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Necessary prerequisites for evidence-based practice: results of investigating nurses' informatics competency and information literacy skills

Original article

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Abstract: This study aimed to evaluate the correlation between nursing informatics (NI) competency and information literacy skills for evidence-based practice (EBP) among intensive care nurses. This cross-sectional study was conducted on 184 nurses working in intensive care units (ICUs). The study data were collected through demographic information, Nursing Informatics Competency Assessment Tool (NICAT), and information literacy skills for EBP questionnaires. The intensive care nurses received competent and low-moderate levels for the total scores of NI competency and information literacy skills, respectively. They received a moderate score for the use of different information resources but a low score for information searching skills, different search features, and knowledge about search operators, and only 31.5% of the nurses selected the most appropriate statement. NI competency and related subscales had a significant direct bidirectional correlation with information literacy skills for EBP and its subscales ($P < 0.05$). Nurses require a high level of NI competency and information literacy for EBP to obtain up-to-date information and provide better care and decision-making. Health planners and policymakers should develop interventions to enhance NI competency and information literacy skills among nurses and motivate them to use EBP in clinical settings.

Keywords: *evidence-based practice • nursing informatics • nursing informatics competency, information literacy • critical care nursing*

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Abbreviations

EBP, Evidence-Based Practice; NI, Nursing Informatics; NICAT, Nursing Informatics Competency Assessment Tool; TIGER, Technology Information Guiding Education Reform; ICUs, Intensive Care Units; CINAHL, Cumulated Index to Nursing and Allied Health Literature; MeSH, Medical Subject Headings; SOP, Standard Operating Procedure.

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1. Introduction

Evidence-based practice (EBP) is a cornerstone of clinical practice in many healthcare disciplines[1–3] and its goal is to integrate the best available research evidence, clinical expertise, and patient expectations and choices into nursing practice, so the nurses can make the best clinical decisions.[4,5] EBP improves patient outcomes, quality of care, skills of care providers, and the cost-efficiency of care.[6–8]

Nursing informatics (NI) competency is a key component for nurses to implement EBP, which is defined as sufficient knowledge, skills, and abilities to perform specific informatics tasks[9,10] and use computers and information technology in nursing practice.[11] It can facilitate EBP delivery, manage resources, prevent errors, and support educational resources for nurses' education by collecting, storing, processing, and modifying patient data in nursing care.[11,12] Nurses with a high level of NI competency are more ready for EBP and can manage multifaceted medical data of patients, evaluate and follow up on their diseases and conditions, and finally enhance their care and safety.[13] As the healthcare system includes many technological tools, nurses need to understand informatics competency and manage patient information in a complex environment.[11,14]

Information literacy is a set of skills needed to create appropriate research questions, seek and retrieve relevant literature, appraise search results critically, and evaluate the applicability of research evidence in clinical practice, and it is an important prerequisite for EBP.[15,16] Intensive care unit (ICU) nurses need a high level of information literacy skills to make informed decisions and provide higher-quality services.[17,18]

According to various studies, some nurses are somewhat familiar with the EBP concept in the nursing curriculum, while most of them have not been involved in EBP.[1,17] The informatics competency of most nurses varies from ineffective to expert levels[13,19,20] and they still lack computer and internet search skills.[17,21–23] Critical care nurses were unwilling to use the EBP due to their low levels of information literacy.[17,24] Some studies reported that nurses had no or insufficient knowledge and skills in computer and search strategies in online scientific databases.[13,16,25–29]

To develop EBP in real conditions, we must implement and adapt the research findings in daily practices, identify potential barriers, and provide appropriate solutions for the protection of EBP in nursing practice. Despite the significance of the necessary prerequisites of the EBP, only a few studies investigated the NI competency and information literacy of ICUs' nurses, so the present research aimed to investigate the intensive care nurses' NI competency and information literacy skills in EBP, as well as the relationship between NI competency and information literacy to design future interventions and increase nurses' readiness for EBP.

2. Materials and methods

2.1. Design and settings

This cross-sectional study was conducted in 10 ICUs of 3 hospitals affiliated with Kerman University of Medical Sciences in southeastern Iran.

