Knowledge of Nursing Journal Winter 2024, 1(4):382-392

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The relationship between the use of patient safety principles and clinical competence of nurses working in the intensive care units

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Abstract

Introduction: Adherence to patient safety principles, despite extensive training, is still one of the major challenges of care. Considering the importance of clinical competence in predicting the quality of nursing care, the present study was conducted to determine the relationship between clinical competence and the application of patient safety principles among nurses working in intensive care units (ICU's).

Materials and Methods: This is descriptive and correlational study that was conducted between April and June 2023 on nurses working in the ICU's of selected hospitals affiliated with Shahid Beheshti University of Medical Sciences in Tehran, Iran. A total of 200 nurses were selected by convenience sampling method. Data collection tools included a demographic information, Clinical Competency Questionnaire for Critical Care Nurses, Ebadi et al. (2024) and the application of patient safety principles questionnaire, Shali et al (2010). The collected data were analyzed by SPSS-22 software using descriptive and inferential statistics.

Results: The mean score of clinical competence of nurses was 173.92 ± 23.54 and the mean score of patient safety principles was 102.47 ± 33.26, which were at moderate level. Among the patient safety principles, the principle of patient harm received the highest score (0.26 out of 3) and conversely, the principle of nursing care delivery received the lowest score (1.83 out of 3). Clinical competency of nurses ($r=0.362$, $p<0.001$) and all its dimensions were significantly correlated to patient safety principles.

Conclusion: With increasing clinical competency and all its dimensions, the use of patient safety principles increases in nurses working in ICU's. It is suggested that, in addition to all educational and intervention programs to promote patient safety, attention should also be paid to the clinical competence of nurses. Highly qualified individuals should be selected when recruiting nurses for ICU's, and interventions that promote clinical competence should be used in plannings.

Keywords: Clinical competence, patient safety, nurse, intensive care units.

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Received: November 2023, **Accepted:** December 2023, ePublish: Winter 2024. Citation: Nesaei F,Nasrabadi T, The relationship between the use of patient safety principles and clinical competence of nurses working in the intensive care units, Knowledge of Nursing Journal. 2024;1(4):382-392.

[Downloaded from knjournal.ir on 2026-11-14]

[DOI: 10.61882/knjournal.1.4.382]

Introduction

Patient safety is one of the important and vital aspects of quality in medical care and services [1]. According to the World Health Organization, in 2024, one in ten patients was harmed while receiving healthcare, meanwhile more than 3 million deaths occur annually due to unsafe care. In low to middle-income countries, 4 out of every 100 people die as a result of unsafe care [2]. Studies have shown that, 3-17% of people admitted to healthcare facilities experience unintentional injuries during their hospitalization, and 30-70% of these injuries are preventable [3]. Reports indicate that deaths due to medical errors are the eighth leading cause of death in the United States [4]. Jean-Pierres (2024) showed that more than 250,000 people die prematurely each year due to preventable injuries [5]. There are no detailed studies in this regard in Iran, but the result of a study by Mazhari and colleagues conducted in hospitals of Tehran showed that the rate of compliance with patient safety is 72%, and the rate of compliance with international standards is 60% [6]. In addition to the direct effects of medical errors on the patient care and treatment, indirect effects of these errors can also be felt by health care providers [7]. These include the provision of additional care by these centers, prolongation of hospital stays, increase of healthcare costs, and low patient satisfaction [3].

Patient safety acts as an indicator for the quality of nursing care and is at the center of high-quality nursing care. Therefore, it seems that patient safety depends on the competence and ability of nurses to perform their tasks correctly [8]. Although patient safety should be a priority in the hospital departments, one of these departments that has a special place in any hospital is ICU's [9]. A study by Farzi and colleagues showed that patient safety compliance in ICU's is low and efforts should be made to improve it [8]. Abdi and colleagues, by examining patient safety in ICU's, showed that patient safety and all its dimensions needs to be improved [10]. Improving the quality of care and preventing clinical errors depend on the nurses' adherence to patient safety principles and their application during care. Patient safety principles are a set of scientific methods that aim to create a reliable health care system [11]. A systematic review by Vaismoradi et al. (2020) showed that individual, systemic (organizational) and environmental factors can affect the extent to which nurses adhere to and apply patient safety principles [9].

