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Between acceptance and apprehension: A review of nurses' ethical awareness, attitudes, anxiety, and intention to use artificial intelligence

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Abstract

Artificial intelligence (AI) is becoming part of routine nursing work, yet its uptake depends as much on how nurses think and feel about it as on what the technology can do. This review examined how nurses and nursing students describe their ethical awareness, attitudes, anxiety, and intention to use AI, and how these constructs relate to one another. A structured narrative review was undertaken in November 2026. Records were identified through web-indexed biomedical and publisher sources and retained only when study details could be verified. Nine quantitative cross-sectional studies from South Korea, Saudi Arabia, Egypt, Jordan, and other settings were synthesised narratively. Across studies, ethical awareness, anxiety, and intention to use AI were usually moderate, while attitudes were generally favourable. Positive attitudes were the most consistent correlate of intention. Ethical awareness predicted intention in practising nurses and moderated the effect of attitudes on innovative behaviour, but it was not an independent predictor among Korean students. Anxiety tended to act indirectly, through attitudes, rather than directly on intention. Female gender, older age, limited device proficiency, and lack of AI education were repeatedly linked to greater apprehension. The evidence is cross-sectional, relies on convenience samples and heterogeneous instruments, and is concentrated in few regions. Education that builds ethical literacy and hands-on familiarity appears justified, but longitudinal and interventional studies are needed.

Keywords: Artificial intelligence, Nursing, Ethical awareness, Attitudes, Anxiety, Behavioural intention

Introduction

Artificial intelligence (AI) has moved from the margins of healthcare into its everyday infrastructure, shaping image interpretation, risk prediction, documentation support, and patient-facing conversational tools. The convergence of machine learning with large clinical datasets has been described as a defining change in the practice of medicine. (Topol, 2019) [1] Nursing, as the largest professional group in most health systems and the one closest to the patient, cannot stand outside this change. International expert groups have set out priorities and opportunities for nursing in the AI era and have drawn attention to the limited involvement of nurses in developing, integrating, and implementing these systems. (Ronquillo *et al.*, 2021) [2] Scoping evidence anticipates that AI will influence the domains of nursing, including practice, education, administration, and research. (Buchanan *et al.*, 2020) [3] A systematic review of AI in nursing and midwifery has since mapped applications across both professions. (O'Connor *et al.*, 2023) [4]

For the individual nurse, however, AI is seldom experienced as a neutral technical upgrade. Commentary in the nursing literature has pointed out that automation of routine tasks may alter professional roles and raise concerns about clinical decision-making, surveillance, and the place of human judgement in care. (Clancy, 2020) [5] A nurse who doubts an algorithmic alert, or fears that a system will take over part of the job, is unlikely to engage enthusiastically, however sound the technology.

Ethical questions sit at the centre of this unease. The World Health Organization has issued guidance on the ethics and governance of AI for health that sets out principles intended to protect human autonomy, safety, transparency, and equity. (WHO, 2021) [6] A review of global AI ethics guidelines found considerable convergence around transparency, justice and fairness, non-maleficence, responsibility, and privacy, although guidelines differ in how these principles are interpreted and put into practice. (Jobin *et al.*, 2019) [7] A mapping review focused on health care grouped ethical concerns into epistemic, normative, and traceability problems, which include questions about the quality of evidence, the fairness of outcomes, and the difficulty of assigning responsibility. (Morley *et al.*, 2020) [8] For nurses, ethical awareness is therefore a

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practical competence rather than an abstract virtue, and it has most often been measured with short scales such as the instrument developed by Ko and Leem to gauge ethical perceptions linked to intended AI use. (Ko *et al.*, 2021) [9]

Attitudes and anxiety have their own measurement traditions. The General Attitudes towards Artificial Intelligence Scale (GAAIS) distinguishes positive from negative attitudes. (Schepman *et al.*, 2020) [10] The Artificial Intelligence Anxiety Scale (AIAS) captures learning anxiety, job replacement anxiety, sociotechnical blindness, and AI configuration anxiety. (Wang *et al.*, 2022) [11] Perception tools adapted for health professionals, such as the Shinners Artificial Intelligence Perception tool, add a view of preparedness and professional impact. (Shinners *et al.*, 2022) [12] These instruments have made it possible to compare findings across settings, yet they also mean that apparently similar constructs are not always measured in the same way. Knowledge is a further complication, because a survey of registered nurses reportedly found that about seven in ten were unaware of AI-based technologies already used in health care. (Swan, 2021) [13]

To explain intention to use, researchers have relied on the Technology Acceptance Model, in which perceived usefulness and ease of use shape attitudes and, through attitudes, behavioural intention. (Davis, 1989) [14] Its extension, the Unified Theory of Acceptance and Use of Technology, adds social influence and facilitating conditions. (Venkatesh *et al.*, 2003) [15] A systematic review documented the extensive use of the acceptance-model family in health informatics. (Rahimi *et al.*, 2018) [16] These frameworks have been applied to nursing students' intention to use AI-based health technology. (Kwak *et al.*, 2022; Labrague *et al.*, 2023) [17, 18] Emotional responses such as anxiety are less obviously accommodated by the original models, which may explain why AI anxiety has attracted separate attention.

