The relationship between informatics competency and clinical competency in nurses working in intensive care units: A Cross-sectional Study in Northeast Iran

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Abstract

Background: The use of information technology improves the competency of nurses at the bedside. This study was conducted to determine the relationship between informatics competency and clinical competency in nurses working in intensive care units.

Methods: In this cross-sectional study, 135 nurses employed in intensive care units affiliated with Golestan University of Medical Sciences, Iran, were included. The inclusion criteria were having at least a bachelor's degree in nursing, a minimum of six months of work experience in the ICU, and current employment in the ICU. The participants were enrolled in 2023 using a stratified sampling method with proportional allocation. Data were collected using demographic information forms, clinical competency questionnaires, and informatics competency questionnaires. Statistical inferential tests included Mann-Whitney, Kruskal-Wallis, multiple linear regression, and generalized multiple linear regression models. The significance level for all statistical tests was set at 0.05.

Results: The mean scores of the nurses' clinical competency and informatics competency were 58.41±8.80 and 45.67±18.88, respectively. There was no statistically significant correlation between these two variables (r = -0.07, p-value = 0.42). When examining the simultaneous effect of explanatory variables, only work experience in the ICU had a significant association with clinical competency (β = 0.30, P = 0.02). Moreover, informatics competency was significantly associated with gender (β = -12.93, P = 0.001) and the duration of using health information systems (β = -6.22, P = 0.008).

Conclusion: There is no significant relationship between informatics competency and clinical competency among ICU nurses. It is suggested that health system policymakers introduce the components of nurses' informatics competence and emphasize their importance in the clinical setting to improve the quality of care. In addition, nurses should be encouraged to enhance their professional skills and acquire competency in new approaches by gaining updated knowledge.

Highlights

What is current knowledge?

Clinical nurses should be familiar with various nursing concepts, such as informatics competency. They should also understand the role of nursing informatics and its relationship with other professional activities, such as clinical tasks, and strive to acquire the necessary competence to improve the quality of clinical care.

What is new here?

In this study, in addition to the weak correlation between informatics competency and clinical competence of ICU nurses, there was no statistically significant difference between them. It seems that attention to the importance of informatics competency as one of the novel dimensions of professional competencies is still in its early stages. Nurses need to possess all the components of professional competence simultaneously to help improve the quality of care.

Introduction

At the beginning of the third millennium, information technology (IT), as the most important axis of transformation in the world, is considered, and in recent decades, it has also been welcomed in the health system (1). Due to the rapid growth of technology, informatics needs to further adapt to the needs of the health system (2).

According to Janson, by transforming data into required information, the influence of informatics leads to improved justice, safety, and quality in clinical nursing care (3). By using informatics skills and integrating them into clinical activities, nurses, as the most extensive care group in the health system, have gained new opportunities to help improve patient status (4). The World Health Organization (WHO) has regarded the use of informatics by nurses as a practical approach to reinforce nursing services and significantly improve health outcomes (5). The influence of informatics in nursing has culminated in nurses' participation in implementing IT in clinical care (6). Nursing informatics organizations, such as the Australian Nursing Informatics Association, the Nursing Informatics Group in Brazil, the Nursing Professionals Group and the

Computer Society in Britain, and the Switzerland Nursing Informatics, have also emphasized the use of technology and computers in nursing care provision (7). Nursing informatics is regarded as one of the principal professional competencies among nurses worldwide (8), and acquiring competencies in basic computer skills and informatics knowledge and skills elevates nurses' clinical capabilities (9).

Nursing informatics competency is an acceptable level of knowledge, skill, and ability to perform specific informatics tasks and is an important ability of nurses (10).

The results of Farokhzadian et al.'s research (6) demonstrated that the highest nursing informatics competency was in the area of basic computer knowledge, while the lowest was in informatics skills (6). The findings of Kaihlanen et al.'s study also revealed that nurses' mean scores of informatics competency were at a desirable level (11). Emphasizing that nurses work in complex settings where technology and functioning are constantly changing, more competencies are thus required to ensure that high-quality care is provided at the bedside (12,13).

