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Original Article

Professional Values and Ethical Sensitivity in Digitalized Care: Nursing Students' Approaches to Artificial Intelligence and Robot Nurses*

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What is already known on this topic?

- *Professional values (PVs) and ethical sensitivity are essential components of ethical nursing practice and have been widely studied among nursing students.*
- *The increasing use of artificial intelligence (AI) and robotic technologies in healthcare has introduced new ethical challenges.*
- *Although PVs and ethical sensitivity have been examined separately, studies addressing ethical sensitivity toward AI in nursing education remain limited.*

What this study adds on this topic?

- *This study investigates the relationship between nursing students' PVs and their ethical sensitivity toward AI and robot nurses.*
- *The findings reveal a statistically significant but weak correlation, indicating that ethical sensitivity is influenced by multiple factors, not just PVs.*
- *The results highlight the need to integrate AI-related ethical content into nursing curricula to support ethical awareness in technology-integrated care.*

ABSTRACT

Objective: This study aimed to examine the relationship between nursing students' professional values (PVs) and their ethical sensitivities toward artificial intelligence (AI) and robot nurses, and to identify the factors influencing these variables.

Methods: This cross-sectional, correlational study was conducted between January and February 2026 with 400 nursing students at a public university in Türkiye, in accordance with the Strengthening the Reporting of Observational Studies in Epidemiology guidelines. Data were collected using a Descriptive Information Form, the Revised Nurses' Professional Values Scale, and the Ethical Sensitivity Scale for AI and Robot Nurses.

Results: The mean Revised Nurses' Professional Values Scale score was 101.24 ± 17.21 and the mean ethical sensitivity score was 54.74 ± 7.61. The scale scores differed significantly according to grade level and knowledge about AI ($P < .05$), whereas Ethical Sensitivity Toward AI and Robot Nurses Scale score differed according to perceptions of the impact of AI on the profession and potential ethical problems ($P < .01$). Professional values were positively correlated with ethical sensitivity ($r = 0.156$, $P < .01$). Hierarchical regression analysis showed that PVs, gender, and perceptions of the impact of AI on the profession were significant predictors of ethical sensitivity, explaining 14% of the variance.

Conclusion: Nursing students exhibited high PVs and moderate-to-high ethical sensitivity toward AI and robot nurses. Although PVs were positively associated with ethical sensitivity, the relatively low explained variance suggests that ethical sensitivity is influenced by multiple factors. Integrating AI-related ethical content into nursing education may support ethical awareness and preparedness for technology-integrated care.

Keywords: Artificial intelligence, ethical sensitivity, nursing students, professional values, robot nurses

Introduction

Digital transformation in healthcare is a paradigm shift that redefines the nature of care, as well as a technical innovation process. While artificial intelligence (AI)-based decision-support systems and robotic applications speed up clinical processes, they also raise questions about the ethical boundaries of nursing practice.[1,2] These applications are expected to facilitate health service delivery in the future by improving quality and efficiency, reducing costs and human/system-related errors, and providing health education students with more realistic experiences.[3,4] Furthermore, these technologies enhance clinical decision-making and patient outcomes, all the while safeguarding empathy and patient-centered care. This ensures that the human touch remains at the heart of nursing.[1] The nursing profession has historically been built

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on professional values (PVs) such as compassion, do no harm, respect for human dignity, advocacy, and non-maleficence. However, integrating AI applications into clinical decision-making processes requires a re-evaluation of ethical concepts such as shared responsibility, accountability, privacy, and autonomy.[5] In particular, robot nurses may be inadequate in establishing the trust-based relationships that human nurses build with patients, and this could negatively impact healthcare services.[2] In this context, ethical sensitivity may play an important role in helping nurses recognize and address ethical challenges associated with AI and robot nurses. According to Rest's Four-Component Moral Development Model, ethical sensitivity is defined as an individual's capacity to recognize the ethical dimension of a situation and constitutes the first and most critical step in the ethical decision-making process.[6] The integration of AI-based decision-support systems and robot nurses into clinical practice has the potential to transform traditional nursing assessment, care planning, and decision-making processes.[7] In technology-enhanced care environments, nurses may increasingly rely on algorithm-supported recommendations when assessing patients' needs, prioritizing interventions, and evaluating outcomes. These technologies may also introduce additional ethical challenges in clinical decision-making.[8] Professional values such as respect for human dignity, advocacy, justice, and accountability may therefore serve as an important foundation for identifying and evaluating ethical concerns associated with AI-supported care.[8,9] Consequently, nursing students who more strongly internalize PV may be better prepared to recognize ethical issues arising from the use of AI and robot nurses in clinical practice.

