Original Article

Understanding Nursing Students' Perceptions of Artificial Intelligence and Its Future in Healthcare

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Abstract

Artificial intelligence (AI) is rapidly redefining the nursing landscape by influencing decision-making processes and transforming patient care models. To ensure its meaningful and ethical integration into nursing education and clinical environments, it is essential to understand how future nurses perceive and interpret this technology. This study sought to uncover nursing students' metaphorical interpretations of artificial intelligence and to explore their expectations concerning its role in the future of healthcare. Using a qualitative descriptive design, twenty nursing students from a university in Central Anatolia, Turkey, were selected through criterion-based purposive sampling. Data were gathered via in-person, semi-structured interviews conducted between November and December 2024. Interview transcripts were subjected to inductive content analysis using MaXQDA software. Three primary themes and twelve subthemes emerged: *envisioning the future of AI in healthcare*, *AI's contribution to community and public health*, and *anticipated ethical and professional challenges of AI*. Participants acknowledged the potential of AI to elevate the quality and efficiency of healthcare services, yet they voiced apprehension about its ethical implications and its possible effects on professional identity. The study underscores the importance of embedding critical, reflective, and ethically oriented discussions about AI into nursing curricula. Preparing nursing students to engage thoughtfully with AI technologies will be key to advancing patient-centered, technology-enhanced healthcare in the future.

Keywords: Artificial intelligence, Nursing education, Nursing students, Qualitative research, Ethics

Introduction

Artificial intelligence (AI) has drawn growing attention across numerous disciplines [1] and has become a pioneering innovation in sectors such as health and medicine [1–4]. Broadly defined, AI refers to technologies designed to emulate human thought and behavior—encompassing abilities such as abstract reasoning, knowledge representation, learning, autonomous decision-making, and natural language communication—to replicate human cognitive processes [5,6]. Today, AI is increasingly embedded not only in everyday life but also across various professional domains, including healthcare [7].The incorporation of AI into healthcare represents a major shift in medical diagnosis, treatment delivery, and overall health management [8]. Although the concept of AI remains relatively new within the field of nursing [9], its influence is expanding rapidly. As technology continues to advance, healthcare professionals—including nurses—must be prepared to understand, adapt to, and engage with AI-driven systems [10].

Technological progress has also reshaped the organization and delivery of nursing services, from the use of electronic health records to the integration of robotics and intelligent systems. These developments are expected to enhance nurses' efficiency, safety, and ability to deliver high-quality, patient-centered care [7].

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Ünal and Avcı's research on neonatal nurses indicated that AI could be utilized in diverse areas such as medical diagnosis, treatment planning, patient monitoring, and health record management [11]. The adoption of AI in nursing practice may help address future professional challenges and elevate care quality by supporting both practice and education. For instance, AI-powered telehealth and robotic systems enable expanded access to nursing care, improve patient follow-up, and strengthen remote monitoring capabilities [12]. By integrating complex data from multiple sources, AI also empowers nurses to provide more individualized and evidence-based care [13,14]. Moreover, recent systematic reviews and meta-analyses on healthcare students' attitudes toward AI suggest that its clinical use can help reduce disparities across educational and healthcare contexts [15].

AI applications benefit nurses and nursing students in several key ways [16]. First, AI can enhance clinical decision-making and improve the development of nursing care plans [17]. Second, AI-supported systems can assume complementary roles in patient care, including continuous remote monitoring [18]. Additionally, AI technologies contribute to both direct and indirect aspects of community health services [19]. As future practitioners and primary users of AI-based tools, nurses and nursing students are well-positioned to influence and lead their implementation within healthcare systems [20]. Therefore, understanding how these users conceptualize, interpret, and adopt such technologies is vital for guiding the effective and ethical integration of AI into nursing practice [21].

Given the rapid expansion of AI in healthcare, exploring nursing students' metaphorical perceptions and future-oriented views of this technology can provide valuable insights for improving its use in public health contexts. Accordingly, the present study aims to explore nursing students' metaphorical understandings of the concept of artificial intelligence and to assess their views on its potential role in the future of healthcare.