Nursing clinical competency, by benefiting from knowledge, skills, experiences, attitudes, and values, as the ultimate goal of nursing education, focuses on the ability to apply nursing knowledge, communication and interpersonal skills, problem-solving, and advanced decision-making skills. Nurses' awareness of their clinical competency status assists in maintaining care standards and encourages them to rethink and play a more active role in patient care (14). The use of informatics in nursing can accelerate the provision of clinical care (15). It also improves the quality of care and patient safety, reduces costs, facilitates information exchange between nurses and clients, and improves interpersonal relationships. In addition, it helps reinforce evidence-based performance, clinical decision-making, and achieving favorable results in nursing (16), particularly among nurses in intensive care units (ICUs), who require more competencies in providing services and caring for patients, in addition to higher vigilance (17). The results of Ghahrisarabi et al.'s study indicated that the clinical competency of ICU nurses was excellent (18).

In addition, the importance of nurses' clinical competency in the patient recovery process (19) and providing safe and effective care in the clinical setting (19,20), as well as nurses' informatics competency (17), can enhance organizational effectiveness by reducing costs, improving standards in patient care (21), better identifying patients, improving patient outcomes, managing

patient information, and increasing satisfaction with nurses' daily activities. IT, including nursing information systems, also improves clinical care planning, access to nursing documents and their readability, reduces duplicate documentation, facilitates the completion of nursing documents and medical examinations, and helps optimize nurses' workflow (22). On the contrary, settings will be inefficient in the absence of clinical and technological competencies (8).

Accordingly, competency evaluation is essential not only to ensure the receipt of quality care but also to identify areas for improvement and determine nurses' training needs (23). Meanwhile, in critical care nursing, clinical nurses are often unaware of new concepts that have entered the nursing literature. Due to a lack of knowledge and understanding, they continue to use only outdated nursing concepts. In fact, clinical nurses need to familiarize themselves with new concepts in nursing, understand their interrelationships, and strive to acquire the necessary competencies to improve the quality of nursing care.

Despite extensive research on these two concepts in other countries, few studies have been conducted in our country in this regard. Considering the role of nurses in providing high-quality care and the significance of applying IT to advance care goals, the present study aimed to determine the relationship between informatics competency and clinical competency in nurses working in ICUs.

Methods

Study design
The present cross-sectional research was conducted on 135 nurses working in the ICUs at hospitals affiliated with Golestan University of Medical Sciences based on sampling and inclusion criteria. The sampling method was stratified with proportional allocation. To determine the sample size, Ansari Jaberi et al.'s (2022) study investigating the association between nurses' informatics competency and professional competency was used (16). Given that in this study, the correlation coefficient between professional competency and informatics competency was estimated to be r = 0.3, the sample size was determined to be 113 people according to the following formula.

$$N = \frac{(z_\alpha + z_b)^2}{\frac{1}{4}\left[\log_e\left(\frac{1+\rho}{1-\rho}\right)\right]^2} + 3$$

In the above formula, α, denoting Type I error, was considered to be 0.05, and β, denoting Type II error, was considered to be 0.1. Considering the non-inclusion criterion, the sample size was increased by approximately 20%, and the final sample size was estimated to be n = 135.

Study setting
The sampling method was stratified according to the number of nurses working in each hospital. Two hospitals were selected from Gorgan city (n = 57), two hospitals from Gonbad city (n = 37), and one hospital from each of the other seven cities in the province (n = 41).

Measurement tools
For data collection, three tools were used: a demographic form (Including age, gender, marital status, work experience in the ICU, education level, work experience, interaction with the hospital information system (HIS), informatics course, frequency of computer use, employment type, position, and ethnicity), the Intensive and Critical Care Nursing Competency Scale-1 (ICCN-CS-1), and the Nursing Informatics Competency Scale (NICS).

The ICCN-CS-1 was designed by Lakanmaa et al. in Finland and translated and culturally adapted by Shouryabi et al. (2017) at Shahid Beheshti University of Medical Sciences by performing face validity, content validity, and construct validity (24). This scale contains 80 statements in 4 dimensions: Knowledge (20 factors), skill (20 factors), attitude and value (20 factors), and experience (20 factors). Scoring was performed using a 5-point Likert scale ranging from very poor (1) to excellent (6). The range of the clinical competency score was from 80 to 400. Scores higher than the average denoted greater clinical competency. The scale's reliability was reported by calculating the Cronbach's alpha coefficient of α = 0.96 for the total scale and 0.93-0.96 for the dimensions.

