

Artificial Intelligence Anxiety Among Physicians and Nurses: A Cross-Sectional Study

Demet KURT¹

Mevlüt KARADAĞ²



¹Hacettepe University Ihsan Dogramaci
Children's Hospital, Intensive Care Unit,
Ankara, Türkiye

²Lokman Hekim University, Vocational School
of Health Services, Department of Statistics,
Ankara, Türkiye



ABSTRACT

Objective: This study aimed to determine artificial intelligence (AI)-related anxiety levels among physicians and nurses and examine their associations with demographic and occupational characteristics.

Methods: This descriptive, cross-sectional study was conducted between September and November 2024 with 331 healthcare professionals (179 physicians and 152 nurses) working at Hacettepe University Hospitals. Data were collected using a Demographic and Occupational Information Form and the four-dimensional Artificial Intelligence Anxiety Scale (AIAS). Construct validity was assessed by confirmatory factor analysis and reliability by Cronbach's alpha and composite reliability coefficients. Independent-samples t tests, one-way ANOVA, Pearson/Spearman correlations, and multiple linear regression were used.

Results: Total AIAS scores were significantly higher among nurses than physicians and among women than men ($P < .05$). Married women reported higher anxiety than single women. AI-related anxiety was positively correlated with age and length of service and negatively correlated with educational attainment. Participants with prior AI training, current AI tool use, and willingness to use AI in clinical practice had significantly lower anxiety scores than their counterparts. In the regression model, age ($\beta = .160$; $P = .031$), gender ($\beta = -.128$; $P = .031$), and willingness to use AI ($\beta = .208$; $P < .001$) were significant predictors, explaining 12.5% of the variance in AI anxiety.

Conclusion: AI-related anxiety was particularly higher among nurses, women, and older healthcare professionals. Targeted training, transparent implementation policies, and clearly defined legal frameworks may support effective and sustainable integration of AI into clinical practice.

Keywords: Artificial intelligence, physicians, nurses, anxiety

INTRODUCTION

Recent advances in artificial intelligence (AI) have transformed various sectors, including healthcare, by automating decision-making processes, improving diagnostic accuracy and enhancing clinical efficiency. AI technologies can now perform tasks that were once the exclusive domain of human expertise, often with greater speed and precision.^{1,2} In this context, AI is increasingly being viewed not only as a technological innovation, but also as a disruptive force that reshapes professional roles and institutional dynamics.³

In healthcare, AI applications are growing rapidly, ranging from clinical decision support systems and diagnostic imaging to administrative automation and robotic surgery. Global reports indicate that the adoption of AI in healthcare is accelerating, particularly in high-resource countries. For instance, a 2022 report by the European Commission emphasised the role of AI in alleviating the burden on healthcare systems, and United States Food and Drug Administration (FDA) has already approved numerous AI-enabled medical devices.^{4,5} However, this growth is accompanied by a parallel increase in concern among healthcare workers regarding job security, professional autonomy, and ethical responsibility.⁶

Research from countries such as Germany, the United Kingdom (UK), the United States (US) and South Korea has shown that healthcare professionals often have mixed feelings about AI adoption. For instance, studies conducted in the United Kingdom National Health Service (NHS) found that, while clinicians acknowledge AI's potential to improve care quality, they also report anxiety about a loss of control and inadequate training.⁷ Similarly, a recent

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Corresponding author:

Mevlüt KARADAĞ

E-mail: mevlut.karadag@lokmanhekim.edu.tr

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survey of US physicians revealed that over 60% were concerned that AI could alter core elements of their medical practice, particularly in diagnostics and patient communication.⁸

Despite the growing global body of literature on this topic, studies on AI anxiety among healthcare professionals in low- and middle-income countries remain limited. Turkey is an important case in point, as it is currently undergoing a rapid digital transformation in healthcare, including the implementation of national AI strategies and health information systems. In Türkiye, recent studies have begun to examine AI-related anxiety, attitudes, and readiness among healthcare professionals and nurses.^{9,10} In addition, the Turkish adaptation of the AIAS has provided a validated measurement tool for assessing AI-related anxiety in Turkish samples.¹¹ However, the literature remains developing, particularly in terms of comparative evidence between physicians and nurses and the simultaneous evaluation of demographic, occupational, and experiential predictors. Therefore, the present study contributes to the literature by examining AI-related anxiety among both physicians and nurses using a validated Turkish form of the AIAS. The present study addresses this gap by examining AI-related anxiety among physicians and nurses at a leading university hospital in Turkey using a validated measurement tool.

