Perceptions, attitudes and anxiety toward artificial intelligence among medical students: A cross-sectional study

Tıp fakültesi öğrencilerinde yapay zekaya yönelik algılar, tutumlar ve kaygı: Kesitsel bir çalışma

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Abstract

Aim: The use of artificial intelligence (AI) technologies in the field of healthcare is becoming increasingly widespread. Due to their dynamic and evolving nature, AI technologies may create anxiety among future healthcare professionals. This study aimed to assess medical students' anxiety levels related to AI and their perceptions and attitudes toward AI applications in healthcare.

Methods: This cross-sectional study was conducted at Yozgat Bozok University Faculty of Medicine. A questionnaire evaluating students' perceptions and attitudes on the use of AI in healthcare and the Artificial Intelligence Anxiety Scale was administered to medical students.

Results: A total of 490 medical students (68.72% of all students) participated in the study. The participants' mean score on the Artificial Intelligence Anxiety Scale was 47.09±12.78 (min:16- max:80). Female participants had significantly higher AI anxiety scores compared to male participants (p<0.001). Participants who were knowledgeable about AI applications in healthcare had significantly lower anxiety scores (p=0.002). Participants who trusted AI-generated diagnoses based on patient records had lower anxiety scores (p =0.006). Participants who did not find AI-generated treatment algorithms reliable had significantly higher anxiety scores (p=0.001). Participants who lacked knowledge about AI applications in healthcare were significantly less willing to utilize AI-generated treatment algorithms (p=0.002). Participants who lacked trust in AI-generated diagnoses based on patient records were significantly less likely to recommend AI-generated treatments to patients (p<0.001).

Conclusions: Artificial intelligence anxiety among medical students is associated with knowledge and trust in AI. Enhancing students' understanding of AI may increase trust, improve attitudes toward AI, and support its responsible integration into future clinical practice.

Keywords: Anxiety; artificial intelligence; attitude; medical education; medical student

Öz

Amaç: Yapay zeka teknolojilerinin sağlık alanında kullanımı yaygınlaşmaktadır. Yapay zeka teknolojileri, dinamik ve gelişime açık uygulamaları içermesi nedeniyle geleceğin sağlık profesyonellerinde kaygı yaratması muhtemeldir. Bu araştırma, tıp öğrencilerinin yapay zekaya ilişkin kaygı düzeylerini ve sağlık alanında kullanılan yapay zeka uygulamalarına yönelik algılarını ve tutumlarını değerlendirmeyi amaçlamaktadır.

Yöntemler: Kesitsel tipte olan bu araştırma Yozgat Bozok Üniversitesi Tıp Fakültesi'nde gerçekleştirilmiştir. Tıp fakültesi öğrencilerine sağlık alanında yapay zeka uygulamalarının kullanımına dair algıları ve tutumlarını değerlendiren anket ve yapay zeka kaygı ölçeği uygulanmıştır.

Bulgular: Çalışmaya toplamda 490 tıp fakültesi öğrencisi (tüm öğrencilerin %68,72'si) katılmıştır. Katılımcıların Yapay Zeka Kaygı Ölçeği ortalama puanı 47,09±12,78 (min: 16 – maks: 80) bulunmuştur. Kadın katılımcıların yapay zeka kaygı puanları, erkeklere göre anlamlı derecede yüksek bulunmuştur (p<0,001). Sağlık alanında kullanılan yapay zeka uygulamaları hakkında bilgi sahibi olan katılımcıların kaygı puanları anlamlı derecede düşük saptanmıştır (p=0,002). Yapay zeka tarafından hasta kayıtlarına dayanılarak üretilen tanılara güvenen katılımcıların, kaygı puanları anlamlı derecede daha düşüktür (p=0,006). Yapay zekanın belirlediği tedavi algoritmalarını güvenilir bulmayan katılımcıların kaygı puanları anlamlı derecede yüksektir (p=0,001). Sağlıkta yapay zeka uygulamaları konusunda bilgi eksikliği olan katılımcılar, yapay zeka tarafından belirlenen tedavi algoritmalarını kullanmaya daha az istekli olduklarını belirtmişlerdir (p=0,002). Hasta kayıtlarına dayanılarak yapay zekanın belirlediği tanılara güvenmeyen katılımcılar, yapay zekanın belirlediği tedavileri hastalara önermeye anlamlı derecede daha az eğilimlidir (p<0,001).

