Artificial intelligence anxiety in future healthcare professionals

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ABSTRACT

The purpose of this article is to review current literature on health professionals' anxiety related to the adoption of artificial intelligence technologies in the delivery of healthcare. The integration of Artificial Intelligence (AI) into the delivery of healthcare presents a transformative opportunity to both enhance patient care, and operational efficiencies. However, a potentially negative consequence of this integration has concurrently given rise to Artificial Intelligence Anxiety (AIA) among healthcare professionals, stemming from concerns about job security, ethical ambiguities, data privacy, and perceived lack of professional preparedness. Our findings suggest that an essential role of education is to address artificial intelligence anxiety in future healthcare professionals by providing appropriate education and training. These educational interventions should develop literacy in artificial intelligence technologies, and cultivate a collaborative, human-centred approach that frames AI as an augmentation tool, empowering healthcare professionals rather than replacing them. The practical implications of effective educational strategies should aim to build a resilient healthcare professional workforce where human expertise and AI capabilities synergistically optimize care delivery. We further suggest that providers of education, along with other stakeholders in the preparation and training of our future healthcare professional workforce, also need to contribute to the establishment of regulatory frameworks and policies which ensure ethical governance of AI.

Keywords: *Anxiety, Artificial, Education, Healthcare, Intelligence, Undergraduate.*

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Highlights of this paper

- The phenomenon of Artificial Intelligence Anxiety (AIA) is a growing concern in healthcare professionals and in students considering a career in healthcare delivery.
- An essential role of education is to address AIA in future healthcare professionals by providing appropriate education and training.
- Educational interventions should develop literacy in artificial intelligence technologies, and cultivate a collaborative, human-centred approach that frames artificial as an augmentation tool, empowering healthcare professionals rather than replacing them.

1. INTRODUCTION

This review explores the multifaceted nature of Artificial Intelligence Anxiety (AIA) in healthcare professionals and proposes a role for providers of education to develop a framework for its mitigation in current and future healthcare professionals. Effective mitigation of AIA among healthcare professionals necessitates education that addresses both the psychological and practical dimensions of AI - this approach should extend beyond theoretical awareness, to cultivate genuine practical proficiency in AI technologies. Education about AI must be comprehensive, collaborative, and continuously adaptable to the evolving technological landscape.

AI is the simulation of human intelligence in machines that are programmed to think and act like humans. AI is able it to understand and respond to human input in a natural, human-like way (Sheikh, Prins, & Schrijvers, 2023). AI can learn, reason, and solve problems in a way that imitates human cognition, and perform tasks that have traditionally required human intelligence. AI is capable of intelligent behavior which can improve various aspects of human existence, including healthcare, education, transportation and entertainment. It is likely that the way humans interact with each other and human societal institutions will be profoundly influenced by AI technologies (Xu et al., 2021).

Healthcare is currently undergoing a profound transformation driven by the rapid advancement of AI (Pepito & Locsin, 2019). This technological evolution offers unprecedented opportunities to revolutionize various aspects of healthcare practice, from enhancing diagnostic accuracy and streamlining clinical workflows, to personalizing treatment plans and ultimately improving patient outcomes (Jallad, Alsaqer, Albadareen, & Al-maghaireh, 2024; Yahagi et al., 2024). Models of AI are demonstrating significant accuracy in predicting recovery outcomes for patients enabling clinicians to identify personalized treatments (Filiz, Güzel, & Şengül, 2022; Lashari, Shabbir, & Shahbaz, 2025). AI can simulate social interaction to address human loneliness and social isolation (Torres, Wenke, Lieneck, Ramamonjiarivelo, & Ari, 2024). Beyond clinical applications, AI is proving instrumental in automating administrative tasks and optimizing resource allocation, thereby enhancing operational efficiency across healthcare (Abdullah & Fakieh, 2020; Bienefeld, Keller, & Grote, 2025). Despite these promising advancements, the accelerated development and integration of AI technologies in healthcare practice have concurrently given rise to artificial intelligence anxiety (AIA) among healthcare professionals (Kim et al., 2025; Teng et al., 2022). AIA can act as a significant psychological barrier, impeding the adoption, utilization, and continuous integration of AI tools, thereby preventing the realization of their full benefits within healthcare. AIA represents a disabling psychological response to these changes in professional healthcare practice (Wu & Li, 2025).

