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## Readiness and Attitudes of Nursing Students Towards Integrating Artificial Intelligence in Radiation Protection: A Cross-Sectional Study

Najwa Ammar Qajjam

General Department, Faculty of Nursing, University of Zawia, Zawia, Libya

[n.gajam@zu.edu.ly](mailto:n.gajam@zu.edu.ly)

### Abstract

Artificial intelligence (AI) is shifting from promise to routine in healthcare, whereas rigorous radiation-protection practices remain essential. We evaluated how well Libyan nursing undergraduates are prepared for both challenges. A cross-sectional study on 77 students of two different courses of study: Anesthesia and Intensive Care (n=49) and General Nursing (n=28) was undertaken at the Faculty of Nursing, University of Zawia in Libya. A structured questionnaire was employed to find data regarding their demographics and previous training, and also their self-rated knowledge level and attitudes towards AI. These findings showed extensive learning shortfalls. Specifically, 61.0% of the students were not previously trained in AI and 77.9% did not have specialized courses in radiation protection. Moreover, their self-reported knowledge revealed only moderate competency levels in AI (58.4%) and only moderate awareness of radiation dangers (41.6%). Despite this limited formal education, students reported favorable attitudes towards the adoption of AI. For instance, 54.5% were optimistic about its future deployment, while 50.6% were willing to take part in professional development courses. These findings identify a pressing need to formally enhance nursing curricula to bridge gaps in AI literacy and radiation protection, thereby preparing graduates for secure, effective, and technologically facilitated clinical practice. This study's generalizability is limited by its single-institution setting and relatively small sample size.

**Keywords:** Nursing education, Artificial intelligence, Radiation protection, Healthcare.

### الملخص:

يشهد الذكاء الاصطناعي (AI) تحولاً متسارعاً من كونه مفهوماً واعداً إلى تطبيق روتيني في قطاع الرعاية الصحية، في حين تظل ممارسات الوقاية من الإشعاع الصارمة أمراً بالغ الأهمية. هدفت هذه الدراسة إلى تقييم مدى استعداد طلبة التمريض الجامعيين في ليبيا لمواجهة هذين التحديين. أجريت دراسة مقطعية شملت 77 طالباً من مسارين دراسيين مختلفين: التخدير والعناية المركزة (ن=49) والتمريض العام (ن=28)، وذلك بكلية التمريض، جامعة الزاوية، ليبيا. تم استخدام استبيان مُنظَّم لجمع بيانات تتعلق بالخصائص الديموغرافية للطلبة وتدريبهم السابق، إضافة إلى تقييم مستوى معرفتهم الذاتية واتجاهاتهم نحو الذكاء



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الاصطناعي. وأظهرت النتائج وجود فجوات تعليمية ملحوظة؛ حيث أفاد 61.0% من الطلبة بعدم تلقيهم تدريبًا سابقًا في مجال الذكاء الاصطناعي، كما لم يسبق لـ 77.9% منهم الالتحاق بدورات متخصصة في الوقاية من الإشعاع. علاوة على ذلك، كشفت التقييمات الذاتية للمعرفة عن مستويات كفاءة متوسطة في الذكاء الاصطناعي (58.4%)، ومستوى وعي متوسط فقط بمخاطر الإشعاع (41.6%). وعلى الرغم من محدودية التعليم النظامي في هذه المجالات، أبدى الطلبة اتجاهات إيجابية نحو تبني الذكاء الاصطناعي؛ إذ عبّر 54.5% منهم عن تفاؤلهم بتطبيقه مستقبلاً، وأبدى 50.6% استعدادهم للمشاركة في دورات التطوير المهني. وتشير هذه النتائج إلى حاجة ملحة لتعزيز مناهج التمريض بشكل رسمي لسد الفجوات في الإلمام بالذكاء الاصطناعي والوقاية من الإشعاع، بما يساهم في إعداد خريجين قادرين على ممارسة سريرية آمنة وفعالة ومدعومة بالتكنولوجيا. وتجدر الإشارة إلى أن قابلية تعميم نتائج هذه الدراسة محدودة نظرًا لاعتمادها على مؤسسة تعليمية واحدة وحجم عينة صغير نسبيًا.