Sonuçlar: Tıp fakültesi öğrencilerinde yapay zeka kaygısı, yapay zekaya ilişkin bilgi düzeyi ve yapay zekaya duyulan güven gibi faktörlerle ilişkili bulunmuştur. Öğrencilerin yapay zekayı daha iyi anlamasını sağlamak, yapay zekaya karşı tutumları olumlu yönde etkileyebilir ve yapay zekanın gelecekteki klinik uygulamalara sorumlu bir şekilde entegrasyonunu destekleyebilir.

Anahtar Sözcükler: Anksiyete; tıp eğitimi; tıp öğrencisi; tutum; yapay zeka

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INTRODUCTION

The integration of artificial intelligence (AI) into healthcare is transforming clinical practice, with AI-driven systems now supporting diagnostic processes, treatment planning, and risk stratification (1–4). While these advancements promise improved efficiency and patient outcomes, they also raise concerns among healthcare professionals, particularly regarding job displacement, accountability, and the erosion of human-centered care (5–7).

Medical students, as future clinicians, are at the forefront of this transformation and may experience heightened anxiety related to AI—a phenomenon increasingly recognized as a potential barrier to the effective adoption of AI in clinical settings. Recent studies indicate that AI applications have demonstrated performance comparable to, or even exceeding, that of physicians in specific medical examinations, which may intensify students' concerns about professional relevance and competence (8,9).

Medical students will shape AI clinical integration as the future generation of healthcare providers. However, most medical schools lack structured AI courses, leading students to adopt attitudes and anxiety based on limited exposure (10,11). Insufficient knowledge may cause uncertainty and worry, decreasing technology adoption (12). Thus, AI-related anxiety and its relationship to students' trust and attitudes must be assessed to inform educational programs and prepare a healthcare workforce that can use AI.

Although research has explored medical students' attitudes toward and readiness for AI, there remains a significant gap in understanding how AI-related anxiety shapes their attitudes, beliefs, and trust toward AI applications in clinical contexts. Specifically, it is unclear whether higher anxiety levels correlate with reduced trust in AI-generated diagnoses or reluctance to use AI-supported treatment algorithms—key components of future clinical workflows.

To address this gap, the present study aims to examine the level of AI anxiety among medical students and to investigate its association with their perceptions, attitudes, and behavioral intentions toward AI in healthcare. This study investigates how AI-related anxiety associates with students' trust in AI-generated outputs and their willingness to incorporate AI tools into future patient care. By exploring these relationships, we aim to contribute to a deeper understanding of the psychosocial factors influencing AI acceptance among the next generation of healthcare providers.

MATERIALS AND METHODS

Participants

This study is descriptive cross-sectional research conducted among medical students. The study population consisted of all students enrolled in Yozgat Bozok University Faculty of Medicine during the 2024–2025 academic year. Since the aim was to reach the entire population, no sampling method was employed. The data was collected between March and June 2025, during time periods that aligned with the students' availability.

Ethical approval was obtained from the Non-Interventional Research Ethics Committee of Yozgat Bozok University (date: 05.03.2025, decision no: 2025-GO-KAEK-255_2025.03.05_391). Prior to data collection, informed consent was obtained from all students who voluntarily agreed to participate. Participants who consented were asked to complete a data collection form and the Artificial Intelligence Anxiety Scale.

Inclusion criteria: Students who were 18 years of age or older, currently enrolled at Yozgat Bozok University Faculty of Medicine and voluntarily agreed to participate by providing written informed consent were included in the study.

Exclusion criteria: Students who were not students at Yozgat Bozok University Faculty of Medicine, under 18 years of age, failed to provide informed consent, withdrew from the study, or provided incomplete or inconsistent survey data were excluded.

