

Assessing nurses' informatics competency and identifying its related factors

Hero Khezri

Health Information Technology, Student Research Committee, Faculty of Management and Information, Tabriz University of Medical Sciences, Iran

Mohammadhiwa Abdekhoda

Assistant Professor of Health Information Management, Department of Medical Library and Information Science, School of Health Management and Medical Informatics, Tabriz University of Medical Sciences, Iran; Iranian Center of Excellence in Health Management (IceHM), Tabriz University of Medical Sciences, Tabriz, Iran

Abstract

Background: Due to the increasing use of informatics as an infrastructure in developing the quality of care and patient safety, informatics competency has become a crucial requirement for nurses.

Aim: This study was conducted to assess nursing informatics competency, and identify related factors in registered nurses.

Method: This research is an analytical descriptive study in which the research community included 205 nurses working at Tabriz University of Medical Sciences' hospitals. The researcher-made questionnaire was developed as a data collection tool ($\alpha = 98\%$). The data was entered into SPSS₁₆ software and correlation analysis and regression were carried out.

Results: The mean score percentage of total nursing informatics competency was 59.92%. The highest mean score was related to informatics skills (62.98), followed by the informatics knowledge subscale (59%). In addition, informatics competency was positively correlated with self-efficacy ($r = 0.27$, $p = 0.001$), evidence-based practice ($r = 0.55$, $p = 0.001$) and time spent on hospital information systems ($r = 0.16$, $p = 0.01$).

Conclusion: Computer skills, self-efficacy, evidence-based practice and time spent on hospital information systems are determinant factors of nurses' informatics competency. Developing nurses' basic computer skills and incorporating informatics education programmes into the curriculum can enhance nurses' informatics competency.

Corresponding author:

Mohammadhiwa Abdekhoda, School of Health Management and Medical Informatics, Tabriz University of Medical Sciences, University Avenue, 0098 Tabriz, Iran.

Email: Abdekhodam@tbzmed.ac.ir

Keywords

computer skills, informatics competency, informatics skills, nurses' informatics, nursing education

Introduction

In the modern healthcare environment, nurses are exposed to a variety of complex clinical technologies, necessitating possession of advanced skills and knowledge in informatics (Kleib and Nagle, 2018). As informatics is gaining interest as the basis for enhancing patient safety and quality of care, informatics competency has become crucial in fulfilling the professional role of nurses (Gassert, 2008; Hwang and Park, 2011). Nursing informatics (NI) competency is defined as an acceptable level of knowledge, skill and ability to complete specific informatics tasks (Hunter et al., 2013), and is recognised as an important capability of nurses (Chang et al., 2011). As nurses embody the main part of the healthcare workforce, their informatics competency is regarded as a determining factor in successful implementation of clinical information systems (Hwang and Park, 2011). Three components of informatics competencies (computer skills, informatics knowledge and informatics skills) are interdependent and of equal importance (Darvish et al., 2014; Staggers et al., 2002). It has been observed that nurses' proficiency in other informatics competencies, such as telehealth and auditing, were below average (Hwang and Park, 2011).

Nurses perceived that they did not have efficient informatics competency and basic computer skills, as reported in a number of research studies (Hwang and Park, 2011). Campbell and McDowell (2011) noted that nurses in a community hospital under study had little or no knowledge of nearly half of the survey items on the NI competency list. As reported by Wilbright et al. (2006), over 28% of nurses working in a hospital considered themselves to have satisfactory or unacceptable proficiency on important computer skills. Garde et al. (2005) demonstrated numerous instances of nurses claiming that their main role in informatics was to use information technology, while approximately 30% considered themselves beginners in their role in informatics.

Head nurses should be able to evaluate the proficiency of their workforce and identify requirements for safe patient care, including the obstacles that restrict their employees' use of Health Information Technology (HIT) (Ball et al., 2011). Hunter et al. (2013) identified one of the gaps in NI competency development as the measurement of competencies. However, there is a dearth of literature on identifying the issues that affect nurses' informatics competency. It is important to examine competency in informatics and factors associated with informatics competency, because 'informatics competency has become an essential requirement for nurses to fulfill their professional roles' (Hwang and Park, 2011). Specifying the factors that correspond with nurses' informatics competency will pave the way for supporting nurses in enhancing the efficient use of information technology in clinical practice. Hence, this study aims to assess nurses' informatics competency and identify its related factors in the context of registered nurses.