Values that are vital for human life are an important component of ethical systems that determine ethical behavior. Professional values are the normative belief systems that shape an individual's professional role and their responses to ethical situations.[10] Internalizing these values enables one to solve conflicts and determine priority actions, ensuring the maintenance of safe, quality, ethical care.[11] The changing world has increased the responsibilities of nurses, creating complex ethical and moral dilemmas.[10] Students begin their nursing education with their own values, developing their professional identity as they adopt and internalize the values of the groups they participate in.[12] However, it is well known that the PV and ethical principles of nursing students and nurses can be a challenging topic in clinical settings.[10]

During the transformation of health services, nursing students occupy a pivotal position. Nursing students develop and internalize PVs throughout their education and professional socialization in clinical practice. Additionally, they are expected to apply these values in order to respond to patients in a respectful and ethically sensitive manner while providing care. Similarly, students' ethical sensitivity (ES) toward technological systems may be related to how they evaluate and respond to AI-supported care. The literature has examined the PV of students[10,12-14] and ES[15-17] separately. However, there is a lack of studies that examine the relationship between PV and ES toward AI and robot nurses within a comprehensive theoretical framework. In particular, the question of how PV shapes or is associated with perceptions of ethical technology within the context of digitalized care remains largely unexplored.

Study Aim

This study aimed to examine the relationship between nursing students' PV and their ES toward AI and robot nurses, and to identify the factors influencing these variables.

1. What are the levels of PV and ES of nursing students toward AI and robot nurses?
2. Is there a relationship between nursing students' PV and their ES toward AI and robot nurses?
3. Which factors influence nursing students' PV and ES toward AI and robot nurses?

Methods

Study Design

This study was designed as a cross-sectional and correlational study. This study was reported in accordance with the Strengthening the Reporting of Observational Studies in Epidemiology guidelines.[18]

Participants and Sample

The study was conducted between January and February 2026 in the Department of Nursing at a public university in Türkiye.

An a priori power analysis was conducted using G*Power 3.1.9.2. Based on a correlational design (two-tailed), assuming a small effect size ($r = 0.20$), an α level of 0.05, and a statistical power of 0.95, the required minimum sample size was calculated as 314 participants. A total of 423 nursing students participated in the study. After data screening, 23 questionnaires were excluded due to missing or incomplete responses. Consequently, the final sample consisted of 400 students, and all statistical analyses were performed using data from these participants.

The inclusion criteria for the study were: (1) volunteering to participate in the study; (2) being enrolled in the Nursing Department; and (3) being actively engaged in clinical practice at the time of data collection. First-year students were excluded from the study.

Data Collection Procedure

Data were collected using a questionnaire administered through face-to-face interviews. The forms were piloted with 10 students. Before data collection began, students were informed about the purpose and scope of the study, and what would be expected of them. They were also informed that participation in the study was voluntary and that the data would be used solely for this research. Data collection took place during students' breaks between classes in communal areas such as the student lounge, library, and cafeteria. Each participant completed the form in approximately 15 minutes.

Data Collection Tools

Data were collected using the "Descriptive Information Form," the "Nurses' Professional Values Scale" and the "Ethical Sensitivity Scale for Artificial Intelligence and Robot Nurses."