On the other hand, the issue that has recently received more attention by the nursing researchers in Iran is the issue of nurses' clinical competence [12]. Clinical competence, which has been the main focus of nursing education system, refers to the thoughtful and constant application of technical and communication skills by nurses [13]. Clinical competence is the essence of nursing profession and is used as an indicator for the evaluation and accreditation of hospitals [14]. The beneficial effects of clinical competence include improved competence [15], improved quality of services, and increased patient satisfaction [16]. However, a question that arises in this regard is that, despite the importance of clinical competence and the efforts to improve it, why is patient safety still a challenge? And can clinical competence be a strong predictor of patient safety? Boltz and colleagues in a study of 44 nurses in 25 hospitals identified clinical competence as

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[DOI: 10.61882/knjournal.1.4.382]

an indicator of reduced patient falls [14]. Zaitoun et al. (2023) also considered nurses' competence to be an effective factor in patient safety culture [17].

Paying attention to patient safety and assessing the competence of nurses in patient safety are not only important for ensuring the safety of care, but also for identifying areas that need improvement such as educational needs of nurses. Considering the beneficial effects of clinical competence on nursing care and taking into account the shortage of studies in this field, we decided to determine the relationship between the use of patient safety principles and clinical competence of nurses working in the ICU's of selected hospitals affiliated with Shahid Beheshti University of Medical Sciences in Tehran, Iran.

Methods

This is a descriptive and correlational study, whose statistical population consisted of all nurses working in the ICU's of selected hospitals affiliated with Shahid Beheshti University of Medical Sciences in Tehran, Iran between April and June 2023. Since the number of statistical populations was known, the sample size was calculated to be 200 people with a confidence level of 95%, a ratio of 0.5, and a desired accuracy of 0.05, using the following formula:

$$n = \frac{N \times Z^2 \times p.q}{N \times d^2 + Z^2 \times p.q}$$

Convenience method was used for the sampling. Inclusion criteria were; being a clinical nurse working in ICU, having a bachelor's degree in nursing or higher education, and providing consent to participate in the research. Exclusion criteria included; withdrawal from the study and incomplete completion of questionnaires. Data collection tools included a demographic information form (including age, gender, marital status, education level, work experience, work experience in ICU's, working shift, and employment status), the Ebadi et al. (2024) clinical competency questionnaire for ICU's nurses[15], and Shali et al. (2010) the application of patient safety principles questionnaire[16].

The clinical competency questionnaire for ICU's introduced by Ebadi et al. (2024) has 5 components and 44 items. These components include care management (17 questions), personal management (11 questions), practical competence (8 questions), research (4 questions), and patient-centeredness (4 questions). A 5-point Likert scale (from a minimum score of 1 to a maximum score of 5) is used to score the items. The average score in this tool is calculated by dividing the score of each component by the number of questions in that component [15]. In the present study, 5 components and 50 items were designed based on face and content validity, which included care management (23 items), personal management (11 items), practical competence (8 items), research (4 items), and patient-centeredness (4 items). The total score of this questionnaire is obtained from the sum of scores related to each component. The lowest score in this tool is 50 and the highest is 250. In this study, to help the audience better understand the level of clinical competency, three levels were determined by subtracting the highest score from the lowest score and dividing it by three. The scores between 50 and 120 indicate low clinical competence, 121 and 185 indicate moderate clinical competence, and scores of between 186 and 250 indicate high clinical competence. The validity of

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[DOI: 10.61882/knjournal.1.4.382]

this questionnaire was confirmed by Ebadi et al. (2024), and its reliability was confirmed with the Cronbach's alpha coefficient of 0.95 [15]. Since more than 5 years has been passed since the validity and reliability of this questionnaire have been assessed, in the present study, the face and content validity (CVI and CVR) of this tool was calculated by 5 experts from the Islamic Azad University of Medical Sciences in Tehran, which resulted in the CVI of 0.82 and CVR of 0.87 for the entire questionnaire. All questions with a score above CVR = 0.7 were retained. For reliability, the Cronbach's alpha coefficient was determined among 20 nurses in the research population, and the Cronbach's alpha was calculated at 0.82. It should be noted that these individuals were excluded from the study.