الكلمات المفتاحية: تعليم التمريض، الذكاء الاصطناعي، الوقاية من الإشعاع، الرعاية الصحية

## 1. Introduction

The healthcare sector is undergoing a profound and extensive transformation, driven to a large extent by the rapid development of Artificial Intelligence (AI) [1]. Beyond its theoretical promise, AI has evolved into an essential adjunct to modern clinical practice, with far-reaching implications for enhancing diagnostic outcomes, strengthening clinical decision support, and substantially improving patient safety [2][3]. Within the realm of radiation protection, AI demonstrates particularly promising potential. Its applications include predictive analytics, real-time dose monitoring, and automated safety systems [4], [5], all of which can contribute to safer clinical practice. Furthermore, the integration of AI into healthcare workflows is widely expected to improve operational effectiveness and reduce system costs [6], [7]. As future stakeholders in this evolving digital ecosystem, nursing students must be adequately prepared to engage with these technologies [8]. Although nurses are not directly responsible for performing radiological interventions, they frequently work in high-risk clinical zones such as emergency departments, intensive care units, and interventional suites, where radiation exposure is a matter of critical concern [9] in this context, the implementation of AI-powered radiation protection systems becomes essential—not only to safeguard patients, but also to enhance occupational safety and efficiency among nursing personnel [10],[11]. Despite this clear need, current research illustrates a fulminating divergence. Recent evidence indicates that healthcare students in general exhibit favorable knowledge and perceptions toward AI integration in their academic training [12]. More specifically, nursing students demonstrate nuanced attitudes shaped by perceived usefulness, ease



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of use, and behavioral intentions toward AI adoption [13]. Nevertheless, systematic discrepancies remain regarding the actual readiness of nursing cohorts, particularly in terms of their preparedness for hands-on applications of AI in specialist domains such as radiation protection [14]. These challenges are further compounded by global pressures to align technological innovation with the United Nations Sustainable Development Goals and to navigate the complex ethical landscape associated with AI adoption in healthcare [15], [16].

By thoroughly assessing five interconnected areas, this study fills a significant gap in the literature on nursing education: (i) students' basic proficiency with artificial intelligence; (ii) their awareness of radiation risks; (iii) their attitude toward incorporating AI into nursing education; (iv) their operational preparedness to use AI-enabled tools in clinical settings; and (v) the moderating impact of demographic profiles on these proficiencies. The resulting empirical insights are well-positioned to inform evidence-based policy and precision-oriented curriculum reform, creating a nursing workforce that is both ethically and technologically savvy.

## 2. Methodology

### Study Design and Participants

This cross-sectional, descriptive-analytical study evaluated attitudes and readiness toward AI-enabled radiation protection among nursing students at the Faculty of Nursing, University of Zawia. Given the college's recent establishment and a total enrolment of fewer than 200 students across the General Nursing and Anesthesia/Intensive Care programmers, we adopted an exhaustive (census-style) approach: the questionnaire was offered to all available students at all study levels, with no formal inclusion or exclusion criteria. Seventy-seven students participated, representing a high proportion of the institution's student body and therefore providing a meaningful portrait of preparedness within this specific setting.

While a formal a priori power calculation was not feasible in this particular context of a small, newly constituted college, the broad participation of eligible students enhances the internal representativeness of the findings. Nevertheless, we explicitly acknowledge that the modest absolute sample size constrains statistical power and the scope of inferential subgroup analyses; consequently, effect estimates may be imprecise and the ability to detect small-to-moderate associations is reduced. Moreover, because data derive from a single, recently established institution, caution is required when extrapolating results to other universities or national programmers.

### Data Collection Instrument

A pre-designed electronic questionnaire was developed for this study to address five domains. The questionnaire underwent an intensive development process, e.g., content validity by expert review and pilot testing on a small group of nursing students (n=10) for clarity and comprehension. Reliability was evaluated with Cronbach's alpha, and excellent internal consistency scores for



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knowledge ( $\alpha = .87$ ), attitudes ( $\alpha = .88$ ), and readiness ( $\alpha = .86$ ) were achieved, indicating high instrument reliability. The first section gathered demographic data like gender, age, study program, and semester. The questionnaire then assessed knowledge regarding basic AI concepts and their applications within healthcare, particularly in patient safety enhancement and supporting SDGs. It also examined the students' understanding of radiation hazards in the clinical setting. The questionnaire also quantified attitudes towards AI adoption by assessing optimism regarding its application in nursing, whether it has the potential to reduce errors, and the ethics involved. Readiness at the practical level was also assessed by the questionnaire by evaluating students' readiness to work with AI tools, apply radiation safety measures, and participate in sustainability efforts.