Descriptive Information Form

This was prepared by the researchers based on relevant literature.[4,19,20] As well as standard sociodemographic data (age, gender, class, etc.), it includes questions about participants' views on AI and robot nurses.

Revised Nurses' Professional Values Scale

The Revised Nurses' Professional Values Scale (NPVS-R) was adapted into Turkish by Geçkil et al.[20] It was used to measure nurses' adoption of PVs. It consists of 26 items and 5 factors (compassion, professionalism, activism, justice, and trust) and uses a 5-point Likert scale (1 = unimportant, 2 = somewhat important, 3 = important, 4 = very important, and 5 = most important). The total score ranges from 26 to 130. A high score indicates a strong embrace of PVs. The scale's reliability coefficient was found to be 0.92.[20] In the present study, the internal consistency of the NPVS-R was high. The Cronbach's alpha coefficient for the total scale was 0.92 while the coefficients for the subdimensions were 0.924 for Caring, 0.868 for Activism, 0.902 for Justice, and 0.825 for Trust.

Ethical Sensitivity Toward Artificial Intelligence and Robot Nurses Scale

This scale, developed by Ergin et al,[4] is designed to assess students' ES toward AI and robot nurses. Consisting of 17 items and 3 subdimensions (do no harm/do good, transparency, privacy/confidentiality, responsibility/accountability), the scale uses a 5-point Likert scale. Scores range from a minimum of 17 to a maximum of 85, with higher scores indicating greater ES. The scale has a total Cronbach's α coefficient of 0.83.[4] In the present study, the internal consistency of the Ethical Sensitivity Scale was acceptable. The Cronbach's α coefficient for the total scale was 0.811. The Cronbach's α coefficients for the subdimensions were 0.818 for Do No Harm/Do Good, 0.628 for Transparency, 0.679 for Privacy/Confidentiality, and 0.653 for Responsibility/Accountability.

Data Analysis

The data were analyzed using the IBM SPSS version 25.0 (IBM Corp., Armonk, NY, USA). The normality of the data distribution was assessed by examining skewness and kurtosis values, with values between −2 and +2 considered indicative of normal distribution.[21] Descriptive statistics, including frequency, percentage, mean, and SD, were used to summarize the data. Depending on the distribution of the data, independent samples *t*-test, Mann–Whitney *U*-test, and 1-way ANOVA were used for group comparisons. When significant differences were identified in ANOVA, Bonferroni-adjusted post hoc test was performed to determine the source of the differences. Pearson correlation analysis was conducted to examine the relationships between variables. Hierarchical multiple linear regression analysis was performed to determine whether PVs independently predicted ethical sensitivity toward AI and robot nurses. Based on the study hypothesis, NPVS scores were entered in the first block as the primary predictor variable. Sociodemographic characteristics and AI-related variables were entered in the second block as control variables to evaluate the incremental contribution of PVs beyond these factors. Prior to regression analysis, assumptions such as normality, linearity, and multicollinearity were checked. A significance level of $P < .05$ was considered statistically significant.

Ethical Approval

Ethical approval for the study was obtained from the Ethics Committee of Bolu Abant İzzet Baysal University (Approval No.: 2026/046; Date: January 28, 2026). Institutional permission was also obtained from the relevant faculty where the study was conducted. Prior to data collection, participants were informed about the purpose and procedures of the study, and written informed consent was obtained from all participants. Participation was voluntary, and confidentiality and anonymity of the data were assured. The study was conducted in accordance with the principles of the Declaration of Helsinki. In addition, permission was obtained from the developers of the scales used in the study.