2.2. Study population

All nurses (N = 235) working in ICUs during the data collection were included in the study using the census method. The inclusion criteria were nurses with bachelor's degrees and at least 6 months of work experience in ICUs; 184 nurses completed the survey.

2.3. Instruments

Data collection was performed using 3 questionnaires; the demographic information questionnaire included the participants' gender, age, work experience, organizational position, type of shift, level of education, marital status, history of attendance in research, EBP, and information literacy courses (Table 1).

The Nursing Informatics Competency Assessment Tool (NICAT), designed by Rahman[30] in the US (2015), investigates the respondents' NI competency via 30 items under 3 dimensions of computer literacy (items 1–10), informatics literacy (items 11–23), and information management skills (items 24–30). This questionnaire is rated on a 5-point Likert scale: not competent (1 score), somewhat competent (2 scores), competent (3 scores), very competent (4 scores), and expert (5 scores). The total attainable scores range from 30 to 150, with 30, 31–59, 60–89, 90–119, and 120–150 scores indicating a novice, advanced beginner, competent, proficient, and expert respondents, respectively.

The validity and reliability ($\alpha = 0.846$) of NICAT have been evaluated in the previous study.[31] Iranian researchers conducted a study and used this instrument for the first time after cross-cultural adaptation and confirmed the validity and reliability ($\alpha = 0.95$) of this instrument.[20]

The third questionnaire was about information literacy skills, which was developed by Mokhtar et al. in Singapore.[32,33] This questionnaire includes 2 sections: the first is to use different information resources and collect information about patient care and clinical

Variables	n	%
Gender		
Male	32	17.4
Female	152	82.6
Age groups		
<25	49	26.5
25–35	62	33.5
36–45	50	27.0
>45	24	13.0
Marital status		
Single	63	34.3
Married	121	65.7
Work experience (years)		
<5	82	44.6
5–10	28	15.2
11–15	42	22.8
16–20	12	6.5
>21	20	10.8
Work experience in ICU (years)		
<5	114	62.0
5–10	31	16.8
11–15	24	13.0
16–20	4	2.2
>21	11	6.6
Work position		
Head nurse	7	3.8
Nurse	177	96.2
Shift work		
Fix	11	6.0
Rotation	173	94.0
The tendency to use databases		
Low	27	14.7
Moderate	85	46.2
High	72	39.1
Attendance at research courses		
Yes	32	17.4
No	152	82.6
Attendance at information literacy courses		
Yes	42	22.8
No	142	77.2
Attendance at literature search and retrieval courses		
Yes	40	21.7
No	144	78.3
Attendance at computer skills courses		
Yes	28	15.2
No	156	84.7

Note: ICUs, intensive care units.

Table 1. Demographic information of the ICU nurses.

decision-making (19 items), which consists of electronic, print, and human information sources. The items are rated on a 5-point Likert scale ranging from "never = 1" to "always = 5". The second section deals with information searching skills and the use of different search features of online databases and web search engines. The nurses were asked how frequently they used several search features, such as subject headings and search operators (10 items), and their responses were rated on a 5-point Likert scale from "never = 1" to "always = 5". Nurses' knowledge of Boolean/Connectors ("OR", "AND", "NOT", or "AND NOT") and Proximity (e.g., W/nn; PRE/nn) operators was measured via 4 items through the following options: yes (one score), no (zero scores), and not sure (zero scores). Nurses were given a hypothetical search topic (Effect of cigarettes on lung Cancer) with 5 possible search statements to select the most appropriate search statement by using Boolean operators for searching on MEDLINE. Item 4, which was about (Cigarettes OR Smoking OR Tobacco) AND ("Lung Cancer" OR "Lung Tumor" OR "Lung Neoplasm") was a more appropriate search statement. The content validity and internal consistency of each subsection of the questionnaire were assessed using Cronbach alpha coefficients (α). The Cronbach alpha of different sections of the questionnaire was between 0.681 to 0.954, indicating that data collected through this questionnaire were reliable. Farokhzadian et al.[17] conducted a study in Iran and assessed the validity and reliability (α = 0.87) of this questionnaire.