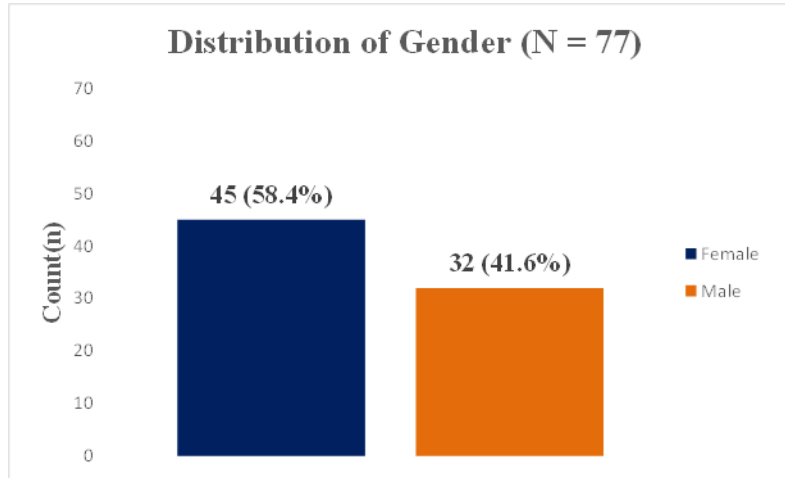
### Data Analysis

Data from 77 respondents were analyzed using SPSS statistical software. Descriptive statistics summarized response distributions and participant characteristics. Inferential analyses were selected to match the data structure and the modest cohort size. Chi-square tests assessed associations between categorical variables, with Fisher's exact test used when expected cell counts were small. Independent-sample t-tests compared mean scores across groups, and Welch's correction was applied when variances were unequal. Effect sizes (Cramér's  $V$  and Cohen's  $d$ ) were reported to convey practical significance. Given  $n = 77$ , statistical power was limited; thus, non-significant findings may reflect the small sample rather than a lack of relationship, and results should be interpreted cautiously.

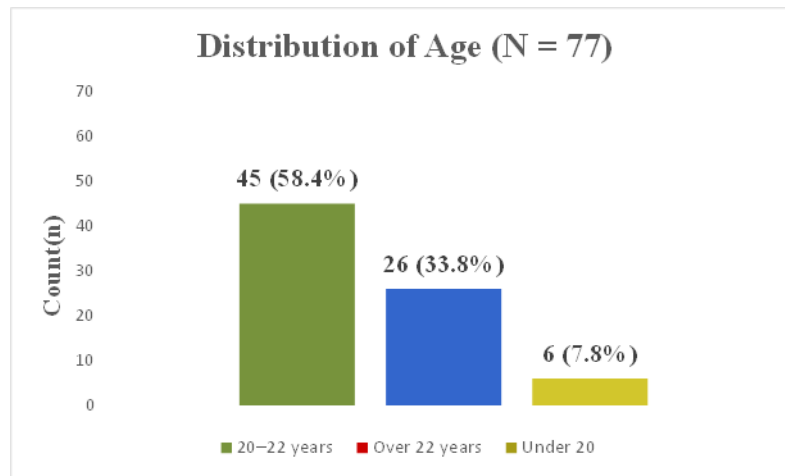
### 3. Results and Discussion

Interpretation of these findings should consider that the sample was drawn from a single institution in Libya and may not reflect national trends.

