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Artificial Intelligence Challenge in Medicine: Physicians' Anxiety and Resilience

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ABSTRACT
Background: Artificial intelligence (AI) anxiety is an emerging problem that could prevent AI technology from being broadly embraced, utilized, and accepted in the healthcare sector. AI Anxiety can drastically affect an individual's views, behaviors, sense of wellbeing, academic performance, and decisions. **Objective:** This study aims to assess Egyptian physicians' anxiety level toward AI and risk factors affecting it. **Subjects and Methods:** This cross-sectional study adopted self-administered web-based questionnaires distributed to 400 Egyptian physicians from April to June 2025. The questionnaire involved sosciodemographic data, work related data, artificial intelligence anxiety scale (AIAS) and resilience scale. **Results:** The findings indicated that 51.8% of physicians had AI anxiety. The median (IQR) total AIAS score was 77 (60-94), with sub-dimensions scores of 22 (16-27) for "learning, " 24 (17.2-32.0) for "job replacement, " 19 (15.0-24.0) for "sociodemographic blindness, " and 12 (8.0-17.0) for "AI configuration." The median (IQR) participants' resilience score was 14.0 (10.0-20.0). **Conclusion:** Physicians had psychological concerns regarding the future of AI-dominated world including fear of replacement, tasks automation and technical blindness. So, programs for continuing education should be encouraged in parallel to enhance the application of AI in healthcare, facilitate adaptation, increase physicians' technological competence, resilience and reduce anxiety related to AI.
Keywords: Artificial intelligence anxiety, AI, resilience, Physicians, Job replacement.

INTRODUCTION

Medical procedures have been completely transformed by the quick adoption of artificial intelligence (AI), which presents novel opportunities for enhancing patient outcomes, treatment planning, and diagnostic precision [(1)]. Machine learning algorithms and predictive analytics are two instances for AI-powered tools that are being used more and more in healthcare settings to help doctors make decisions and lessen administrative workloads [(2)]. The use of AI in healthcare has sparked worries among medical professionals despite its potential advantages, especially in light of job displacement, loss of autonomy, and ethical considerations [(3)]. These beliefs have given rise to a phenomenon known as AI anxiety, defined as the fear, worry, or trepidation connected to the incorporation of AI technologies into professional practices [(4)]. In other words, ""AI anxiety (AIA)" refers to a state of panic and tension brought on by uncertainty about the course of AI development [(5)].

AI anxiety among healthcare workers can show up as resistance to implementing new technology, doubts about the accuracy of AI tools, or a fear of being supplanted by automated systems [(6)]. Such concern can have a detrimental influence on doctors' well-being and job satisfaction in addition to hindering the successful application of AI in healthcare. However, individual differences in resilience, the capacity to adjust and bloom in the face of adversity, may play a critical role in mitigating the effects of AI anxiety [(7)].

By encouraging adaptive coping mechanisms and cultivating an optimistic mindset, resilience has been demonstrated to act as a buffer against stress and anxiety in high-pressure professions including medicine [(8)]. In this sense, resilient people are better equipped to handle technology stressors and overcome obstacles rather than viewing technological demands as dangerous. Given this, they may be more likely to recover from any technological setback. As a result, even if they had previously experienced a technological failure, they are more likely to experiment with new and improved technologies [(9)].

Few studies have explored the psychological effects of adopting AI on doctors, especially the connection between AI anxiety and resilience, despite the expanding corpus of research on AI in healthcare. Developing solutions that help doctors adjust to technology changes while preserving their mental health and professional effectiveness requires an understanding of this relationship. This study aims to assess the prevalence of AI anxiety among physicians and examine the relationship between AI anxiety and physicians' resilience.

SUBJECTS AND METHODS

Study type: It was a cross-sectional study.