2.4. Data collection

The anonymous, self-reported questionnaires were distributed among nurses to collect the study data. The first author visited the research settings during different shifts and asked the eligible participants to complete the questionnaires. She explained to the participants the study objectives, instructed them on how to fill in the questionnaires, and eliminated any ambiguity in terms of the questionnaire items. In addition, the nurses' consents were obtained to participate in the study.

2.5. Statistical analysis

The data were analyzed in SPSS 21 (IBM Corporation, Armonk, New York, United States) followed by the application of descriptive (frequency, percentage, mean, and standard deviation [SD]) and inferential (independent samples *t*-test, ANOVA, Pearson's correlation coefficient, and multivariate linear regression) statistics. The Kolmogorov-Smirnov test showed that the data followed a normal distribution. The significance level was considered ≤0.05.

3. Results

3.1. Demographic information

In this study, we obtained a 78.30% response rate (184 out of the 235 nurses completed the survey). The majority of the participants were female (82.6%), married (65.70%), aged between 25 years and 35 years, with work experience less than 5 years (44.6%) and work experience less than 5 years in ICUs (62.00%). Most of the respondents were regular nurses (96.20%), had shift rotation, (94.00%), and had a moderate tendency to use databases (46.2%). In addition, most of the nurses had not attended research and EBP courses (82.60%), information literacy courses (77.2%), and computer skills courses (84.7%) (Table 1).

3.2. NI competency

Results showed that mean scores of the intensive care nurses' NI competency were at the "competent" level (88.69 ± 22.76) (Table 2). The results revealed that 42.9% of the nurses were competent, 37.5% of them were proficient, 12% were expert, and 7.6% were beginners. We used the ANOVA and independent sample *t*-test to compare the mean NI competency score according to demographic information. The results indicated a statistically significant difference in NI competency based

Variables	Minimum	Maximum	Mean ± SD	Mean ± SD per items
Computer literacy	11	50	30.20 ± 8.95	3.13 ± 0.89
Informatics literacy	13	65	38.36 ± 10.17	3.03 ± 0.78
Informatics management skills	7	35	20.13 ± 5.87	3. 01 ± 0.84
Total of NI competency	35	150	88.69 ± 22.76	3. 05 ± 0.83

Note: NI, nursing informatics; SD, standard deviation.

Table 2. Scores of the intensive care nurses' NI competency and its dimensions.

Information resources	Categories	Mean	SD
Print	Pamphlets/handouts (produced by healthcare companies, hospitals)	3.08	0.90
	Reference books (e.g., medical dictionaries, encyclopedias)	2.67	1.07
	Textbooks	2.43	1.06
	Newspapers	3.35	0.99
	Journal articles	2.95	0.96
	Total	2.90	0.74
Electronic	Google (websites providing information about a specific medicine, treatment, or symptom)	2.70	1.08
	Hospital resources:electronic SOP (i.e., work instructions, support documents)	2.78	1.08
	Nursing e-books	2.31	1.08
	Digital medical and nursing libraries	2.54	0.99
	Up to Date	3.34	1.05
	Online tutorials provided by professional associations, medical libraries, and overseas hospitals	2.57	1.05
	Medical databases (e.g., CINAHL)	2.50	1.07
	Blogs on EBP	2.30	1.11
	Total	2.63	0.84
Human	Ward colleagues	3.60	0.87
	Physicians	3.03	0.90
	Nurse supervisor	2.89	0.99
	Professional friends working in other hospitals and clinics	2.69	0.99
	Nursing management staff	3.09	0.99
	Nursing Research Committee/EBP Group	2.98	0.97
	Total	3.05	0.65

Note: CINAHL, Cumulated Index to Nursing and Allied Health Literature; EBP, evidence-based practice; SD, standard deviation; SOP, standard operating procedure

Table 3. Scores of use of different information resources for patient care and clinical decision-making.

on attendance at computer skills courses (t = 4.23, P = 0.04) and the tendency to use databases (F = 3, P = 0.05). NI competency had no significant difference based on other variables.

