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The Relationship between Nursing Informatics Competency and Caring Behaviors among Nurses in Intensive Care

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Abstract

Background: Intensive care nursing increasingly relies on information and communication technologies (ICT) and electronic medical records (EMRs), yet caring behaviors remain central to quality nursing practice. **Objectives:** The purpose of this study was to examine the relationship between nursing informatics competency and caring behaviors among ICU nurses in governmental hospitals in the West Bank, Palestine. **Methods:** A cross-sectional descriptive correlational study was conducted (Aug 1–Sep 1, 2025) among ICU nurses (N=224) recruited by convenience sampling from 10 governmental hospitals in the West Bank. Nursing informatics competency was measured using SANICS and caring behaviors using CBAN-SF. Data were analyzed using Pearson correlations, an independent t- test, and multiple linear regression. **Results:** Participants' mean age was 34.1±8.3 years; 75.9% were male, 79.0% held a bachelor's degree, and nurses spent 3.6±1.8 hours/shift using EMRs. Informatics competency was moderate overall (M=3.1±0.2), with the lowest subdomain in applied computer skills (M=2.3±0.5). Caring behaviors were high (M=103.9±14.6). Caring behaviors correlated strongly with SANICS (r=.867, p<.001) and EMR time (r=.716, p<.001). In regression, SANICS (B=50.17, p<.001), EMR time (B=1.22, p=.002), rotating shift (B=3.37, p=.001), and master's degree or higher (B= 2.61, p=.038) predicted caring behaviors; the model explained 78.3% of variance (R²=0.783). **Conclusion:** Among ICU nurses, higher nursing informatics competency especially alongside greater EMR engagement was associated with stronger caring behaviors. Strengthening applied informatics skills might help ensure technology functions as an enabler of patient-centered care rather than a barrier.

Keywords: Intensive Care Units, Nursing Informatics, Caring Behaviors, Patient-Centered Care

1. Introduction

The integration of information and communication technologies (ICT) into healthcare delivery has transformed nursing practice worldwide, particularly in intensive care units (ICUs), where critically ill patients require rapid, precise, and coordinated interventions [1,2]. Over the past two decades, the increasing adoption of electronic health records (EHRs), clinical decision support systems, patient monitoring technologies, and telehealth applications has underscored the importance of nursing informatics competency [3,4]. Nursing informatics competency refers to the knowledge, skills, and attitudes that enable nurses to effectively use health information systems to support evidence-based decision-making, improve care coordination, and ensure patient safety [5,6]. In the ICU setting, where patient conditions can deteriorate within minutes, strong informatics skills are indispensable for supporting timely interventions, enhancing interdisciplinary communication, and reducing preventable medical errors [7,8].

At the same time, the essence of nursing practice remains rooted in caring behaviors [9,10]. Caring in nursing is not only a professional value but also a relational process that encompasses empathy, emotional presence, advocacy, and holistic support for patients and their families [11,12]. Even in highly technological environments, patients and families consistently identify nurses' caring behaviors such as attentive listening, reassurance, and emotional support as critical determinants of satisfaction and trust in healthcare [13–14]. The ICU presents unique challenges to caring, as nurses must balance the technical demands of advanced monitoring and treatment with the psychosocial needs of vulnerable patients [15–16]. In this context, the interplay between technology and caring behaviors becomes highly significant [17].

1.1 Background

Despite the advantages of health technologies, concerns remain about their potential to depersonalize care [18]. Studies have reported that excessive documentation requirements, prolonged system navigation, and continuous interaction with monitoring devices can contribute to nurse frustration, burnout, and reduced opportunities for compassionate patient interactions [19]. For some nurses, the reliance on electronic systems creates a perceived barrier to establishing meaningful nurse patient relationships, raising fears of a decline in the humanistic aspects of care [20]. Conversely, research also suggests that high levels of informatics competency may empower nurses to streamline clinical processes, minimize medication errors, and allocate more time for therapeutic communication, thereby strengthening rather than diminishing caring behaviors [21].

1.2 Objectives

The purpose of the current study was to examine the relationship between nursing informatics competency and caring behaviors among ICU nurses in governmental hospitals in the West Bank, Palestine.