AIM

This study aimed to determine the level of AI-related anxiety among physicians and nurses and to examine its associations with demographic, occupational, and AI-related experiential factors.

Research questions

- What is the level of AI-related anxiety among physicians and nurses?
- Do AI anxiety levels differ according to demographic and occupational characteristics?
- Are prior AI-related training, current AI tool use, and willingness to use AI associated with lower AI anxiety?
- Which demographic and occupational variables independently predict AI anxiety?

METHODS

Research Design

This descriptive, cross-sectional study was conducted among physicians and nurses working at Hacettepe University Adult Hospital, Children's Hospital, and Oncology Hospital in Ankara.

Research Population and Sample

The study population consisted of 2,380 healthcare

professionals, including physicians and nurses. Quota sampling was used to ensure proportional representation among occupational groups. Quotas were determined based on the distribution of physicians and nurses in the study population. Since physicians constituted 53.8% of the total population and nurses 46.2%, the target sample was planned to reflect this occupational distribution as closely as possible. In each occupational group, eligible participants were invited to volunteer until the planned quota was reached. A total of 331 people participated in the study, 179 of whom were physicians and 152 were nurses. This number corresponds to 14% of the population.

The inclusion criteria for the study were: (a) being actively employed at the hospital and (b) providing voluntary consent. Participants were excluded if they had been diagnosed with any psychiatric disorder, as this could confound the assessment of anxiety levels. As the study was cross-sectional, there was no follow-up period.

Data Collection Tools

Demographic and Professional Information Form: A structured questionnaire was used to collect demographic and professional data from physicians and nurses, including their age, gender, marital status, level of education, years of service, whether they had previously received AI training, their current usage of AI, and their willingness to use AI in clinical practice.

Artificial Intelligence Anxiety Scale (AIAS): The AIAS, developed by Wang and Wang in 2019, is a widely used instrument in studies examining anxiety related to artificial intelligence. Originally designed as a 7-point Likert-type scale, the AIAS was reduced from 59 items to 21 items following validity and reliability analyses aimed at improving its psychometric robustness and conceptual clarity. The main purpose of this revision was to assess AI-related anxiety in a more consistent, concise, and interpretable manner.¹² The scale was adapted to Turkish culture in two separate studies conducted by Terzi and Akkaya et al., in which its validity and reliability within the Turkish context were examined.^{11,13} During the Turkish adaptation process, the response format of the original 7-point Likert scale was converted into a 5-point Likert format, ranging from 1 = Strongly Disagree to 5 = Strongly Agree. This modification was made to enable participants to respond to the items more easily and clearly, while maintaining the conceptual integrity of the original instrument.

To ensure content validity, linguistic and cultural equivalence procedures were carried out with expert evaluations. During the translation process, revisions made by experts proficient in both Turkish and English were

carefully reviewed by language specialists. After final linguistic and cultural agreement was achieved, the scale was adapted into Turkish. Subsequently, a pilot application was conducted, and the internal consistency, assessed using Cronbach's alpha (CA), and construct validity of the Turkish version were confirmed.

In the present study, the Turkish form of the AIAS was used. The scale consists of four subdimensions: Learning (Items 1-5), Job Displacement (Items 6-9), Socio-Technical Blindness (Items 10-13), and AI Embodiment (Items 14-16). Items are rated on a 5-point Likert scale ranging from 1 = strongly disagree to 5 = strongly agree. Total scores are obtained by summing item scores, with higher scores indicating higher AI-related anxiety.

Data Collection Process

Data were collected between September and November 2024 using a structured self-report questionnaire. The questionnaire was administered in paper format by contacting all participants in person. Those who could not be reached in person were invited via their institutional email addresses to complete a Google Form questionnaire. The first section of the questionnaire contained an informed consent form. Those who agreed to participate in the study answered the questionnaire on a voluntary basis. No personally identifiable information was requested from physicians and nurses. The questionnaire took an average of 10 minutes to complete.