3.3. Information literacy skills in EBP

3.3.1. Use of different information resources

The total score of use of different information resources was 3.05 ± 0.65 among the intensive care nurses and it was at a moderate level according to the median score of the subscale (score = 3). The results demonstrated that nurses used human resources (3.05 ± 0.65) followed by printed information resources (2.90 ± 0.74) and electronic resources (2.63 ± 0.84) more frequently (Table 3). We used ANOVA and independent sample *t*-test to compare the mean use of different information resources scores according to demographic information. The results showed a statistically significant difference in information literacy skills based on gender (t = 6.71, P = 0.01) and attendance at literature search and retrieval courses (t = 4.11, P = 0.04). The use of different information resources had no significant difference based on other variables.

3.3.2. Information searching skills and use of different search features

The total score of skills of searching information and using different search features was 2.48 ± 1.15 among intensive care nurses, which was lower than the average based on the questionnaire's median score (score = 3). Nurses used the "quick/basic" search option (3.17 ± 1.11) more and "Proximity operators" less frequently (1.95 ± 0.99) compared with other search features. "AND" (2.42 ± 1.24) and "NOT" (2.19 ± 1.17) were the most and the least frequently used Boolean operators, but the mean scores attributed to using all Boolean operators were quite low (Table 4).

The ANOVA and independent sample *t*-test indicated no significant difference in information searching skills and use of different search features based on demographic information.

Search features	Mean score	SD
Quick/basic search	3.17	1.11
Advanced search	2.97	1.11
Index browsing (e.g., author, title, resource)	2.72	1.11
Truncations/wildcards (e.g., '', '?')*	2.50	1.05
MeSH	2.25	1.29
Search Limits (e.g., publication date)	2.30	1.27
Proximity operators (e.g., W/nn)	1.95	0.99
Boolean operators		
'AND'	2.42	1.24
'OR'	2.37	1.21
'NOT' or 'AND NOT'	2.19	1.17
Total	2.48	1.15

Note: MeSH, Medical subject headings; SD, standard deviation.

Table 4. Comparison of scores of information searching skills and use of different search features.

3.3.3. Knowledge about search operators

The total score of knowledge about search operators was 0.27 ± 0.04 among intensive care nurses, which was lower than the average according to the median score of this section (0.5). The majority of the nurses (72.8%) selected items no and not sure. These results showed that most of the nurses had no knowledge about the function of search operators and how Boolean and proximity operators would change their searches (Table 5).

The ANOVA and independent sample *t*-test suggested no significant difference in knowledge about search operators based on demographic information.

3.3.4. Developing search strategy and selecting search statements

The intensive care nurses were asked to choose the most appropriate statement from a list of 5 possible search statements. Only 31.5% of the nurses selected the most appropriate statement using some synonyms

Operators and items	N	%	Mean	SD
AND				
Yes	59	32.1	0.32	0.04
No and not sure	126	67.9		
OR				
Yes	54	29.3	0.29	0.04
No and not sure	131	70.7		
NOT				
Yes	50	27.2	0.27	0.04
No and not sure	135	72.8		
Proximity				
Yes	39	21.2	0.21	0.04
No and not sure	146	78.8		
Total				
Yes	50	27.2	0.27	0.04
No and not sure	135	72.8		

Note: SD, standard deviation.

Table 5. Scores of knowledge about search operators.

Variables	Computer literacy	Informatics literacy	Informatics management skills	Total of informatics competency
Use of different information resources				
Print	$r = 0.36$ $P = 0.001$	$r = 0.45$ $P = 0.001$	$r = 0.40$ $P = 0.001$	$r = 0.45$ $P = 0.001$
Electronic	$r = 0.57$ $P = 0.001$	$r = 0.58$ $P = 0.001$	$r = 0.59$ $P = 0.001$	$r = 0.64$ $P = 0.001$
Human	$r = 0.33$ $P = 0.001$	$r = 0.33$ $P = 0.001$	$r = 0.36$ $P = 0.001$	$r = 0.37$ $P = 0.001$
Total	$r = 0.55$ $P = 0.001$	$r = 0.59$ $P = 0.001$	$r = 0.59$ $P = 0.001$	$r = 0.63$ $P = 0.001$
Use of different search features	$r = 0.61$ $P = 0.001$	$r = 0.60$ $P = 0.001$	$r = 0.58$ $P = 0.001$	$r = 0.66$ $P = 0.001$
Knowledge about search operators	$r = 0.25$ $P = 0.002$	$r = 0.21$ $P = 0.004$	$r = 0.24$ $P = 0.001$	$r = 0.25$ $P = 0.001$

Note: EBP, evidence-based practice; NI, nursing informatics.