Data collection form and scale

The data collection form was developed by the researchers and included 17 questions evaluating participants' age, gender, grade, income level, parental education level, perceptions and attitudes on the use of AI in healthcare. In order to assess participants' perceptions and attitudes toward AI, questions were asked in a yes/no format, such as "Are you familiar with AI-supported applications used in the field of health?", "Would you trust a diagnosis or treatment determined

by AI based on a patient's medical records?", "Would you recommend a treatment determined by AI based on a patient's medical records?", "Does the use of AI in healthcare reduce medical errors?", and "Does the use of AI in healthcare reduce excessive and unnecessary diagnoses or treatments?"

The Artificial Intelligence Anxiety Scale (AIAS) was originally developed by Wang and Wang in 2019 (13), and it was adapted into Turkish with validity and reliability testing conducted by Akkaya et al. (14). The scale consists of 16 items and is structured as a 5-point Likert-type scale (1 = strongly disagree, 5 = strongly agree). Total scores range from a minimum of 16 to a maximum of 80. The scale includes four subdimensions: "learning," "job replacement," "sociotechnical blindness" and "AI configuration."

Statistical analysis

The data were analyzed using the SPSS Statistics for Windows (Statistical Package for the Social Sciences package program version 20.0, IBM Corp., Armonk, N.Y., USA). To assess the normality of distribution, skewness and kurtosis coefficients were examined. Descriptive statistics were presented as frequencies and percentages. For the analysis of the relationships between continuous variables and other variables, independent samples t-tests, one-way ANOVA, and Kruskal-Wallis tests were used. The chi-square test was employed for the analysis of categorical variables. A p-value of less than 0.05 was considered statistically significant.

A post-hoc power analysis conducted using G*Power (version 3.1) indicated that, with a sample size of 490 and an alpha level of 0.05, the study achieved a power exceeding 0.95 to detect small-to-moderate effect sizes (Cohen's d = 0.30, w = 0.15) in both group comparisons and association analyses, supporting the robustness of the findings.

The dependent variable of this study is the participants' level of anxiety toward artificial intelligence. The independent variables include demographic characteristics such as gender, age, grade, balance of income and expenses and parental education level, as well as participants' general life experience with AI, their knowledge regarding AI applications in the field of health and their beliefs and confidence levels concerning the potential benefits (such as reduction of medical errors and prevention of unnecessary prescriptions) and risks (such as unnecessary tests or treatments) that AI systems may present.

Study outcomes

The primary outcome of this study was the level of AI-related anxiety among medical students, as measured by the AIAS.

The secondary outcomes were:

- The association between AI anxiety levels and sociodemographic characteristics (age, gender, parental education, income level),
- The relationship between AI anxiety and students' knowledge of AI applications in healthcare, trust in AI-generated outputs and willingness to use AI tools in clinical settings,
- The influence of AI-related perceptions on students' attitudes and behavioral intentions regarding AI-assisted diagnosis, treatment recommendations and prescribing practices.

RESULTS

A total of 490 medical students participated in the study, representing 68.72% of all students. Of the participants, 60.4% (n=296) were female and 39.6% (n=194) were male. The mean age of participants was 21.80 ± 2.45 years (min: 18–max: 41). By grade, 16.5% (n=81) were first grade, 20.6% (n=101) second grade, 19.2% (n=94) third grade, 13.1% (n=64) fourth grade, 15.1% (n=74) fifth grade, and 15.5% (n=76) sixth grade students.

A total of 55.5% (n=272) of participants indicated that their income matched their expenses. Additionally, 26.5% (n=130) reported expenses exceeding income, while 18% (n=88) reported income exceeding expenses. For parental education, 38.6% of mothers (n=189) were primary school graduates and 39.8% of fathers (n=195) were university graduates (Table 1).

Of the participants, 74.1% (n=363) indicated knowledge of AI applications in daily life, while 50.8% (n=249) reported familiarity with AI applications in healthcare. Additionally, 91.2% (n=447) considered the implementation of AI in healthcare necessary.