Study population: Egyptian physicians without a prior diagnosis of any mental health disorder and accept to participate was included in the study

Sample size: Sample size calculated based on **ALkhalifah *et al.*** [(10)] study results using Epi info Soft calculator version 3 according to the following equation,

$$SS = Z^2 * (P) * (1-P) / E^2$$

- **Z** = Z value (e.g. 1.96 for 95% confidence level)
- **P** = Prevalence of the condition
- **E**= Standard error expressed as decimal (e.g., .05).

The study power was 80 % with a confidence level of 95%, the anticipated prevalence of AI deployment anxiety among workers was 86.3 %. The minimal calculated sample size is 220. To improve the accuracy of the estimates and compensation for possible non-

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response or incomplete data, the sample size was increased to 400 participants. A convenience sampling method was employed to recruit eligible physicians who were deemed suitable and accessible for participation. Data was collected using a structured Google Form.

Study duration: Collection of data was done from April to June 2025.

Study tool:

Data were collected using self-administered web-based questionnaire translated into Arabic include the following:

1. **Sociodemographic data and work-related data** of the participants were determined including; age, residence, economic status, marital status number of children, occupation, number of working hours, working days/week and working duration.
2. **Artificial Intelligence Anxiety Scale** adopted by **Wang and Wang [11].** Artificial Intelligence Anxiety Scale included 21 items with four dimensions; learning (8 items), job replacement (6 items), sociotechnical blindness (4 items), and AI configuration (3 items). The items are scored with a seven-point Likert-type rating scale (1 = never through 7 = completely)
3. **Brief Resilience Scale (BRS) (Smith *et al.*, 2008)[12]** Using the 1 -5 scale (5 - Strongly agree, 4- Agree, 3 – Neutral, 2 - Disagree, 1 - Strongly disagree)

1. I tend to bounce back quickly after hard times 5.
2. I have a hard time making it through stressful events.
3. It does not take me long to recover from a stressful event.
4. It is hard for me to snap back when something bad happens.
5. I usually come through difficult times with little trouble.
6. I tend to take a long time to get over set-backs in my life.

Pilot study: A pilot study was conducted with 20 physicians (5% of the planned sample size of 400) to assess the feasibility, cultural relevance, and comprehensibility of the questionnaire. The results confirmed the practicality of the study design and the appropriateness of the survey instrument for the target population, supporting its use in the full-scale study.

Ethical considerations: Benha University Institutional Review Board (IRB) from RC 9-4-2025 granted ethical approval for this project. All study practices protected the rights, welfare, and privacy of participants by adhering to the ethical guidelines set forth in the Declaration of Helsinki and its subsequent amendments.

Statistical analysis

The data was coded, entered, and analyzed using the Statistical Package for the Social Sciences (SPSS) version 25.0 for Windows (SPSS Inc., Chicago, IL, USA). While categorical variables were represented by frequencies and percentages. For quantitative data, the normality of distribution was assessed using the Kolmogorov-Smirnov test. Quantitative variables were represented by median and interquartile range (IQR) as appropriate for non-parametric data. The Mann-Whitney test was used for inferential analysis when comparing means between two groups, and the Kruskall-Willis test was used for comparisons between more than two groups. Spearman correlation was conducted between quantitative variables. Simple and multiple linear regression analysis were employed to identify significant determinants of AI anxiety. All statistical tests were two-tailed, and a p-value of less than 0.05 was considered statistically significant.

RESULTS

The median (IQR) age of the study participants was 28.0 (26.0-35.0) years. The majority of the study participants were females and from rural areas. About half of the study participants had MBBCH degree (Table 1).