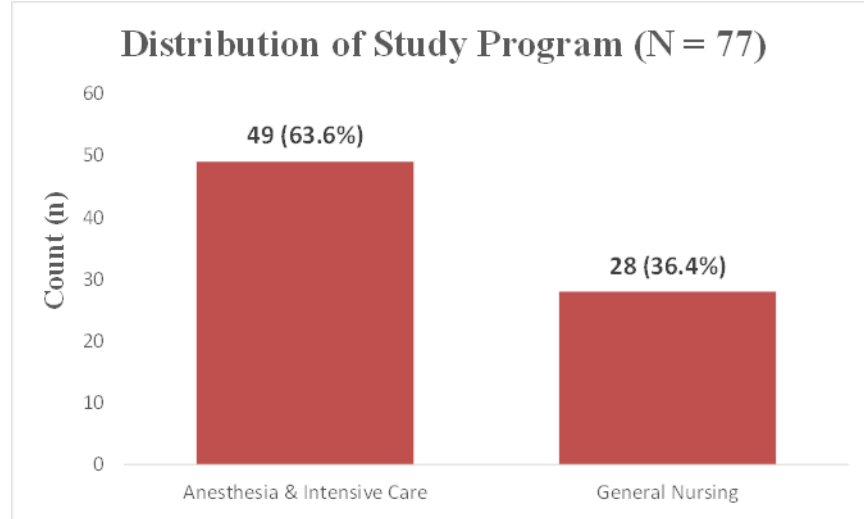
This cross-sectional study explores how nursing students view the integration of artificial intelligence in radiation protection. We collected 77 valid responses from students at various academic levels and specializations. Most respondents were female (58.4%,  $n = 45$ ), while 41.6% were male ( $n = 32$ ). The age distribution showed that more than half of the participants (58.4%) were between 20 and 22 years old. About one-third (33.8%) were older than 22, and only 7.8% were younger than 20, as depicted in Figure 1, Figure 2. Most students (63.6%,  $n = 49$ ) were enrolled in Anesthesia & Intensive Care programs, whereas 36.4% ( $n = 28$ ) were in General Nursing, as illustrated in Figure 3. Only **39.0%** of participants had attended an AI-related workshop or training; **22.1%** had completed a formal course in radiation protection. Results for each cohort are displayed in Tables (Table 1 and Table 2). To streamline the narrative, full descriptive statistics for demographic variables now appear in Appendix A; only key percentages are retained here.



**Figure 1.** Distribution of Gender among participants (N = 77)



**Figure 2.** Distribution of Age among participants (N = 77)



**Figure 3.** Distribution of participants by study program (N = 77).

**Table 1:** Attendance at AI-related workshop or training (N = 77).

| Category | Count | Percent |
|----------|-------|---------|
| No       | 47    | 61.0    |
| Yes      | 30    | 39.0    |

**Table 2:** Completion of a formal radiation-protection course (N = 77).

| Category | Count | Percent |
|----------|-------|---------|
| No       | 60    | 77.9    |
| Yes      | 17    | 22.1    |

Descriptive statistics for the survey items are presented in Table 3 as mean  $\pm$  SD. In the knowledge domain, average scores ranged from 2.65 to 2.94, indicating limited familiarity with AI fundamentals. Students reported the lowest knowledge regarding the UN health-related Sustainable Development Goals (SDGs) (M = 2.65, SD = 1.12) and the highest knowledge for basic AI concepts (M = 2.94, SD = 0.83). These low scores corroborate previous findings that nursing students often lack formal instruction in AI [12], [14].

On the other hand, attitude statements scored significantly higher at 3.64 – 3.91. Participants agreed that AI in nurse education improves graduate quality (M = 3.91) and that there must be a clear legal and ethical framework (M = 3.90). Optimism toward future AI use (M = 3.70) and agreement that radiation protection is part of nursing ethics (M = 3.64) indicate that students recognize both benefits and challenges. These positive perceptions align with prior studies in which nursing cohorts expressed enthusiasm for AI's potential to enhance care quality [13].

Readiness scores were moderate (M = 3.03 – 3.57). Students were most willing to join AI training (M = 3.57) and contribute to sustainability (M = 3.53), but felt least confident applying radiation-protection protocols (M = 3.03). This “competency–willingness gap” echoes educational theory