The application of patient safety principles questionnaire consists of 9 scales and 96 subscales. The main scales include drug administration, nursing care, patient injury during care, patient identification, patient fall, patient education, diagnostic and therapeutic methods, infection control, and safe blood transfusion. In this study, 4 scales and 36 subscales were designed and also 5 scales and 60 subscales were adapted from the study of Shali (2011)[16]. This questionnaire was designed to assess the number of errors in nursing care during the past month in the form of items and based on a four-point Likert scale (0-4), ranging from never, 1-3 times, 3-5 times, to more than 5 times. The reliability coefficient of the standard questionnaire for the application of patient safety principles was also confirmed in the study of Ahmad Fkhrodin and colleagues, using a preliminary study conducted on a sample of 30 people with a one-month interval between the distribution of the final questionnaire and the Cronbach's alpha coefficient [16]. In the present study, the face and content validity (CVI and CVR) of this tool was calculated by 5 experts from the Islamic Azad University of Medical Sciences in Tehran, which resulted in the CVI of 0.88 and CVR of 0.91 for the entire questionnaire. All questions with a score above CVR = 0.7 were retained. For reliability, the Cronbach's alpha coefficient was determined among 20 nurses in the research population, and the Cronbach's alpha was calculated at 0.85. It should be noted that these individuals were excluded from the study.

The first author visited the hospital departments daily at all shifts (morning, evening and night), and conducted sampling based on the inclusion criteria. The demographic and clinical competency questionnaires were completed by the nurses on their free time. The other questionnaire, which was related to the application of patient safety principles was completed by the researcher while observing the nurses' performance. This project was approved by the Ethics Committee of Tehran Islamic Azad University of Medical Sciences with the ethics code: IR.IAU.TMU.REC.1401.452. Necessary permission was also obtained from the hospital officials. The study method and objectives were explained to the participants and they were informed that participation in the study is completely voluntary. The participants were also ensured about the confidentiality of their personal information, and then an informed consent was obtained from them. Descriptive statistics in the form of graphs and tables were used to analyze and describe the data. Similarly, analytical statistics in the form of independent t-tests,

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one-way analysis of variance and Pearson correlation coefficient were used to analyze the data through SPSS-22 software.

Results

A total of 200 nurses participated in this study. The mean age of the nurses was 33.26 ± 6.48 years. Also, most nurses (65.5%) were female, married (66%), and had bachelor's degree in nursing (81%) with 52.5% of them having permanent employment. The mean work experience of nurses was 10.51 ± 17.7 years. Also, the mean work experience of nurses in ICU was 1.90 years with the standard deviation of 1.22.

The average clinical competence of nurses was 173.92 ± 23.54, which was at moderate level, considering that it ranged between 121 and 185. Among the components, the patient-centeredness component received the highest score (3.65 out of 5) and the component of research received the lowest (2.90 out of 5). The mean score of patient safety principles 102.47 ± 33.26, which was at moderate level, considering that ranged between 97 and 193. Among the safety principles, the patient harm had the highest level of compliance with a score of (0.26 out of 3) and nursing care delivery had the lowest level of compliance with a score of (1.83 out of 3), (Table 1).