2. Related Work

Globally, a growing body of research has begun to explore the relationship between informatics proficiency and nursing care quality, yet findings remain inconsistent and context-dependent [22,23]. Some studies reported a positive association between informatics skills and nurses perceived caring efficacy, while others emphasized the risks of technological overload [2,19,21]. However, in Palestine, limited empirical evidence exists on this issue. Most local studies to date have examined either nursing informatics training and barriers to technology adoption, or nurses' caring behaviors and patient perceptions in isolation, without integrating the two domains. The Palestinian healthcare system presents additional contextual factors that make this inquiry important. ICUs in the West Bank often operate under resource constraints, with limited staffing, high patient acuity, and variable access to advanced health technologies [24]. Ultimately, the findings may guide the development of targeted educational strategies, capacity-building initiatives, and supportive policies that balance the dual imperatives of informatics and caring, ensuring that technology serves as an enabler rather than a barrier to patient-centered nursing practice.

3. Methodology

3.1 Design, Setting, Population, and Sample

A cross-sectional, descriptive correlational study was conducted among ICU nurses in the West Bank, Palestine, between August 1 and September 1, 2025. The sample size was calculated using Raosoft software with the following parameters: a population size of 500, a 50% response distribution, a 5% margin of error, and a 95% confidence interval, yielding a required sample of 218 participants. To accommodate potential non-responses, a convenience sample of 240 ICU nurses was initially recruited from 10 governmental hospitals across the West Bank. Ultimately, 224 nurses completed and returned the questionnaires. Governmental hospitals were selected because they play a pivotal role in delivering public healthcare services to a wide and diverse patient population. Moreover, these hospitals function under unified regulations and often face resource limitations, making them ideal for exploring the practical application of caring behaviors and nursing informatics in settings where efficiency and adaptability are essential.

To ensure that the participants had completed unit orientation/preceptorship and sufficient exposure to ICU workflows and routine EMR use, it was determined that the eligible participants should be full-time ICU nurses with at least six-month experience. This, in turn, would provide stable self-assessments of informatics competency and caring behaviors and willingness to participate. Nurses who were on leave or absent during the data collection period were excluded.

3.2 Study instruments

A structured self-administered survey was used to collect data from participants. The survey consisted of three main components:

Socio-demographic variables (i.e., age, gender, education level, years of ICU experience, work shift, and time spent using EMRs during a shift).

The SANICS, developed by Yoon et al. (2009) [25], was used to evaluate nurses' self-perceived informatics competencies across five domains: basic computer knowledge and skills, wireless device skills, clinical informatics knowledge, clinical informatics attitudes, and applied computer skills for clinical practice. The scale contains 30 items rated on a 5-point Likert scale, ranging from 1 (not competent at all) to 5 (very competent), with higher scores indicating greater informatics competency. Competency levels were categorized using mean scores as follows: low/novice (1.00–2.59), moderate/beginner (2.60–3.39), and high/competent (3.40–5.00) [26]. The SANICS has demonstrated strong validity and reliability [25,26]. Additionally, it has been culturally validated for use in Palestine [27,28]. In the current study, the tool showed excellent internal consistency, with a Cronbach's alpha of 0.90.

The CBAN-SF, developed by Akgün et al. (2020) [29], was used to evaluate participants' perceptions of caring behaviors. This instrument comprises 27 items rated on a five-point Likert scale (1 = least important to 5 = most important), covering seven domains: humanism/faith-hope/sensitivity, helping/trust, expression of positive/negative feelings, supportive/protective/corrective environment, teaching/learning, human needs assistance, and existential/phenomenological/spiritual forces. Total scores range from 27 to 135, with higher scores indicate higher perceived importance of caring behaviors. The CBAN-SF has demonstrated strong psychometric validity, with an overall Cronbach's alpha of 0.97 and subscale alphas ranging from 0.79 to 0.90 [29]. Additionally, it has been culturally validated for use in Palestine [9,30]. In the current study, the tool showed excellent internal consistency, with a Cronbach's alpha of 0.92.

3.3 Data Collection

Following ethical approval from the relevant institutional review board, the researchers visited the selected hospitals and identified the head nurses responsible for ICUs. During the initial meetings, the researchers explained the study's purposes and procedures and requested staff rosters and work schedules to facilitate participant recruitment.