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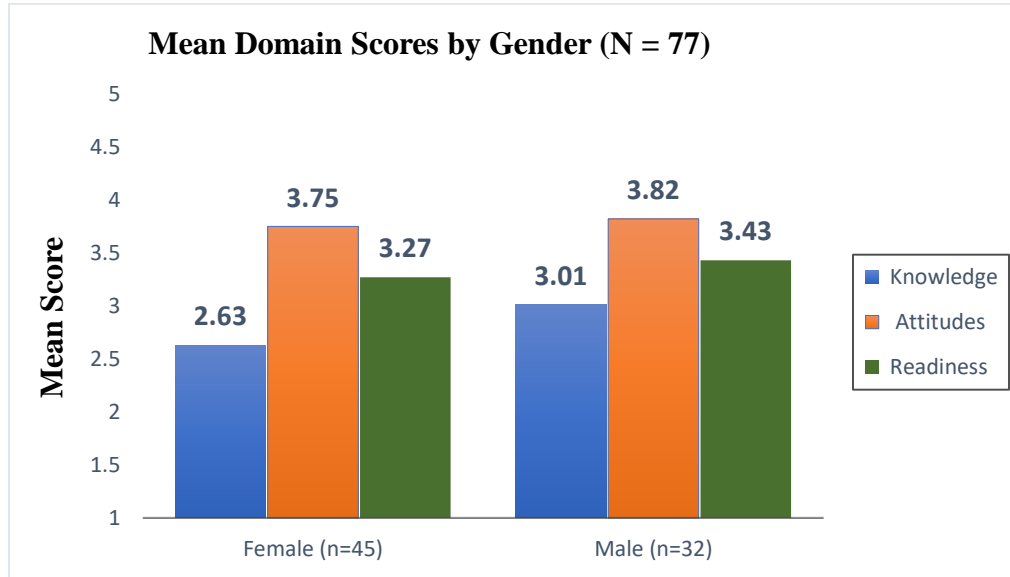
suggesting that motivation alone does not translate into performance without adequate experiential learning.

Internal reliability was excellent (Cronbach's  $\alpha = .87$  for knowledge,  $.88$  for attitudes, and  $.86$  for readiness), indicating consistent measurement of each construct. Inter-construct correlations showed a strong association between knowledge and readiness ( $r \approx .50$ ), a weak association between knowledge and attitudes ( $r \approx .12$ ), and a moderate association between attitudes and readiness ( $r \approx .30$ ). Taken together, these patterns suggest that enhancing theoretical knowledge has a more direct impact on functional preparedness than on attitudes, which are already favorable—a finding consistent with “minimal-threshold” models in health-professional education [13].

**Table 3:** Mean (M) and SD of Questionnaire Items by Construct (Knowledge, Attitude, Readiness)

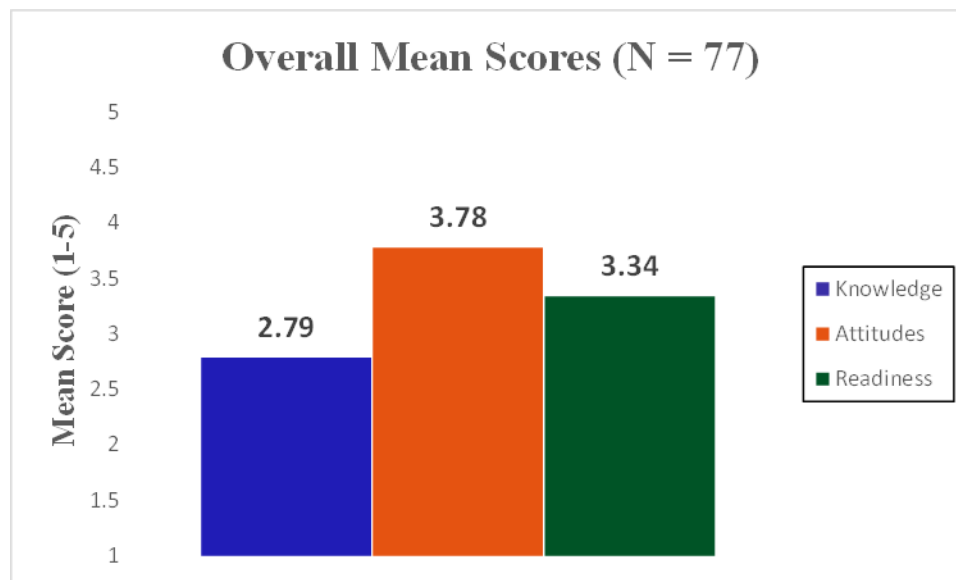
| Construct        | Item   | M    | SD   |
|------------------|--|------|------|
| <b>Knowledge</b> | Basic AI concepts knowledge                          | 2.94 | 0.83 |
|                  | Knowledge of AI applications in healthcare           | 2.71 | 0.94 |
|                  | Awareness of radiation hazards                       | 2.75 | 1.04 |
|                  | Knowledge of AI impact on patient safety             | 2.88 | 1.00 |
|                  | Understanding of UN health-related SDGs              | 2.65 | 1.12 |
| <b>Attitude</b>  | AI integration in nursing education improves quality | 3.91 | 0.76 |
|                  | AI enhances accuracy & reduces radiation errors      | 3.74 | 0.75 |
|                  | Optimism toward future AI use                        | 3.70 | 0.92 |
|                  | Radiation protection is integral to nursing ethics   | 3.64 | 0.87 |
|                  | Modern tech adoption contributes to SDGs             | 3.79 | 0.71 |
|                  | Need for clear legal/ethical AI framework            | 3.90 | 0.84 |
| <b>Readiness</b> | Readiness to join AI training                        | 3.57 | 0.88 |
|                  | Ability to handle AI-based medical systems           | 3.22 | 0.94 |
|                  | Ability to apply radiation-protection protocols      | 3.03 | 1.04 |
|                  | Readiness to contribute to sustainable initiatives   | 3.53 | 0.87 |