Successful integration of AI into healthcare settings is critically dependent on the readiness, competency, and psychological acceptance of AI technologies by the very professionals who will utilize them (Hassanein et al., 2025). There is a disconnect between the potential of AI, and the perception of this potential among healthcare professionals. While AI demonstrably offers considerable benefits, a significant psychological barrier persists among healthcare professionals (Fan, Zhang, Li, & Man, 2025). Thus, the perceived impact of AI often overshadows its advantages during the initial phases of AI adoption, indicating that technological advancement alone is

insufficient for successful integration – human factors, particularly psychological acceptance, are paramount (Mills, Bali, & Eaton, 2025). Consequently, education of both current and future healthcare professionals must proactively address this disconnect, and begin to dispel underlying fears of AI, rather than simply promoting the benefits of technology.

1.1. Antecedents of AIA in Healthcare Professionals

Although AIA has numerous causes, some of the main antecedents of AIA in healthcare professionals are shown in Table 1. Key drivers of Artificial Intelligence Anxiety (AIA) in healthcare professionals. A contributor to AIA in current and future healthcare professionals is the fear of being replaced or rendered redundant by AI technologies (Coban, Kar, & Berk, 2025). This anxiety is not limited to the automation of manual or repetitive tasks by AI, but also it extends into cognitive and versatile roles traditionally held by healthcare professionals. Beyond outright job loss, healthcare professionals also express anxiety about "deskilling", fearing the erosion of their professional identity and the loss of expertise cultivated over years of learning and practice. This anxiety reflects a deeper apprehension about relinquishing human control to AI and the potential negative impact on human ownership of core clinical skills (Pham, Zhang, Gao, & Zhu, 2024). While AI is designed to free up time from administrative duties, the fear of deskilling suggests a more profound anxiety about the diminution of core professional competencies. Thus, the perceived benefit of a reduced administrative burden is often overshadowed by the fear that if AI assumes too many routine cognitive tasks, professionals' critical thinking and diagnostic skills might atrophy. Educational strategies must ensure that AI training and implementation are designed to genuinely augment, rather than diminish, human expertise, ensuring continuous professional development that integrates AI as a tool for deeper analysis rather than a substitute for complex human judgment (Grunhut, Marques, & Wyatt, 2022).

Table 1. Key drivers of artificial intelligence anxiety (AIA) in healthcare professionals.

Category	Specific Concerns
Fear of Job Displacement	Job replacement; erosion of professional identity; loss of expertise; deskilling; overreliance on technology.
Ethical and Legal Ambiguities	Algorithmic bias; lack of explainable AI; unclear liability for errors; data privacy and security breaches; re-identification of anonymized data.
Lack of Preparedness & Support	Insufficient training; low digital literacy; inadequate organizational support; cultural hesitancy.
Impact on Humanistic Care	Erosion of patient-provider relationships; diminution of human empathy; depersonalization of care.

AIA can stem from the lack of transparency inherent in some AI technologies, often referred to as "black box" AI, where the decision-making processes are opaque (Arvai, Katonai, & Mesko, 2025). This opacity makes it challenging for healthcare professionals to understand the AI's reasoning, thereby hindering trust, especially when medical decisions carry implications. The lack of transparency directly contributes to a trust deficit among healthcare professionals, as understanding why AI makes certain decisions is as crucial as knowing what decision it makes (Filiz et al., 2022). This means that education providers, regulatory bodies, and AI developers must prioritize interpretability and explainability, not just accuracy, to ensure effective human oversight and accountability, which are critical for AI acceptance in healthcare.

Ambiguity surrounding liability for errors made by AI technologies is a further source of AIA in healthcare professionals – this ambiguity can lead to "analysis paralysis" and decision-making uncertainty. The absence of clear rules defining who is responsible and how to respond to harm resulting from AI decisions creates a complex

legal and ethical burden for healthcare professionals. Without clear legal frameworks for AI accountability, healthcare professionals face increased personal risk, potentially leading to hesitation in utilizing AI even when it could be beneficial. This highlights that robust regulatory frameworks are not merely about patient safety but also about protecting and empowering healthcare professionals by clearly defining responsibilities (Zhu et al., 2025).