Method

Study design and participants

This research is an analytical descriptive study. The research community included nurses working at Tabriz University of Medical Sciences hospitals, 205 of which were selected as the sample based on Morgan's table.

Sample

The research population included nurses working at Tabriz University of Medical Sciences hospitals, 205 of which were selected as the sample based on Krejcie and Morgan's table, which demonstrates sample size in line with a certain degree of community size and reliability (Krejcie and Morgan, 1970). The non-probabilistic sampling technique with a combination of convenient sampling methods was applied to obtain responses from the study population. Inclusion criteria were being a registered nurse in Tabriz University of Medical Sciences, inclination to cooperate in the study, and familiarity with nursing informatics based on the nurse's self-declaration. Random sampling was used as the sampling method.

Instrument

The researcher-made questionnaire was developed as a data collection tool based on the literature related to information literacy and evidence-based practice, such as the doctoral dissertation by Susanne Tacaraya Fehr (2014). In order to check the validity of the questionnaire, a validation form was provided, in which three aspects of relevance, clarity and simplicity were considered for each item. The validation forms were distributed among 10 specialists in the realm of nursing, health information management and medical informatics. The content validity index (CVI) and content reliability ratio (CVR) were considered for each item, and items that received a low score were eliminated. In order to determine reliability, the questionnaire was distributed among 30 nurses and then the internal correlation among the questionnaire items was measured and Cronbach's alpha was obtained (0.98). Finally, the questionnaire was developed with 7 variables and 65 items, including the variables of demographic information with 7 items, job satisfaction with 6 items, self-efficacy with 4 items, evidence-based practice with 11 items and informatics competency with 37 items (comprising computer literacy with 19 items, informatics skills with 10 items, and informatics knowledge with 8 items). Data were collected by distributing questionnaires in nursing stations of Tabriz University of Medical Sciences' hospitals. Survey questions used to measure the nurses' informatics competency are presented in Table 1.

Data analysis

Statistical analysis was done using the SPSS 16 statistical software package. Cleaning of data was carried out to be sure that there were no missing or abnormal data by running frequencies and descriptive statistics. Data were presented using descriptive statistics as

Table 1. Survey questions used to measure nurses' informatics competency.

Variables	Item number	Items
Self-efficacy	1	I will be able to accomplish most of the objectives I have determined for myself
	2	When faced with challenging tasks, I have the confidence to manage them
	3	I think that I can obtain pre-determined results
	4	I believe that I can succeed in the majority of my pre-determined programmes
Evidence-based practice	5	I can formulate a question clearly based on Pico protocol for EBP searches
	6	I can track down evidence-based practice based on formulated questions
	7	I can critically appraise and evaluate results obtained from a systematic review
	8	I can integrate the evidence-based results with my previous experience
	9	I can evaluate the outcomes of my practice
	10	I can share evidence-based information with my colleagues
	11	I believe new evidence is so important in my practice that I should make time for it in my schedule
	12	I welcome questions and challenges in my practice and prefer to come up with evidence-based solutions
	13	I believe evidence-based practice is fundamental to my professional practice
	14	My professional performance can be enhanced through evidence-based practice
Job satisfaction	15	I believe evidence-based practice is very important to me and thus work hard at achieving it
	16	I am satisfied with my work conditions
	17	It is easy for me to meet with the hospital management
	18	My profession provides me with social credibility
	19	I am satisfied with the hospital matron in responding to my needs
	20	In the section I work for, employee competency is considered
	21	I am satisfied with my income
Informatics skills	22	I can use the internet using different methods (phone line, mobile, phone, cable, wireless, satellite) or communicate with other systems (access data, upload, download)
	23	I can use the internet to obtain information or carry out tasks such as e-learning or teleworking
	24	I can use different database programs (e.g. access) to develop a simple database and/or table
	25	I can use database applications to enter and retrieve information
	26	I can use presentation graphics (e.g. power point) to present my work
	27	I can use different networks to navigate the system (e.g. LAN,WLAN,WAN).
	28	I can access shared data sets (e.g. clinical log Database, Minimum Data Set)
	29	I can extract data from clinical data sets (e.g. clinical log Database, Minimum Data Set)

(continued)

Table 1. Continued.