Table 1. Distribution of mean and standard deviation of clinical competence and patient safety principles and their components

	Variables	Number of questions	Minimum-maximum	Mean ± SD	Mean by number of questions
Clinical competence	Care Management	23	54-108	81.11±11.44	3.52
	Personal Management	11	26-53	38.86±5.40	3.53
	Practical Competence	8	17-40	27.70±4.34	3.46
	Research	4	5-20	11.63±2.63	2.90
	Patient-Centeredness	4	8-20	14.60±2.23	3.65
	Total Clinical Competence	**50**	**118-227**	**173.90±23.54**	**3.47**
Patient safety principles	Drug interventions	17	0-51	29.61±8.17	1.74
	Nursing care delivery	24	0-71	44.13±11.39	1.83
	Patient harm	4	0-12	1.06±2.26	0.26
	Patient identification	10	0-30	3.08±5.84	0.30
	Patient fall	5	0-15	1.43±3.15	0.28
	Patient education	13	0-32	6.68±3.34	0.51
	Diagnostic and therapeutic methods	5	0-6	2.53±1.16	0.50
	Infection control	6	0-13	8.45±2.13	1.40
	Safe blood transfusion	12	0-13	5.49±2.29	0.45
	Total patient safety principles	96	0-239	102.47±33.26	1.06

Based on Pearson correlation coefficient, nurses' clinical competence and some of its dimensions (care management, personal management, practical competence, research

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[DOI: 10.61882/knjournal.1.4.382]

and patient-centeredness) had a significant but weak relationship with patient safety principles (P<0.05)(Table 2).

Table 2: Relationship between clinical competence components and dimensions of patient safety principles

Clinical competence / Patient safety	Care management		Personal management		Practical competence		Research		Patient centeredness		Total competence	
	r	*p*	r	*p*	r	*p*	r	*p*	r	*p*	r	*p*
Drug interventions	-0.210	0.003	-0.221	0.002	-0.173	0.01	-0.186	0.008	-0.134	0.05	-0.218	0.002
Nursing care delivery	-0.201	0.004	-0.197	0.005	-0.158	0.02	-0.172	0.01	-0.155	0.02	-0.206	0.003
Patient harm	-0.489	P<0.001	-0.456	P<0.001	-0.394	P<0.001	-0.311	P<0.001	-0.388	P<0.001	-0.486	P<0.001
Patient identification	-0.470	P<0.001	-0.433	P<0.001	-0.377	P<0.001	-0.299	P<0.001	-0.358	P<0.001	-0.467	P<0.001
Patient fall	-0.456	P<0.001	-0.441	P<0.001	-0.367	P<0.001	-0.307	P<0.001	-0.372	P<0.001	-0.460	P<0.001
Patient education	-0.456	P<0.001	-0.445	P<0.001	-0.380	P<0.001	-0.320	P<0.001	-0.364	P<0.001	-0.464	P<0.001
Diagnostic & therapeutic methods	0.090	0.20	0.018	0.80	0.052	0.46	0.038	0.59	0.083	0.24	0.070	0.32
Infection control	-0.079	0.26	-0.107	0.13	-0.095	0.17	-0.081	0.25	-0.026	0.71	-0.092	0.19
Safe blood transfusion	-0.015	0.83	0.013	0.85	-0.030	0.67	-0.046	0.51	0.014	0.84	-0.014	0.84
Total patient safety principles	-0.356	P<0.001	-0.349	P<0.001	-0.292	P<0.001	-0.266	P<0.001	-0.267	P<0.001	0.362	P<0.001

Discussion

This study was conducted with the aim of investigating the relationship between the use of patient safety principles and clinical competence of nurses working in the intensive care units of selected hospitals affiliated with Shahid Beheshti University of Medical Sciences, Tehran, Iran. The results showed that the clinical competence of nurses was at moderate level. Among the components of clinical competence, patient-centeredness received the highest score (3.65 out of 5) and conversely, research received the lowest score (2.90 out of 5) by the nurses. In line with the results of present study, Ghorbanzadeh et al. (2022) in a study investigated the relationship between clinical competence and nurses' job satisfaction in all wards and showed that, the clinical competence of nurses was at moderate level [18]. Saadati et al. (2019) reported the clinical competence of nurses in the pediatric ward to be at moderate level [19]. Competence is one of the important topics in the field of health care, and has a great importance in various therapeutic areas including education, clinical practice and management [18]. Developing the clinical