Materials and Methods

Study type
This research employed a phenomenological qualitative design using semi-structured interviews. The phenomenological approach was selected to gain a deeper understanding of participants' lived experiences and conceptualizations of artificial intelligence, aligning with constructivist paradigms that emphasize subjective meaning-making [22]. The study adhered to the Consolidated Criteria for Reporting Qualitative Research (COREQ) guidelines to ensure methodological transparency and rigor in reporting [23].

Participants
The research was carried out between November and December 2024 with students enrolled in the nursing department of a university in Turkey. Participants were chosen through criterion-based purposive sampling, a method that allows the inclusion of individuals most likely to provide meaningful insights relevant to the research questions. Before recruitment, the researcher met with all students in the department to explain the objectives of the study and the participation requirements. Those who met the criteria and voluntarily agreed to participate were included.

Sampling continued until the point of data saturation, when no new ideas or codes emerged, and the responses began to repeat existing concepts [24]. Saturation was reached after twenty interviews. The inclusion criteria specified that participants should be nursing students who had taken part in project-based activities such as Teknofest, TÜBİTAK, or European Union programs during their high school or university education.

Data collection tools
Data were obtained through a personal information form and a semi-structured interview guide prepared by the researchers. The interview form was reviewed by three faculty members before data collection, and revisions were made in line with their feedback. It included three open-ended questions that encouraged students to reflect on the potential future of artificial intelligence in health, its contributions to public well-being, and the challenges or adverse effects it might create.

The personal information form gathered basic demographic data, such as age and gender, and contained an open-ended metaphor prompt—"Artificial intelligence is like … because …"—which aimed to elicit students' figurative and conceptual associations with the term.

A pilot test was conducted with three students to refine the questions and improve the flow of the conversation. These preliminary interviews were excluded from the final dataset. The main interviews were conducted in person by the researcher at times agreed upon with each participant. Sessions were held in a quiet, private meeting room to minimize interruptions. Each conversation lasted between twenty and forty minutes and was audio recorded with the participants' permission to ensure an accurate record of their statements.

Data analysis
The interviews were analyzed using content analysis with the aid of MaXQDA version 10. Audio files were transcribed verbatim immediately after each interview. Two researchers independently coded the transcripts and

then compared their analyses to enhance the reliability of the findings. A third expert with experience in qualitative methodology reviewed the initial code structure, and adjustments were made based on this evaluation. Themes were developed by grouping related codes and refined through discussion among the researchers. The thematic framework was finalized after consultation with a faculty member experienced in qualitative research to ensure coherence and credibility.

Trustworthiness
The study's rigor was maintained according to Lincoln and Guba's criteria of credibility, transferability, dependability, and confirmability [25]. Credibility was reinforced by allowing participants to review and validate their own interview statements. Transferability was ensured through a detailed description of each stage of the research process, enabling other scholars to assess the applicability of the findings in different settings. Dependability was achieved by systematically documenting the research design and analytic procedures, while confirmability was supported by transparent presentation of the coding and theme development process.
All interviews were carried out by the same researcher to maintain consistency, and the data were analyzed independently by two researchers before being reviewed by a social scientist to strengthen confirmability.

Ethical considerations
The study received ethical clearance from the university's ethics committee (approval number 23.10.2024-18/44), along with written permission from the Dean's Office (E-88148187-020-271784). Prior to data collection, informed consent was obtained from all participants. They were assured that participation was voluntary and that their decision would not affect their academic standing. The study followed the ethical principles outlined in the Declaration of Helsinki (2013).

Results and Discussion

Interviews were completed with twenty nursing students—sixteen women and four men—with a mean age of 20.85 ± 0.26 years. Analysis of their metaphorical expressions indicated that "convenience" was the most frequent metaphor used to describe artificial intelligence. This choice of metaphor reflected the participants' general perception of AI as a facilitator that simplifies and supports healthcare practice **(Table 1)**.