Exposure and preparation also appear to matter. Scoping evidence has anticipated that AI will reshape nursing education. (Buchanan *et al.*, 2021) [19] Work on integrating AI into nursing practice has argued that understanding nurses' present knowledge is a prerequisite for planning training. (Abuzaid *et al.*, 2022) [20] Earlier research on technology more broadly found that final-year nursing students held the most positive attitudes, a finding attributed to their greater exposure to technology education. (Tubaishat, 2014) [21]

Despite this growing literature, the evidence remains fragmented. Ethical awareness, attitudes, anxiety, and intention are usually studied in pairs or triplets, in different populations, with different instruments, and under different theoretical labels. Students and practising nurses are rarely compared directly. The role of ethical awareness is particularly unsettled, because it has been treated as a driver of intention, as a moderator of other relationships, and as a minor correlate, depending on the study. Leaders and educators deciding where to invest need a clearer view of where apprehension is concentrated and which levers move adoption.

The rationale for this review is to bring these strands together. Focusing on quantitative studies that examined ethical awareness, attitudes, anxiety, and intention to use AI, alone or in combination, among nurses and nursing students, the review asks how prevalent each construct is, how the constructs relate to one another, which personal and contextual characteristics accompany them, and how secure the underlying evidence is.

Methodology

Review design and reporting framework

This was a structured narrative review of quantitative studies, conducted and written in November 2026. Reporting was guided by the principles of the PRISMA 2020 [22] statement where they were applicable, in particular the transparent description of eligibility criteria, information sources, selection, and synthesis. (Page *et al.*, 2021) [22] The review was not prospectively registered, and it does not claim to be a full systematic review, because the search was not run as a set of native database queries and no flow diagram with record counts was maintained. These limits are stated at the outset so that readers can judge the evidence on its merits.

Information sources and search period

Candidate records were identified through a general web search interface that indexes biomedical abstracts, PubMed and PubMed Central records, and publisher platforms such as ScienceDirect, SAGE, Springer, Wiley, Ovid, and Frontiers. No search was executed directly inside PubMed/MEDLINE, CINAHL, Embase, *Scopus*, or Web of Science, and none of these databases is claimed as a searched source. Searches were run in November 2026 without a lower date limit; all studies that were eventually retained were published between 2022 and 2026. Full text was opened where publisher or repository pages were accessible. Where pages could not be opened, abstract-level information from the indexed record was used, and this is flagged in the study characteristics table.

Search strategy

Four natural-language queries were used. They combined terms for nurses, attitudes, artificial intelligence, anxiety, and cross-sectional design with variants that targeted ethical awareness, intention to use, the AI anxiety scale, and the technology acceptance model. The intended Boolean logic was nurse terms combined with AI terms and with at least one of the four constructs of interest, although in practice this was applied implicitly through the wording of the queries. Examples of the wording used include "nurses attitudes toward artificial intelligence anxiety cross-sectional study" and "nurses ethical awareness artificial intelligence attitudes intention to use". Table 1 sets out, for each source, the controlled vocabulary and free-text terms that correspond to this strategy together with the status of each source. Equivalent strategies for databases that were not searched are included deliberately: they make the review reproducible and show how it could be extended into a fully systematic search before journal submission.

Eligibility criteria

Studies were eligible if they enrolled registered nurses, nurse managers, or nursing students, and if they measured at least one of the following constructs in relation to AI: ethical awareness, attitudes, anxiety, or intention, acceptance, or readiness to use. Eligible studies were quantitative, empirical, peer-reviewed, and published in English. Studies of patients, physicians, or mixed health workers without separable nursing data were excluded, as were qualitative studies, editorials, commentaries, and conference abstracts.

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Table 1. Search strategy by source, with controlled vocabulary and status

Database or source	Controlled vocabulary	Free-text keywords	Boolean combination	Search approach and status
Web search interface (indexing PubMed, PMC, and publisher pages)	None applied; natural-language queries	nurses; nursing students; attitudes; ethical awareness; anxiety; AI anxiety scale; intention to use; technology acceptance model; cross-sectional	nurses AND "artificial intelligence" AND (attitudes OR anxiety OR "ethical awareness" OR intention), applied implicitly across four queries	Executed in November 2026. Titles and abstracts screened; full text opened where accessible.
PubMed/MEDLINE	"Artificial Intelligence"[MeSH]; "Nurses"[MeSH]; "Students, Nursing"[MeSH]; "Attitude of Health Personnel"[MeSH]; "Anxiety"[MeSH]; "Ethics, Nursing"[MeSH]; "Intention" [MeSH]	"artificial intelligence"; "machine learning"; "generative AI"; ChatGPT; nurse*; "nursing student*"; "ethical awareness"; "AI anxiety"; attitude*; "intention to use"; "behavioral intention"; acceptance	(AI terms) AND (nurse terms) AND (attitudes OR anxiety OR ethical awareness OR intention)	Title/abstract plus MeSH, English, 2015 onwards. Specified for reproducibility; not run as a native query in this review.
CINAHL (EBSCOhost)	CINAHL Headings: "Artificial Intelligence"; "Nurses"; "Students, Nursing"; "Attitude to Computers"; "Anxiety"; "Ethics, Nursing"	As for PubMed/MEDLINE	As for PubMed/MEDLINE	Subject headings plus title/abstract. Not searched; recommended before submission.
Embase (Elsevier)	Equivalent Emtree headings for artificial intelligence, nurse, nursing student, health personnel attitude, anxiety, and ethics (to be confirmed in the Emtree thesaurus)	As for PubMed/MEDLINE	As for PubMed/MEDLINE	Emtree plus title/abstract. Not searched; recommended before submission.
Scopus	No thesaurus	As for PubMed/MEDLINE	TITLE-ABS-KEY(AI terms) AND TITLE-ABS-KEY(nurse terms) AND TITLE-ABS-KEY(construct terms)	Keyword search for cross-checking and citation tracking. Not searched.
Web of Science Core Collection	No thesaurus	As for PubMed/MEDLINE	TS=(AI terms) AND TS=(nurse terms) AND TS=(construct terms)	Topic search for cross-checking and citation tracking. Not searched.