Figure 4 illustrates mean scores across gender, age and prior training. Male students reported slightly higher knowledge and readiness than females, whereas older students ( $> 22$  years) exhibited the highest readiness ( $M = 3.48$ ). Consistent with previous research [14], students who had attended an AI workshop or studied radiation protection out-performed peers across all constructs, underscoring the transformative effect of formal training.



**Figure 4:** Mean knowledge, attitudes, and readiness scores by gender (N = 77)

Figure 5 summarizes mean scores for each item. The flat knowledge profile underscores a systemic lack of foundational AI literacy, whereas pronounced attitude scores for legal-ethical considerations mirror the growing global discourse on AI governance in healthcare [15], [16].



**Figure 5:** Overall mean scores for knowledge, attitudes, and readiness (N = 77)



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### Critical Interpretation and Study Limitations

Although the descriptive findings offer a useful snapshot, a deeper, critical reading is warranted. First, the strong correlation between knowledge and readiness ( $r \approx .50$ ) suggests that curricular interventions targeting theoretical content could yield tangible improvements in practice-readiness. However, the weaker link between knowledge and attitudes implies that positive perceptions alone are insufficient drivers of competency, aligning with cognitive-dissonance theory whereby attitudes may adjust only when supported by robust learning experiences.

Second, sample characteristics impose clear limits on generalizability. The single-center design and modest size ( $n = 77$ ) constrain statistical power and may accentuate institutional idiosyncrasies. Comparative analysis with studies from other regions (e.g., Nigeria) reveals similar demographic patterns but divergent exposure to AI coursework [15], bolstering the argument for multi-center investigations. Likewise, the cross-sectional design precludes causal inference; longitudinal studies tracking competence growth after curricular reforms are therefore recommended.

Third, the competency–willingness gap underscores the need for blended pedagogies. Simulation-based modules using AI-enabled diagnostic devices, coupled with scenario-driven radiation-safety drills, could bridge the theoretical–practical divide, as supported by experimental evidence from Martínez-Ortigosa et al. and Santos et al. [11], [15]

### 4. Conclusion and Recommendations

Nursing students in this single-center Libyan cohort held favorable attitudes toward AI integration and acknowledged the need for robust ethical–legal frameworks, yet their knowledge and practical readiness remained moderate. The positive associations between prior training and competency scores highlight the urgency of embedding AI- and radiation-protection content—combining theory, simulation and ethics—into nursing curricula. Such reforms can foster a technologically adept, socially responsible workforce, thereby enhance clinical safety and advance relevant Sustainable Development Goals. These recommendations remain provisional due to the study’s modest, self-reported sample; larger multi-center, longitudinal investigations are required to validate and extend these findings.