150

Table 1. Metaphors formed by nursing students about "Artificial Intelligence".

Participants	Metaphors
P1	AI is like TECHNOLOGY. Because it constantly develops.
P2	AL is like THE MIND. Because it contains information
P3	AL is like a MOUNTAIN. Because you can fall while climbing.
P4	AL is like SOPHİSTİCATİON. Because it imitates human intelligence using technology.
P5	AL is like a ROBOT. Because it does what it is told.
P6	AL is like a HUMAN. Because it imitates human intelligence.
P7	AL is like a FRİEND. Because it offers a solution to every problem of the person.
P8	AL is like a JET. Because the results reach us quickly.
P9	AL is like IMITATION. Because it fulfils certain tasks.
P10	AL is like CONVENİENCE. Because we can reach the information we want to reach in a second and without getting tired.
P11	AL is like a GHOST. Because its existence is fake but convincing.
P12	AL is like a COMPUTER. Because it performs what we want it to do.
P13	AL is like a HUMAN. Because it develops and grows as time passes.
P14	AL is like a HELPER. Because it makes things easier and helps.
P15	AL is like the horizon LıNE. Because there is no certain limit.
P16	AL is like CONVENİENCE. Because it helps in every job.
P17	AL is like a LIBRARY. Because it covers wide topics and information.
P18	AL is like CONVENIENCE. Because it facilitates human work.
P19	AL is like a VOLCANO ERUPTION. Because it cannot be known how it will have consequences at what time and in which direction it will affect whom.
P20	AL is like an OCTOPUS. Because it can benefit all sides as if it has arms.

Results of content analysis
The data obtained from semi-structured interviews were grouped under three main themes **(Figure 1)**.
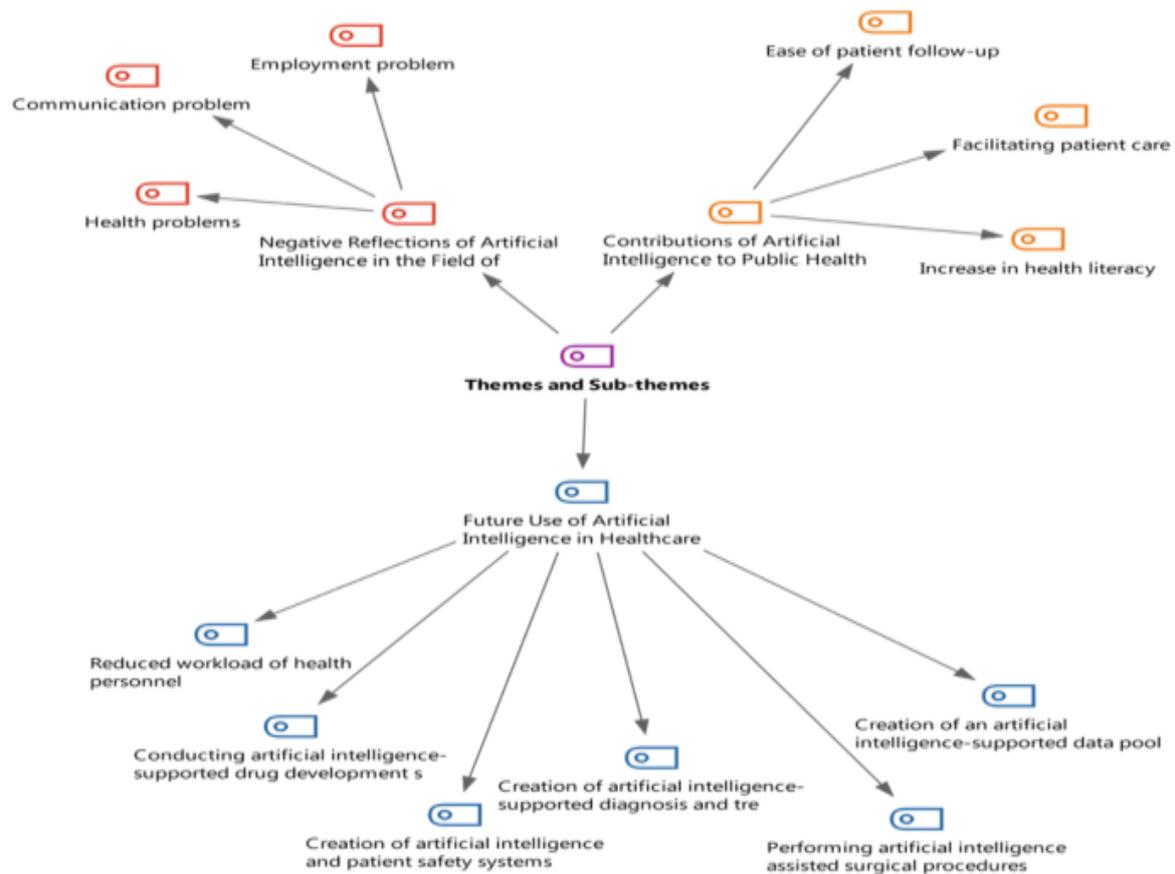
Figure 1. Themes and sub-themes