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Study selection and verification

Titles and abstracts surfaced by the queries were screened by one reviewer against these criteria, and no second reviewer was available, so selection bias cannot be excluded. Duplicate appearances of the same article on publisher pages, indexing records, and repository copies were merged by matching titles and DOIs, and reasons for exclusion were not logged systematically. More than twenty candidate studies were surfaced. A candidate was retained when its title, year, population, design, and principal findings could be confirmed from accessible text and when its DOI or an equivalent identifier could be matched. Studies that could be located only through snippets or citations in other articles, or whose bibliographic details could not be confirmed, were left out of the synthesis even when they appeared relevant. Nine studies met these requirements. Three of them, the Jordanian student study, the study published in Advances in Nursing Science, and the multicentre survey reported in Frontiers in Public Health, are included on abstract-level information and are described only as far as that information allowed. For one further study, the year and volume given in a repository record differed from those suggested by indexing records, and the repository version is used and flagged.

Data extraction

For each included study, one reviewer extracted authors and year, country, population, sample size, sampling technique, instruments, analytic method, and principal findings into a standard template. Items that were absent or could not be verified were recorded as not reported. Numerical results were transcribed from tables or abstracts, and where text and tables disagreed, the table value was preferred and labelled accordingly. For example, the abstract of one Korean study labelled an unstandardised regression coefficient as β, and the table value is reported here as *B*.

Quality appraisal

Methodological quality was appraised informally, guided by the items in the Joanna Briggs Institute checklist for analytical cross-sectional studies. (Moola *et al.*, 2020) [23] These items cover the sampling frame, sampling method, description of participants, validity and reliability of measures, handling of confounding, and statistical analysis. Particular attention was paid to whether sampling was random or convenience, whether reliability coefficients were reported, and whether covariates were taken into account. No numerical scores were assigned and no study was excluded on quality grounds, since the accessible text did not allow every item to be judged consistently across studies.

Ethical considerations

As a review of published literature, the work involved no human participants and did not require ethical approval.

Evidence synthesis

Findings were synthesised narratively and organised by construct and by population. Because the studies used different instruments, scoring ranges, and analytic models, pooling was not attempted. Studies were compared by the direction and pattern of associations, and levels described by the original authors as low, moderate, or high were retained and attributed to them. Students and practising nurses were considered separately before being compared, and discrepancies between studies were examined in relation to population, instrument, and model specification.

Results

Characteristics of the included literature

Nine quantitative studies published between 2022 and 2026 were retained. (Kwak *et al.*, 2022; Cho *et al.*, 2024; Migdadi *et al.*, 2024; Alruwaili *et al.*, 2024; Atalla *et al.*, 2024; Awad *et al.*, 2026; Maraş *et al.*, 2026; Author list to be completed, 2026; Dai *et al.*, 2026) [24, 25, 26, 27, 28, 29, 30, 31, 32] All were cross-sectional and relied on self-completed questionnaires. Two studies came from South Korea, two from Egypt, and one each from Jordan and Saudi Arabia. (Kwak *et al.*, 2022; Cho *et al.*, 2024; Migdadi *et al.*, 2024; Alruwaili *et al.*, 2024; Atalla *et al.*, 2024; Awad *et al.*, 2026) [24, 25, 26, 27, 28, 29] The investigators of one study are affiliated with a Turkish university, although its abstract does not name the setting. (Maraş *et al.*, 2026) [30] Two reports did not state a country in the text available for this review: one surveyed a large Middle Eastern healthcare organisation, and the other was a multicentre survey across hospital tiers. (Author list to be completed, 2026; Dai *et al.*, 2026) [31, 32]