Ethical Considerations

Approval for the study was obtained from the Scientific Research Ethics Committee of Lokman Hekim University (Date: July 31, 2024; Decision no. 2024/175). Institutional permissions were granted by the relevant hospital administrations. Participation was voluntary, and digital informed consent was obtained prior to data collection. No personally identifiable information was recorded. All processes were conducted in accordance with the Declaration of Helsinki and national research ethics regulations.

Statistical Analysis

The data were analysed using IBM SPSS Statistics v26 and AMOS v24 software. Descriptive statistics (mean, standard deviation (SD), frequency and percentage) were calculated. The normal distribution assumption of the data was tested using skewness and kurtosis values within the ± 1.5 acceptance range.¹⁴

Construct validity of the AIAS was examined using second-order Confirmatory Factor Analysis (CFA), performed with a bootstrap method using 10,000 samples. Factor loadings

are given at a 95% confidence interval. Fit indices, as listed in Table 1, were used in the CFA.¹⁵⁻¹⁸

Table 1. Compatibility Indices

Compatibility Indices	Good Compatibility	Acceptable Compatibility
χ^2/df	≤ 3	≤ 5
NFI	$.95 \leq NFI \leq 1.00$	$.90 \leq NFI < .95$
RFI	$.95 \leq RFI \leq 1.00$	$.90 \leq RFI < .95$
GFI	$.95 \leq GFI \leq 1.00$	$.90 \leq GFI < .95$
AGFI	$.90 \leq AGFI \leq 1.00$	$.85 \leq AGFI < .90$
RMR	$0 < RMR \leq .05$	$.05 < RMR \leq .08$
SRMR	$0 < SRMR \leq .05$	$.05 < SRMR \leq .08$

AGFI, adjusted goodness-of-fit index; GFI, goodness-of-fit index; NFI, normed fit index; RFI, relative fit index; RMR, root mean square residual; SRMR, standardized root mean square residual; χ^2/df , Chi-square divided by degrees of freedom.

The reliability of the scale was assessed using CA and composite reliability (CR) coefficients. As the data from the compared groups exhibited a normal distribution, a t-test was employed to analyse two independent groups and an ANOVA test to analyse three or more independent groups. Groups showing differences in the ANOVA test were identified using Bonferroni-corrected multiple comparison tests. Chi-square tests were used to analyse relationships between categorical variables. Pearson and Spearman correlation tests were used to assess the relationships between variables. Multiple linear regression analysis was performed to determine predictors of AI anxiety and VIF values were calculated to check for multicollinearity. The level of statistical significance was set at $P < .05$.

RESULTS

A total of 331 healthcare professionals took part in the study, of whom 179 were physicians (54.1%) and 152 were nurses (45.9%). The mean age was 36.42 years (SD = 9.53). The majority of participants were female (71.3%), married (53.2%), and had a bachelor's degree (38.7%). Only 10.9% reported having received prior training in AI. Of those, 38.7% indicated that they currently use AI tools in practice and 85.8% expressed a willingness to integrate AI into their clinical work (Table 2).