In the context of clinical application, 88% (n=431) of students reported a willingness to use AI-generat-

Table 1. Distribution of participants according to sociodemographic characteristics

		n	%
Age	18-20 years	143	29.2
	21-23 years	253	51.6
	24 years and above	94	19.2
Gender	Female	296	60.4
	Male	194	39.6
Grade	Grade 1	81	16.5
	Grade 2	101	20.6
	Grade 3	94	19.2
	Grade 4	64	13.1
	Grade 5	74	15.1
	Grade 6	76	15.5
Monthly income	Income exceeds expenses	88	18
	Income equals expenses	272	55.5
	Expenses exceed income	130	26.5
Maternal education level	Literate	17	3.5
	Primary education	189	38.6
	High school	132	26.9
	University	129	26.3
	Postgraduate	23	4.7
Paternal education level	Literate	4	0.8
	Primary education	113	23.1
	High school	134	27.3
	University	195	39.8
	Postgraduate	23	4.7

n: Number, %: Percentage

Table 2. Examination of the sub-dimensions of the artificial intelligence anxiety scale

		Mean±SD	Min-Max
Artificial intelligence anxiety scale subdimensions	Learning	12.25±4.57	5-25
	Job replacement	12.48±4.22	4-20
	Sociotechnical blindness	13.44±3.79	4-20
	AI configuration	8.92±3.19	3-15

SD: Standard deviation, Min: Minimum, Max: Maximum, AI: Artificial intelligence

ed algorithms for diagnostic purposes. Despite this, 64.7% (n=317) considered diagnostic outcomes produced by AI from patient medical records to be unreliable. Similarly, 86.9% (n=426) expressed interest in AI-generated treatment algorithms, yet 61.4% (n=301) did not trust treatment recommendations based on patient records, and 53.7% (n=263) would not advise patients to follow such recommendations.

Furthermore, 67.8% (n=332) of participants indicated that the implementation of AI in health sciences would reduce medical error rates. In contrast, 59.6% (n=292) expressed concern that the use of patient medical records by AI could result in unnecessary tests or treatments. Additionally, 69% (n=338) reported that AI integration in healthcare delivery could decrease the frequency of unnecessary prescriptions.

The mean score on the AIAS among participants was 47.09 ± 12.78 (min: 16–max: 80). The mean scores for the subdimensions of the scale are presented in Table 2. The internal consistency coefficient for the AIAS was 0.935.

AIAS scores were significantly higher among female participants compared to male participants ($p<0.001$). Participants who indicated knowledge of AI applications in healthcare exhibited significantly lower anxiety scores ($p=0.002$).

Students in the clinical phase had higher average AIAS scores (mean: 47.80±13.22) than those in the preclinical phase (mean: 46.55±12.43); yet, this difference was not statistically significant ($p=0.273$).

Participants who considered AI-generated diagnoses based on patient health records to be reliable exhibited significantly lower anxiety scores ($p=0.006$),

Table 3. The relationship between participants' artificial intelligence anxiety scores with various variables

		n (%)	Mean ±SD	Min-Max	p
Gender	Female	296 (60.4)	48.84±12.31	16-80	<0.001*
	Male	194 (39.6)	44.42±13.07	16-73	
Knowledge status regarding AI- supported applications used in healthcare	Yes	249 (50.8)	45.35±12.63	16-80	0.002*
	No	241 (49.2)	48.90±12.72	16-77	
Trust in AI-generated diagnoses using patients' medical records	Yes	173 (35.3)	44.93±12.74	16-74	0.006*
	No	317 (64.7)	48.27±12.67	16-80	
Trust in AI-recommended treatments using patients' medical records	Yes	189 (38.6)	44.64±12.56	16-74	0.001*
	No	301 (61.4)	48.63±12.70	16-80	
Intention to utilize AI-based treatment algorithms derived from patients' medical records	Yes	426 (86.9)	46.56±12.30	16-80	0.017*
	No	64 (13.1)	50.65±15.25	16-80	
Belief that the use of AI reduces the rate of medical errors	Yes	332 (67.8)	45.74±12.14	16-74	0.001*
	No	158 (32.2)	49.93±13.66	16-80	
Belief that the use of AI leads to unnecessary and excessive diagnosis/ treatment	Yes	292 (59.6)	48.11±12.27	16-80	0.033*
	No	198 (40.4)	45.60±13.40	16-77	

n: Number, %: Percentage, SD: Standard deviation, Min: Minimum, Max: Maximum, AI: Artificial intelligence, p: p value, * p<0.05

Table 4: Examination of participants' knowledge of artificial intelligence and their utilization of AI