Face-to-face sessions were subsequently conducted with ICU nurses to present the study objectives and methodology in detail. Nurses who agreed to participate were asked to sign an informed consent form, confirming their voluntary participation.

The researcher also used anonymous questionnaires, in which no personally identifiable information is recorded, stored, or linked to a participant's responses, which were then returned in sealed envelopes to a locked collection box accessed by the researcher only. This safeguarded the participants' privacy and the confidentiality of the process. Those paper-based questionnaires were distributed in person during nurses' break times to minimize disruption to clinical duties and were answered in English since the Palestinian nurses are proficient in English.

3.4 Analysis Methods

Data were analyzed using IBM SPSS Statistics version 28. Prior to analysis, the dataset was examined for completeness, missing values, and normality to ensure the integrity of inferential tests. The data met the assumptions of normality, and no missing values were identified. Descriptive statistics (means, standard

deviations, frequencies, and percentages) were used to summarize participants' demographic characteristics, nursing informatics competency, and caring behaviors scores. To identify significant predictors of caring behaviors, multiple linear regression analysis was conducted. Variables showing significant associations or differences in the bivariate analysis ($p < 0.05$) were included in the regression model using the enter method. Statistical significance was set at $p < 0.05$.

4. Experiments and Results

A total of 224 out of 240 participants completed the study, yielding a response rate of 93.3%. The mean age of participants was 34.1 ± 8.3 years, with the majority being male 170 (75.9%). Most participants held a bachelor's degree 177 (79.0%), and their average nursing experience was 9.6 ± 7.7 years. Additionally, 155 participants (69.2%) reported working rotating shifts. On average, they spent 3.6 ± 1.8 hours per shift using EMRs, as shown in Table 1.

Table 1. Demographic Characteristics of the Study Sample (N=224)

Characteristics	Categories	N (%)	M (SD)
Age			34.1(8.3)
Gender	Male	170 (75.9)	
	Female	54 (24.1)	
Educational Level	Bachelor's	177 (79.0)	
	Master's and above	47 (21.0)	
Experience in ICU			9.6(7.7)
Work Shift	Day Shift	69 (30.8)	
	Rotation Shift	155 (69.2)	
Time Spent on EMR during Shift			3.6(1.8)

The analysis revealed that that participant reported a moderate level of nursing informatics competency ($M = 3.1 \pm 0.2$). Among the subdomains, the highest mean score was in Clinical informatics role ($M = 3.8 \pm 0.9$), while the lowest was in Applied computer skills for clinical informatics ($M = 2.3 \pm 0.5$). Concerning caring behaviors, the average score was ($M = 103.9 \pm 14.6$), reflecting a strong satisfaction with caring behaviors. The highest mean scores were in the dimensions of Expression of Positive/Negative Feelings ($M = 4.0 \pm 0.4$) and Human Needs Assistance ($M = 4.0 \pm 0.8$), while Teaching/Learning had the lowest mean score ($M = 3.7 \pm 0.7$) and Helping/Trust ($M = 3.7 \pm 0.8$), as seen in Table 2.

Table 2. Levels of Nursing Informatics Competency and caring behaviors among participants

Variable	M (SD)	Range
SANICS	3.1(0.2)	1-5
Basic computer knowledge and skills	2.6(0.2)	1-5
Wireless device skills	3.2(0.2)	1-5
Clinical informatics role	3.8(0.9)	1-5
Clinical informatics attitude	3.1(0.2)	1-5
Applied computer skills for clinical informatics	2.3(0.5)	1-5
Caring Behaviors	103.9(14.6)	27-135
Humanism/Faith-hope/Sensitivity	3.9(0.5)	1-5
Helping/Trust	3.7(0.8)	1-5
Expression of Positive/Negative Feelings	4.0(0.4)	1-5
Teaching/Learning	3.7(0.7)	1-5
Supportive/Protective/Corrective Environment	3.8(0.7)	1-5
Human Needs Assistance	4.0(0.8)	1-5

Existential/Phenomenological/Spiritual Forces	3.9 (0.4)	1-5
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M: Mean; SD: Standard Deviation

The analysis revealed that caring behaviors were strongly and positively correlated with SANICS scores ($r = .867, p < .001$) and time spent on EMRs during shifts ($r = .716, p < .001$), while they were negatively correlated with age ($r = -.358, p < .001$) and ICU experience ($r = -.347, p < .001$). Caring behaviors were significantly higher among nurses working rotating shifts compared to those on fixed day shifts ($p = .006$) and among those with a master’s degree or higher compared to bachelor’s degree holders ($p = .020$), as seen in Table 3.