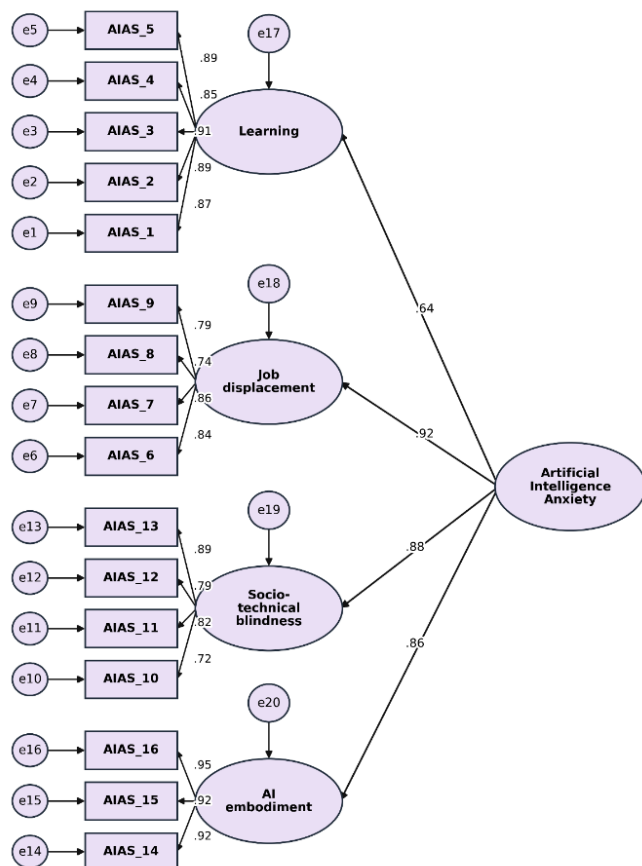
Scale validity and reliability

CFA supported the four-factor structure of the AIAS. Model fit indices indicated an excellent fit between the model and the data ($\chi^2/df = 2.680$; Goodness of Fit Index (GFI) = .993; Adjusted Goodness of Fit Index (AGFI) = .991; Normed Fit Index (NFI) = .992; Relative Fit Index (RFI) = .990; Root Mean Square Residual (RMR) = .077; Standardized Root Mean Square Residual (SRMR) = .047) (Figure 1). Factor loadings ranged from .722 to .954 across the four dimensions: Learning, Job Displacement, Socio-Technical Blindness, and

Table 2. Sociodemographic and Occupational Characteristics of Participants (n = 331)

Variable		n	%
Age (mean±SD)		36.42±9.53	
Gender	Female	236	71.3
	Male	95	28.7
Marital status	Married	176	53.2
	Single	155	46.8
Level of education	Bachelor's	128	38.7
	Master's	102	30.8
	Doctorate	101	30.5
Occupation	Physician	179	54.1
	Nurse	152	45.9
Length of service at current institution	0-3 year	113	34.1
	4-7 year	77	23.3
	8-11 year	21	6.3
	≥ 12 year	120	36.3
Previous training in AI techniques/ products	Yes	36	10.9
	No	295	89.1
Desire to use AI techniques/ products in professional life	Yes	284	85.8
	No	47	14.2
Current use of AI techniques/products	Yes	128	38.7
	No	203	61.3
Total		331	100

AI, artificial intelligence; n, number of participants; SD, standard deviation.

**Figure 1.** Second-order CFA model of the AIAS

AI Embodiment. Internal consistency was high, with CA coefficients of .947 for Learning, .881 for Job Displacement, .882 for Socio-Technical Blindness, .951 for AI Embodiment, and .948 for the total scale. CR coefficients were .947, .883, .882, and .951 for the four dimensions, respectively, and .977 for the total scale, supporting the reliability of the AIAS.

The mean AIAS score was 42.01 (SD = 15.67), indicating moderate anxiety levels across the sample (Table 3). The mean scores were 10.19 ± 5.22 for the Learning dimension, 10.96 ± 4.63 for the Job Displacement dimension, 12.62 ± 4.52 for the Socio-Technical Blindness dimension, 8.04 ± 3.98 for the AI Embodiment dimension, and 41.80 ± 15.45 for the total AIAS.

Table 3. Descriptive Statistics and Distribution Characteristics of AIAS Scores

Dimensions	Mean	SD	Median	Skewness	Kurtosis
AIAS	42.01	15.67	43	-.574	.115
Learning	10.19	5.22	10	-.041	.834
Job Displacement	10.96	4.63	11	-.948	.057
Socio-Technical Blindness	12.62	4.52	13	-.651	-.358
AI Embodiment	8.04	3.98	8	-1.065	.274

AIAS, Artificial Intelligence Anxiety Scale; SD, standard deviation.

Based on the calculated kurtosis and skewness values regarding the normal distribution, it was determined that the AIAS and its sub-dimensions showed normal distribution (± 1.5).