Results

The descriptive characteristics of the nursing students and the mean scale scores are presented in Table 1. The NPVS-R scores differed significantly according to grade level ($F = 11.53$, $P < .001$). Bonferroni post hoc analyses showed that second-year students had significantly lower NPVS-R scores than third- and fourth-year students. The NPVS-R scores also differed according to students" level of knowledge about AI and robot nurses ($F = 3.10$, $P = .046$), although Bonferroni-adjusted pairwise comparisons did not reveal significant differences between groups. The Ethical Sensitivity Toward Artificial Intelligence and Robot Nurses Scale (ESSAIRN) scores differed significantly according to perceptions of the impact of AI and robot nurses on the nursing profession ($F = 21.69$, $P < .001$), with higher scores observed among students with more positive perceptions. Significant differences were also found in NPVS-R ($F = 6.20$, $P = .002$) and ESSAIRN scores ($F = 6.70$, $P = .001$) according to beliefs about whether AI and robot nurses may lead to ethical problems. Bonferroni post hoc analyses indicated that students who believed AI and robot nurses may create ethical problems reported higher NPVS-R scores, whereas students who were partially concerned reported higher ESSAIRN scores (Table 1). A statistically significant positive correlation was found between age and the NPVS total score ($r = 0.127$, $P = .011$).

Table 2 presents the subscale and total mean scores of the NPVS and ESSAIRN among nursing students (Table 2).

There was a weak but statistically significant positive correlation between NPVS-R and ESSAIRN scores ($r = 0.156$, $P < .01$) (Table 3).

A hierarchical multiple linear regression analysis was conducted to identify the predictors of ethical sensitivity toward AI and robot nurses. In Model 1, only PV were included, and the model was statistically significant, $F_{(1, 398)} = 9.89$, $P = .002$. PV were a significant predictor of ES ($\beta = .156$, $P = .002$), explaining 2.4% of the variance ($R^2 = .024$). In Model 2, sociodemographic variables and AI-related perceptions were added to the model. Model 2 was statistically significant, $F_{(8, 391)} = 7.04$, $P < .001$, explaining 14% of the total variance in ES ($R^2 = .140$, Adjusted $R^2 = .120$). The inclusion of these variables significantly increased the explained variance ($\Delta R^2 = .115$, $P < .001$). According to Model 2, the significant predictors of ES were PV ($\beta = .141$, $P = .005$), gender ($\beta = .142$, $P = .003$), and perceived impact of AI on the profession ($\beta = -.301$, $P < .001$). Other variables were not statistically significant ($P > .05$). No multicollinearity issues were detected (Variance Inflation Factor range: 1.03-1.63) (Table 4).

Discussion

Ethical Sensitivity Toward Artificial Intelligence and Robot Nurses

With the rapid advancement of digital technologies, new ethical challenges are emerging in healthcare, particularly in relation to the use of AI in care practices. Nursing students are expected to adapt to this transformation by aligning their PV with evolving technological contexts and by developing their ethical awareness accordingly.[22-24] In this context, understanding nursing students' ES toward AI and robot nurses is of critical importance.

The findings of this study indicated that nursing students demonstrated a moderate-to-high level of ES toward AI and robot nurses. When interpreted within the framework of Rest's Four-Component Model of moral development, these findings suggest that students have developed moral sensitivity, defined as the ability to recognize ethical issues, which constitutes the initial and most critical step in the ethical decision-making process. Moreover, this indicates that students are capable of identifying potential ethical dilemmas arising from the integration of AI technologies into clinical practice. This result is consistent with previous studies reporting moderate[3] and high[19] levels of ES among nursing students. Ethical sensitivity is not an inherent trait but a dynamic and developable construct shaped by education, clinical exposure, and contextual factors.[23]

The integration of AI into nursing practice gives rise to significant ethical implications that necessitate a critical re-evaluation of existing ethical principles.[25] When each subdimension of the scale was examined, it was observed that students received the highest scores in the "Do No Harm/Do Good" and the lowest scores in the "Transparency" and "Responsibility/Accountability" subdimensions. Students' high scores on the "non-maleficence" subdimension indicate a high level of ES toward patient safety and potential risks. This finding suggests that students adopt a cautious and awareness-based approach that takes potential harms into account when evaluating AI applications.