Table 3. Factors Correlating with caring behaviors among the Participants

Variable	N	M	SD	Statistical test	P. Value	
SANICS				$r = .867^{**}$	$p < .001$	
Age				$r = -.358^{**}$	$p < .001$	
Time Spent on EMR during Shift				$r = .716^{**}$	$p < .001$	
Experience in ICU				$r = -.347^{**}$	$p < .001$	
Gender	Male	170	102.8941	14.74961	$t = -1.878$.064
	Female	54	107.0185	13.83664		
Work Shift	Day	69	99.6522	15.62504	$t = -2.805$.006
	Rotation	155	105.7742	13.77441		
Educational level	Bachelor	177	102.7345	14.60163	$t = -2.378$.020
	Master and above	47	108.2340	13.95834		

Table 4 shows the unstandardized regression coefficients for predictors of caring behaviors. The model was statistically significant ($p < .001$), explaining 78.3% of the variance in caring behaviors. For every one-unit increase in SANICS, caring behavior scores increased by 50.2 points ($p < .001$). Time spent on EMRs during shifts also had a positive effect, with each additional hour associated with a 1.2-point increase ($p = .002$). Nurses working rotating shifts scored 3.4 points higher than those on day shifts ($p = .001$). Additionally, having a master’s degree or higher was associated with a 2.6-point increase in caring behavior scores ($p = .038$).

Table 4. Predictors of caring behaviors

Predictors	B	Beta	t. test	p-value	95.0% CI		Collinearity	
					Lower	Upper	Tolerance	VIF
SANICS	50.171	.780	15.038	$p < .001$	43.596	56.747	.371	2.697
Age	-.452	-.257	-1.269	.206	-.250	1.154	.024	4.942
Time Spent on EMR during Shift	1.223	.153	3.133	.002	.454	1.993	.420	2.380
Experience in ICU	-.438	-.231	-1.159	.248	-1.183	.307	.025	3.861
Work Shift (Rotation)	3.371	.107	3.230	.001	1.314	5.428	.914	1.094
Educational Level (Master or above)	2.606	.073	2.092	.038	.151	5.060	.825	1.212
R= 0.885, R ² = 0.783, Adjusted R ² = 0.777, F = 130.830, p < .001, Durbin-Watson= 0.357								

5. Discussion

This study found moderate nursing informatics competency alongside high perceived caring behaviors. Importantly, caring behaviors showed a strong positive correlation with informatics competency and with time spent using EMRs during the shift. In the multivariable model, SANICS and EMR time remained significant predictors, and the model explained a large proportion of variance in caring behaviors. These findings suggest that, in this sample, informatics capability is not competing with caring; rather, it is statistically aligned with nurses' perceptions of caring practice. A rational interpretation is that informatics competency may function as an "enabler" of caring in technology-dense ICU work. When nurses can navigate documentation, retrieve information efficiently, and use systems confidently, cognitive load and workflow friction may decrease freeing attention for presence, communication, and responsiveness. This aligns with broader evidence that ICTs can influence multiple dimensions of nursing care (including time management, documentation quality, and nurse patient relationship), with effects depending on implementation and users' competence [2]. The ICU context is especially relevant: digital systems and bedside devices shape rounds and interprofessional work, and nurses' ability to integrate these tools into clinical routines affects both efficiency and human interaction [1]. From a caring-science perspective, technology is ethically acceptable when it supports, rather than replaces, the relational and humanistic core of nursing so competence becomes a practical pathway for protecting caring values under technological pressure [12].