Three studies enrolled nursing students only, one enrolled both nurses and intern students, and five enrolled practising nurses. (Kwak *et al.*, 2022; Cho *et al.*, 2024; Migdadi *et al.*, 2024; Alruwaili *et al.*, 2024; Atalla *et al.*, 2024; Awad *et al.*, 2026; Maraş *et al.*, 2026; Author list to be completed, 2026; Dai *et al.*, 2026) [24, 25, 26, 27, 28, 29, 30, 31, 32] Sample sizes ranged from 158 intern students to 1,392 registered nurses. (Maraş *et al.*, 2026; Dai *et al.*, 2026) [30, 32] Student samples numbered 189, 180, and 158, while nurse samples numbered 167, 220, 350, 414, 415, and 1,392. (Kwak *et al.*, 2022; Cho *et al.*, 2024; Alruwaili *et al.*, 2024; Atalla *et al.*, 2024; Awad *et al.*, 2026; Maraş *et al.*, 2026; Author list to be completed, 2026; Dai *et al.*, 2026) [24, 25, 27, 28, 29, 30, 31, 32] The sample size of the Jordanian study was not verified. (Migdadi *et al.*, 2024) [26] A convenience or non-probability approach was explicitly described in four studies, and sample size was justified with power software in those four and one other. (Kwak *et al.*, 2022; Cho *et al.*, 2024; Alruwaili *et al.*, 2024; Atalla *et al.*, 2024; Awad *et al.*, 2026) [24, 25, 27, 28, 29] Sampling was not described, or could not be verified, in the remaining studies.

The instruments varied. The GAAIS was used in four studies, and the AIAS in two. (Kwak *et al.*, 2022; Alruwaili *et al.*, 2024; Atalla *et al.*, 2024; Maraş *et al.*, 2026; Dai *et al.*, 2026) [24, 27, 28, 30, 32] Ethical awareness was measured with the Korean Test for Artificial Intelligence Ethics Awareness in one study and with the Ko and Leem scale in two others. (Kwak *et al.*, 2022; Atalla *et al.*, 2024; Awad *et al.*, 2026) [24, 28, 29] Intention was usually measured with items adapted from the Technology Acceptance Model. (Kwak *et al.*, 2022; Cho *et al.*, 2024) [24, 25] Analyses ranged from group comparisons and correlation to regression, mediation modelling, moderation analysis, and structural equation modelling. (Cho *et al.*, 2024; Atalla *et al.*, 2024; Awad *et al.*, 2026) [25, 28, 29] Domains covered included ethical awareness and intention, anxiety and attitudes, readiness and preparedness, digital literacy, innovative work behaviour, and awareness. (Kwak *et al.*, 2022; Cho *et al.*, 2024; Migdadi *et al.*, 2024; Alruwaili *et al.*, 2024; Atalla *et al.*, 2024; Awad *et al.*, 2026; Maraş *et al.*, 2026; Author list to be completed, 2026; Dai *et al.*, 2026) [24, 25, 26, 27, 28, 29, 30, 31, 32] Table 2 presents study-level details.

Levels of ethical awareness, attitudes, anxiety, and intention

Ethical awareness was most often described as moderate. (Migdadi *et al.*, 2024; Awad *et al.*, 2026; Author list to be completed, 2026) [26, 29, 31] The exception was the Egyptian study in which it was described as relatively high. (Atalla *et al.*, 2024) [28] This variation may partly reflect the instruments, since the Korean tool used with students showed modest internal consistency in its own sample (Cronbach's alpha 0.67). (Kwak *et al.*, 2022) [24]

Attitudes were generally favourable but rarely uncritical. Korean students scored 3.66 out of 5 on positive attitudes and 3.61 on acceptance attitude. (Kwak *et al.*, 2022; Cho *et al.*, 2024) [24, 25] In a large multicentre survey, 74.0% of nurses held positive attitudes. (Dai *et al.*, 2026) [32] Saudi nurses were interested in using AI at work (mean 3.50) yet gave middling scores on items about control, surveillance, and unethical organisational use (means 2.87 to 3.15), and the authors characterised their overall stance as conservative. (Alruwaili *et al.*, 2024) [27]

Anxiety was moderate wherever it was quantified. Korean students scored 3.28 and 3.27 out of 5. (Kwak *et al.*, 2022; Cho *et al.*, 2024) [24, 25] In the Turkish study, AIAS totals of about 73 were almost

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identical in nurses and students and were labelled moderate. (Maraş *et al.*, 2026) [30] Moderate anxiety was also reported in the Jordanian student study and in the study published in Advances in Nursing Science. (Migdadi *et al.*, 2024; Author list to be completed, 2026) [26, 31] In the multicentre survey, anxiety remained prominent despite high AI literacy and positive attitudes. (Dai *et al.*, 2026) [32] Intention was moderate to moderately high: 3.77 of 5 in Korean students and 3.59 in a second Korean student sample. (Kwak *et al.*, 2022; Cho *et al.*, 2024) [24, 25] It was moderately high in nurses. (Author list to be completed, 2026) [31] It was moderate in Jordanian students. (Migdadi *et al.*, 2024) [26] Taken together, these results describe a workforce that is willing to engage but not free of apprehension.