		Intention to use AI-determined treatment algorithms		
		Yes n (%)	**No n (%)**	**p**
Knowledge status regarding AI-supported applications used in the healthcare	Yes	228 (53.5)	21 (32.8)	0.002*
	No	198 (46.5)	43 (67.2)	

n: Number, %: Percentage, AI: Artificial intelligence, p: p value, * p<0.05

Table 5: The relationship between participants' trust in AI-determined diagnoses and the recommendation of AI-determined treatments to patients

		Recommending AI-determined treatment to the patient		
		Yes n (%)	**No n (%)**	**p**
Trust in AI-determined diagnoses	Yes	155 (68.3)	18 (6.8)	<0.001*
	No	72 (31.7)	245 (93.2)	

n: Number, %: Percentage, AI: Artificial intelligence, p: p value, * p<0.05

whereas those who did not trust AI-generated treatment algorithms showed significantly higher anxiety levels (p=0.001). Additionally, participants unwilling to utilize AI-generated treatment algorithms also demonstrated higher anxiety scores, which was statistically significant (p=0.017).

Participants who believed that the implementation of AI in health sciences would reduce the incidence of medical errors exhibited lower anxiety scores (p=0.001). In contrast, those who perceived that AI's utilization of patient health records might result in unnecessary or excessive testing or treatment demonstrated significantly higher anxiety levels (p=0.033) (Table 3). No statistically significant relationship was found between AI anxiety scores and participants' age, income level, year of study, or parental education level (p>0.05).

Participants with limited knowledge regarding AI applications in healthcare were significantly more likely to express reluctance to use AI-generated treatment algorithms (p=0.002) (Table 4). Similarly, participants who lacked trust in AI-generated diagnoses based on patient records were significantly less inclined to recommend AI-generated treatments to patients (p<0.001) (Table 5). Furthermore, participants who believed that the use of AI in healthcare would reduce unnecessary prescribing also reported that it would decrease the rate of medical errors; this association was statistically significant (p<0.001).

Female students scored significantly higher than males in the subdimensions of job replacement (p<0.001), sociotechnical blindness (p=0.001), and AI configuration (p<0.001). Although their score in the learning subdimension was also higher, the difference was not statistically significant (p=0.094).

DISCUSSION AND CONCLUSION

This study evaluated AI anxiety among medical students and its relationship with their perceptions, attitudes and behavioral intentions toward AI applications in clinical contexts. A review of the literature revealed no prior research specifically examining the association between AI anxiety and students' intentions to use AI tools in future practice. The findings of this study are discussed in light of existing research and literature analyses.

AI applications and AI-based decision support systems have become increasingly common in healthcare. The growing use of AI may contribute to elevated levels of AI-related anxiety among medical students. In this study, students' anxiety levels were assessed using the AIAS, and considering the maximum possible score on the scale, the overall AI anxiety level was found to be moderate. To our knowledge, no comparable study has assessed AI anxiety in medical students using the same scale. However, studies evaluating AI anxiety among students in health sciences have reported moderate levels of anxiety (15,16). The moderate level of AI anxiety observed in students may be attributed to their belonging to a generation familiar with technology, coupled with a mixture of concern and curiosity regarding AI.

Higher AI anxiety significantly correlated with lower levels of knowledge about AI applications in healthcare, in line with existing literature (17–19). This finding demonstrates the value of integrating AI literacy into medical curricula. Early exposure to AI-supported clinical decision tools during preclinical and clinical training may not only enhance technical understanding but also mitigate anxiety by creating an environment that promotes autonomy and competence.

Gender is another factor influencing AI-related anxiety. The literature presents different findings regarding the relationship between gender and AI anxiety (20-22). In this study, female students exhibited significantly higher AI anxiety scores than their male counterparts. This is consistent with studies indicating that female students may perceive emerging technologies as more threatening to job security and professional identity (20,21). While the underlying mechanisms require further exploration, potential factors include differences in self-efficacy, prior technology exposure, or socialization patterns in technology and data-driven fields.

