Original Article

Journal of Occupational Health and Epidemiology
Journal homepage: http://johe.rums.ac.ir

Can Nurses' Informatics Competency Predict Their Professional Competency?

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Citation: Ansari Jaberi A, Sahebi Z, Riahi Paghaleh Z, Asari Jaberi K, Negahban Bonabi T. Can Nurses' Informatics Competency Predict Their Professional Competency? J Occup Health Epidemiol 2022; 11(1):41-7.

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Article history
Received: Sep 2021
Accepted: Jan 2022

10.52547/johe.11.1.41

Print ISSN: 2251-8096
Online ISSN: 2252-0902

Peer review under responsibility of Journal of Occupational Health and Epidemiology

Abstract

Background: Understanding the way nurses' informatics competencies affect their mastery of professional competencies can help with providing high quality care and design contents for continuing nursing education. This study aimed to determine the association between nurses' informatics and their clinical competencies.

Materials & Methods: A total of 150 nurses who met the inclusion criteria were enrolled in this descriptive study from three general public hospitals in Rafsanjan, Iran, using stratified random sampling method. Self-reporting data collection was performed applying three questionnaires of (1) personal and job characteristics, (2) the Self-Assessment of Nursing Informatics Competencies Scale (SANIC), and (3) the Competency Inventory for Registered Nurses (CIRN). Data were analyzed using SPSS 22.0 and Kolmogorov-Smirnov, Chi-square, Pearson's correlation coefficient, and linear regression statistical tests.

Results: Female nurses had higher CIRN scores than male ones (p = 0.027). The results of the Pearson's correlation coefficient showed a moderate significant positive association between SANIC and CIRN scores (r = 0.341, p = 0.001). Furthermore, results of the linear regression analysis showed that about 11% of the CIRN score was associated to the SANIC score (P = 0.001). After adjustment based on gender (p = 0.060) and education (p = 0.064), the correlation was not significant.

Conclusion: Given the effect of gender and level of education, there was no significant association between Nursing Informatics Competencies and nurses' competency. The level of application of informatics in nursing should be reviewed contextually.

Keywords: Nursing, Informatics, Clinical Competency, Professional

Introduction

Information and communications technology (ICT), as a support system for healthcare professionals and plans, has dramatically affected all aspects of health [1]. Accordingly, healthcare systems are shifting to a new model called "digital health" [2]. Emergence and growth of digital health have revolutionized medical practice by introducing innovative treatment forms and rapidly exchanging patient data. In fact, digital health has brought tremendous benefits to all professionals providing

health services [3]. In response to digital transformations in the health sector, nurses have expanded their field of activity by going through this innovative process [4].

The World Health Organization (WHO) has recognized digital health as a major driver of advancing health coverage globally and obtaining sustainable global goals. Therefore, it recommends the use of digital health by nurses worldwide as a practical way to strengthen nursing services to significantly improve health outcomes [5]. The importance of nursing informatics in the healthcare system has become so prominent that it is considered the core competency of professional nurses [6].

Attentiveness to professional competency is an essential aspect of high quality, safe, and cost-effective healthcare, which in clinical practice reflects the reality of patient care and the complex nature of professional practice. Although competency is an essential feature of a person, which is directly related to various measurable aspects of their effective job performance [7], competency development is an ongoing process meant to improve knowledge, attitude, and skills, being influenced by several factors [8]. The results of the systematic review showed that six factors were involved in developing nurses' professional competency; accordingly, these factors included the work experience, type of nursing, work environment, level of education received, commitment to professionalism, critical thinking, and individual factors [9].

