh et al. (2019) found that only 5.9% reported having a good familiarity with AI. Despite this low figure, a vast majority (83.4%) considered AI beneficial in the medical field (Oh et al., 2019). As in Orlova et al. (2023), one problem referenced by respondents was the possibility of AI being unable to assist in situations when inadequate information was available. Only 35.4% of those questioned believed AI would replace doctors. Half of German General Practitioners (GPs) interviewed between March and May 2020 expressed anxiety about the possibility of AI-enabled systems replacing their tasks (Buck et al., 2022). Among the GPs surveyed, only 22% had experience with AI-enabled healthcare systems, and only half of those reported experience using it in their work. Again, despite this lack of experience and anxiety about AI replacing their tasks, survey respondents generally reported a positive attitude toward AI-enabled systems. The GP often serves as the first point of contact for patient care, and these physicians are dealing with a shrinking amount of doctor-patient time. AI-enabled systems have the potential to augment the work of these physicians and help reduce diagnostic errors.

AI viewed as a supplemental tool

Slightly over half of physicians surveyed in a tertiary teaching hospital in Malaysia considered themselves tech-savvy (Reffien et al., 2021). The authors found that doctors reporting themselves as tech-savvy had more positive attitudes toward AI than non-tech-savvy doctors. Non-clinical physicians, such as administrators, were found to have more positive attitudes toward AI than clinical physicians. Despite 82% of respondents preferring doctors' opinions over AI in clinical judgment, most surveyed had positive expectations for AI assisting clinicians in their practice. One central concern cited again was AI system reliability in the face of incomplete or inadequate information. This was seen as a reason for AI to augment physician expertise rather than function as a replacement for doctors.

Several studies echoed the idea of AI as a supplemental tool rather than a replacement for human doctors. In a study of Italian radiologists working in departments where AI technologies were being tested and used, Lombi and Rossero (2023) found a range of views from fearful to enthusiastic about the use of AI within their field, with most taking a positive outlook. Study participants expressed hope that AI systems could lessen the time they spend on administrative or repetitive and time-consuming tasks. Faced with the risk of other medical professionals 'improvising' radiologists' work with the belief that an AI system could replace them, Lombi and Rossero (2023) found that the radiologists adopted two discursive strategies. One strategy focused on defending the radiologist's identity – emphasizing aspects of their work other than simple image interpretation. The other strategy adopted the idea that AI use would increase the prestige of radiologists via skills acquired from special training. The findings of their study suggest that AI should serve to assist radiologists, not replace them.

Another concern expressed was the explainability of results. Samhammer et al. (2022) performed a qualitative content analysis of expert interviews with experienced nephrologists after testing an Artificial Intelligence-driven decision support system (AI-DSS) for predicting risks in kidney transplant care. While generally positive attitudes toward AI were found among those interviewed, concerns were stated about a potential loss of autonomy and expertise. Physicians were also concerned about the ability to explain AI-augmented results and expressed a desire to exert control over the AI-DSS systems. Successful integration of the AI-DSS hinges on issues of transparency and control.

Different global regions share a positive view

Physicians in different global regions seem to share this positive attitude towards using AI in healthcare. In a cross-sectional survey of physicians practicing in Bahrain, about 71% of respondents reported having average or above-average levels of AI knowledge, and the study showed generally positive attitudes toward using AI in medicine (Al-Medfa et al., 2023). No relation was found between positive attitudes and respondents' gender, age, AI knowledge, or years of experience. The authors found that attitudes seemed to vary among clinical specialties. They found pathologists to be more welcoming of the future use of technology than other specialties. Most respondents agreed that one of the benefits of the use of AI would be a reduction in diagnosis time. Despite the generally positive attitudes, most of those surveyed also believe that AI would affect employment rates in the healthcare industry. The study did not specify if the participants believed employment in their specialty to be at risk – just if rates would be affected in healthcare overall. Seemingly contrary to the overall positive attitudes toward AI in medicine, only 26% of participants believed that AI would perform with a lower error rate than human physicians. Other studies from the Middle East echoed a similar attitude toward the role of AI in healthcare. In a cross-sectional, quantitative survey of primary care physicians in Qatar's Primary Health Care Corporation (PHCC), Waheed and Liu (2024) found that AI is seen as playing a positive role in improving healthcare practice. No statistically significant differences were found between gender and age groups. AI was not seen as superior to human physicians in terms of clinical judgment ability. Accountability, data protection, and confidentiality were identified as ethical concerns.

There is a lack of solely U.S.-based research on physician attitudes toward AI-enabled systems in healthcare. In a cross-sectional survey of gastroenterologists in the United States, Wadhwa et al. (2020) explored physician sentiment toward artificial intelligence. Specifically, they focused on two areas: whether the physicians expected AI to improve endoscopic performance and what potential barriers to adoption may exist. Of those surveyed, 84% believed computer-aided polyp detection (CADe) tools would improve their endoscopic performance. Findings from a mixed methods study of primary care providers in Southern California revealed that while PCPs have mostly positive views of AI, attitudes varied based on the particular use cases (Allen et al., 2024). Particular concerns reported centered around equity of access and its effects on the essential doctor-patient relationship in primary care.