As shown in Figure 2, all AIAS subdimensions were positively and significantly correlated ($P < .05$), with correlation coefficients ranging from $r = .63$ to $r = .75$. The strongest correlation was observed between Socio-Technical Blindness and AI Embodiment ($r = .75$), whereas the weakest correlation was between Job Displacement and Socio-Technical Blindness ($r = .63$).

Differences according to demographic and professional characteristics

Following the analysis of the demographic and occupational characteristics of the study population, Nurses demonstrated significantly higher anxiety than physicians across all subscales (Respectively: $t = 2.720$, $P = .007$; $t = 3.028$, $P = .003$; $t = 1.996$, $P = .047$; $t = 4.074$, $P < .001$) and the total AIAS score ($t = 3.468$; $P < .001$). The most pronounced differences were observed in the Learning and Job Displacement dimensions.

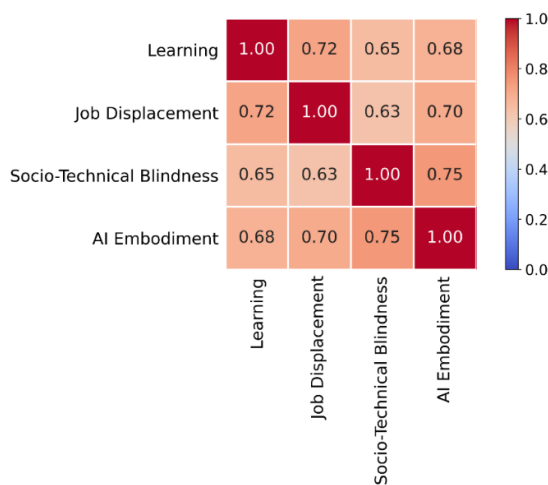


Figure 2. Correlation matrix of the AIAS and its sub-dimensions

.015; $t = 3.017$, $P = .003$; $t = 2.705$, $P = .007$; $t = 5.201$, $P < .001$) and the total AIAS score ($t = 4.174$, $P < .001$). Married individuals reported higher anxiety scores than single individuals in the AI Embodiment ($t = 3.018$, $P = .003$) subdimension and in the total AIAS score ($t = 2.225$, $P = .025$).

Participants with a bachelor's degree reported significantly higher anxiety than those with a master's or doctoral degree (AIAS score $F = 3.089$, $P = .047$), particularly in the Job Displacement ($F = 3.472$, $P = .032$) and AI Embodiment ($F = 6.483$, $P = .002$) dimensions.

Participants with prior AI training reported significantly lower anxiety scores in the Job Displacement ($t = -2.226$, $P = .031$), Socio-Technical Blindness ($t = -2.450$, $P = .015$) and AI Embodiment ($t = -3.350$, $P = .001$) subdimensions, as well as the total AIAS score ($t = -2.793$, $P = .006$).

Participants who expressed a willingness to use AI in their professional work reported significantly lower anxiety scores across all subdimensions (Respectively: $t = -4.744$, $P < .001$; $t = -3.953$, $P < .001$; $t = -3.550$, $P < .001$; $t = -4.108$, $P < .001$) and the total AIAS score ($t = -5.190$; $P < .001$).

Those currently using AI tools scored significantly lower in the Learning ($t = -3.925$, $P < .001$), Job Displacement ($t = -2.742$, $P = .006$), AI Embodiment ($t = -1.829$, $P = .068$) subdimensions and in the total AIAS score ($t = -3.6$, $P < .001$).

A multiple linear regression analysis was conducted to identify significant predictors of AI anxiety. The model was statistically significant ($F = 6.224$, $P < .001$) and explained 12.5% of the variance in AIAS scores (adjusted $R^2 = .125$; Table 4). As shown in Table 4, age ($\beta = .160$, $P = .031$), gender (reference = female; $\beta = -.128$, $P = .031$), and willingness to use AI in professional life (reference = yes; $\beta = .208$, $P < .001$) were significant predictors of AI anxiety. Older participants reported higher anxiety, males reported lower anxiety than females, and participants who were unwilling to use AI reported higher anxiety than those who were willing to use it. No multicollinearity concerns were identified, as all VIF values were below 10.