Theme 1: Future use of artificial intelligence in healthcare
This theme encompassed six interrelated subthemes describing students' expectations of how artificial intelligence (AI) will shape the healthcare sector.

Sub-theme 1.1. AI-assisted surgical procedures
Participants widely anticipated that AI technologies would become integral to surgical practice. They envisioned robots performing or assisting in operations to enhance precision and safety. As one student noted, "In the future, artificial intelligence will be actively used in surgeries," while another added, "Robots will perform operations using their own memory and software for more successful outcomes." Several participants emphasized AI's potential to support surgical teams, particularly during complex and prolonged procedures.

Sub-theme 1.2. Development of AI-based data systems
Students highlighted the role of AI in creating structured, accessible, and reliable medical data pools. They believed AI would streamline data recording, organization, and sharing across healthcare systems. One participant stated that "artificial intelligence can help record data in a more systematic way," and another observed that "data can be accessed and transferred easily thanks to AI."

Sub-theme 1.3. AI-driven diagnosis and treatment
A strong consensus emerged around AI's role in facilitating accurate diagnosis and personalized treatment. Participants envisioned systems capable of interpreting patient complaints, analyzing results, and recommending suitable therapies. They particularly stressed early disease detection: "Artificial intelligence will explain diseases in detail and identify appropriate treatments," one student explained. Another mentioned that "AI can diagnose illnesses rapidly by interpreting tests and selecting the most effective medications."

Sub-theme 1.4. AI and patient safety
Students recognized AI's potential to enhance patient safety and minimize human error. They believed automated monitoring and predictive systems could significantly reduce surgical and clinical risks. As one participant stated, "Thanks to artificial intelligence, risks arising during surgeries will be eliminated, leading to more successful operations."

Sub-theme 1.5. AI-supported drug discovery
Participants also pointed to AI's growing influence in pharmaceutical research. They suggested that AI could accelerate the development of new medications and improve production efficiency. One respondent reflected, "It will contribute to the creation of new drugs," while another remarked that "artificial intelligence can speed up the process of drug development."

Sub-theme 1.6. Reduction in healthcare workload
Lastly, participants predicted that AI would relieve much of the manual and administrative burden placed on healthcare personnel. They associated automation with both efficiency and a potential reduction in staffing needs. As one student expressed, "The workload of health professionals will decrease—most of the tasks will be handled by artificial intelligence."

Theme 2: Contributions of Artificial Intelligence to Public Health
This theme encompassed three key subthemes reflecting participants' perceptions of how AI could enhance community health outcomes: improving health literacy, simplifying patient monitoring, and facilitating patient care.