Table 1. Comparison of Revised Nurses' Professional Values Scale and Ethical Sensitivity Toward Artificial Intelligence and Robot Nurses Scale Mean Scores According to Sociodemographic Characteristics (n = 400)

Sociodemographic Characteristics	n	%	NPVS-R (Mean ± SD)	ESSAIRN (Mean ± SD)
Gender				
Female	342	85.5	101.66 ± 17.19	54.31 ± 7.38
Male	58	14.5	98.79 ± 17.27	57.24 ± 8.52
Test, *P*			*t* = 1.18, *P* = .241	*t* = −2.73, *P* = .007
Class level				
Second year	159	39.8	96.33 ± 17.50	54.66 ± 7.90
Third year	128	32	103.77 ± 15.51	54.03 ± 6.57
Fourth year	113	28.9	105.29 ± 17.10	55.63 ± 8.25
Test, *P*			*F* = 11.53, *P* < .001*	*F* = 1.335, *P* = .264
Voluntary choice of nursing				
Yes	289	72.3	101.82 ± 16.52	54.70 ± 7.44
No	111	27.8	99.73 ± 18.87	54.81 ± 8.09
Test, *P*			*t* = 1.087, *P* = .278	*t* = −.130, *P* = .897
Knowledge about AI and robot nurses				
Yes	49	12.3	105.26 ± 17.90	55.83 ± 8.42
Partially	228	57	101.87 ± 17.03	54.67 ± 7.40
No	123	30.8	98.48 ± 16.97	54.41 ± 7.70
Test, *P*			*F* = 3.098, *P* = .046*	*F* = .626, *P* = .535
Perceived impact of AI on profession				
Positive	86	21.5	103.81 ± 15.91	58.68 ± 7.10
Partially positive	253	63.3	101.37 ± 16.73	54.32 ± 6.53
Negative	61	15.3	97.11 ± 20.22	50.90 ± 9.86
Test, *P*			*F* = 2.744, *P* = .066	*F* = 21.693, *P* < .001*
Ethical concerns about AI				
Yes	171	42.8	104.61 ± 15.84	53.70 ± 7.79
Partially	194	48.5	99.12 ± 17.38	56.09 ± 6.96
No	35	8.8	96.57 ± 20.04	52.25 ± 8.92
Test, *P*			*F* = 6.195, *P* = .002*	*F* = 6.696, *P* = .001*
Experience of ethical dilemmas related to AI				
Yes	115	28.8	100.38 ± 15.89	55.26 ± 8.45
No	285	71.3	101.59 ± 17.73	54.74 ± 7.61
Test, *P*			*t* = −.638, *P* = .524	*t* = .868, *P* = .386

Independent samples *t*-test and 1-way ANOVA were used for normally distributed variables, and Mann–Whitney *U*-test was used for non-normally distributed variables. Bonferroni-adjusted post hoc comparisons were performed following significant 1-way ANOVA results to account for unequal group sizes among categories.

AI, artificial intelligence; ESSAIRN, Ethical Sensitivity Toward Artificial Intelligence and Robot Nurses Scale; NPVS-R, Revised Nurses' Professional Values Scale.

*$P < .05$.

The research findings indicate that male students have a higher level of ES toward AI and robot nurses. This finding is limited in the literature but noteworthy. This result may be related to differences in technological exposure, interest, or perceived competence regarding digital systems, which could influence awareness of ethical issues related to AI. However, this finding should be interpreted cautiously, as male students constituted a relatively small proportion of the sample. Further studies with more balanced gender distributions are needed to confirm this association. In a different study, female students were found to have a higher tendency toward ethical values.[19]

More than two-thirds of the students reported having knowledge of AI and robot nurses, and the majority stated that technological advances would have a positive influence on the nursing profession. These findings are supported by several studies in the literature.[26,27]Furthermore, students who believed that AI technologies in healthcare would have a positive impact on the nursing profession were found to have significantly different ES.This suggests that a positive attitude toward technology and ethical awareness are not mutually exclusive.