Views of AI by medical students

But what about the next generation of doctors? What are their perceptions of the prospect of AI-enabled tools in healthcare? Liu et al. (2022) surveyed 390 medical students in the United States from 17 medical training programs. A substantial majority of those who responded agreed that AI would be a significant feature in medicine during their lifetime (90%) and expressed excitement about using AI during their future practice as a physician (79.4%). Echoing studies about practicing physicians and AI, only a small percentage (13.9%) indicated knowledge of AI concepts. 84.9% of those surveyed expressed interest in learning about AI in medicine. This gap between the level of current AI knowledge of the students and their enthusiasm for learning about AI represents an opportunity in medical education.

Methodology

Instrument

The survey instrument for this study was self-designed. Surveys are useful for the collection of self-reported data from a sample that can be generalized to a population of interest (Fowler, 2014). The researcher used two constructs for the study extracted from 10 items. The constructs were— perceptions of AI – five questions, and concerns about AI – also five questions. The constructs and their associated items are as follows:

Physician Perceptions Toward AI

1. AI has the potential to improve the accuracy of medical diagnoses.
2. AI can help reduce the workload of physicians.
3. I trust AI to provide accurate and unbiased medical advice.
4. AI is a valuable tool for medical research.
5. I am comfortable using AI-powered medical tools in my practice.

Physician Concerns Toward AI

1. There is a risk of AI replacing human physicians in the future.
2. AI may lead to a decrease in the quality of patient care.
3. The use of AI in medicine raises ethical concerns.
4. AI is too complex for most physicians to understand.
5. I am concerned about AI replacing physicians in my medical specialty.

The instrument used a 5-point Likert-type scale with the following scoring: 1 = Strongly Disagree, 3 = Neutral, 4 = Agree, and 5 = Strongly Agree. Likert scales are noted for suitability in studies regarding subject perceptions, attitudes, and emotions (Adeniran, 2019).

Subjects and Procedure

Convenience sampling was used to administer the survey via social media and newsletters. Convenience sampling is often used in survey research due to its practicality and efficiency, allowing researchers to quickly gather data (Golzar et al., 2022). An internet-based survey tool, SurveyMonkey, was used to acquire and review the data. The data was then loaded into IBM SPSS version 29. Fifty-five subjects completed the survey. Before administering the survey, Institutional Review Board (IRB) approval was obtained to use human subjects. The subjects for this study were practicing physicians (MDs and DOs) in the United States, ages 18 years and up. All subjects agreed to consent to participate in the study. No incentives were provided to complete the survey. Confidentiality and anonymity were assured, and information security policies were strictly followed to secure data.

Data Analysis

Descriptive statistics were used to summarize sample demographics. Univariate ANOVAs were used to investigate if there were significant interaction effects between the predictor variables of age and employment and the dependent variables of perceptions of AI and concerns about AI (RQ1 and RQ2). ANOVA was used to compare the mean perceptions and concerns about AI for RQs 3 and 4. Where significant differences were found, post hoc tests (e.g., Tukey's HSD) were conducted to identify specific group differences.

A significance level of $p < 0.05$ was used.

Results

Demographics were collected and are presented in Table 1. Results indicated that the majority of the respondents were male (73%) and practiced medicine in the state of Tennessee (93%). Demographic results are presented in Table 1. Research questions 1 – 6 were evaluated using one-way ANOVA to compare the effect of the independent variables on the dependent variables, as outlined in tables 2 - 7 below.

Table 1. Demographic Data for Respondents

Characteristic	N	%
Age Range		
18 to 24	0	0
25 – 34	0	0
35 – 44	11	20
45 – 54	18	33
55 – 64	16	29
65 and up	10	18
Gender		
Male	40	73
Female	15	27
Not listed / prefer not to say	0	0
Primary Practice State		
Georgia	1	2
Kentucky	2	4
Tennessee	51	93
Virginia	1	2

Primary Medical Specialty		
Anesthesiology	4	8
Dermatology	5	10
Family Practice / General Practice	7	13
Gastroenterology	1	2
General Surgery	3	6
Internal Medicine	3	6
Obstetrics and Gynecology	2	4
Oncology	3	6
Pediatrics	3	6
Physical medicine and rehabilitation	1	2
Radiology	15	29
Urology	1	2
Other / not listed	4	8
Did not answer	3	6
Years Practicing Medicine		
0 - 10 years	9	16
11 – 20 years	16	29
21 – 30 years	16	29
31 – 40 years	11	20
>40 years	3	5

Reliability Analysis of Instrument

The reliability of each construct was measured via Cronbach's alpha. An initial Cronbach's alpha value of α=.813 was found for perceptions of AI and α=.655 for concerns about AI. There were no items in the perceptions of the AI construct, which, if removed, would increase Cronbach's alpha. Item 4 in concerns about AI, "AI is too complex for most physicians to understand," increased Cronbach's alpha if removed to α=.672 and was removed before analysis.