In the Palestinian context, the strong association observed in this study was plausible because governmental hospitals often face intense workload and system constraints; in such environments, being "fluent" with EMRs and digital workflows may be one of the few immediately modifiable factors that helps nurses preserve caring behaviors under pressure. The Palestinian Ministry of Health has explicitly pursued digital transformation and strengthened health information management, while also acknowledging ongoing challenges such as limited technical staffing and insufficient staff capacity/skills in information technology [31]. When workforce capability is uneven, informatics competency can become a differentiator: nurses who are more competent may experience fewer delays, fewer documentation backlogs, and smoother coordination conditions that plausibly support more consistent caring behaviors.

The results also showed caring behaviors were negatively correlated with age and ICU experience in bivariate analysis. One reasonable explanation is not that older/more experienced nurses "care less," but that prolonged exposure to high-acuity environments plus repeated administrative burdens can erode perceived caring performance or the time available for visible caring behaviors (a pattern discussed in the broader literature on technology burden and work strain). In the West Bank, evidence from other recent hospital studies highlights the importance of patient-centered communication and the reality of resource-limited settings, where staffing and workload issues can shape nursing care experiences [32]. In such conditions, informatics competency may partially buffer the "time squeeze" by making required system tasks faster and less disruptive, thereby protecting caring behaviors.

Finally, the finding that nurses spent an average of 3.6 hours per shift using EMRs reinforces how central digital work has become in ICU nursing. In Palestine, efforts to strengthen and integrate electronic records and national health information systems continue to evolve, including initiatives to unify records within national information platforms [31]. At the same time, published work on EHR development in Palestine emphasizes persistent barriers such as interoperability, infrastructure, and governance factors that can either amplify or reduce

documentation burden at the bedside [33]. Therefore, beyond individual training, system-level usability, workflow design, and policy support are essential to ensure technology strengthens (rather than fragments) caring practice in Palestinian ICUs.

6. Strengths and limitations

This study's strengths include its multi-center sample from 10 West Bank governmental hospitals, a high response rate (93.3%), and the use of validated, reliable instruments with strong internal consistency in this sample (SANICS $\alpha=0.90$; CBAN-SF $\alpha=0.92$), alongside multivariable regression to identify predictors of caring behaviors.

Limitations include the cross-sectional, convenience-sampling design (limiting causality and generalizability), exclusive focus on governmental hospitals in the West Bank (excluding other Palestinian settings), and reliance on self-reported measures collected at one time point, which increases risk of social desirability and common-method bias especially relevant given the very strong correlation between informatics competency and caring behaviors ($r=.867$).

Future research should use longitudinal or prospective designs and multi-source/objective indicators (e.g., supervisor ratings, chart audit/usage logs, patient outcomes) to reduce shared-method variance and clarify directionality. Mechanisms could be tested by examining whether variables such as workload, unit culture, training exposure, or self-efficacy mediate or moderate the relationship between informatics competency and caring behaviors, and by evaluating targeted educational interventions using experimental or quasi-experimental designs.

7. Conclusions and Future Work

Among ICU nurses in West Bank governmental hospitals, nursing informatics competency was moderate overall with a notable deficit in applied clinical computer skills, while caring behaviors were high. Nursing informatics competency showed a strong positive association with caring behaviors and remained the most influential predictor in multivariable analysis, alongside EMR time, rotating shifts, and higher education. These findings support prioritizing practical informatics capacity-building in Palestinian ICUs paired with workflow improvements so that expanding digital health systems strengthens (rather than constrains) patient-centered caring

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9. Declarations

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Consent for publication

Not applicable.

Data availability

The data supporting the findings of this study are available from the corresponding author upon reasonable request.

Conflict of interest/Competing interests

Researcher declares no conflict of interest with any organization regarding the materials discussed in this paper.

Ethics approval and consent to participate

Ethical approval for this study was granted by the Arab American University (IRB: J-2025/A/36/N). Prior to distributing consent forms, the researcher clearly explained the study's purpose, voluntary nature, and the participants' right to withdraw at any time without consequences. Only those who provided written informed consent were included in the study. Participants' confidentiality was strictly maintained throughout the research process. No names or identifying personal information were collected or disclosed. All data were handled securely and used solely for research purposes.

Author(s) Contribution

Ahmad Ayed conducted the study and wrote the manuscript. The author read and approved the final manuscript.

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