# RESEARCH



# From knowledge management to evidencebased practice among nurses: a structural equation modeling study



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# Abstract

**Background** Knowledge management can provide effective strategies for enhancing the evidence-based practice (EBP) of nurses. Accordingly, by establishing a knowledge management system in healthcare centers, the knowledge present in the organization can be provided to all staff. Therefore, this research aimed at examining the model predicted from the effect of knowledge management on EBP among nurses.

**Methods** This descriptive cross-sectional study was conducted with 250 nurses who were selected using a cluster random sampling method in Mashhad, Iran. Data were collected using a questionnaire, which comprised demographic information (4 items), knowledge management (23 items), and evidence-based practice (EBP) (30 items). Data analysis was performed using SPSS 25 and AMOS 24.

**Results** Knowledge management showed a direct effect on forming EBP ( $\beta$  = 0.229, *p* < 0.007, Cl 95%=0.075–0.383). In addition, knowledge management through acquiring knowledge about EBP and generating attitudes about EBP showed an indirect effect on forming EBP ( $\beta$  = 0.015, *p* < 0.001, Cl 95%=0.004-0.036).

**Conclusions** Today a massive volume of knowledge is generated in healthcare centers. Thus, the implementation of knowledge management systems in these centers would lead to the storage and organization of the knowledge of staff in healthcare centers. Given their important role in patient care, nurses can acquire positive knowledge and attitude about EBP through knowledge management and would be able to employ EBP instead of traditional practice when providing nursing care.

Keywords Knowledge management, Evidence-based practice, Nurses

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# Background

Today, the effective strategy in applying scientific and research methods is the use of high-quality scientific documents and evidence as well as the assessment of the effect of this evidence on treatment plus its outcomes for patients. Evidence-based practice (EBP) is the application of research results along with knowledge, expertise, clinical experiences, and attention to patient values in providing clinical care [1, 2]. In other words, evidencebased practice is the scientific method for organizing and applying current data to improve health care decisions [3]. Today, EBP is considered as a key factor in enhancing clinical care quality as well as favorable outcomes for patients [4]. Further, it has a significant role in resolving the gap of knowledge and practice in response to eliminating the healthcare system inequalities [5]. Nurses believe that EBP leads to the provision of the most favorable type of care for patients, which can be associated with enhanced quality of clinical care. However, they often see themselves as individuals with no time or necessary skills to participate in this process [6] and rarely apply this method for clinical care [7] which indicates the necessity of paying attention to EBP. Successful implementation of EBP is possible only when first nurses have a positive attitude about it and secondly valuable evidence exists that can have a positive influence on the patient. Thus, in the first step, the views of nurses about EBP are important, for which knowledge, attitude, and practice (KAP) theoretical model can be used. KAP theory is a health behavioral change theory, propounded by Everett M. Rogers in the 1960s. This theory considers changes in the human behavior to have three consequent stages: acquiring knowledge, developing attitude (belief), and formation of behavior (practice). Knowledge refers to factual information and people's understanding of a specific topic or issue. Attitudes include beliefs, and feelings towards a topic or issue. Attitudes are influenced by knowledge and can influence subsequent behavior or practice. Practice refers to the specific actions that people exhibit in specific conditions and instances. These behaviors are directly shaped by an individual's knowledge and attitude [8]. KAP theory has been widely applied in different fields, especially in medicine and nursing management [9]. Results of several studies show that increase of knowledge would lead to improvement of attitude; thus amelioration of attitude would result in enhanced practice of the person [10-13]. For example, White-Williams et al. [14] reported that constant training leads to development of changes in the attitude, knowledge, and usage of EBP among nurses. Also, in another research, more experienced nurses showed better attitude about EBP and fewer obstacles for research, where the nurses' attitude about EBP was better than their knowledge and practice [15]. Similar results showed a positive attitude of nurses toward EBP, while their evidence-based practice and knowledge were reported to be low [16, 17].