The study showed that although students believed in the positive outcomes of these technologies, the vast majority were concerned about the ethical issues that AI and robot nurses might cause. In a study conducted by Doğan and Aksoy[1] about AI and robotic technologies, the students expressed concern about potential violations of patient privacy and autonomy, as well as the possibility of injustice.[1] Similarly, a systematic review reported that while students generally held positive attitudes toward AI, they also expressed ethical concerns regarding its use.[28] Additionally, it was found that students who expressed ethical concerns regarding AI technologies had significantly different levels of ES. A study conducted by Aydınlı et al[3] supports this finding. Additionally, students' ethical sensitivity differed according to their beliefs about whether AI and robot nurses may create ethical problems. Interestingly, students who were partially concerned about potential ethical problems demonstrated higher ethical sensitivity scores than those who either clearly endorsed or rejected such concerns. This finding may suggest that a balanced and reflective consideration of both the benefits and risks of AI technologies is associated with greater ethical awareness. Such students may be more likely to critically evaluate

Table 2. Mean Scores of Revised Nurses' Professional Values Scale and Ethical Sensitivity Toward Artificial Intelligence and Robot Nurses Subscales (n = 400)

Subscales of NPVS-R	Number of Items	Mean ± SD	Min-max
Caring	8	32.45 ± 5.82	13-40
Professionalism	7	26.47 ± 4.58	12-35
Activism	5	19.33 ± 3.72	9-25
Justice	3	11.80 ± 2.25	5-15
Trust	3	11.18 ± 2.45	6-15
Total score	26	101.24 ± 17.21	45-130
Subscales of ESSAIRN			
Do no harm/Do good	5	16.56 ± 3.08	8-25
Transparency	3	8.44 ± 2.29	3-15
Privacy/Confidentiality	5	15.50 ± 3.09	8-25
Responsibility/Accountability	3	8.44 ± 2.29	3-15
Total Score	17	54.74 ± 7.61	30-85

ESSAIRN, Ethical Sensitivity Toward Artificial Intelligence and Robot Nurses Scale; Max, maximum; Min, minimum; NPVS-R, Revised Nurses' Professional Values Scale; α, Cronbach's alpha.

the ethical implications of AI rather than adopting exclusively positive or negative views. However, it should not be overlooked that concerns about AI may also stem from insufficient knowledge, misunderstandings, or uncertainty regarding its use.[3,29]

Professional Values

Professional values are influenced by individuals' values and their attitudes toward ethical behavior.[19] The mean score of NPVS-R score was 101.24 ± 17.21. Given that the maximum possible score on the scale is 130, it can be concluded that the students demonstrated a high level of PV. This finding is consistent with several studies in the literature.[13,14,19,30]

In the present study, nursing students achieved the highest score in the caring subdimension and the lowest score in the trust subdimension. Similarly, previous studies have reported that students tend to score highest in the caring subdimension; however, the lowest-scoring subdimensions vary across studies.[13,19,30,31] Caring is considered the most essential and valuable PV for nursing students and lies at the core of nursing practice in providing patient care.[31]

Table 3. Correlation Between Revised Nurses' Professional Values Scale and Ethical Sensitivity Toward Artificial Intelligence and Robot Nurses Scale Scores

Variables	NPVS-R	ESSAIRN
NPVS	1	.156**
ESSAIRN	.156**	1

Pearson correlation analysis was used.
ESSAIRN, Ethical Sensitivity Toward Artificial Intelligence and Robot Nurses Scale; NPVS-R, Revised Nurses' Professional Values Scale.
**$P < .01$.

The findings also revealed that older students and those in higher academic years had higher NPVS-R scores. This may reflect the cumulative contribution of nursing education, clinical experiences, and professional socialization processes to the development of PVs. Supporting evidence in the literature indicates that both age[30] and academic year[31] may influence PVs. As students progress through their nursing education, they are increasingly exposed to professional standards, ethical principles, and clinical experiences that may facilitate the internalization of PVs. It has been reported that students acquire PVs not only through formal education but also by observing and adopting the moral and professional attitudes of registered nurses.[32] Therefore, the higher NPVS-R scores observed among older and more advanced students may be associated with greater professional maturity and exposure to nursing practice.