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[DOI: 10.61882/knjournal.1.4.382]

and professional competence of nurses is an investment to ensure the safety and quality of patient care [11]. Maintaining and improving the status should be on the agenda of health managers and administrators, because competence, which refers to the autonomy in performing nursing activates, is of great importance [20]. However, in contrast to the results of present study, Keshavarzi et al. (2021) in a study conducted on the neonatal intensive care nurses in Tehran showed that clinical competence of nurses was high [21]. Fattah Ahari et al. (2019) in a study also showed that the clinical competence of psychiatric nurses was desirable from their own and their head nurses' perspectives [22]. Fotohi et al. (2019) in another study reported a high clinical competence of nurses working in intensive care units, using the questionnaire of Ebadi et al. [11]. According to the researcher, the differences in clinical competency assessment tools, the number of samples, the research environment, the time and different research settings (hospital department) are the main reasons for the differences in the results of these studies. In the present study, the researchers examined the clinical competency of nurses working in the ICU's of selected hospitals affiliated with Shahid Beheshti University of Medical Sciences, while Fattah Ahari et al. (2019) examined the clinical competency of nurses working in the psychiatric hospitals, and Keshavarzi et al. (2021) examined the clinical competency of nurses in neonatal intensive care units. In the present study, a specific clinical competency questionnaire for nurses working in ICU's was used to measure clinical competency, but Fattah Ahari et al. (2019) used researcher-made questionnaires.

Other results of present study showed that the nurses moderately used patient safety principles in their practice. Among the dimensions of patient safety, patient harm received the highest score (0.26 out of 3) and nursing care delivery received the lowest score (1.83 out of 3) by the nurses. In line with the results of present study, Salamat et al. (2019) also reported a moderate level of safety culture among 63% of the participating nurses [23]. Aghakhani et al. (2019) in a study conducted on elderly patients hospitalized in the medical wards of hospitals affiliated with Urmia University of Medical Sciences showed that 61% of nurses had a moderate level of performance [24]. Moghadam et al. (2020) conducted a study to determine the relationship between moral distress and safe nursing care in emergency department and revealed that, safe nursing care in emergency department was at moderate and desirable levels [25]. Since one of the most important human rights is the right to be safe from risks and harms when receiving health services, and also as a large percentage of patients are experiencing complications and injuries during health care delivery in health care systems, especially hospitals, paying attention to the issue of patient safety is of great importance in different countries [26]. In the present study, the level of patient safety was determined to be at moderate level. However, while this level is initially acceptable, efforts should be made by stackholders to improve the level of patient safety in the Iranian hospitals. This is an important issue, because even a small negligence in adhering to patient safety principles can have irreparable consequences for patients. On the other hand, the issue of patient safety is even a more prominent issue in the intensive care

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[DOI: 10.61882/knjournal.1.4.382]

units, where patients often have lower level of consciences that prevents them from reporting such issues. The use of complicated medical devices in ICUs can also increase the possibility of medical errors. However, contrary to the results of present study, Bayatmanesh et al. (2019) [27] in a study conducted on nurses working in the ICU's of selected hospitals affiliated with Yasuj University of Medical Sciences showed that, the score of nurses' compliance with patient safety was 53.43 out of 100 (unsatisfactory). In their study, the highest level of compliance was related to blood transfusion (89.52 out of 100; desirable), and the lowest was related to the care of post-operative complications (23.3 out of 100; undesirable). Also, more than half of nurses in the study of Aziz Mamdouh et al. (2020) in Egypt had poor performance and low level of safe care knowledge [28]. We believe that, the differences in the time and place of these studies, different tools used for measuring the level of patient safety compliance, and the number of samples are the main reasons for differences in the results of these studies and the present study. In the present study, the researcher tried to measure the level of compliance with patient safety principles by nurses working in the ICU's of selected hospitals affiliated with Shahid Beheshti University of Medical Sciences in Tehran, with a valid, reliable, and localized instrument. It is worth mentioning that, these hospitals accept patients from different parts of the country. Patient safety and its compliance have always been an interesting topic for nursing researchers, who believe that the most important step to improve it is to assess it periodically, especially in ICU's. It is clear that the level of compliance with patient safety principles in the hospitals examined in the present study needs to be improved if we want to achieve the slogan of a safety-focused hospital.