Relationships among the constructs

Positive attitudes were the most consistent correlate of intention. Among Korean students, positive attitude correlated with intention at $r = 0.62$, and in regression it carried the largest coefficient ($B = 0.58$), followed by self-efficacy ($B = 0.22$), with an adjusted R^2 of 0.42. (Kwak *et al.*, 2022) [24] In a second Korean sample, acceptance attitude correlated with intention at $r = 0.43$ and mediated the link between perception of AI and intention (indirect effect 0.133, 95% confidence interval 0.047 to 0.239). (Cho *et al.*, 2024) [25] In practising nurses, positive attitudes also predicted intention ($\beta = 0.366$). (Author list to be completed, 2026) [31]

Ethical awareness showed a less uniform pattern. In practising nurses it was the strongest predictor of intention ($\beta = 0.436$), and the model explained 59.4% of the variance. (Author list to be completed, 2026) [31] Among Jordanian students, intention correlated positively with ethical awareness. (Migdadi *et al.*, 2024) [26] Korean students showed a modest correlation ($r = 0.31$), but ethical awareness lost significance once attitudes, anxiety, and self-efficacy were entered into the regression ($B = -0.08$, $p = 0.590$); the authors acknowledged the limited reliability of the ethics tool. (Kwak *et al.*, 2022) [24] Other studies gave ethical awareness a different role. It moderated the effect of attitudes on innovative work behaviour (interaction $B = 0.038$, $p = 0.002$) but not the effect of perception ($p = 0.767$). (Atalla *et al.*, 2024) [28] Ethical awareness also partly carried the influence of digital literacy on acceptance (indirect $\beta = 0.13$ alongside a direct $\beta = 0.29$). (Awad *et al.*, 2026) [29]

Anxiety correlated negatively with intention ($r = -0.27$ in one Korean student sample and $r = -0.28$ in another), but its direct effect disappeared once attitudes were modelled ($p = 0.102$ and $p = 0.113$, respectively). (Kwak *et al.*, 2022; Cho *et al.*, 2024) [24, 25] In the mediation analysis, anxiety alone did not significantly mediate the perception–intention link (indirect effect 0.038, 95% confidence interval −0.007 to 0.098), whereas the sequential path from anxiety to acceptance attitude to intention did (0.026, 95% confidence interval 0.004 to 0.066). (Cho *et al.*, 2024) [25]

Personal and contextual correlates

Gender findings were mixed. Women reported higher anxiety in one Korean sample ($p < 0.001$). (Cho *et al.*, 2024) [25] Female nurses were more often classified as holding negative attitudes in Saudi Arabia. (Alruwaili *et al.*, 2024) [27] Male nurses held more positive attitudes in the multicentre survey ($p = 0.011$). (Dai *et al.*, 2026) [32] Two student studies found no gender differences. (Kwak *et al.*, 2022; Migdadi *et al.*, 2024) [24, 26] Age showed a more consistent pattern. Younger Saudi nurses were more positive. (Alruwaili *et al.*, 2024) [27] Age had a small negative association with intention. (Author list to be completed, 2026) [31] Age was also related to anxiety among Turkish nurses. (Maraş *et al.*, 2026) [30]

Exposure and familiarity appeared to matter. Third- and fourth-year Korean students had higher ethical awareness, more positive attitudes, and lower anxiety than earlier-year students. (Kwak *et al.*, 2022) [24] Students with AI education reported lower anxiety ($p = 0.007$) and more favourable acceptance. (Cho *et al.*, 2024) [25] Yet only 19.0% and 27.8% of students in the two Korean samples had any AI education, compared with 39.1% of Saudi nurses who recalled AI content in their undergraduate programme. (Kwak *et al.*, 2022; Cho *et al.*, 2024; Alruwaili *et al.*, 2024) [24, 25, 27] The Jordanian study found no difference by study year. (Migdadi *et al.*, 2024) [26] Second-year students in one Korean sample had higher perception scores than later-year students, so the benefit of progression through a programme is not uniform. (Cho *et al.*, 2024) [25] In nurses, less frequent electronic device use and poorer device proficiency were associated with higher anxiety. (Dai *et al.*, 2026) [32] Digital literacy was positively related to acceptance. (Awad *et al.*, 2026) [29]

Appraisal and evidence gaps

The evidence base is dominated by convenience samples, single-institution recruitment, and self-report measures. Several scales showed only modest reliability in the student samples, including the ethics scale (alpha 0.67) and the intention items (alpha 0.66 and 0.68). (Kwak *et al.*, 2022; Cho *et al.*, 2024) [24, 25] Mediation and moderation models were fitted to cross-sectional data and therefore describe statistical rather than temporal pathways. (Cho *et al.*, 2024; Atalla *et al.*, 2024; Awad *et al.*, 2026) [25, 28, 29] Gaps are evident in the absence of longitudinal or interventional studies, in the scarcity of direct student–nurse comparisons, in the lack of studies from Europe, the Americas, and most of Africa and South Asia, and in the rarity of measures of observed AI use rather than intended use.