Table (1): Sociodemographic and work-related characteristics of the study participants

Variable	N.=400	N. (%)
Age (years)	Median (IQR)= 28.0 (26.0-35.0)	
Age groups	<28	180 (45.0 %
	≥28	220 (55.0%)
Sex	Male	87 (21.8%)
	Female	**313** (**78.3%**
Residence	Urban	137 (34.3%
	Rural	**263** (**65.8%**
Education	MBBCH	198 (**49.5%**
	Master	67 (16.8%)
	MD	135 (33.8%)
Working years	<4	198 (49.5%)
	≥4	202 (**50.5%**
Working hours /day	<8	148 (37.0%
	≥8	252 (**63.0%**
Working days/week	<4	136 (34.0%
	≥4	264 (**66.0%**
Working department	Surgery	41 (10.3%
	Rheumatology	57 (14.3%
	Radiology	38 (9.5%)
	Orthopedics	18 (4.5%)
	Ophthalmology	52 (13.0%)
	Internal	14 (3.5%)
	General practitioner	57 (14.3%)
	Family	30 (7.5%)
	ENT	15 (3.8%)
	Dermatology	58 (**14.5%**
	Chest	20 (5.0%)

IQR: interquartile range; ENT: Ears, Nose & Throat

More than half the study participants (51.8%) had AI anxiety. The median (IQR) total AI anxiety and resilience scores among the study participants were 77 (60-94) and 14.0 (10.0-20.0) respectively (Table 2).

Table (2): AI anxiety and resilience distribution among the study participants

Variable (N.=400)		Statistic N. (%)	
AI anxiety	Yes	207	(51.8%)
	No	193	(48.2%)
		Median (IQR)	
Total AI Anxiety score		77 (60-94)	
AI Learning domain		22 (16-27)	
Job Replacement domain		24 (17.2-32.0)	
Sociotechnical Blindness domain		19 (15.0-24.0)	
AI Configuration domain		12 (8.0-17.0)	
Total resilience score		14.0 (10.0-20.0)	

IQR: interquartile range

There were significant differences between the study participants total AI anxiety score according their sociodemographic and work-related characteristics. Total AI anxiety score was significantly higher among higher age groups and those from urban areas. Total AI anxiety score was significantly higher among those had MD degree. Total AI anxiety score was significantly higher among longer working hours per day, working days per week, working experience.

Total AI anxiety score was significantly different among doctors at different departments. The highest total AI anxiety score was among dermatological doctors, followed by ophthalmology doctors and radiology doctors. The lowest total AI anxiety score was among ENT doctors (Table 3).

Table (3): Differences between the study participants regarding their total AI anxiety score

Variable		Total AI anxiety score Median (IQR)	Test of significance	P value
Age (years)	<28	71.5 (58.0-87.0)	3.75	**0.001(HS)**
	≥28	81.0 (65.0-100.0)		
Sex	Male	81.0 (65.0-87.0)	0.145	0.88
	Female	77.0 (58.0-100.0)		
Residence	Urban	81.0 (68.0-98.0)	3.5	**0.001(HS)**
	Rural	72.0 (57.0-94.0)		
Education	MBBCH	72.0 (58-83)	21.9	**0.001(HS)**
	Master	81.0 (67.0-103.0)		
	MD	91.0 (57.0-112.0)		
Working years	<4	72 (58.0-83.0)	4.6	**0.001(HS)**
	≥4	88 (63.7-105.0)		
Working hours/day	<8	71.0 (56.0-91.0)	4.4	**0.001(HS)**
	≥8	81.0 (65.0-103.0)		
Working days/week	<4	72.0 (56.0-87.0)	4.2	**0.001(HS)**
	≥4	81.0 (61.0-101.5)		
Working department	Surgery	87 (82.5-91)	100.1	**0.001(HS)**
	Rheumatology	80 (65-81)		
	Radiology	**88** (77-100)		
	Orthopedics	64.5 (45.7-74.0)		
	Ophthalmology	**90** (72.0-111.0)		
	Internal	78 (68.0-90.5)		
	General practitioner	67 (58.0-91.0)		
	Family	56 (34.0-57.0)		
	ENT	**40** (40.0-56.0)		
	Dermatology	**92** (50.0-124.0)		
	Chest	79.5 (44.7-115.5)		

IQR: interquartile range HS: highly significant (P= 0.01); ENT: Ears, Nose & Throat

There was significant positive correlations between total AI anxiety score and age, working hours, working days and working years. There were significant negative correlation between total AI anxiety score and resilience score.