Variables	Item number	Items
Computer skills	30	I have considerable abilities in information technology skills (ICDL skills)
	31	I have the ability in transforming my information needs to research questions based on cell phone applications
	32	I can work well with Microsoft Office (Word, Power point, Excel, Access)
Informatics knowledge	33	I have the ability to determine the utility of software applications
	34	I can participate in the selection process, design, implementation and evaluation of systems
	35	I can transfer my knowledge to others
	36	I can search for and have access to available sources of ethical and rational decision-making in the cyber domain
	37	I can assist my managers in incorporating innovations and up-to-date informatics methods into their area of specialty
	38	I understand that health information systems are expanding at a high rate
	39	I understand that the computer is only a tool to provide better nursing care and that there are human functions that cannot be performed by a computer
	40	I understand that one does not have to be a computer expert to make effective use of a computer in nursing
	41	I understand that the cooperation of healthcare professionals in designing, selecting, implementing and evaluating the system is crucial in healthcare

frequencies and percentages for categorical variables, means and standard deviations for continuous variables. Spearman correlation analysis was used for assessment of relationships among quantitative variables.

Results

As shown in Table 2, the nurses' mean age was 34.08 years (range 21–55 years). Regarding level of education, most participants had a Bachelor's degree (76.6%). Also, most participants were on evening/night duty (41%) in the internal medicine ward (19.7%) and had the position of ward nurse (57.6%). Most participants spent less than 3 hours working with the hospital information systems (HIS) (73.7%) and had work experience of 1–5 years (42%).

Table 3 shows the distribution of total NI subscale scores among studied subjects. According to the table, the mean score percentage of total NI competency was 59.92%. The highest mean score was related to informatics skills (62.98%), followed by the computer skills subscale (58.70%), while the lowest mean score was related to computer skills (58.70%).

Table 4 shows a positive correlation between informatics competency and self-efficacy ($r=0.27$, $p=0.001$), evidence-based practice ($r=0.55$, $p=0.001$) and time spent on HIS ($r=0.16$, $p=0.01$), but a negative correlation with nurses' age ($r=0.23$, $p=0.001$) and

Table 2. Description of sample characteristics.

Variable	Category	Frequency (%)	Mean (SD)
Age	20–30	79 (38.5)	34.08 (8.4)
	31–40	67 (32.7)	
	41–50	57 (22.4)	
	>50	2 (6.4)	
Job position	Pilot	43 (21)	
	Nurse	118 (57.6)	
	Head nurse	22 (10.7)	
	Supervisor	21 (10.2)	
	Matron	1 (.5)	
Education level	Diploma	1 (.5)	
	Bachelor's	157 (76.6)	
	Master's	47 (22.9)	
Shift	Morning	46 (22.4)	
	Evening	4 (2.0)	
	Night	2 (1.0)	
	Morning/evening	69 (33.7)	
	Evening/night	84 (41.0)	
Clinical experience	≤5	86 (42)	9.71
	5–10	70 (34.2)	
	11–25	87 (42.5)	
	>26	5 (2.5)	
Time spent on HIS	≤3	151 (73.7)	2
	3–6	42 (23.9)	
	>6	12 (2.4)	

SD: standard deviation.

Table 3. Distribution of total nursing informatics subscales scores among studied subjects ($n = 205$).

Variables	Total score	% of mean score	Mean	Std. Deviation	Minimum	Maximum
Informatics skills	50	62.98	31.49	7.83	10.00	50.00
Computer skills	95	58.70	55.77	15.36	19.00	95.00
Informatics knowledge	40	59	23.60	7.12	8.00	40.00
Total nursing informatics competency	185	59.92	110.86	30.31	37	185

clinical experience was reported ($r=0.18$, $p=0.01$). The data also show there is no significant relationship between the variable of education level, shift and job position with informatics competency.

Data from Table 5 indicate that self-efficacy, job satisfaction, time spent on HIS and clinical experience have a direct and significant effect on nurses' informatics competency. Conversely, age has an indirect and significant effect on nurses' informatics competency.