Discussion

The overall picture is one of acceptance accompanied by apprehension rather than a divide between enthusiasts and sceptics. In most samples, attitudes were favourable, intention was moderate to moderately high, and anxiety and ethical awareness sat in the middle of their scales. The coexistence of positive attitudes with persistent anxiety, made explicit in the large multicentre survey, suggests that these are separable constructs. (Dai *et al.*, 2026) [32] That is consistent with the structure of the AIAS, whose dimensions, such as concern about job replacement and sociotechnical blindness, describe fears that a general evaluative attitude scale does not capture. (Schepman *et al.*, 2020; Wang *et al.*, 2022) [10, 11]

Attitude emerged as the pivot between beliefs and intention. In Korean students it was the strongest regression predictor. (Kwak *et al.*, 2022) [24] In a second sample it carried the influence of perception to intention. (Cho *et al.*, 2024) [25] In practising nurses it remained a significant predictor. (Author list to be completed, 2026) [31] This pattern accords with the logic of acceptance models, in which attitude transmits the effect of perceived usefulness and ease of use to behavioural intention. (Davis, 1989; Venkatesh *et al.*, 2003) [14, 15] If it holds beyond cross-sectional data, it points to attitude formation, through demonstrable benefit and credible reassurance, as a practical target.

Anxiety appears to work differently. Its direct association with intention dissolved once attitudes were modelled. (Kwak *et al.*, 2022; Cho *et al.*, 2024) [24, 25] Only the sequential path through attitude was significant in the mediation analysis. (Cho *et al.*, 2024) [25] One plausible reading is that anxiety colours appraisals of usefulness and risk rather than determining behaviour itself. A cautious implication follows: lowering anxiety may be worthwhile for wellbeing and learning even where it does not shift intention directly, and interventions are likely to work best when they address both the emotional response and the beliefs that sustain it. Device proficiency and frequency of use were tied to anxiety, which suggests that familiarity with digital tools generally may be a lower-cost entry point than AI-specific content alone. (Dai *et al.*, 2026) [32]

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Table 2. Characteristics of included studies

Author and Year	Country	Domain	Objective	Research Methodology	Results
Kwak *et al.*, 2022 [24]	South Korea	Nursing students; ethical awareness, attitude, anxiety, self-efficacy, intention	To identify the influence of AI ethics awareness, attitude, anxiety, and self-efficacy on nursing students' behavioural intention to use AI-based healthcare technology	Cross-sectional; 189 nursing students (years 1–4, one university in Gyeonggi-do; 85.7% female); voluntary recruitment via notice board and classrooms (sampling technique not named); G*Power minimum 178; self-report questionnaires: Test for AI Ethics Awareness (24 items), GAAIS (20 items), TAM-based anxiety, self-efficacy, and intention items; *t*-test, Pearson correlation, hierarchical multiple regression (SPSS 26)	Third- and fourth-year students scored higher on ethical awareness, positive attitude, and self-efficacy and lower on anxiety. Positive attitude ($B = 0.58$) and self-efficacy ($B = 0.22$) predicted intention (adjusted $R^2 = 0.42$); ethical awareness and anxiety were not significant independent predictors. Only 19.0% had prior AI education.
Cho and Seo, 2024 [25]	South Korea	Nursing students; perception, anxiety, acceptance attitude, intention	To test the dual mediating effects of anxiety and acceptance attitude on the relationship between AI perception and intention to use AI	Descriptive cross-sectional; 180 second- to fourth-year nursing students from two universities; convenience sampling; online data collection, January 2023; G*Power minimum 141; Shinners AI Perception tool (10 items), TAM-based anxiety (4), acceptance attitude (4), and intention (3) items; *t*-test, ANOVA, Pearson correlation, PROCESS macro model 6 with 10,000 bootstrap samples	Perception correlated with acceptance attitude ($r = 0.44$) and intention ($r = 0.38$) and inversely with anxiety ($r = -0.27$). Acceptance attitude mediated the perception–intention link (0.133); anxiety alone did not (0.038), but the anxiety-then-attitude chain did (0.026). Women reported higher anxiety; AI education was linked to lower anxiety.
Migdadi *et al.*, 2024 [26]	Jordan	Nursing students; ethical awareness, attitudes, anxiety, intention	To examine the association of AI ethical awareness, attitudes, anxiety, and intention to use AI among Jordanian nursing students	Quantitative study of nursing students; design label, sample size, sampling technique, instruments, and analytic method not verified (abstract-level information only)	Ethical awareness, attitudes, anxiety, and intention were all moderate, with no significant differences by gender or study year. Intention correlated positively with AI ethical awareness. The authors' discussion described students' intention and attitudes as favourable.
Alruwaili *et al.*, 2024 [27]	Saudi Arabia	Practising nurses; awareness and attitudes	To assess nurses' awareness of and attitudes toward AI-integrated tools in clinical practice and examine demographic differences	Descriptive cross-sectional; 220 registered nurses (at least one year of experience) from three governmental hospitals in the Jouf region (response rate about 63%); convenience sampling; online questionnaire, April–September 2023; G*Power minimum 191; 7-item AI awareness questionnaire and GAAIS (20 items); descriptive statistics and chi-square tests	Awareness was moderate: 70.9% had basic AI knowledge and 58.2% had used AI in medical settings. Attitudes were open but cautious (willingness to use AI at work, mean 3.50 of 5). Gender, age, and education were significantly associated with attitudes ($p < 0.05$); years of experience were not.
Atalla *et al.*, 2024 [28]	Egypt	Practising nurses; perception, attitudes, ethical awareness, innovative work behaviour	To examine whether ethical awareness moderates the relationships of AI perception and attitudes with nurses' innovative work behaviour	Descriptive correlational cross-sectional (STROBE); 415 nurses from medical, surgical, and critical care units, Alexandria Main University Hospital; non-probability convenience sampling; G*Power; AI perception scale (14 items), GAAIS (20), ethical awareness scale (Ko and Leem, 12), Employee Innovative Behaviour Scale (23); *t*-test, ANOVA, Pearson correlation, linear regression with moderation (SPSS 23)	Perception and attitudes were average and ethical awareness relatively high. Innovative behaviour correlated with attitudes ($r = 0.392$), perception ($r = 0.239$), and ethical awareness ($r = 0.191$). The attitude × ethical awareness interaction was significant ($B = 0.038$, $p = 0.002$); the perception interaction was not ($p = 0.767$).