In addition, the NICS was designed by Staggers et al. and translated and culturally adapted by Farzandipour et al. (2018) at Kashan University of Medical Sciences. This scale contained 38 statements in three dimensions: Computer skills (15 statements), informatics knowledge (13 statements), and informatics skills (10 statements). Scoring was performed using a 4-point Likert scale ranging from very low (1) to very high (5). Scores higher than the average denoted greater informatics competency. The range of the informatics competency score was from 38 to 152. The scale's reliability was confirmed by an intraclass correlation coefficient (ICC) of 0.97 for the total scale and 0.95-0.99 for the dimensions (8).

With ethical approval code from the university's Deputy of Research and Technology and according to the sampling framework, the researcher visited the ICU at hospitals affiliated with the university and explained the research objectives and information confidentiality to nurses meeting the inclusion criteria. After obtaining written consent, the researcher provided the questionnaires to them. Due to the conditions of some ICU nurses' busy

schedules and with prior coordination for entering the ICU, the nurses were given a week to ten days to fill out the questionnaires at their leisure.

The inclusion criteria for nurses included having at least a bachelor's degree in nursing, having at least 6 months of work experience in the ICU, working in the ICU, current employment in the ICU, and willingness to participate in the research. The exclusion criterion included incomplete questionnaires (24).

Statistical methods
The data were then entered into SPSS version 21 (SPSS Inc., Chicago, IL, USA). Descriptive parameters such as mean, median, and standard deviation were used, and the Shapiro-Wilk test was applied to assess the normality of the data. Spearman's rank correlation coefficient, Mann-Whitney, and Kruskal-Wallis tests were used due to the non-normality of the data. Non-normal variables included clinical competency such as knowledge, skill, attitudes and values, experience, and total. Furthermore, multiple linear regression and generalized multiple linear regression models were used. The significance level of all statistical tests was set at 0.05. Standardized and unstandardized beta coefficients were estimated along with a 95% confidence interval.

Results

In the present study, 135 ICU nurses were included, with a mean age of 30.75 ± 5.91 years (Range: 20 to 48) and a median age of 30 years. The highest total mean score of clinical competencies in the nurses was 58.41 ± 8.80, with the lowest being 31.15 and the highest being 68.75, denoting a favorable competency. In addition, regarding the areas of clinical competency, the highest and lowest mean scores belonged to the dimensions of value and attitude and experience, respectively (Table 1).

Table 1. The frequency distribution of demographic and professional characteristics of ICU nurses

Variable		Frequency	Percent
Gender	Male	42	31.1
	Female	93	68.9
Marital status	Single	46	34.1
	Married	89	65.9
Ethnicity	Persian	84	62.2
	Turkman	40	29.6
	Other	11	8.2
Educational level	BS	131	97
	MSc	4	3
Position	Head nurse	7	5.2
	Nurse	128	94.8
Work experience (Year) in the ICU	1 <	21	15.6
	1-5	77	57
	6-11	24	17.8
	12-15	6	4.4
	> 15	7	5.2
The frequency of using computer	Several times a day	107	79.3
	Once a day	11	8.1
	Several times a week	10	7.4
	Several times a month	7	5.2
Type of employment	Informal	76	56.3
	Formal	59	43.7
The informatics course	Yes	40	29.6
	No	95	70.4
Interaction with the hospital information system (Day)	Less than half an hour	35	25.9
	0.5-1 hour	52	38.5
	1-2	31	23
	>2	6	4.5
	Less than a day	11	8.1
Work experience (Year)	1-5	61	45.2
	6-11	48	35.5
	12-15	10	7.4
	>15	16	11.9

Moreover, the total mean score of informatics competency in the research units was 45.67 ± 18.88, with the lowest being 0 and the highest being 92.98, denoting a favorable competency. Concerning the dimensions of informatics competency, the highest and lowest mean scores belonged to the dimensions of informatics skills and informatics knowledge, respectively (Table 2).

In investigating the relationship between clinical competency and informatics competency, Spearman's test results indicated no statistically significant association between clinical competency and informatics competency (r = 0.07, P = 0.42).

In investigating the simultaneous effects of explanatory variables on clinical competency, generalized multiple linear regression was used because the assumptions of the linear regression model were not met. Among the variables,

only work experience in the ICU had a statistically significant relationship with clinical competency (β = 0.30, p = 0.02) (Table 3).

In investigating the simultaneous effects of explanatory variables on informatics competency, after ensuring the regression model assumptions by conducting multiple linear regression, only gender (β = -12.93, P = 0.001) and duration of using HIS in the ICU (β = -6.22, P = 0.008) indicated a statistically significant association with informatics competency (Table 4).