Table 6. Correlation between NI competency and information literacy skills in EBP.

Variables	Beta	*t*	*P*-value
Use of different information resources	0.27	3.39	0.001
Information searching skills and use of different search features	0.51	5.89	<0.001
Knowledge about search operators	–0.10	–1.63	0.104
Frequency of selection of search statements	0.51	5.89	0.001
Gender	–0.089	–1.60	0.11
Age groups	0.046	0.61	0.54
Marital status	–0.300	–0.48	0.62
Work experience (year)	–0.033	–0.35	0.72
Work experience in ICU (year)	–0.135	–1.75	0.08
Work position	–0.090	–1.42	0.15
Shift work	0.018	0.29	0.77
The tendency to use databases	–0.069	–1.01	0.31
Attendance at research courses	0.043	0.63	0.52
Attendance at information literacy courses	–0.084	–1.29	0.22
Attendance at literature search and retrieval courses	–0.031	–0.43	0.66
Attendance at computer skills courses	0.064	1.09	0.27

Note: ICU, intensive care unit; NI, nursing informatics.

Table 7. Multivariate regression model for all variables and NI competency.

of the concepts “cigarette” and “lung cancer” and putting them in parentheses.

3.4. Correlation results

According to the Pearson’**s** correlation coefficient test, NI competency and all its subscales had a significant direct bidirectional correlation with information literacy skills **in** EBP and all subscales (Table 6).

3.5. Regression analysis

The multivariate linear regression (Forward stepwise method) indicated that the use of different information resources, skills of information searching, and use of different search features, as well as the frequency of selection of search statements were the significant predictors for NI competency (Table 7).

4. Discussion

This study investigated NI competency and information literacy skills in EBP among ICUs nurses in southeastern Iran. Based on the findings, 42.9% of the nurses were competent in NI.

This finding agrees with Jouparinejad et al.,[20] who investigated NI competency level and indicated that critical care nurses in the intervention and control groups were competent in the pretest stage. Some studies supported our findings and assessed NI competency among nurses; they reported nurses’ NI competency at a competent level.[31,34] The reason for the same results can be the low percentage of participation in computer skill courses.

The present study finding disagrees with Hassona and Ali,[19] who indicated that most of the nurses were expert in NI competency, as well as with Elsayed et al.,[13] who demonstrated that 34% of the studied subjects were proficient and 32% were expert in NI competency. The reasons for disagreements with present study can be attributed to the participants. The above authors selected nurses from all wards of the hospital, who participated in computer training courses and had

extensive experience in using computers. Jouparinejad et al.[20] found that the intervention group became proficient in NI competency after using the training program in the post-test stage.[20] The findings suggest integrating computer skills into the nursing curriculum and holding more practical workshops.

The total score of nurses' use of different information resources was at an average level and nurses also tended to use human resources more than print and electronic resources. The result is similar to the findings of Agyei et al.[35] and Farokhzadian et al.[17] indicating that nurses used human and printed resources more frequently than electronic resources to seek information because human resources were easier, more accessible, and less time-consuming and they required no special skills to obtain information. However, Wahoush and Banfield[16] reported that electronic sources of information were the most resource used by novice nurses. They concluded that newly graduated nurses were more inclined to use electronic resources than experienced nurses working in clinical practice.

The findings reported that nurses' information searching skills and use of different search features were lower than the average; nurses usually used quick/basic search but rarely used Boolean operators. The results also revealed that most of the nurses had no knowledge about the function of search operators and how Boolean and proximity operators would change their searches, and most of them were unfamiliar with the search strategy and selection of search statements. Janavi et al.[24] supported the results of the current study and showed that participants rarely used advanced search but usually used proximity operators. Agyei et al.[35] indicated that the nurses were unaware of how to use online searching tools like the "advanced search options"; truncation/wildcards (e.g., "*", "?"); Boolean Operators ("OR", "AND", "NOT"). Farokhzadian et al.[17] found that nurses had no information about the search operators' purpose or function, such as Boolean and proximity operators and selection of search statements. According to Alving et al.,[36] nurses were unable to use bibliographic databases due to a lack of skills in information searching. Unfamiliarity with search skills in the present study is because only 22% and 60% of the samples participated in information literacy, literature search and retrieval courses, respectively, and they had a low-moderate tendency to use medical databases; therefore, strategies should be designed to motivate more nurses.