Table 4. Correlation between nursing informatics competency and related factors.

Variables	Nursing informatics competency	Sig. (2-tailed)
Self-efficacy	.27**	.001
Evidence-based practice	.55**	.001
Job satisfaction	.012	.862
Time spent on HIS	.167*	.017
Clinical experience	-.18**	.010
Age	-.23**	.001

*Correlation is significant at the 0.05 level (2-tailed); **correlation is significant at the 0.01 level (2-tailed).

Table 5. Regression analyses.

Variables	Unstandardized coefficients B	Standardized coefficients Beta	Sig.	R square
Self-efficacy	.024	.235	.001	5.5
Age	-.071	-.231	.001	5.3
Job satisfaction	.012	.073	.000	.5
Time spent on HIS	.009	.182	.001	3.3
Clinical experience	-.75	-.208	.003	20

Discussion

Nursing informatics competency is considered as a main factor that affects the quality of services in healthcare. As a vital component of the clinical staff, nurses have a great role in clinical practice, and the success and failure of the medical intervention is significantly dependent on their abilities and competencies. The results of this study clearly acknowledge that self-efficacy, job satisfaction, time spent on HIS and clinical experience have a direct and significant effect on nurses' informatics competency. Also, we found that age has an indirect and significant effect on nurses' informatics competency.

The findings of the present study showed that computer skills have the lowest mean score compared with informatics knowledge and informatics skills subscales. This result agreed well with that of Elsayed et al. (2017), who investigated nurses' attitudes concerning evidence-based practice. The findings of the latter study reported that the highest mean score percentage was related to the informatics literacy subscale, while the lowest mean score was related to computer literacy. These findings disagreed with Fehr (2014), who found that the mean score of computer skills was low.

The findings of the current study also revealed that there was a statistically significant correlation between the total score of the qualified nurses' informatics competency and nurses' age, clinical experience, self-efficacy, evidence-based practice and time spent on HIS. This result is in accord with Elsayed et al. (2017), who revealed that age and years of experience are significant factors in NI competency.

There was no significant relationship between the variable of education level, shift and job position with informatics competency. This result also coincides with Elsayed et al. (2017), who found no statistically significant relationship between total NI competency score and the educational level of the study participants. However, this result disagreed with Yang et al. (2014), who studied the manager nurses' perspectives on informatics competencies and reported that education level had a significant impact on informatics competencies. The results are also contrary to those of Fehr (2014), who found a statistically significant difference in NI competency between the diploma nurses and MSN nurses, and those of Kleib and Nagle (2018), who found significant differences in total mean scores of competency in relation to education level, suggesting that competency scores were more likely to increase with higher education.

Conclusion

Based on the literature and the results of this study, nurses' informatics competencies have a more critical impact on patient outcomes and organisational success than the information systems themselves. It is therefore vital to support informatics as a core competency of professional practice among current and future nurses. This study clearly identified NI competency-related factors and also shed light on the necessity for informatics competency in practice, and opportunities that should be grasped by managers and educators to enrich the informatics competency of nurses. In order to achieve this aim, nurse's basic computer skills should be improved, while incorporating informatics education programmes into the curriculum. The results indicate that informatics knowledge, computer skills and self-efficacy require considerable attention in planning for high-quality educational programmes. Moreover, to train nurses for informatics practice, the components related to informatics competency such as self-efficacy and time spent on HIS. will be the first steps in initiating suitable strategies to achieve this goal.

Limitations

In this study, the setting was limited to nurses working at Tabriz University of Medical Sciences' hospitals, and the items of the questionnaire were selected based on nurses' selection, which might have a self-selection bias. These issues should be considered in future studies.

Key points for policy, practice and/or research

- Nurses' informatics competencies have a critical impact on care outcomes.
- Computer skills have direct and significant effects on nurses' informatics competency.
- Evidence-based practice skills have a significant effect on nurses' informatics competency.
- Informatics knowledge requires considerable attention in nursing education programmes.
- Nurses' computer skills should be improved, while incorporating informatics education programmes.

Acknowledgements

We would like to thank the student research committee, the nursing staff of Tabriz University of Medical Sciences educational therapy centres, and the faculty members of the School of Health Management and Information Sciences who helped the researchers with carrying out this study.