There were significant positive correlations between AI anxiety domains (learning, job replacement, sociotechnical blindness, and AI configuration) and participants' age, working hours, working days, and years of experience. The only exception was AI configuration, which did not show a significant correlation with working hours.

There were significant negative correlations between AI anxiety domains (learning, job replacement, sociotechnical blindness and AI configuration domains) and resilience score. There were significant negative correlations between resilience score and age and working years (Table 4).

Table (4): Spearman correlation between the study participants' total AI anxiety score, AI anxiety domains and resilience scores

	Anxiety	**Learning**	**Job Replacement**	**Sociotechnical Blindness**	**AI Configuration**	**Resilience**
Age						
Correlation coefficient	0.280	0.250	0.291	0.228	0.129	-0.219
P value	**0.001****	**0.001****	**0.001****	**0.001****	0.**010***	**0.001****
Working hours						
Correlation coefficient	0.221	0.280	0.223	0.166	0.085	0.037
P value	**0.001****	**0.001****	**0.001****	**0.001****	0.088	0.458
Working days						
Correlation coefficient	0.239	0.208	0.232	0.198	0.126	0.048
P value	**0.001****	**0.001****	**0.001****	**0.001****	**0.012***	0.337
Working years						
Correlation coefficient	0.277	0.231	0.294	0.205	0.135	-0.211
P value	**0.001****	**0.001****	**0.001****	**0.001****	**0.007****	**0.001****
Resilience score						
Correlation coefficient	-0.201	-0.161	-0.174	-0.201	-0.186	-
P value	**0.001****	**0.001****	**0.001****	**0.001****	**0.001****	

**HS: highly significant (P= 0.01); *S: significant (P= 0.05).

The simple linear regression analysis presented in **Table (5)** identifies factors associated with AI anxiety among the study participants. Age, residence, education master and MD degree, working hours per day, days of work per week and working years were positively significant predictors of AI anxiety. In contrast, Resilience score was negatively significant predictors of AI anxiety.

The multiple linear regression analysis presented in **Table (5)** shows that age, residence, working hours per day and days of work per week were positively significant predictors of AI anxiety. In contrast, Resilience score was negatively significant predictors of AI anxiety.

Table (5): Linear regression analysis to predict AI anxiety among the study participants

Variable	Simple linear		Multiple linear	
	β coefficient (95% C.I)	**P value**	**β coefficient (95% C.I)**	**P value**
Age	1.35 1.00 - 1.70	**0.001(HS)**	2.64 1.66- 3.63	**0.001(HS)**
Residence Rural Urban	 -8.24 2.98- 13.49	**0.002 (HS)**	 7.86 3.06- 12.67	**0.001 (HS)**
Education MBBCH Master MD	 - 4.29 .94- 7.64 2.50 0.72- 4.28	**0.001(HS)**	 - 1.65 -2.65 -5.96 -6.752 -14.918 -1.414	 0.45 0.10
Working hours	1.26 0.65 -1.86	**0.001(HS)**	0.984 0.413 1.556	**0.001(HS)**
Working days	4.35 2.56 -6.14	**0.001(HS)**	2.565 0.808 4.322	**0.004 (HS)**
Working years	1.49 0.95 -2.02	**0.001(HS)**	-1.289 -3.445 0.867	0.240
Resilience score	-1.05 -1.53- -.57	**0.001(HS)**	-0.580 -1.039 -0.120	0.**014 (S)**

C.I: confidence Interval; HS: highly significant (P= 0.01); S:significant (P= 0.05).