Nowadays, the impact of integration of the health information technology (HIT) on patient care has turned into a challenging issue. Some researchers have highlighted its positive aspects, such as improving quality of care and patient safety, reducing costs, facilitating exchange of information between nurses and clients, improving their interpersonal relationships [10], helping enhance evidence-based practice, making best clinical decisions, and achieving desired outcomes [11]. Despite well-documented positive effects of HIT, some studies have reported that the introduction of HIT in clinical settings is associated with intended and unintended adverse effects, such as adverse patient outcomes, patient safety risks, and patient harm [12, 13]. Among other negative consequences, one can refer to burnout of nurses and physicians, HIT-related stress, dissatisfaction with HIT, a tendency to reduce clinical working hours, and an inclination to leave current activities [14-17].

In addition to the challenges mentioned above, scientists believe that in the broader context of healthcare delivery and professionalism, there is no proper understanding of the scope and impact of informatics knowledge on clinicians' practice [18]. Accordingly, accurate understanding of this issue can help medical education professionals design rich curricula and continue education programs to empower healthcare workers. Against this backdrop, this study was conducted to determine the relationship between nurses' informatics competency and their clinical competency.

Materials and Methods

This study was conducted in 2021 at three general public hospitals with permission from Rafsanjan University of Medical Sciences, north of Kerman Province, Iran.

In this descriptive study, 150 nurses meeting the inclusion criteria were enrolled using a stratified random sampling method. The study population included 504 nurses with at least a bachelor's degree. The inclusion criteria of this study were providing bedside care for at least one year, having at least a bachelor's degree in nursing, and giving consent to participation in the study. The exclusion criteria were incomplete completion of the questionnaires and withdrawal from the study.

Due to the lack of access to similar studies, the sample size, with the expected r = 0.3 as the lowest correlation coefficient between the two components of professional competency and informatics competency (based on the results of a pilot study by researchers in the beginning of the study), α = 0.05, and β = 0.1 based on the formula below, was estimated at 121. Considering the possibility of dropouts, 150 qualified nurses were included in this study.

Formula 1.

$n= [z\alpha+z\beta/C(r)]2+3$

$C=0.5\times \ln[1+0.3/1-0/3]=0.3$

Wards of hospitals (Alin Ebn Abitaleb Hospital with 400 nurses, Moradi Hospital with 56 nurses, and Nik Nafs Hospital with 48 nurses) were considered as sampling classes. After determining the sample share for each ward of the hospital in relation to the total sample size, qualified nurses were selected by the simple random sampling method. In the case of nursing cancellations, the samples were replaced by random selection of other nurses. Besides, data collection took place from January to March 2021.

After receiving approval from the Vice Chancellor for Research and Development of the University of Medical Sciences, the Ethics Code (IR.RUMS.REC.1398.150) was obtained, and the

researchers started the sampling task. Data collection was performed through self-reporting. The questionnaires consisted of three parts; the first part included personal and job characteristics, and the second part included the Self-Assessment of Nursing Informatics Competencies Scale (SANIC) designed in 2009 by Sunmoo et al [19], which was later reviewed by Choi et al. The scale had a valid five-factor structure, with the variance of 69.38%, high internal consistency reliabilities (0.96 for the total scale as well as 0.84 to 0.94 for subscales), and good responsiveness (standardized response mean = 0.99) [20]. This scale contained 30 questions in five areas of basic computer knowledge and skills (11 questions), computer skills and clinical informatics (5 questions), clinical role of informatics (5 questions), attitudes about clinical informatics (4 questions), and data management skills (5 questions) on a 5-point Likert scale for responding. Accordingly, the scores ranged from 1 to 5. In view of this, score 30 was unqualified, scores 31-59 were somewhat qualified, scores 60-89 meant qualified, scores 119-90 denoted very qualified, and scores 150-120 meant experienced. The third part of the questionnaires was the Competency Inventory for Registered Nurses (CIRN) that was created by Lui et al (2009) [21], and Ghasemi et al (2014) performed a psychometric evaluation of its Persian version [22]. This questionnaire contained 55 phrases in 7 areas of clinical care, leadership, interpersonal relationships, ethical/legal performance, professional development, coaching-training, and willingness to do research-critical thinking. Tool validity, content validity, structural validity, and reliability of this questionnaire were confirmed with a Cronbach's alpha coefficient of 0.93 and the overall CVI index of 0.94, having been 1-0.83 for each item. The answers were provided on a 5-point Likert scale within the score range of 0-4. Score 0 meant no qualification, score 1 meant little qualification, score 2 indicated some qualification, score 3 implied sufficient qualification, and score 4 showed high qualification. Scale scores ranged from 0-220. Accordingly, score range 165-220 implied high qualification, score range 165-110 showed medium qualification, and scores less than 110 implied low qualification. In addition, data were collected by the self-report method.