### References

- [1] R. Al-Dmour, H. Al-Dmour, E. Basheer Amin, and A. Al-Dmour, “Impact of AI and big data analytics on healthcare outcomes: An empirical study in Jordanian healthcare institutions,” Jan. 01, 2025, SAGE Publications Inc. doi: 10.1177/20552076241311051.
- [2] F. S. AlDhaen, “AI-Powered Transformation of Healthcare: Enhancing Patient Safety Through AI Interventions with the Mediating Role of Operational Efficiency and Moderating Role



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of Digital Competence—Insights from the Gulf Cooperation Council Region,” *Healthcare* (Switzerland), vol. 13, no. 6, Mar. 2025, doi: 10.3390/healthcare13060614.

[3] L. Wang et al., “Artificial intelligence in clinical decision support systems for oncology,” 2023, Ivyspring International Publisher. doi: 10.7150/ijms.77205.

[4] J. Dlama, “The Application Artificial Intelligence (AI) in Radiation Protection and Medical Imaging: How prepared are Radiographers?” *J Med Imaging Radiat Sci*, vol. 53, no. 4, p. S61, Dec. 2022, doi: 10.1016/j.jmir.2022.10.210.

[5] C. K. C. Ng, “Artificial Intelligence for Radiation Dose Optimization in Pediatric Radiology: A Systematic Review,” Jul. 01, 2022, Multidisciplinary Digital Publishing Institute (MDPI). doi: 10.3390/children9071044.

[6] J. Wolff, J. Pauling, A. Keck, and J. Baumbach, “The economic impact of artificial intelligence in health care: Systematic review,” Feb. 01, 2020, JMIR Publications Inc. doi: 10.2196/16866.

[7] S. K. Zhou et al., “A Review of Deep Learning in Medical Imaging: Imaging Traits, Technology Trends, Case Studies with Progress Highlights, and Future Promises,” *Proceedings of the IEEE*, vol. 109, no. 5, pp. 820–838, May 2021, doi: 10.1109/JPROC.2021.3054390.

[8] I. Al Khatib and M. Ndiaye, “Examining the Role of AI in Changing the Role of Nurses in Patient Care: Systematic Review,” 2025, JMIR Publications Inc. doi: 10.2196/63335.

[9] M. M. Rehani and Z. Brady, “CONTEMPORARY ISSUES IN RADIATION PROTECTION IN MEDICAL IMAGING SPECIAL FEATURE: EDITORIAL Contemporary issues in radiation protection in medical imaging: introductory editorial 1,” 2021.

[10] K. Seibert et al., “Application Scenarios for Artificial Intelligence in Nursing Care: Rapid Review,” Nov. 01, 2021, JMIR Publications Inc. doi: 10.2196/26522.

[11] A. Martinez-Ortigosa, A. Martinez-Granados, E. Gil-Hernández, M. Rodriguez-Arrastia, C. Ropero-Padilla, and P. Roman, “Applications of Artificial Intelligence in Nursing Care: A Systematic Review,” 2023, Wiley-Hindawi. doi: 10.1155/2023/3219127.

[12] M. M. Alsultan et al., “Knowledge and perception of artificial intelligence education among undergraduate healthcare students,” *BMC Med Educ*, vol. 25, no. 1, Dec. 2025, doi: 10.1186/s12909-025-07577-x.

[13] L. J. Labrague and M. Al Harrasi, “Nursing students’ perceptions of artificial intelligence (AI) using the technology acceptance model: A systematic review,” Jul. 01, 2025, Elsevier Inc. doi: 10.1016/j.teln.2025.02.032.

[14] F. Vera, “ORIGINAL ARTICLE Students’ Perceptions of the Integration of Artificial Intelligence Nursing Education: A Study at a Private Chilean University.” [Online]. Available: <https://revistatransformar.cl/index.php/transformar>



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- [15] A. Clement David-Olawade, O. Z. Wada, Y. J. Adeniji, I. V. Aderupoko, and D. B. Olawade, “Artificial intelligence readiness among healthcare students in Nigeria: A cross-sectional study assessing knowledge gaps, exposure, and adoption willingness,” *Int J Med Inform*, vol. 204, p. 106085, Dec. 2025, doi: 10.1016/j.ijmedinf.2025.106085.
- [16] E. Ratti, M. Morrison, and I. Jakab, “Ethical and social considerations of applying artificial intelligence in healthcare—a two-pronged scoping review,” Dec. 01, 2025, BioMed Central Ltd. doi: 10.1186/s12910-025-01198-1.