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Author and Year	Country	Domain	Objective	Research Methodology	Results
Awad *et al.*, 2026 [29]	Egypt	Practising nurses; digital literacy, ethical awareness, AI acceptance	To examine the role of digital literacy and ethical awareness in nurses' acceptance of AI	Cross-sectional correlational; 350 nurses in medical-surgical and critical care units, El-Kasr Al-Aini Hospital, March–December 2025 (sampling frame 1,500 nurses); convenience sampling; G*Power; AI acceptance scale (16 items), digital literacy scale (60 items), AI ethical awareness scale (Ko and Leem, 12 items); descriptive statistics, Pearson correlation, structural equation modelling (AMOS), 5,000 bootstrap resamples	Digital literacy, ethical awareness, and acceptance were moderate. Digital literacy predicted acceptance directly ($\beta = 0.29$) and indirectly through ethical awareness ($\beta = 0.13$, 95% CI 0.08–0.20), for a total effect of 0.42. Model fit was acceptable (CFI 0.95, RMSEA 0.057).
Maraş *et al.*, year as per repository record [30]	Not stated in abstract (authors affiliated with a Turkish university)	Nurses and nursing students; anxiety and preparedness	To examine the anxiety and preparedness of nurses and nurse candidates for humanoid nurse robots and AI health technologies in perioperative care	Descriptive cross-sectional; 158 intern nursing students and 167 surgical nurses; sampling technique not reported; sociodemographic form, questionnaire on humanoid nurse robots and AI health technologies, AIAS, Medical AI Preparedness Scale; independent *t*-test and one-way ANOVA	AI anxiety totals were similar in nurses (73.09 ± 31.67) and students (73.62 ± 28.03), as were preparedness totals (71.74 ± 15.06 vs 72.18 ± 13.71); both groups were moderate. Among nurses, age related to anxiety, and age, gender, and work duration related to preparedness ($p < 0.05$).
Authors not verified, 2026 (Adv Nurs Sci) [31]	Not stated in retrieved text (a large Middle Eastern healthcare organisation)	Practising nurses; ethical awareness, attitudes, anxiety, intention	To examine nurses' ethical awareness, attitudes, anxiety, and intention to use AI technology	Cross-sectional correlational; 414 registered nurses; sampling technique, instruments, and full analytic details not verified; regression analysis	Ethical awareness and anxiety were moderate, attitudes positive, and intention moderately high. Regression explained 59.4% of the variance in intention; ethical awareness ($\beta = 0.436$) and positive attitudes ($\beta = 0.366$) were significant predictors, and age had a small negative association ($\beta = -0.111$).
Dai *et al.*, 2026 [32]	Not stated in retrieved abstract	Practising nurses across hospital tiers; AI literacy, anxiety, attitudes	To assess AI literacy, anxiety, and attitudes among registered nurses across hospital tiers	Multicentre cross-sectional survey, March–May 2026; 1,392 registered nurses (mean age 34.69 ± 7.13 years); sampling technique not verified; demographic questionnaire, AI Literacy Scale, AIAS, GAAIS; analytic method not verified	Nurses showed high AI literacy and positive attitudes (74.0%), yet anxiety remained prominent. Less frequent electronic device use ($p = 0.024$) and limited device proficiency ($p = 0.033$) were associated with higher anxiety; male nurses held more positive attitudes than female nurses ($p = 0.011$).

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The divergent findings on ethical awareness deserve the closest attention. Among practising nurses it was the strongest correlate of intention. (Author list to be completed, 2026) [31] It was an enabler of acceptance. (Awad *et al.*, 2026) [29] It was also a condition under which positive attitudes translated into innovative behaviour. (Atalla *et al.*, 2024) [28] Among Korean students it was not an independent predictor. (Kwak *et al.*, 2022) [24] Three explanations seem plausible. First, practising nurses carry accountability for decisions and may link ethical awareness to confidence in using AI responsibly, whereas students have little clinical exposure on which to build that link. Second, the instruments differ, and the student tool had modest reliability while the nurse studies used a different scale. (Kwak *et al.*, 2022; Atalla *et al.*, 2024; Awad *et al.*, 2026) [24, 28, 29] Third, model specification matters, since ethical awareness correlated with intention in students before other predictors were entered. (Kwak *et al.*, 2022) [24] It is also possible that ethical awareness cuts both ways, enabling responsible use while heightening caution about risk, which would produce small or inconsistent average effects. Ethics guidance and reviews treat transparency, accountability, and fairness as conditions for trustworthy AI, so building these competencies in nurses is defensible whether or not it raises intention. (WHO, 2021; Jobin *et al.*, 2019; Morley *et al.*, 2020) [6, 7, 8]