Sub-theme 2.1. Enhancement of Health Literacy
Participants consistently emphasized that AI could empower individuals by broadening access to accurate health information and supporting public awareness. They believed such technologies could help people make more informed health decisions and adopt healthier lifestyles. One student noted that "artificial intelligence can expand society's access to knowledge and raise general awareness," while another explained that "by providing easy access to medical information, AI will help create a more informed society." Similarly, others highlighted its role in "increasing people's understanding of health and promoting healthier living."

Sub-theme 2.2. Streamlining Patient Monitoring
Students underlined AI's capacity to simplify continuous patient tracking and follow-up. They envisioned systems that could monitor daily health indicators, remind patients about medication schedules, and alert healthcare providers to potential complications. As one participant explained, "AI can remind diabetic patients about their medication and diet, following them day by day." Another student suggested that "a system could integrate a patient's history, test results, and ongoing care to detect problems and suggest solutions." Others also believed that such systems could track laboratory data, signal upcoming examinations, and monitor risk factors to enhance population health.

152

Sub-theme 2.3. Facilitating Patient Care
Participants anticipated that AI-driven tools would play a growing role in patient care delivery, especially in settings requiring continuous observation. One student commented that "AI systems will help care for patients who need constant attention in intensive care units." Another observed that such technologies could support families by "detecting problems in infants, providing relevant information, encouraging healthy routines, and reminding vaccination dates." Students also mentioned that AI could assist in care planning and medication management by analyzing patients' needs and offering personalized guidance.

Theme 3: Anticipated negative reflections of artificial intelligence in future healthcare
The third theme captured participants' concerns about possible adverse outcomes of AI integration, particularly regarding health behaviors, employment, and interpersonal communication.

Sub-theme 3.1. Adverse health implications
Several students warned that excessive reliance on AI could lead to sedentary lifestyles and reduced cognitive engagement, contributing to health deterioration. As one participant expressed, "Artificial intelligence encourages passivity, limits critical thinking, and may increase chronic diseases such as obesity." Others feared psychological consequences, suggesting that "AI might raise stress and anxiety levels by reducing social interaction." Participants generally agreed that the growing use of AI might indirectly contribute to physical inactivity and related disorders.

Sub-theme 3.2. Employment concerns
A recurring apprehension among participants was that AI's expansion might displace human labor in the health sector. They believed automation could decrease the need for healthcare staff, resulting in job losses and economic instability. "Job opportunities will decline, and unemployment may rise," one student predicted, while another stated that "the robotization of services could hinder economic growth." Others shared that professionals might be forced out of their fields as machines assume an increasing number of tasks.

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Sub-theme 3.3. Communication barriers

Participants also voiced concern that AI could weaken human relationships and diminish the interpersonal dimension of healthcare. They feared that reliance on technology might erode the emotional connection between patients and providers. As one student explained, "Our communication with patients will likely weaken," and another added, "AI will reduce people's direct communication with one another."

This study explored nursing students' metaphorical perceptions of artificial intelligence (AI) and their views on its future role in healthcare. Through qualitative analysis, three overarching themes were identified: (1) the future use of AI in healthcare, (2) AI's contributions to public health, and (3) potential negative implications of AI in the health sector.

The integration of AI into nursing practice presents significant opportunities to enhance clinical efficiency, support decision-making, and deliver personalized patient care [26]. Previous studies have consistently highlighted nurses' generally positive attitudes toward these technologies. Sommer *et al.* reported that approximately two-thirds of nurses view AI as a promising opportunity in their field [27]. Likewise, the implementation of AI tools has been shown to reduce nurses' workload and improve task management [28]. In parallel, participants in the present study emphasized that AI would help ease their workload, echoing findings from Ergin *et al.* where more than half of operating room nurses stated that robotic systems could lessen their workload [29]. Similarly, research involving nurse managers revealed that 67.2% believed robotic nurses could benefit the profession [30].