Table 4. Multiple Linear Regression Model Predicting AI-related Anxiety

Variable	B	Standard Error	β	t	P	VIF
Fixed	9.560	11.784	-	.811	.418	
Age	.259	.120	.160	2.162	.031	2.059
Gender (reference: female)	-4.374	2.014	-.128	-2.172	.031	1.315
Marital status (reference: married)	.046	1.773	.001	.026	.979	1.241
Education level	1.583	1.684	.085	.940	.348	3.078
Occupation (reference: physician)	1.004	3.247	.032	.309	.757	4.149
Length of service at current institution	.267	.975	.022	.274	.784	2.491
Previous training in AI techniques/products (reference: those who have received training)	4.620	2.610	.093	1.770	.078	1.046
Desire to use AI techniques/products in professional life (reference: those who want to use them)	9.193	2.401	.208	3.829	< .001	1.113
Current use of AI techniques/products (reference: those who use them)	1.486	1.889	.047	.787	.432	1.341

AI, artificial intelligence; B, unstandardized regression coefficient; β , standardized regression coefficient; VIF, variance inflation factor.

DISCUSSION

The research findings suggest that AI anxiety is generally moderate ($X = 42.01 \pm 15.67$), although there are significant differences across different demographic and occupational subgroups. These results are consistent with national and international studies that have highlighted the

psychological and occupational effects of AI integration in healthcare.¹⁹⁻²¹

In the regression model, occupation was not an independent predictor of AI anxiety after adjustment for demographic and experiential variables ($\beta = .032$, $t = 0.309$, $P = .757$). However, group comparisons showed that nurses

had significantly higher total AIAS scores than physicians ($t = 3.468$, $P = .001$). This distinction is important because bivariate group differences may partly reflect other variables included in the regression model, such as age, gender, education level, prior AI-related training, current AI use, and willingness to use AI. Therefore, the higher anxiety observed among nurses should be interpreted as a group-level difference rather than evidence that professional role independently predicts AI anxiety. The more pronounced differences in the Learning and Job Displacement dimensions may suggest that nurses have greater concerns about acquiring AI-related competencies and the possible effects of AI on professional roles; however, these mechanisms were not directly measured in the present study and should be examined in future research. AI learning and job replacement anxiety have also been examined in university student populations, indicating that these dimensions of AI-related anxiety are relevant beyond healthcare settings.²²

From a broader perspective, these findings can be interpreted within the context of professional identity and digital transformation in healthcare. AI technologies may be perceived not only as technical tools but also as systems that reshape professional roles, decision-making processes, and expectations of competence. This may be particularly relevant for nurses, whose work involves continuous patient care, coordination, documentation, and adaptation to changing clinical workflows. Therefore, strengthening AI literacy and technology readiness among healthcare professionals, particularly nurses, may help reduce uncertainty and support more confident engagement with AI-based systems.²³

Female participants reported significantly higher AI anxiety than male participants, both in the total AIAS score and across all subdimensions. Gender also remained a significant predictor in the regression model, indicating that male participants had lower AIAS scores than female participants after adjustment for other variables ($\beta = -.128$, $P = .031$). This finding suggests that gender-related differences in AI anxiety may be relevant in the healthcare context. However, these differences should not be interpreted as inherent gender-based characteristics. Instead, they may reflect differences in previous exposure to digital technologies, perceived technological self-efficacy, access to AI-related training, or sociocultural patterns of technology use. Therefore, future studies should examine gender-related differences in AI anxiety together with digital literacy, AI readiness, and professional technology experience.