Ethical approval for the study was obtained from the Ethics Committee of Rafsanjan University of Medical sciences. Besides, after the purpose of the study was explained to the RNs, oral consent was obtained from them to participate in the study. Next, the participants received the questionnaires. Besides, they were ensured that participation was voluntary, and that they could withdraw at any time. In addition, all participants were ensured that their identity would be kept confidential. Furthermore, the researcher was present at the time of data collection to answer their questions.

Data were analyzed using SPSS 22.0, the Kolmogorov-Smirnov test (to determine normality of quantitative variables), the chi-square test (to compare ratios), the Pearson's correlation coefficient test (to determine the correlation between two quantitative variables), as well as linear regression and multivariate linear analysis (to find the best line predicting nurses' profession competencies from informatics competencies).

Results

In this study, data on 150 nurses were analyzed. The results of the Kolmogorov–Smirnov test, skewness, and kurtosis showed that all quantitative variables were distributed normally except for the nurses' age. In addition, the mean and standard deviation of the nurses' age were 33.73 ± 7.72 with minimum and maximum ages of 22 and 53, respectively. In terms of gender, 125 nurses (83.3%) were female. Besides, the employment status of 69 nurses (46%) was permanent, and that of 25 (16.7%) was temporary to permanent, with the rest having been contract-based. Furthermore, 134 nurses (89.3%) had a bachelor's degree, and the rest had a master's degree.

The mean and SD of the nurses' informatics competency were 85.20 ± 30.4 with the maximum and minimum of 150 and 31, respectively. Besides, the mean and SD of the nurses' professional competency were 209.64 ± 33.68, with the maximum and minimum of 220 and of 102, respectively.

Comparison of the mean scores of the nurses' professional competency by gender showed that female nurses had higher clinical competency scores than men ($p = 0.027$), but no significant difference was observed in terms of age and education ($p > 0.05$) (Table 1).

Table 1. Comparison of the mean scores of nurses' informatics and professional competencies by gender

Variable	Male Mean ± SD	Female Mean ± SD	P-value
Informatics competency	86.3200 ± 28.53466	84.9840 ± 30.86468	0.842
Professional competency	196.1200 ± 38.84834	212.3520 ± 32.04615	0.027

Furthermore, results of the comparison of the mean scores of the nurses' informatics competency by education and gender showed no statistically significant difference ($p > 0.05$). Additionally, the study of the correlation between the nurses' age and their informatics competency showed no significant relationship ($p > 0.05$).

However, the results of the Pearson's correlation coefficient between the informatics competency and the nurses' professional competency showed a significantly moderate and positive relationship ($r = 0.341$, $p = 0.001$).

Table 2 shows the results of the correlation between informatics competency and professional competency subscales. As the table shows, all professional competency subscales (except for ethics) had a direct weak to moderate correlation with informatics competency subscales, with their relationship having been statistically significant ($p < 0.05$).