AIA can arise from the insufficient education and low digital literacy among graduating healthcare professionals. For example, a substantial proportion of nursing students do not receive formal AI education, contributing to varying levels of anxiety related to technological competency (Castonguay et al., 2023; Jallad et al., 2024). This lack of foundational understanding of AI can leave nursing students, and potentially other future healthcare professionals, feeling unsure about how to effectively utilize AI (Fan et al., 2025). Although many healthcare professionals are concerned about the use of AI in health (Filiz et al., 2022) doctors may be less concerned about AI than other healthcare professionals (Alghamdi & Alashban, 2024; Baser, Altuntaş, Kolcu, & Özceylan, 2021). It is possible that medical education for doctors incorporates some instruction about AI, and therefore doctors are more knowledgeable about AI. Some doctors are already using AI in their own specialist fields, and they are not worried about being replaced by AI (Abdullah & Fakieh, 2020) – sentiments inconsistent with other healthcare professionals (Castonguay et al., 2023).

The introduction and ongoing use of AI technologies in healthcare combined with already demanding workloads and limited training resources, significantly diminishes healthcare professionals' willingness to engage with and trust AI. The absence of formal AI education directly contributes to low AI literacy, which then fuels "learning anxiety" creating a negative feedback loop where apprehension about AI hinders engagement with education about AI, thereby perpetuating the knowledge gap (Zhu et al., 2025). This highlights that educational institutions must proactively integrate comprehensive AI literacy into curricula and provide ongoing professional development to break this cycle and foster a more confident healthcare workforce.

1.2. Educational and Training Interventions

Mitigation of AIA lies in appropriate educational and training interventions designed to foster AI literacy and practical competency among healthcare professionals (Chen, Hu, & Wei, 2025; Kim et al., 2025). An education strategy should involve integrating AI literacy into existing curricula and provide opportunities for continuous professional development. This strategy should extend beyond theoretical awareness of AI technologies to cultivate genuine practical proficiency in the use of AI (Coban et al., 2025). Suggestions as to how an AI-adapted curricula might look are shown in Figure 1. Comparison of traditional (left) with AI adapted (right) curricula - from Kim et al. (2025).