Table 2. The distribution of clinical competency and informatics competency scores and their dimensions for ICU nurses

Dimension	Range of score	Mean± SD	Median	IQR
Knowledge	45	85.95±11.48	87.50	20.00
Skill	81.25	85.43±13.19	86.25	17.50
Attitudes and values	77.50	87.26±13.23	88.75	20.00
Experience	71.25	84.50±14.27	87.76	20.00
Total score	53.44	58.41±8.80	59.37	11.88
Computer skills	100	46.25±21.93	44.44	24.44
Informatics knowledge	100	43.19±19.69	38.46	23.08
Informatics skills	100	48.02±21.05	46.66	30.00
Total score	100	45.67±18.88	43.85	25.44

Table 3. The simultaneous effects of all explanatory variables on the clinical competency of ICU nurses

Variables	B	Standard Error	Wald Chi-Square	Confidence Interval 95% Lower Bound	Confidence Interval 95% Upper Bound	P-Value
Constant	5.679	0.1450	1535.035	5.395	5.964	0.0001
Position	-0.064	0.0493	1.702	-0.161	0.032	0.192
Gender	-0.024	0.0186	1.631	-0.060	0.013	0.202
Age	0.002	0.0025	0.883	-0.003	0.007	0.347
Marital status	0.002	0.0210	0.006	-0.040	0.043	0.937
Education level	-0.099	0.0600	2.743	-0.217	0.018	0.098
Work experience	-0.022	0.0150	2.152	0.051	0.007	0.142
ICU work experience	0.030	0.0132	5.159	0.004	0.056	0.023
The frequency of using computer	0.007	0.0144	0.212	-0.022	0.035	0.645
Type of employment	-0.008	0.0120	0.156	-0.161	0.032	0.702
The informatics course	0.032	0.0196	2.621	-0.007	0.070	0.105
Interaction with the hospital information system	0.009	0.0111	0.711	-0.012	0.031	0.139

Table 4. The simultaneous effects of all explanatory variables on the informatics competency of ICU nurses

Variables	Unstandardized coefficients B	Standard Error SE	Standardized coefficients β	t	Confidence Interval 95% Lower bound	Confidence Interval 95% Upper bound	P-Value
Constant	86.488	15.545	-	5.564	55.720	117.250	0.0001
Position	-1.260	9.456	-0.013	-0.134	-19.978	17.450	0.894
Gender	-12.930	3.769	-0.279	-3.431	-20.394	-5.473	0.001
Age	0.243	0.510	0.067	0.476	-0.766	1.252	0.635
Marital status	1.209	4.310	0.027	0.281	-0.732	9.741	0.780
Education level	-0.067	0.040	2.432	1.000	-0.227	0.042	0.076
Work experience	1.766	3.082	0.091	0.573	-4.334	7.865	0.568
ICU work experience	3.680	2.722	0.163	1.350	-1.718	9.0845	0.180
The frequency of using computer	0.831	2.976	0.023	0.279	-5.059	6.723	0.781
Type of employment	-0.950	4.370	-0.022	-0.219	-9.606	7.690	0.827
The informatics course	-5.760	4.106	-0.123	-1.404	-13.892	2.365	0.163
Interaction with the hospital information system	-6.220	2.314	-0.236	-2.688	-10.800	-1.640	0.008

Discussion

In this study, the distribution of the scores of the informatics and clinical competency variables and their subscales was optimal, but there was no statistical relationship between the two variables of informatics nursing competency and clinical nursing competency. In addition, among the demographic variables, only work experience showed a statistically significant relationship with clinical competency, while gender and interaction with HIS showed a statistically significant difference with informatics competency.

In the present study, there was no statistically significant uniform relationship between the nurses' clinical competency and informatics competency. On the contrary, Ansari Jaberi et al.'s (16) research confirmed the correlation between nurses' informatics competency and professional-clinical competency. Jung et al.'s (25) research also indicated a positive and strong relationship between nurses' informatics competency and clinical performance, which is not in line with the results of the current study.

In investigating the concurrency of explanatory variables with the clinical competency of nurses, only the work experience variable showed a statistically significant difference. This finding is in line with Elhami et al.'s (26) study but not with studies conducted by Faraji et al. (27) and Mirlashari et al. (28).