While the use of AI in healthcare introduces innovative approaches to service delivery, it also raises ethical concerns. AI can facilitate faster progress in healthcare, promoting efficient use of human resources and time. However, a critical ethical issue is the lack of transparency regarding accountability. For instance, there is no clear consensus on who holds responsibility in cases of erroneous clinical decisions or medical errors resulting from AI-supported systems (23,24). In this study, students with lower AI anxiety were more likely to believe that AI would reduce medical errors. Such beliefs may reflect their limited professional experience and consequent lack of awareness about the potential implications of medical errors, as well as insufficient understanding of AI's capabilities and its legal boundaries.

The ability of AI to offer personalized diagnostic and therapeutic options makes its application in healthcare particularly appealing. Although AI algorithms provide clinicians with significant support by delivering high accuracy and speed in diagnosis and treatment, their opaque nature limits their trustworthy use (25-27). Research assessing medical students' perspectives on AI usage indicates concerns about trust issues and potential breaches of professional

confidentiality associated with AI in healthcare delivery (28,29). Consistent with the literature, the present study found that medical students with higher AI anxiety levels tended to distrust AI-generated diagnostic and treatment algorithms and reported reluctance to recommend AI-suggested treatments to patients. Future efforts to enhance algorithmic transparency through explicable AI approaches may help address concerns regarding trust and accountability among future healthcare providers.

The literature also highlights that AI-based decision support systems' personalized treatment plans are expected to prevent unnecessary and excessive interventions (30-32). While existing literature supports the notion that AI usage contributes to quaternary prevention, this study revealed that students with higher AI anxiety were more likely to believe that AI's reliance on patient health records could lead to unnecessary and excessive testing or treatments. This attitude may stem from concerns that AI might replace physicians, reduce clinicians' oversight in error detection, and potentially make incorrect decisions.

AI is also employed in healthcare delivery through prescription systems. AI-assisted systems show promise in reducing inappropriate prescribing. In China, the AI-assisted prescription review system lowered irrational prescriptions from 27.7% to 24.1% and reduced high-risk cases from 13.6% to 1.5% (33). Another study reported that the use of clinical decision support systems was associated with a reduction in the number of overprescribed medications (34). Consistent with the literature, this study found that the majority of medical students believe that the use of AI in healthcare delivery can reduce unnecessary prescriptions. This consistency between students' perceptions and empirical evidence suggests that future physicians are likely to embrace AI as a supportive tool in future clinical workflows. However, further studies are needed to explore how these positive attitudes will translate into real-world prescribing practices.

The main limitation of this study is that it was conducted as a single-center cross-sectional study, which prevents the generalization of the results to all medical students. Conducting multicenter and longitudinal studies that evaluate students throughout their medical education would enhance the generalizability of the findings.

The response rate of 68.72% suggests that non-respondents may differ systematically from participants, potentially affecting the representativeness of the sample.

As participation is voluntary, the probability that individuals with an interest in the subject are more likely to take part in the study may pose a source of bias. Since the survey responses were based on self-assessment, there is a possibility that participants provided socially desirable answers.

To our knowledge, this is one of the first studies in Türkiye to investigate how AI-related anxiety influences medical students' attitudes and behavioral intentions toward AI in healthcare. It reveals the role of perceived reliability, knowledge, and trust in shaping students' openness to AI integration in future practice.

The findings of this study indicate that AI-related anxiety among medical students is significantly associated with knowledge deficits and perceived reliability of AI-generated clinical outputs. Students without knowledge about AI applications in healthcare reported higher anxiety, suggesting that familiarity with AI may play a moderating role in emotional responses to emerging technologies. Similarly, reluctance to adopt AI tools was linked to distrust in AI-generated diagnoses and treatments, highlighting the importance of perceived trustworthiness in technology adoption.

These results align with the Technology Acceptance Model (TAM), where perceived usefulness and perceived ease of use are key determinants of behavioral intention. These findings suggest that educational initiatives aimed at improving AI literacy and familiarity with clinical decision support systems could play a role in mitigating anxiety and fostering acceptance among future physicians.

Given the expanding role of AI in healthcare, further exploration of how structured curricular integration of AI literacy impacts student anxiety and their behavioral intentions to adopt AI in future clinical roles is warranted.

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Conflict-of-interest and financial disclosure

The authors declare that they have no conflict of interest to disclose. The authors also declare that they did not receive any financial support for the study.

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