The investigation of these subscales shows that the information literacy of the participants is between low and moderate which is a prerequisite for EBP.[37] Janavi et al.[24] agreed with the result of the current study and showed that the subjects' levels of information literacy were not up to mark. Osman[38] mentioned that nurses' levels of information literacy skills were low and they needed these skills to use electronic databases and select high-quality clinical practice guidelines for decision-making. Janavi et al. study,[24] our study, and Osman's study on nurses working in clinical wards, and nursing, midwifery, and community health students reported similar results.[38]

The results of the current study disagree with Carter-Templeton,[39] who reported that the vast majority of participants self-reported their information literacy skills as proficient to highly proficient. The reason for the discrepancy is that participants are nursing faculty members and nursing students involving information literacy in theoretical and clinical settings.

The findings of the current study showed a bidirectional correlation between the total NI competency and information literacy skills in EBP, meaning that the higher the information literacy skills, the higher the informatics competency and vice versa. The positive correlation between the use of different information resources and NI competency shows that the use of various information sources, especially electronics, requires a high level of NI competency. A significant correlation is available between the use of different search features and NI competency, so a high level of NI competency is necessary for the effective use of search features.

The results also showed that information literacy subscales, such as the use of different information resources, information searching skills, and use of different search features, as well as the frequency of selection of search statements were predictors of NI competency.

Al-Hawamdih and Ahmad[40] explained that nurses competent in NI competency knew how to find, evaluate, and use information efficiently; therefore, competent nurses have a high level of information literacy. Özbıçakçı et al.[41] mentioned that information literacy provided the baseline for informatics competencies and an information-literate nurse could weigh the quality and significance of evidence for patient care and decision-making. Therefore, NI competency and information literacy skills are essential components for applying EBP and hence they should be enhanced.

To enhance NI competency and information literacy among nurses, the following interventions are recommended: incorporating computer and information skills into the nursing curriculum as a core course for nurse students, planning and running continuous training and practical workshops on information literacy and computer skills for nurses of clinical wards, giving access to online resources in clinical wards and subscription of medical databases, as well as conducting programs to motivate and encourage nurses to use EBP. It is also

suggested that researchers evaluate the effectiveness of these interventions through longitudinal or interventional studies.

5. Conclusions

Based on the findings, nurses were competent in informatics, but their information literacy level was between low and moderate. Nurses do not have the necessary skills to search for the information they need and are unfamiliar with many search principles. Nurses require a high level of NI competency and information literacy for EBP to acquire up-to-date information and provide better care and decision-making. The use of human and print resources is due to a weakness in information literacy skills. Our results support the need for an educational plan to train nurses in NI competency and information literacy. Therefore, health planners and policymakers should pay significant attention to NI competency and information literacy in the use of EBP to enhance clinical practice. This is the first study that examines the relationship between NI competency and information literacy. The findings facilitate employing EBP in the clinical setting to increase community health.

Limitations

The current study used a questionnaire to determine the level of informatics competency and information literacy skills in EBP, so nurses might have perceived their skills more than the actual amount. Therefore, real skills can be measured by performing practical tests. This study was conducted among nurses working in the intensive care units; other researchers are recommended to investigate nurses in other wards for the generalizability of the findings.

Availability of data and materials

The data used during the current study are available from the corresponding author upon reasonable request.

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Authors' contributions

JF and FFM contributed to conceiving and designing the research. The data were collected, analyzed, and interpreted by JF, SJ, MM, EB, AS, and FFM. JF, SJ, MM, EB, AS, and FFM contributed equally to writing and revising the manuscript and approving the final manuscript.

Ethical approval

After obtaining the necessary permissions from the Ethics Committee of Kerman University of Medical Science, (code of ethics No. IR.KMU.REC.1398.595), the present study was conducted. The participants were also explained about the confidentiality of information and voluntary participation in the study so that they could withdraw at any stage. All nurses were also required to sign informed consent forms to participate in the study.