The results indicated no statistically significant difference in ES based on whether students had chosen the profession voluntarily. Similar findings have been reported in the literature.[19] This suggests that willingness in choosing the profession does not significantly influence ES or PV.

Revised Nurses' Professional Values Scale scores differed according to students' self-reported knowledge of AI and robot nurses; however, Bonferroni-adjusted pairwise comparisons did not reveal significant differences between specific groups. Nevertheless, the literature highlights the potential of digital transformation in healthcare to improve the quality of care and patient experience.[33] Familiarity with emerging technologies may contribute to students' understanding of future healthcare practices and support the development of a broader professional perspective. Therefore, the relationship

Table 4. Hierarchical Multiple Linear Regression Analysis of Predictors of Ethical Sensitivity (n = 400)

Variables	Model 1 β	Model 2 β	*t*	*P*
NPVS-R (total score)	0.156**	0.141**	2.832	.005
Age (years)	—	−0.055	−1.076	.283
Gender	—	0.142**	2.959	.003
Class level	—	−0.016	−0.308	.758
Voluntary choice of department	—	−0.007	−0.148	.882
Perceived impact of AI on profession	—	−0.301***	−6.08	<.001
Does it create ethical problems?	—	−0.006	−0.119	.905
Experience of ethical dilemmas related to AI	—	−0.062	−1.299	.195
Model fit statistic	Model 1		Model 2	
R	0.156		0.374	
R^2	0.024		0.14	
Adjusted R^2	0.022		0.12	
F	9.891		7.037	
P	0.002		<.001	
ΔR^2	–		0.115***	

Model 1 includes NPVS-R. Model 2 includes NPVS-R, sociodemographic variables, and artificial intelligence-related variables.
AI, artificial intelligence; NPVS, Nurses' Professional Values Scale; β, standardized regression coefficient.
*$P < .05$,
**$P < .01$.
***$P < .001$.

between knowledge of AI and PVs warrants further investigation in future studies.

Additionally, students who believed that AI and robot nurse applications would have a positive impact on the nursing profession demonstrated higher levels of ES toward AI and robot nurses. This finding may reflect greater openness to technological innovations while maintaining awareness of their ethical implications. The literature suggests that AI technologies can optimize clinical decision-making processes, enhance the quality of patient care, and streamline nurses' workflows.[34]Students who recognize these potential benefits may be more inclined to engage critically with the ethical dimensions of AI integration in healthcare.

Students who believe that AI in healthcare could lead to potential ethical problems are likely to possess positive PV stemming from a higher level of ethical awareness. For the nursing profession, which is based on ethical principles, ethical responsibility forms the foundation of PV.[35] Digitalization and AI applications in healthcare practices may create challenges in ethical principles related to autonomy, privacy, data security, and justice.[32] Therefore, students with ethical sensitivity capable of identifying such risks are expected to pay greater attention to PV.

The Relationship Between Professional Values and Ethical Sensitivity

Although a statistically significant relationship was identified between PV and ES, the strength of this relationship was weak ($r = 0.156$). This finding suggests that PV alone is not sufficient to explain nursing students' ethical sensitivity toward AI and robot nurses. Ethical sensitivity is a multidimensional construct that may be influenced by various individual, educational, and contextual factors such as ethical climate, clinical experience, digital literacy, and exposure to ethical dilemmas.[3,4,15] Therefore, while PV contributes to ethical sensitivity, their explanatory power remains limited. Similar findings in the literature also indicate that ethical sensitivity is shaped by a complex interaction of factors rather than a single determinant.[15] This highlights the need to consider broader educational and environmental influences when aiming to enhance ethical awareness in technology-integrated care settings.