Regarding RQ1 – "Is there a significant interaction effect between the predictor variables of age and gender regarding perception of AI?"- a univariate ANOVA was performed for the predictor variables (age range and gender) and the dependent variable, Perceptions of AI. The results are shown in Table 2 below. The analysis showed no significant interaction effect between age range and gender on Perceptions of AI ($F(3, 47) = 1.851$, p=.151), suggesting that the combined impact of these variables does not significantly affect Perceptions of AI. Given the lack of significant interaction, no post-hoc analyses were performed.

Table 2. Univariate ANOVA – Perceptions of AI

Source	Type III Sum of Squares	*df*	Mean Square	F	*p*
Corrected Model	4.513	7	.645	1.193	.325
Intercept	176.939	1	176.939	327.451	<.001
Age Range	1.027	3	.342	.633	.597
Gender	.038	1	.038	.069	.793
Age Range * Gender	3.001	3	1.000	1.851	.151
Error	25.397	47	.540		
Total	374.160	55			
Corrected Total	29.910	54			

Regarding RQ2 – "Is there a significant interaction effect between the predictor variables of age and gender regarding concerns about AI?"- a univariate ANOVA was performed for the predictor variables (age range and gender) and the dependent variable, Concerns about AI. The results are shown in Table 2 below. The analysis showed no significant interaction effect between age range and gender on Concerns about AI ($F(3, 47) = 1.491$, $p=.229$), suggesting that the combined impact of these variables does not significantly affect Concerns about AI. Given the lack of significant interaction, no post-hoc analyses were performed.

Table 2. Univariate ANOVA – Concerns about AI

Source	Type III Sum of Squares	*df*	Mean Square	F	*p*
Corrected Model	3.902	7	.557	.931	.492
Intercept	245.052	1	245.052	409.148	<.001
Age Range	2.271	3	.757	1.264	.298
Gender	.073	1	.073	.121	.729
Age Range * Gender	2.678	3	.893	1.491	.229
Error	28.150	47	.599		
Total	459.063	55			
Corrected Total	32.052	54			

As it relates to research question three, the results in table 3 show no significant mean differences were found between years of practice regarding perception of AI at the 0.05 significance level.

Table 3:

	Sum of Squares	*Df*	Mean Square	F	Sig.
Between Groups	.461	4	.115	.196	.939
Within Groups	29.449	50	.589		
Total	29.910	54			

To answer research question 4, a one-way ANOVA was used to assess whether there was a significant mean difference between years of practice and concerns about AI use. As shown in Table 4 below, no significant mean differences were found at the 0.05 significance level.

Table 4:

	Sum of Squares	*Df*	Mean Square	F	Sig.
Between Groups	22.919	12	1.910	1.713	.098
Within Groups	46.827	42	1.115		
Total	69.745	54			

Discussion

The research contributes to the literature by establishing there is no significant interaction effect between the predictor variables of age and gender regarding concerns about AI or perceptions of AI. The research also established that there are no significant mean differences between years of practice and perceptions of AI or concerns about AI. The results of this study align with those of Al-Medfa et al. (2023), which found no significant differences in attitudes based on respondents' gender, age, AI knowledge, or years of experience. Also echoed were the results of Reffien et al. (2023), who found no significant mean differences between age, duration of practice, or gender and physician's attitude toward AI. Similarly, Radhwi and Khafaji (2024) found that age, gender, and experience did not influence familiarity, attitude, or perceived applications and risks of AI in healthcare. Taken collectively, the research shows us a similarity in perceptions and concerns about AI across age, gender, and experience, which can inform efforts to educate physicians about AI in healthcare.

A moderate statistically significant inverse relationship was found between Perceptions of AI and Concerns about AI. This relationship should be explored in further research.

Conclusion

This study aimed to examine the perceptions of U.S.-based physicians on the use of artificial intelligence in medicine. The results showed that neither age range nor gender nor years of experience significantly impacted physicians' perceptions of AI or concerns about AI.

These findings provide valuable insights, helping to fill the knowledge gap about physicians' perceptions of AI in the U.S. and can inform the development of strategies to help increase AI acceptance in medicine. While many studies have examined physician perceptions of AI internationally, few exist in the United States. This study helped fill that gap.

Limitations of the study

Despite the insights gained from the study, there are some limitations that must be acknowledged. While the selected population was appropriate, the limited sample size may have impacted the robustness of the findings. A low response rate limited the study. There was difficulty in getting physician responses, which should be considered for future studies. There is also the possibility of selection bias – participants may have expressed more positive attitudes than those who opted not to take part in the survey.

Recommendations for future research

As few studies exist on the perceptions of U.S. physicians on the use of AI in medicine, additional studies could lend further insights. Larger sample sizes could lead to more generalizable results as well as

exploring physician perceptions in geographic areas not covered by this study. Additionally, as nurse practitioners play an increasingly essential role in healthcare delivery in the United States, exploring their perceptions of the use of AI in medicine could provide valuable understanding.

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