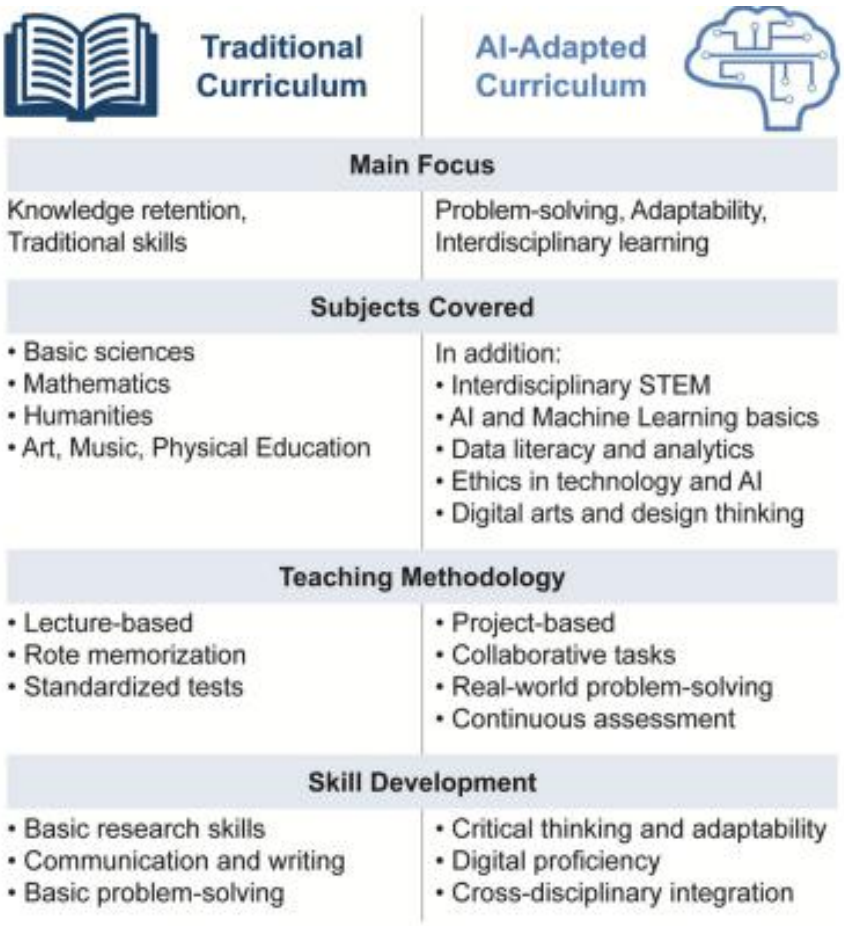

Figure 1. Comparison of traditional (left) with AI adapted (right) curricula - from.

Source: Kim et al. (2025).

Formal education integration by incorporating AI into existing healthcare, nursing, and medical curricula is required (Risling, 2017). In getting more healthcare professionals involved in AI technologies, there is a need to reframe current healthcare education to integrate AI into curricula. This integration needs to cover AI foundations, machine learning principles, and practical applications of AI through real-world case studies (Baidoo-Anu & Ansah, 2023). Education institutions and governing bodies need to offer formal educational opportunities (for example, courses and programs verified by certification) on AI for both future and existing healthcare professionals, addressing AI development and its implementation in clinical settings. The goal of this formal education integration should shift from merely informing healthcare professionals about AI to equipping them with usable, practical AI competencies (Tam et al., 2023). This implies a need for experiential learning and integration into daily workflows, moving beyond traditional didactic methods of education. The underlying mechanism here is that merely knowing about AI does not alleviate anxiety, whereas the ability to use and interact with AI effectively does.

Given the rapid evolution of AI in healthcare practice, ongoing professional development and continuous training is needed for the existing healthcare workforce. This may include short-course development by education providers, and upskilling initiatives to familiarize staff with new AI tools and their functionalities. Again, the emphasis needs to be placed on hands-on experiential learning to foster practical engagement with AI tools. This type of educational experience can significantly enhance learning and reduce AIA (Alghamdi & Alashban, 2024; Baser et al., 2021; Chen et al., 2025).

Students anxious about AI in their future healthcare practice may be less likely to be current users of AI technologies while they study, however, the education sector is rapidly embracing AI (Gosak, Pruinelli, Topaz, & Stiglic, 2024; Gunawan, Aungsuroch, & Montayre, 2024; Kwak, Seo, & Ahn, 2022). For example, AI technologies can assist in the development and implementation of an AI-adapted health education curricula. AI assistance in personalized student feedback, language translation, interactive learning, and adaptive learning are also examples of AI's current role in education (Baidoo-Anu & Ansah, 2023; Park et al., 2024). It can help develop curricula which are personalized and tailored to the needs of students, introducing AI technologies where appropriate and developing competencies in AI technologies as students' progress through their education. AI can provide novel learning experiences for students, and be used to provide tutoring and homework help, by answering questions and providing explanations to help students understand difficult concepts (Derakhshanian, Wood, & Arruzza, 2024; O'Connor, 2023). In addition, AI technologies could be used to help students organize and manage their time, by providing reminders and helping them schedule their tasks and assignments. Competencies with AI while studying are likely to help reduce AIA in healthcare graduates such that they are less likely to be anxious about AI in healthcare.

2. CONCLUSION

A call to action? Perhaps now is the time for education providers and the healthcare professions to begin to develop a cohesive and unified plan to prepare AI literate professionals for a workplace where AI is becoming ubiquitous. Comprehensive education about AI serves as a critical trust-building mechanism. When healthcare professionals understand the capabilities and limitations of AI, and feel adequately supported by their employers, their anxiety levels will likely decrease. Effective education will demystify AI, making it less threatening and more controllable, thereby fostering both "technological trust" (confidence in the AI's reliability) and "organizational trust" (confidence in the employer's support for AI use). This trust, in turn, reduces AIA and promotes the continuous adoption of AI technologies. Therefore, education is not merely about knowledge acquisition but is a vital component of change management and cultural transformation, cultivating a sense of psychological safety and shared purpose within the healthcare workforce.

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