The regression analysis further supports this interpretation. In Model 1, PV were found to be a significant predictor of ES; however, they explained only a limited proportion of the variance (2.4%). When demographic variables and AI-related perceptions were included in Model 2, the explained variance increased to 14%, indicating that additional factors play a substantial role in shaping ethical sensitivity. Notably, perceptions regarding the impact of AI on the nursing profession emerged as the strongest predictor of ES, exceeding the effect of PV. This finding suggests that students' attitudes and perceptions toward technology may have a more pronounced influence on ethical awareness in digitalized care contexts than traditional value-based frameworks alone.

The relatively low proportion of explained variance suggests that ES toward AI may be influenced by additional factors not examined in the present study, such as digital literacy, ethical climate, prior exposure to AI technologies, and individual moral reasoning. Ethical sensitivity should be considered a multidimensional phenomenon that is shaped by the interplay of cognitive, affective, educational, professional, and contextual influences. Therefore, variables beyond those included in the present model may contribute substantially to its development and expression.

Strengths and Limitations

This study has several limitations. Firstly, the results are not easily generalizable because the data were collected over a specific time period within a nursing department. The cross-sectional nature of this study precludes the establishment of causal relationships between variables. Therefore, the findings should be interpreted as indicating associations rather than cause-and-effect relationships. Secondly, the research data were collected using a survey method, and the lack of qualitative interviews limited the depth of understanding. Thirdly, the study data were collected using self-report measures based on the nurses' own perceptions. This method carries the risk of social acceptability bias, whereby participants may have provided socially acceptable responses rather than their true feelings or actions. Another limitation of this study is that variables potentially associated with ES toward AI, such as digital literacy, level of technology use, and prior experience with AI technologies, were not assessed.

Recommendations

- To ensure that AI complements rather than undermines nursing values, nurses should be equipped with strong digital literacy, advanced ethical reasoning skills, and the ability to critically engage with AI technologies. In this context, nursing education should incorporate training modules that foster ethical decision-making within technology-driven care environments.
- Moreover, comprehensive and structured training programs, along with clear institutional policies, should be developed to address both the technological and human dimensions of AI use in healthcare settings.
- Simulation-based learning approaches and case-based discussions involving AI-assisted care scenarios can play a crucial role in helping students recognize, analyze, and effectively manage ethical dilemmas.
- Future nursing curricula should move beyond providing knowledge about AI and its ethical implications and instead promote higher levels of learning as described in Bloom's Taxonomy.
- Educational strategies incorporating AI-assisted care scenarios, robotic nursing applications, and simulation-based learning should encourage students to analyze ethical dilemmas, evaluate competing values and courses of action, and create ethically justified care decisions.
- Integrating these learning experiences within institutional quality assurance frameworks and standardized assessment processes may contribute to the systematic development and evaluation of ethical competence in technology-enhanced nursing practice.
- Future research should adopt longitudinal or mixed-methods designs to explore how ethical sensitivity and PV evolve over time and how these constructs contribute to their internalization in clinical practice.

Conclusion

In conclusion, nursing students demonstrated high levels of PV and moderate-to-high levels of ES toward AI and robot nurses. Although a statistically significant relationship was identified between these variables, the strength of this association was weak, indicating that PVs alone are insufficient to explain ES in technology-integrated care contexts. The findings further revealed that, while PVs significantly contributed to ES, students' perceptions of the impact of AI on the nursing profession were more strongly associated with ES than PVs. This suggests that technology-related attitudes and awareness may be important factors associated with ethical decision-making in digitalized healthcare environments. Gender was also identified as a contributing factor. Overall, these results suggest that ethical sensitivity in the context of AI is influenced by a complex interplay of value-based, cognitive, and contextual factors.

Data Availability Statement: The data that support the findings of this study are available on request from the corresponding author.

Artificial Intelligence Usage Statement: During the preparation of this work, the authors used AI for grammatical correction and language refinement. After using this tool/service, the authors reviewed and edited the content as needed and took full responsibility for the content of the publication.

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