In the present study, clinical competence of nurses and some of its dimensions were significantly related to patient safety principles. This means that the higher the clinical competence of nurses, the more effort they put into implementing the principles of safe care for patient. In this regard, Halabi et al. (2021) conducted a study in Saudi Arabia entitled: "Professional competence and its relationship with the quality of nursing care and patient safety", and showed a statistically significant relationship between professional competence, the quality of nursing care and patient safety [29]. Yu et al. (2021) conducted a study in China entitled: "Clinical competence and its relationship with students' self-efficacy and clinical learning", and revealed that the improvement of clinical competence was associated with an increase in self-efficacy and clinical learning of undergraduate nursing students [30]. Arabkhazaie et al. (2020) conducted a study entitled: "Investigating clinical competence and its relationship with the competency of operating room technologists," and showed that clinical competence was a result of different competency areas and was related to the competency areas of operating room technologists [31]. Ghorbani et al. (2021) conducted a study on novice nurses and reported that improving the competency of nurses is important for increasing the quality of patient care as one of the main programs of nursing managers [32]. Mohamadirizi et al. (2015) in a study entitled: "Investigating the relationship between clinical competence and clinical self-efficacy in nursing and midwifery students" showed that the

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relationship between clinical competence and clinical self-efficacy in nursing and midwifery students is significant and positive, and with increasing clinical competence, clinical self-efficacy in nursing and midwifery students increases [33]. Adib Haj Bagheri and Eshraghi Arani (2018) conducted a descriptive study entitled: "assessing nurses clinical competence from their own viewpoint and the viewpoint of head Nnurses: a descriptive study ", and showed a positive relationship between nurses' clinical competence and the level of application of these competencies [34]. Most studies conducted in the field of clinical competence indicate the beneficial and important effects of clinical competence in nurses and nursing students. However, despite the importance of observing patient safety and applying safe care in nursing, the relationship between clinical competence and safe patient care was investigated to a limited extent. The results of present study showed that when nurses have high clinical competence, they perform better in providing safe care. In general, the standards of ICU's can be classifed in six areas of management and organization, management.

The main result of present study showed that the nurses' clinical competence and some of its dimensions such as care management, personal management, practical competence, research and patient-centeredness were significantly correlated to the use of patient safety principles. It is suggested that, in addition to all educational and intervention programs to promote patient safety, attention should also be paid to the clinical competence of nurses, and highly qualified nurses should be selected in the recruitment process for ICU's. The interventions that promote clinical competence should also be used in planning. Among the limitations of this study, we can point to the self-reporting nature of data collection tools, in a way that we had to rely on the nurses' statements. Also, since the compliance with safety principles was assessed by observation, it may have been stressful for nurses, reducing their concentration as a result.

Conclusion

The results of this study showed that with the increase in clinical competence and some of its dimensions, the application of patient safety principles among nurses working in ICU's will increase. It is suggested that, in addition to all educational and interventional programs to promote patient safety, attention should also be paid to the clinical competence of nurses, and both highly qualified individuals should be selected in the recruitment of nurses for intensive care units and interventions that promote clinical competence should be used in planning.

Acknowledgements

This aricle is part of a Master's thesis in medical-surgical nursing at the Faculty of Nursing and Midwifery, Islamic Azad University of Tehran Medical Sciences in 2023. Therefore, we would like to express our deepest gratitude to the university's postgraduate education, ethics committee, nursing faculty officials, and the respected administrators and nurses without whom this research would not have been possible.

Conflict of Interest

There was no conflict of interest in writing this article.

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[DOI: 10.61882/knjournal.1.4.382]

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