The study findings demonstrated that the mean score of clinical competencies in the nurses was reported to be favorable, which is consistent with Qorbanzadeh et al. (29), who also reported a favorable mean score of clinical competencies among nurses. Other studies, such as those by Fotouhi et al. (30), Zakeri et al. (31), and Sasaki et al. (32), similarly indicated a favorable mean score of competencies among nurses. On the other hand, the clinical competency score was reported to be at an excellent level in Kolagari et al.'s (33) study and at an average level in Karami et al.'s (34) study. In Ghonem et al.'s (35) study, the mean competency scores on the total scale and in various dimensions were poor. It seems that differences in the correct distribution of clinical nursing forces, the continuous evaluation of clinical competencies, the implementation of educational programs to improve clinical competency, and variations in setting facilities are among the contributing factors.

Among the clinical competency dimensions, the highest mean belonged to the attitude and value dimension, and the lowest to the experience dimension. In line with the present study, Ghahrisarabi et al. (18) also reported the highest mean score for the attitude and value dimension and the lowest for the knowledge dimension, whereas in Kolagari et al.'s (33) study, the highest and lowest mean scores were observed in the knowledge and skill dimensions, respectively. It can be acknowledged that the attitude and value dimension of most nurses working in clinical settings is equally influenced by their discipline, lessons learned, and the knowledge upon which they base their care for patients at the bedside. The difference in clinical competency scores among the dimensions highlights the gap between theory and clinical practice. Nurses need more experience and skill to achieve competency, while knowledge and awareness serve as predisposing factors.

The results of the present study also demonstrated that the mean score of informatics competency was generally favorable, which is consistent with the findings of Ansari Jaberi et al.'s (16) research, showing favorable informatics competency scores among participants. Farokhzadian et al. (6) and Jung et al. also reported that participants' mean IT competency scores were at a favorable level, aligning with the present study findings. On the contrary, Batran et al.'s (36) study revealed that participants' mean informatics competency scores were not favorable. In this study, the highest and lowest mean scores of informatics competency were in the informatics skills and informatics knowledge dimensions, respectively. Similarly, Kleib et al.'s (9) study indicated that participants' self-reported mean score for informatics skills was optimal, whereas in Khezri et al.'s (37) research, basic computer skills had the highest mean score among participants. Differences in the level of informatics competency among nurses and its components across various studies may stem from the health system's emphasis on IT and its role in advancing medical science professions, including nursing.

In investigating the concurrency of explanatory variables with nurses' informatics competency, only the interaction with HIS and gender variables showed a statistically significant difference. Regarding HIS, it was observed that increased interaction with HIS was associated with reduced informatics competency. Consistent with the findings of the current research, Khezri et al.'s (37) study demonstrated an inverse correlation between informatics competency scores and the amount of time spent interacting with the hospital's HIS, indicating that greater time spent with HIS led to reduced informatics competency. However, studies by Kinnunen et al. (38), Farzandipour et al. (8), and Karim et al. (39) found no statistically significant difference between nurses' informatics competency and interaction with HIS. It may be suggested that the HIS variable is not contradictory to the components of informatics competency and that working with HIS may not significantly influence these competency components.

Regarding the gender variable, the results revealed a statistically significant difference between the participants' informatics competency and gender. On the contrary, the findings of Al-Hawamdih et al.'s (40) study indicated no statistically significant difference between participants' informatics competency and gender.

This study also had several limitations that should be considered when interpreting the data, including the complexity of ICU conditions compared to other hospital wards, the lack of sufficient time to complete the questionnaires, and the use of self-report questionnaires for data collection.

Conclusion

The findings showed that although the overall scores of informatics competency and clinical competence among the nurses were appropriate, there was no significant relationship or difference between the two variables. It seems that the importance of informatics competency, as one of the new dimensions of competence in the clinical setting, is still in its early stages, and more knowledge about it is needed. Therefore, it is recommended to emphasize the necessity of nurses' skills and competence in the field of technology within the clinical setting. In addition, nurses should be motivated to improve professionally and acquire competency in new approaches by gaining updated knowledge.

Ethical statement

The present study was approved by the Ethics Committee of Golestan University of Medical Sciences, Gorgan, Iran (Code: IR.GOUMS.REC.1402.325). Written informed consent was obtained from the nurses participating in this research. In addition, the right to withdraw from the study and maintain the confidentiality of the data was ensured.

Conflicts of interest

None.

Author contributions

ShK designed the study, FT collected the data, and NGH analyzed and interpreted the data. ShK and KhY were major contributors to writing the manuscript. All authors read and approved the final manuscript.

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