Age was positively associated with AI anxiety and remained

a significant predictor in the regression model ($\beta = .160$, $P = .031$). This finding suggests that older healthcare professionals may experience greater uncertainty when adapting to rapidly changing AI-based technologies or may perceive AI as more disruptive to established clinical routines. Previous studies have similarly reported that AI-related anxiety may vary according to age and professional experience, particularly in relation to socio-technical concerns and perceived adaptation difficulties. However, because the present study was cross-sectional, age-related differences should be interpreted as associations rather than causal effects. Future studies should examine whether digital literacy, previous exposure to AI tools, and perceived technology readiness mediate the relationship between age and AI anxiety.^{20,21,24}

Another important finding was that unwillingness to use AI in professional practice was associated with higher AI anxiety ($\beta = .208$, $P < .001$). In addition, participants with prior AI-related training and those currently using AI tools generally reported lower anxiety levels. These findings suggest that familiarity with AI technologies, practical experience, and willingness to engage with AI may be associated with lower anxiety. This interpretation is consistent with previous studies suggesting that AI-related knowledge, familiarity, and training needs are important factors in healthcare professionals' attitudes and anxiety toward AI.^{9,25,26} However, because this study did not directly measure professional self-confidence, digital self-efficacy, or perceived technological competence, these mechanisms should not be interpreted as confirmed explanations. Future studies should examine whether AI literacy, digital competence, perceived usefulness, and organizational support mediate the relationship between AI experience and AI anxiety.

Although the regression model was statistically significant, it explained only 12.5% of the variance in AI anxiety. This indicates that AI anxiety cannot be fully explained by the demographic and experiential variables included in the present model. Similarly, a recent study among healthcare professionals in Türkiye found that mental well-being explained only a small proportion of the variance in AI anxiety, suggesting that AI-related anxiety may be influenced by multiple factors.²⁷ Work-related psychological factors may also be relevant, as research outside the healthcare sector has examined the relationship between AI anxiety and employee motivation.²⁸ Organizational digital culture, perceived managerial support, digital literacy, AI self-efficacy, perceived usefulness of AI, workload, patient safety concerns, and professional identity may also influence AI-related anxiety among healthcare professionals.

Limitations

This study has several limitations that should be considered. Firstly, due to its cross-sectional design, it is not possible to assess causal relationships between the use of AI in healthcare and anxiety; therefore, the findings should be interpreted in terms of association rather than causation. Secondly, the quota sampling method and single-centre design limit the generalisability of the results to a broader population of healthcare workers. Selection bias may have occurred because participants were selected using a non-probability quota sampling strategy. Healthcare professionals who are more interested in or more sensitive to AI-related concerns may be more likely to participate. Therefore, these findings should not be generalized to all physicians and nurses. Comparative studies should be conducted in organisations with different structures and in different cities.

Another limitation is the relatively low explanatory power of the regression model. Although age, gender, and willingness to use AI were significant predictors, the model explained only a limited proportion of variance in AI anxiety. This suggests that other unmeasured psychological, organizational, and technological factors may also contribute to AI anxiety.

This study examined the level of AI-related anxiety and its associated factors among physicians and nurses in a large academic hospital in Türkiye. Overall, AI anxiety was moderate and was higher among nurses, female participants, older professionals, and those with lower exposure to AI-related training or practice. In the regression model, age, gender, and willingness to use AI were significant predictors of AI anxiety. These findings suggest that AI integration in healthcare should be supported by targeted training, AI literacy initiatives, and transparent implementation strategies that address the concerns of different professional groups.

Future research should use longitudinal or prospective cohort designs to better capture temporal dynamics and clarify causal relationships. Multicentre studies covering public, private and university hospitals in different regions and countries would increase representativeness and validity. Furthermore, studies should analyse the relationship between AI anxiety and variables such as job satisfaction, organisational commitment and patient safety using structural equation modelling. These studies should also evaluate anxiety profiles separately for different AI applications (e.g. robotic surgery and clinical decision support systems).

Ethics Committee Approval: Ethics committee approval was obtained from Lokman Hekim University Scientific Research Ethics Committee

(Date: July 31, 2024, Number: 2024/175)

Informed Consent: All participants were informed about the purpose, scope, and procedures of the study, and digital informed consent was obtained prior to data collection

Peer-review: Externally peer-reviewed.

Author Contributions: Concept -DK; Design- DK, MK; Supervision- MK; Resources- DK, MK; Data Collection and/or Processing- DK; Analysis and/or Interpretation- MK; Literature Search- DK, MK; Writing Manuscript- MK; Critical Review- MK

Conflict of Interest: The authors have no conflicts of interest to declare.

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Use of Artificial Intelligence: No artificial intelligence-powered applications were used for this study

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