DISCUSSION

The current study revealed that more than half of the participating physicians (51.8%) experienced anxiety due to artificial intelligence (AI). This finding reflects a growing psychological worry as AI technologies become more integrated into healthcare systems. This finding is in line with research from around the globe that indicates medical personnel commonly suffer from anxiety due to artificial intelligence. Several instances of global research that brought up these difficulties were noted by **Arvai *et al.*** [13] in a thorough scoping analysis. In an international survey on AI in radiology, for example, 38% of respondents reported they were worried about being supplanted by AI systems. In a comparable approach, 45% of respondents to the survey on anesthesiology expressed worry that the employment of AI will reduce the demand for anesthesiologists and negatively impact their wages.

According to **Elnaggar *et al.*** [14], 73.3% of Saudi physicians disclosed concern that doctors might eventually be replaced by AI. Similarly, in a 2024 Medscape study, 49% of US physicians expressed anxiety about AI-powered clinical devices, claiming concerns about diagnostic accuracy and professional autonomy [15].

Physicians' significant discomfort with AI integration in healthcare is indicated by the reported median (IQR) AI anxiety score of 77 (60-94). This score indicates that more and more individuals are aware of and emotionally impacted by innovations brought out by AI. The digital transformation of clinical environments is one example of this trend. According to earlier studies, physicians usually view automation as a threat because they fear that clinical judgment would be lost or compromised and that an over-reliance on algorithmic tools will lead to incorrect diagnoses [16].

In this study, the median resilience score of 14 (IQR 10–20) suggests that doctors have a relatively poor capacity to handle stressors like technological instability. Resilience is crucial for AI innovations in order to control emotional reactions, foster adaptation, and support lifelong learning. **Frenkenberg and Hochman** [17] found that poorer resilience may exacerbate anxiety responses and impede confidence in new technology, However, **Zhao** [18] concluded that those who are more resilient are more likely to employ AI technologies in a positive way.

The combination of significant AI anxiety and relatively low resilience in this study suggests a possible psychological vulnerability that could affect how readily AI is applied in healthcare settings. **According to Alitabar and Parsakia** [8], it emphasizes the need for institutional strategies like peer support groups, resilience-building initiatives, and continuous AI literacy training that have been shown to reduce anxiety and promote a more flexible attitude toward innovation.

The current study demonstrated that the AI anxiety scores of elderly doctors were significantly higher than those of their younger peers. This finding is in line with other studies showing older healthcare professionals typically express greater concerns about using AI in clinical settings [19]. This may be due to generational differences in exposure to digital technologies during

crucial educational years, technological stress, and resistance to the digital transition in healthcare. Furthermore, the finding that doctors from urban areas experienced more anxiety related to AI is consistent with **Mwogosi's** [20] findings that urban facilities may be early adopters of AI tools, which might lead to circumstances where clinicians feel overpowered by the speed at which technology is developing.Rural doctors, on the other hand, scored lower on AI anxiety, foremost due to slower adoption timeframes and less exposure to the technology. Similarly, a survey of primary care physicians in Alberta, Canada, found that rural physicians were more comfortable and interested in adopting AI tools, such as ECG interpreters and language translators, than their urban colleagues. This is most likely due to the lack of immediate institutional push to implement AI in rural areas [21].

The present study revealed that doctors with an MD degree expressed noticeably more fear about AI than doctors with a Master's degree or MBBCh. This result might be explained by the variations in clinical duties and professional role expectations that are frequently connected to advanced medical degrees. Similarly, after implementing AI, senior clinicians often voice concerns about clinical deskilling and disruptions to workflow [22]. Additionally, **Zhang *et al.*** [23] highlighted that when clinical liability is fully assumed and the decision-making process is unclear, physicians are less likely to rely on AI tools. Physicians who reported more working days per week, longer working hours per day, and more years of professional experience had significantly higher total AI anxiety scores. These results are in line with a Saudi Arabian study that found that lengthy workdays are a significant risk factor for mental health issues among healthcare professionals, such as anxiety and depression [24].