Conflicts of interest

All contributing authors declare no conflicts of interest.

References

1. Farokhzadian J, Jouparinejad S, Fatehi F, Falahati-Marvast F. Improving nurses' readiness for evidence-based practice in critical care units: results of an information literacy training program. *BMC Nurs*. 2021;20:79.
2. Saunders H, Vehviläinen-Julkunen K. The state of readiness for evidence-based practice among nurses: an integrative review. *Int J Nurs Stud*. 2016;56:128–140.
3. Schaefer JD, Welton JM. Evidence based practice readiness: a concept analysis. *J Nurs Manage*. 2018;26:621–629.
4. English R. Evidence-based teaching tactics for frontline staff using the clinical nurse scholar model. *J Nurse Pract*. 2016;12:e1–e5.
5. Song CE, Kim WG, Lim YJ. An analysis of evidence-based practice courses in Korean nursing education systems. *Heliyon*. 2019;5:e02650.
6. Melnyk BM. An urgent call to action for nurse leaders to establish sustainable evidence-based practice cultures and implement evidence-based interventions to improve healthcare quality. *Worldviews Evid-Based Nurs*. 2016;13:3.
7. Melnyk BM, Fineout-Overholt E, Giggleman M, Choy K. A test of the ARCC© model improves implementation of evidence-based practice, healthcare culture, and patient outcomes. *Worldviews Evid-Based Nurs*. 2017;14:5–9.
8. Melnyk BM, Gallagher-Ford L, Zellefrow C, et al. The first U.S. study on nurses' evidence-based practice

competencies indicates major deficits that threaten healthcare quality, safety, and patient outcomes. *Worldviews Evid Based Nurs*. 2018;15:16–25.
9. Kleib M, Nagle L. Factors associated with Canadian nurses' informatics competency. *Comput Inform Nurs*. 2018;36:406–415.
10. Chung SY, Staggers N. Measuring nursing informatics competencies of practicing nurses in Korea: nursing informatics competencies questionnaire. *Comput Inform Nurs*. 2014;32:596–605.
11. Nes AAG, Steindal SA, Larsen MH, Heer HC, Laerum-Onsager E, Gjevjon ER. Technological literacy in nursing education: a scoping review. *J Prof Nurs*. 2021;37:320–334.
12. Abdrbo AA. Nursing informatics competencies among nursing students and their relationship to patient safety competencies: knowledge, attitude, and skills. *Comput Inform Nurs*. 2015;33:509–514.
13. Elsayed WA, Hussein FM, Othman WN. Relation between nursing informatics competency and nurses' attitude toward evidence-based practice among qualified nurses at Mansoura oncology center. *Int J Nurs Didact*. 2017;7:26–33.
14. Darvish A, Bahramnezhad F, Keyhanian S, Navidhamidi M. The role of nursing informatics on promoting quality of health care and the need for appropriate education. *Globl J Health Sci*. 2014;6:11.
15. Shamsaee M, Mangolian shahrbabaki P, Ahmadian L, Farokhzadian J, Fatehi F. Assessing the effect of virtual education on information literacy competency for evidence-based practice among the undergraduate nursing students. *BMC Med Inform Decis Mak*. 2021;21:48.
16. Wahoush O, Banfield L. Information literacy during entry to practice: Information-seeking behaviors in student nurses and recent nurse graduates. *Nurse Educ Today*. 2014;34:208–213.
17. Farokhzadian J, Khajouei R, Ahmadian L. Information seeking and retrieval skills of nurses: nurses readiness for evidence based practice in hospitals of a medical university in Iran. *Int J Med Inform*. 2015;84:570–577.
18. Smart AN, Carter-Templeton HD, Brown SC. Developing an information literacy workshop to foster evidence-based practice among nurse practitioner students. *J Dr Nurs Pract*. 2016;9:145–151.
19. Hassona FM, Ali AZ. Relationship between nursing informatics competency and innovativeness among qualified nurses. *EvidBased Nurs Res*. 2019;1:180–188.
20. Jouparinejad S, Foroughameri G, Khajouei R, Farokhzadian J. Improving the informatics competency of critical care nurses: results of an interventional study in the southeast of Iran. *BMC Med Inform Decis Making*. 2020;20:220.
21. Ashktorab T, Pashaeypoor S, Rassouli M, Alavi-Majd H. Nursing students' competencies in evidence-based practice and its related factors. *Nurs Midwifery Stud*. 2015;4:e23047.
22. Mangolian Shahrbabaki P, Farokhzadian J, Nouhi E. Evaluation of the knowledge and performance of nursing students regarding evidencebased care. *Strid Dev Med Educ*. 2016;13:235–245.
23. Pashaeypoor S, Negarandeh R, Borumandnia N. Factors affecting nurses' adoption of evidence-based practice based on Rogers' Diffusion of Innovations Model: a path analysis approach. *J Hayat.* 2016;21:103–112.
24. Janavi E, Ansari M, Pashaeypoor S. The association between information literacy and evidence-based practice in nurses of the critical care units of public hospitals, Tehran, Iran. *Shiraz E-Med J*. 2018;19:e62335.
25. Esfandani K, Aliyari S, Pishgooei AH, Ebadi A. Promoting critical care nurses' information literacy through an evidence-based practice workshop: a quasi-experimental study. *J Crit Care Nurs*. 2017;10:e12042.
26. Farokhzadian J, Ahmadian L, Khajouei R, Mangolian Shahrbabaki P. Information literacy and training needs of nursing managers for evidence-based practice. *Iran J Nurs*. 2016;29:43–56.
27. Khezri H, Abdekhoda M. Assessing nurses' informatics competency and identifying its related factors. *J Res Nurs*. 2019;24:529–538.
28. Moghadam HS, Salami M, Narimani MR, Razmkhah M. The rate of information literacy of faculty members and PhD students of faculty of nursing and midwifery based on successful evidence healthcare. *J Nurs Educ*. 2016;5:60–66.
29. Vehko T, Hyppönen H, Puttonen S, et al. Experienced time pressure and stress: electronic health records usability and information technology competence play a role. *BMC Med Inform Decis Mak*. 2019;19:160.
30. Rahman A. Development of a Nursing Informatics Competency Assessment Tool (NICAT) [doctoral dissertation]. Walden University; 2015.
31. Abd El Fattah M. Innovation behavior levels and its relation with TIGER-based nursing informatics competencies among critical care nurses. *Egypt Nurs J*. 2017;14:59.