Table 2. Pearson's correlation coefficient between the nurses' informatics and professional competencies

NPCSand it's subscales / NICS and It's subscales	Professional competency	Informatics competency	Willingness to do research	Coaching-training	Professional development	Ethical / legal performance	Interpersonal relationships	Leadership	Clinical care
Basic computer knowledge and skills	r=0.344 p=0.001	r=0.949 p=0.001	r=0.550 p=0.001	r=0.347 p=0.001	r=0.304 p=0.001	r=0.097 p=0.239	r=0.253 p=0.002	r=0.283 p=0.011	r=0.210 p=0.010
Computer skills and clinical informatics	r=0.278 p=0.001	r=0.953 p=0.001	r=0.445 p=0.01	r=0.262 p=0.001	r=0.256 p=0.002	r=0.045 p=0.582	r=0.255 p=0.006	r=0.226 p=0.005	r=0.195 p=0.017
Clinical role of informatics	0.363 p=0.001	r=0.829 p=0.001	r=0.495 p=0.001	r=0.372 p=0.001	r=0.333 p=0.001	r=0.118 p=0.150	r=0.295 p=0.001	r=0.336 p=0.001	r=0.213 p=0.009
Attitude about clinical informatics	r=0.288 p=0.001	r=0.958 p=0.001	r=0.461 p=0.001	r=0.269 p=0.001	r=0.260 p=0.001	r=0.042 p=0.612	r=0.232 p=0.004	r=0.237 p=0.004	r=0.210 p=0.01
Data management skills	r=0.289 p=0.001	r=0.952 p=0.001	r=0.460 p=0.001	r=0.270 p=0.001	r=0.260 p=0.001	r=0.041 p=0.618	r=0.234 p=0.004	r=0.239 p=0.003	r=0213 p=0.009
Informatics competency	r=341 p=0.001	r=1	r=0.531 p=0.001	r=0.333 p=0.001	r=0.307 p=0.001	r=0.078 p=0.340	r=0.266 p=0.001	r=0.286 p=0.001	r=0.227 p=0.006
Professional competency	r=1	r=0.341 p=0.001	r=0.764 p=0.001	r=0.877 p=0.001	r=0.802 p=0.001	r=0.749 p=0.001	r=0.903 p=0.001	r=0.890 p=0.001	r=0.860 p=0.001

Linear regression analysis was used to answer the question "whether the nurses' informatics competency could predict their occupational competency". Accordingly, the results showed that about 11% of the nurses' occupational competency score was related to their informatics competency score, which was statistically significant ($P = 0.001$) (Table 3), with its prediction model presented in the following section. This means that upon assuming constant the other remaining variables, by adding one unit to the nurses' informatics competency score, 0.377 unit would be added to their professional competency score.

Formula 2.

NPC = 177+0.377NIC

Table 3. Results of regression analysis for predicting nurses' clinical competency scores through their informatics competency scores

Model	Unstandardized coefficient		Standardized coefficient	Adjusted R square	t	P-value
	B	Std. Error	Beta			
1 Constant	177.48	7.774			22.92	0.001
NICS	0.377	0.086	0.341	0.110	4.40	0.001

To study the effect of the variables of age, gender, and education as confounder factors, the multiple linear regression test was repeated, which was statistically significant in terms of age. Table 4 shows details of the results.

Table 4. Results of regression analysis for predicting nurses' clinical competency scores through their informatics competency scores in terms of age, gender, and education as confounder factors

Model	Unstandardized coefficient		Standardized coefficient	t	P-value
	B	Std. Error	Beta		
1 Constant	111.73	19.91		5.61	0.001
NICS	0.376	0.084	0.339	4.48	0.001
Age (Numerical with a continuous value)	1.38	0.335	0.314	4.12	0.001
Gender (Male, Female)	12.92	6.802	0.144	1.98	0.060
Education (Bs, MSc)	-3.78	8.303	-0.35	-0.456	0.0649

Discussion

The results of this study showed that female nurses had higher professional competency than male ones, but professional competency of the nurses had no relationship with their level of education, employment status, and age. It must be accepted that healthcare is a domain with female dominance, so is nursing. Besides, perhaps the observation that female nurses were more competent than male ones, based on the results of this study, could be just a cultural issue.

Several studies have examined the relationship between various demographic variables and nurses' competence, with various results having been reported. Some studies reported a low to moderate relationship between nurses' age and work experience with their competence [23-25]. However, in some other studies, they found no relationship between nurses' age and work experience with their competence [26, 27].