The current study found that doctors from various clinical departments had significantly variable overall AI anxiety scores. Interestingly, physicians who practiced dermatology expressed the most fear about AI integration, followed by radiologists and ophthalmologists, while ENT specialists showed the least amount of anxiety. This departmental variance in anxiety connected to AI might be a reflection of how different specialties are exposed to, perceive, and use AI in clinical settings. AI advancements are having the biggest effects in the fields of radiology and dermatology, especially in image identification and diagnostic support systems [25]. AI systems have proven to be highly accurate at tasks like radiography interpretation and skin lesion categorization, sometimes exceeding humans in controlled environments [26]. Although these developments are encouraging, they have increased practitioners' worries about their future responsibilities in diagnostic decision-making, professional autonomy, and job security [27].

In dermatology, direct to consumer diagnostic techniques (such as smartphone-based skin lesion analysis) and AI-based apps are growing quickly, which could increase perceived competition, particularly in private practice settings [28]. Similar to this, the FDA has approved AI systems like IDx-DR for autonomous diabetic retinopathy screening in ophthalmology, highlighting the trend toward diagnosis automation [29]. These changes probably make doctors in these disciplines more anxious because they could worry about becoming marginalized in their careers. Even while new research highlights AI's supportive rather than replacement function in radiology workflows, the ongoing myth that "AI is replacing radiologists" could account for the higher anxiety levels in this group [30].

Compared to other specialties in the current study, ENT doctors had the lowest levels of fear related to AI. This discovery is consistent with more general research showing that the use of AI in ENT practice is still in its early stages, with little integration into routine diagnostic processes and no perceived danger to daily clinical autonomy. Only 8% of American otolaryngologists surveyed in a mixed-methods study said they had received AI training during their residency, despite 72% being aware with general AI ideas; none of the interviewees had personal experience with AI in a clinical setting [31].

The current study demonstrated that resilience was a negative predictor of AIA and had a negative correlation with AIA. This is consistent with the findings of the **Kenku and Uzoigwe** [7] study, which disclosed that people with high resilience tend to have lower levels of AI anxiety. A plausible reason for this could be that people who are resilient are capable of handling change well and adjusting to new situations are less likely to feel anxious about AI in particular because they see it as a chance for personal development. Another explanation would be because resilient people are able to adjust and overcome obstacles, which can assist them in navigating the unknowns that arise from anxiety related to artificial intelligence. Consequently, this is consistent with other earlier observations **Olashore *et al.*** [32] they found that anxiety and resilience during the COVID-19 epidemic were inversely correlated.

Significant negative correlation between career adaptability and AIAS scores further verified this [33]. According to the study, AI anxiety was positively significantly predicted by age and length of employment. This is in line with the findings of studies by **Itse *et al.*** [34] and **Alkhalifah *et al.*** [10], which found a positive correlation between rising age and rising AI anxiety levels. Additionally, according to **Ochiai *et al.*** [35] and **Alkhalifah *et al.*** [10], anxiety levels were noticeably higher at 180 hours (45 hours per week) than in the group with regular working hours. Implying that those who are just starting out in their careers may be

less conscious of or more receptive to the risks that artificial intelligence may provide.

STUDY LIMITATIONS

This study has limitations, such as a small sample size of 400 participants and cultural and geographic diversity that could make it difficult to generalize the findings. Since the survey was self-administered, bias between respondents cannot be ruled out.

CONCLUSION

The study tackles a timely and vital challenge, investigating the intersection of technology and human psychology. Using a structured survey to systematically gather data on anxieties related to AI. This research makes it possible to draw comprehensive conclusions on how AI-based technology developments interact with human experience and fostering discussions and taking appropriate steps to address these existential issues. The results of the study can inspire a creative method for developing AI systems that respect human values and encourage adaption techniques to live in harmony with cutting-edge technology.

Data Availability Statement: The datasets are available from the corresponding author on reasonable request.

Authors' Contributions: All authors contributed significantly to the work reported, whether it was in the idea, study design, data collection, analysis, or interpretation. They all participated in the article's drafting, revision, and critical review, and they all approved the final version before publication.

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