Existing reviews also support the notion that automating repetitive or administrative tasks through AI can mitigate occupational stress and enhance care quality [31]. For instance, Wagner *et al.* observed that robotic operating room assistants took on a substantial share of procedural tasks, alleviating staff shortages and improving workflow efficiency [32]. Consistent with these insights, qualitative studies by Yousif *et al.* and Yoo *et al.* have both underscored the role of AI in saving time and resources, enhancing professional efficiency, and optimizing patient outcomes [33,34]. Moreover, Hatem *et al.* found broad agreement among participants that AI could reduce treatment errors and lighten physicians' workloads [8]. In a study of medical students by Jha *et al.*, nearly half anticipated that AI would lower their professional burden [35].

Conversely, not all findings in the literature align with this optimistic outlook. Tuncer and Tuncer reported that 42.4% of nurses surveyed did not believe that AI or applications like ChatGPT would meaningfully reduce their workload [36]. This divergence highlights an important area for ongoing inquiry: while many healthcare professionals perceive AI as an aid, others remain uncertain or skeptical about its practical impact on their day-to-day responsibilities.

153

Taken together, the results of the present study reinforce the growing consensus that AI can serve as a supportive tool in nursing practice—streamlining workflow, enhancing accuracy, and enabling nurses to dedicate more time to complex, human-centered aspects of care. The metaphors used by participants, such as "facilitator," "assistant," and "companion," encapsulate a vision of AI not as a replacement for nurses, but as an empowering partner that enhances their professional capabilities. These metaphorical perceptions reveal a forward-looking and constructive attitude among nursing students, suggesting readiness to engage with technological advancements while maintaining the humanistic foundations of nursing practice.

Artificial intelligence has become increasingly embedded in healthcare—from clinical decision-making and treatment planning to medication management—prompting both optimism and apprehension among nurses. Many express concern that the growing reliance on AI could eventually displace human workers [7, 37]. In Doğaner's study involving health sciences students, participants anticipated that AI might contribute to unemployment in the future [38]. Similarly, Yiğit and Açıkgöz reported that some nursing students believed AI could undermine the nursing profession by disrupting care delivery and diminishing the human role in healthcare [39]. Comparable findings were obtained by Yılmaz *et al.*, where students voiced anxiety that advances in AI might reduce the need for healthcare staff, thus intensifying job insecurity [40]. In studies conducted by Abdullah and Fakieh [41] and by Kaplan and Uçar [42], the majority of participants also feared that AI would ultimately replace human labor.

These concerns were mirrored in the present study, where several participants described AI as a potential threat to employment. Their metaphorical expressions—such as comparing AI to a "volcanic mountain" whose eruption is unpredictable—illustrated a sense of uncertainty and apprehension regarding the future of human roles in healthcare. However, not all evidence in the literature supports these fears. For instance, Ergin *et al.* found that most operating room nurses did not believe that robots would fully replace them [29], while Maraş *et al.* reported that both nurses and nursing students generally viewed humanoid nurse robots as incapable of substituting the professional judgment and empathy of human nurses [43]. Consistent with these perspectives, a study conducted in Nigeria showed that 57.8% of participants did not think AI would lead to job loss [44], and Ergin and colleagues reported that 86.2% of nurse managers shared this view [30]. Conversely, Rony *et al.* identified a subset of nurses who were concerned about potential job displacement caused by AI [12]. Collectively, these findings suggest that perceptions of AI's impact on employment vary widely, often reflecting individual beliefs about professional identity, technological familiarity, and trust in innovation.

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Beyond employment concerns, participants in the present study acknowledged the potential of AI to enhance patient monitoring and care delivery. They described AI as a supportive tool that could streamline patient tracking, contribute to data management, and optimize clinical workflow. Such observations align with findings by Maraş *et al.* who concluded that humanoid nurse robots and AI-based health technologies can facilitate patient care [43]. Similarly, Tuncer and Tuncer reported that 58.3% of their participants believed AI and ChatGPT-like programs would positively influence patient care [36]. Rony *et al.* also noted that practicing nurses often view AI as a valuable adjunct to improve care efficiency and quality [12]. Experimental evidence supports these perspectives; for example, a randomized controlled trial evaluating a data-collection robot for older adults demonstrated that AI tools could effectively assist healthcare staff by conducting structured interviews [44]. In a related study, Joo *et al.* found that AI-based systems enhanced nursing practices and contributed to the development of future frontline care models [45]. These results underscore the promising role of AI in improving patient outcomes while also emphasizing the need for structured education and training programs to ensure the safe and effective integration of such technologies into nursing practice.