Authorship statement

Mohammadhiwa Abdekhoda and Hero Khezri were responsible for the conception, study design and data analysis. Both authors critically revised the manuscript.

Author contribution

HK was the main researcher and performed the study, collected the data and wrote the paper. MA was the corresponding author, supervisor and did a final review of the manuscript.

Declaration of conflicting interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Ethics statement

Different ethical aspects of the present research were approved by the Ethics Council of Tabriz University of Medical Sciences (IR.TBZMED.REC.1396.58746).

Funding

The author(s) disclosed receipt of the following financial support for the research, authorship, and/or publication of this article: This paper is the result of an approved research project and has been carried out with the financial support of the student research committee of Tabriz University of Medical Sciences.

References

- Ball MJ, Douglas JV, Walker PH, et al. (2011) *Nursing Informatics: Where Technology and Caring Meet*. New York: Springer Science & Business Media.
- Campbell CJ and McDowell DE (2011) Computer literacy of nurses in a community hospital: Where are we today? *The Journal of Continuing Education in Nursing* 42: 365–370.
- Chang J, Poynton MR, Gassert CA, et al. (2011) Nursing informatics competencies required of nurses in Taiwan. *International Journal of Medical Informatics* 80: 332–340.
- Darvish A, Bahramnezhad F, Keyhanian S, et al. (2014) The role of nursing informatics on promoting quality of health care and the need for appropriate education. *Global Journal of Health Science* 6: 11.
- Elsayed WA, Hussein FM and Othman WN (2017) Relation between nursing informatics competency and nurses' attitude toward evidence-based practice among qualified nurses at Mansoura Oncology Center. *International Journal of Nursing Didactics* 7(6): 26–33.
- Fehr ST (2014) *Examining the relationship between nursing informatics competency and evidence-based practice competency among acute care nurses*. PhD Thesis, George Mason University, Fairfax, VA.
- Garde S, Harrison D and Hovenga E (2005) Skill needs for nurses in their role as health informatics professionals: a survey in the context of global health informatics education. *International Journal of Medical Informatics* 74: 899–907.
- Gassert CA (2008) Technology and informatics competencies. *Nursing Clinics of North America* 43: 507–521.
- Hunter KM, McGonigle DM and Hebda TL (2013) TIGER-based measurement of nursing informatics competencies: The development and implementation of an online tool for

- self-assessment. *Journal of Nursing Education and Practice* 3: 70.
- Hwang J-i and Park H-a. (2011) Factors associated with nurses' informatics competency. *Computers, Informatics, Nursing* 29: 256–262.
- Kleib M and Nagle L (2018) Factors associated with Canadian nurses' informatics competency. *Computers, Informatics, Nursing* 36(8): 406–415.
- Krejcie RV and Morgan DW (1970) Determining sample size for research activities. *Educational and Psychological Measurement* 30: 607–610.
- Staggers N, Gassert CA and Curran C (2002) A Delphi study to determine informatics competencies for nurses at four levels of practice. *Nursing Research* 51: 383–390.
- Wilbright WA, Haun DE, Romano T, et al. (2006) Computer use in an urban university hospital: Technology ahead of literacy. *Computers, Informatics, Nursing* 24: 37–43.
- Yang L, Cui D, Zhu X, et al. (2014) Perspectives from nurse managers on informatics competencies. *The Scientific World Journal* 2014: 391714.

Hero Khezri, PhD student in health information management, Tabriz University of medical science. Hero Khezri received Bachelor in medical record from Kashan University of medical science in 2006 and received a MSc in health information technology from Tabriz University of medical sciences in 2014. Research interests include evaluating of information systems, Electronic health records, nursing informatics, and business intelligence. She has nine years' experience in the medical records department of the hospital.

Mohammadhiwa Abdekhoda received his PhD in Health information sciences form Iran University of medical sciences. Currently working as an assistance professor in Health Information Management, Department of Medical Library and Information Sciences, School of Health Management and Medical Informatics, Tabriz University of Medical Sciences, Tabriz, Iran. His research interests include: Health information systems, information systems adoption, scientometric, medical library and information sciences.