32. Mokhtar IA, Majid S, Foo S, et al. Evidence-based practice and related information literacy skills of nurses in Singapore: an exploratory case study. *Health Informatics Journal*. 2012;18:12–25.
33. Majid S, Foo S, Luyt B, et al. Adopting evidence-based practice in clinical decision making: nurses' perceptions, knowledge, and barriers. *J Med Libr Assoc*. 2011;99:229.
34. Yang L, Cui D, Zhu X, Zhao Q, Xiao N, Shen X. Perspectives from nurse managers on informatics competencies. *Sci World J*. 2014;2014:391714.
35. Agyei DD, Kofi CY, Fiankor D, Osman H. The experience of information literacy in evidence-based practice (EBP) among professional nurses in the Ho municipality of Ghana. *Libr Philos Pract*. 2015;1236:1–21.
36. Alving BE, Christensen JB, Thrysøe L. Hospital nurses' information retrieval behaviours in relation to evidence based nursing: a literature review. *Health Info Libr J*. 2018;35:3–23.
37. Brettle A, Raynor M. Developing information literacy skills in pre-registration nurses: an experimental study of teaching methods. *Nurse Educ Today*. 2013;33:103–109.
38. Osman H. Nursing students' experience with information literacy skill. *Yangtze Med*. 2017;1: 157–168.
39. Carter-Templeton HD, Patterson RB, Mackey S. Nursing faculty and student experiences with information literacy: a pilot study. *J Nurs Educ Pract*. 2013;4:208–217.
40. Al-Hawamdih S, Ahmad MM. Examining the relationship between nursing informatics competency and the quality of information processing. *Comput Inform Nurs*. 2018;36:154–159.
41. Özbıçakçı Ş, Gezer N, Bilik Ö. Comparison of effects of training programs for final year nursing students in Turkey: differences in self-efficacy with regard to information literacy. *Nurse Educ Today*. 2015;35:e73–e77.