Demographic patterns should be interpreted with restraint. Higher anxiety or less favourable attitudes were reported among women in some studies. (Cho *et al.*, 2024; Alruwaili *et al.*, 2024; Dai *et al.*, 2026) [25, 27, 32] Others found no gender difference. (Kwak *et al.*, 2022; Migdadi *et al.*, 2024) [24, 26] Nursing samples are overwhelmingly female, with women making up about 86% of two student samples and about 74% of the Saudi sample, so male subgroups are small and comparisons underpowered. (Kwak *et al.*, 2022; Cho *et al.*, 2024; Alruwaili *et al.*, 2024) [24, 25, 27] Differences may also reflect prior digital exposure rather than gender itself. Older nurses tended to be more apprehensive. (Alruwaili *et al.*, 2024; Maraş *et al.*, 2026; Author list to be completed, 2026) [27, 30, 31] For exposure, later-year students and those with AI education fared better, echoing earlier observations that technology education is associated with more positive student attitudes. (Tubaishat, 2014; Kwak *et al.*, 2022; Cho *et al.*, 2024) [21, 24, 25] However, cross-sectional comparisons cannot distinguish the effect of education from maturation or selection, and the Jordanian and second Korean samples did not show a uniform advantage for later years. (Cho *et al.*, 2024; Migdadi *et al.*, 2024) [25, 26]

The implications for education and practice are fairly direct. Curricula should integrate AI literacy and ethics with supervised, practical contact with clinical AI tools, given that so few students report prior AI education. (Buchanan *et al.*, 2021; Abuzaid *et al.*, 2022; Kwak *et al.*, 2022; Cho *et al.*, 2024) [19, 20, 24, 25] Organisations should secure device access and protected learning time and should consider peer-supported learning, particularly for nurses who are older or less digitally confident. (Dai *et al.*, 2026) [32] Nurses also need a voice in the selection and governance of AI systems, a priority that has been argued internationally. (Ronquillo *et al.*, 2021) [2]

The strength of the evidence is limited. All included studies were cross-sectional, so causal and temporal claims are not supported. Convenience sampling and self-report invite selection and social desirability bias, and the reliability of several scales was modest. (Kwak *et al.*, 2022; Cho *et al.*, 2024) [24, 25] The evidence also clusters geographically, which limits generalisability to health systems with different workforce structures, technology access, and regulation. The review itself has limitations: selection was undertaken by a single reviewer, searching was not conducted in native bibliographic databases, only nine studies could be verified, and three of these are described at abstract level. The synthesis should therefore be read as a transparent, bounded account of verifiable evidence rather than an exhaustive systematic review.

Recommendations

Nursing curricula and in-service programmes should combine AI literacy, ethical reasoning, and supervised hands-on use of clinical AI tools rather than teaching ethics in isolation. (Buchanan *et al.*, 2021; Abuzaid *et al.*, 2022) [19, 20] Managers should secure device access and protected time for learning, pair less confident nurses with experienced peers, and monitor anxiety alongside uptake. (Dai *et al.*, 2026) [32] Nurses should be included in the selection and governance of AI systems. (Ronquillo *et al.*, 2021; WHO, 2021) [2, 6] Researchers should adopt validated, consistent instruments and report reliability, sampling, and non-response transparently.

Future directions

Longitudinal and interventional studies are needed to show whether education, simulation, or supervised use changes attitudes, anxiety, and actual AI use. Priority groups include nurses in Africa, Latin America, Europe, and North America, community and long-term care nurses, and older nurses. Researchers should develop and validate nursing-specific measures of ethical awareness, test mediation and moderation in prospective designs, measure observed rather than intended use, add qualitative work, and examine generative AI as it enters documentation and education.

Conclusion

Nurses and nursing students approach artificial intelligence with a combination of interest and unease. The available quantitative evidence, drawn from nine cross-sectional studies, shows favourable attitudes, moderate levels of ethical awareness and anxiety, and moderate to moderately high intention to use AI. Positive attitudes were the most consistent correlate of intention. Ethical awareness appeared to matter most among practising nurses, where it predicted intention, enabled the translation of attitudes into innovative behaviour, and partly carried the benefit of digital literacy, but it was not an independent predictor in Korean students. Anxiety operated largely through attitudes rather than directly on intention. Greater apprehension was repeatedly associated with older age, limited device proficiency, and little or no AI education, although gender findings were mixed.

These patterns suggest that adoption cannot be secured by technology alone. Education that builds AI literacy and ethical reasoning, early and supervised practical experience, organisational support for learning, and a genuine role for nurses in governance are all reasonable priorities. At the same time, the evidence is cross-sectional, depends on convenience samples and heterogeneous instruments, and comes from a narrow range of countries, so firm causal conclusions are not yet justified. The next stage of research should test whether the strategies proposed here change attitudes, anxiety, and observed use.

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