However, the results showed no difference between nurses' informatics competency in terms of their gender, employment status, and educational level. In the study of Bathish et al, no significant relationship was found between work experience and education levels with nurses' competency [27]. These results indicate that nursing competency can be formed independently of their individual characteristics, being based on environmental and managerial conditions of their workplace. Researchers, in a systematic review, reported that salary, among individual factors, had the greatest impact on nurses' competency. In addition, clinical competency was positively affected by job satisfaction and negatively affected by burnout. Besides, the effect of specialized knowledge was not statistically significant [28].

According to the results, the nurses were able to obtain an average of almost 90% of the total score of professional competency, while the score was equal to 56% of the total score of informatics competency. In fact, the degree of the integration of health information technology in the context of health service providers is diverse, with this issue being in early stages in developing countries, including Iran. Therefore, one can say that weaknesses in organizational structures and processes in terms of performing professional tasks in the context of informatics can be another reason for low informatics capabilities of nurses in this field of study. Accordingly, this may lead to the creation of professional competency independent of informatics competency.

Based on the results of this study, there was a direct moderate relationship between the nurses' professional competency and their informatics competency; however, there was no significant relationship between SANIC and CIRN scores in terms of the effect of gender and level of education. Therefore, the nurses' informatics competency could not play a role in predicting their professional competency. The review of the relevant literature shows that researchers have a limited focus on the relationship between nurses' professional competency and informatics competency. In the study of Chang et al, there was a very high agreement among nursing professionals to consider informatics competency one of the necessities of the nursing practice in today's world [29]. In another study involving 21 European countries, a list of nurses' key competencies was evaluated and prioritized. Accordingly, informatics competency was ranked second among the five major areas of nursing competencies [30].

Today, information technology greatly affects the nursing profession, so nurses should use informatics to optimize patient outcomes, despite their diverse experiences and levels of education. It seems that the difference in the relationship between the two variables of nurses' professional and informatics competencies is greatly influenced by the level of application of informatics in the context of their professional duties in different health systems. Understanding how nurses' IT competency affects their mastery of professional competencies can help design the content for continuing nursing education. Accordingly, researchers suggest that nursing should expedite its transformation into a digitally capable

profession by investing in the fields of education, research, and IT training [31]. The American Association of Nursing Colleges has recently considered core competencies required for nursing education in informatics, social media, and emerging technologies as critical for decision-making and quality of professional practices [24].

The limitation of this study was the self-reporting nature of the tools used. As a rule, all nurses tend to be considered qualified in the field of care, with this reducing the variety of responses in the Likert spectrum and shifting responses between "usually" and "always". Thus, quantitative review of competencies may not always indicate qualitative diversity in individual performance. Despite the mentioned limitation, this study had a strength in terms of giving sufficient insight into the subjects of the study. In addition, this study was able to highlight the need for moving towards the introduction of health information technology in the context of health services in the research environment to improve nurses' competencies so as to keep pace with today's modern society.

Conclusion

The results of this study showed that the nurses' professional competency was independent of their age, level of education, and employment status; however, female nurses' professional competency was higher than that of male ones. Except for the ethics subscale, there was a significant positive relationship between professional competency sub-skills and nurses' informatics competency. In addition, the results of this study showed that professional competency had a moderate relationship with informatics competency, but after adjustment in terms of gender and level of education, the relationship was not significant. Weaknesses in organizational structures and processes for integrating health information technology into healthcare systems can be another reason for nurses' low informatics capabilities in this field of study. Accurate knowledge of the causes and paths of informatics impact on nurses' performance in the context of the Iranian health system is suggested as a future research subject.

Acknowledgement

The authors appreciate the Deputy for Research and Technology at Rafsanjan University of Medical Sciences for his financial support as well all nurses having assisted us with this study.

Conflict of interest: None declared.

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