Participants' metaphors, such as comparing AI to a "robot" or an "octopus," symbolized its perceived ubiquity and multifunctionality—suggesting that AI is viewed as capable of extending its reach into various aspects of daily life and healthcare operations. This aligns with existing research asserting that AI adoption can augment the capabilities of the nursing workforce, enabling safer, higher-quality, and more consistent care delivery [46]. Similarly, Doğaner reported that students believed AI would improve treatment success rates [38], and Yılmaz *et al.* observed that many health sciences students expected AI to enhance their professional competencies and enable them to provide more comprehensive patient care [40]. Clifton *et al.* further demonstrated that the integration of machine learning into clinical systems could improve emergency department outcomes by enhancing diagnostic accuracy and decision-making efficiency [47].

Consistent with these observations, participants in this study anticipated that AI-driven innovations would advance diagnostic and therapeutic processes. Their metaphors, such as likening AI to a "jet," conveyed a sense of speed, precision, and progress—capturing both the technological momentum and transformative potential of AI in shaping the future of healthcare.

Some participants in this study expressed concerns that AI technologies could negatively impact communication in healthcare. Using imitation metaphors, they suggested that while AI can mimic human intelligence, it is unable to replicate the compassionate and empathetic interactions central to nursing practice [17]. This highlights a critical challenge: ensuring that the adoption of AI does not compromise the relational and humanistic aspects of patient care [48].

Successful and safe integration of AI into healthcare also requires specific competencies and skills [49]. Active engagement with AI tools enables nurses not only to utilize these technologies effectively but also to shape the future of healthcare delivery while safeguarding fairness, safety, and quality [50]. These considerations underscore the importance of structured education and targeted training for healthcare personnel to promote proficient and ethical use of AI.

Conclusion

The findings of this study reveal that nursing students hold diverse perceptions regarding the future of AI in healthcare. Participants recognized the potential benefits of AI, including streamlining nursing workflows, supporting data management, and enhancing patient care outcomes. However, concerns persist regarding possible job displacement and the erosion of human-centered care. To optimize the integration of AI into nursing practice, comprehensive educational programs and skill-building initiatives are essential. Moreover, maintaining the humanistic core of nursing—centered on empathy, communication, and patient relationships—remains a vital priority as technology becomes increasingly prevalent in healthcare.

Relevance for clinical practice

This study underscores the importance of addressing both the opportunities and challenges associated with AI in healthcare. AI has the potential to enhance patient monitoring, improve workflow efficiency, and support clinical decision-making, ultimately raising the quality of care. To maximize these benefits, nursing education should incorporate training on AI applications, ethical considerations, data privacy, and the maintenance of empathy in care. In clinical settings, nurses require ongoing professional development to build AI literacy and effectively collaborate with AI systems. By fostering both technical proficiency and human-centered care, healthcare organizations can ensure that technological advancements strengthen, rather than undermine, compassionate nursing practice.

Limitations

Several limitations should be considered. First, the study was conducted at a single university in Turkey, limiting the generalizability of the findings to other nursing populations. Second, the data rely on participants' self-reported

154

perceptions collected through interviews, which may be influenced by personal experiences and interpretations. Future studies with larger and more diverse samples are needed to validate and expand upon these findings.

Abbreviations

AI: Artificial Intelligence
P: Participant

Acknowledgments: None.

Conflict of interest: None.

Financial support: None.

Ethics statement: None.

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155

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156

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157

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