Meanwhile, among service organizations, healthcare centers, given their close association with the health and life of patients, should apply useful methods for providing desirable and high-quality services to resolve the patient's needs, which can be realized by applying novel knowledge management methods. Knowledge management is an activity for the emergence of hidden assets in people's minds, and this individual asset should become the organization's asset, so that all people in the organization can access it [18]. According to Bhatt's belief, knowledge management refers to the process of creating, evaluating, presenting, sharing and applying knowledge [19]. Knowledge management has a considerable effect on improving the performance of different organizations including medical and healthcare centers [20]. Knowledge management is regarded as a useful and practical strategy to tackle problems including the increasing demand for clinical care and service costs [21]. This is because knowledge is a strategic and important source in healthcare centers [22]. Studies show that nurses' mastery over knowledge management directly influences the patient safety as well as the quality and effectiveness of treatment [23, 24]. Kosklin et al. [25] found that one of the most significant and perhaps the main effects of knowledge management in healthcare is on the performance of caregivers in patient care and the continuous improvement of clinical activities. However, Al-Lenjawi et al. [26] reported factors such as shortage of time, lack of empowerment for procedural changes, lack of support of peers to apply research results in practice, and lack of access to research papers as the most important organizational factors against implementation of EBP. In case knowledge management systems are established, these obstacles can be eliminated to some extent. The knowledge management process provides effective strategies for enhancing EBP. By establishing a knowledge management system in healthcare centers, the available knowledge in the organization can be provided to all staff [27]. A knowledge management system is a computer-based information system that supports the management of organizational knowledge, including its creation, storage, transfer, and application [28]. In case the experiences and knowledge of nurses are recorded in knowledge management systems, it can become a source for establishing knowledge that is followed by enhanced EBP of nurses.

Considering the importance of knowledge in healthcare centers, knowledge management bylaw was prepared in September 2020, and announced to the medical sciences universities of Iran by the vice presidency for development of knowledge, resources and planning of the Ministry of Health. Furthermore, comprehensive knowledge management software was designed and run under provision of this ministry and began its operation. Initially, recording system for experience was run in the Ministry of Health and Medical Education. However, on 21/3/2021, its operation was halted, whereby knowledge management system (km.behdasht.gov.ir), replaced it for recording and benefiting from the experiences and knowledge in healthcare areas. Thus, it seems that considering the importance of up-to-date knowledge for clinical care, nurses should gain access to knowledge management systems which contain organized and evaluated knowledge for providing EBP. In studies conducted so far, no research has dealt with exploring the effect of knowledge management on EBP. Therefore, in this study, structural equation modeling was employed for examining the model predicted from the effect of knowledge management on EBP among nurses (Fig. 1), whereby the following main hypothesis and sub hypotheses were conceived:

**Main hypothesis.** Knowledge management directly and indirectly, through knowledge and attitude about EBP, affects the formation of EBP.

**Hypothesis 1** Knowledge management significantly affects knowledge about EBP.

**Hypothesis 2** Knowledge management significantly affects the formation of EBP.

**Hypothesis 3** Knowledge management significantly effects on attitude about EBP through knowledge about EBP.

**Hypothesis 4** Knowledge about EBP significantly affects attitude about EBP.

**Hypothesis 5** Attitude about EBP significantly affects the formation of EBP.

**Hypothesis 6** Knowledge about EBP significantly affects the formation of EBP through attitude about EBP.

**Hypothesis** 7 Knowledge management through knowledge about EBP and attitude about EBP significantly affects forming EBP.

# Methods

# Study design and setting

Researchers conducted a cross-sectional study at two hospitals affiliated with Mashhad University of Medical Sciences (MUMS), Mashhad, Iran from May to August 2023.

# Participants

The statistical population of this research included all nurses employed at hospitals affiliated with MUMS (5000 nurses). The criteria for entering this study were having a nursing degree and working in one of the mentioned hospitals.

# Sampling and sample size

The sample size was estimated based on 10 people for each parameter [29]. Based on the formula  $v^*(v+1)/2$ [30], the number of model parameters was 21. Accordingly, the minimum sample size was estimated at 210, which was increased to 300 people by taking into account the possibility of lack of response by some sample members, and increasing the validity. The sampling was done through the cluster random sampling method, whereby out of all hospitals affiliated with MUMS, two hospitals were randomly chosen. Next, four wards were chosen



Fig. 1 Conceptual path model. Note. EBP, evidence-based practice

from each hospital randomly (general and critical care units).

# Data collection tools and procedure

In this research, for data collection, a questionnaire was employed. It comprised three parts: demographic information items, knowledge management items, and evidence-based practice (EBP) items. Knowledge management items included knowledge acquisition and identification (8 items), knowledge sharing (7 items), and knowledge application (8 items) adapted from Ugwu [31], and Jette et al. [32] questionnaire.

Evidence-based practice items consisted of knowledge about EBP, attitudes about EBP, and formation of EBP. The items of knowledge about EBP (10 items) as well as the items of the formation of EBP (10 items) were adapted from the Degu questionnaire [4], while the items on attitudes about EBP (10 items) were adapted from the Degu [4] and Jette et al. [32] questionnaires. The all items were modified by the research team to some extent. The questionnaire items were designed in the form of a five-point Likert scale ranging from very much to very low, with higher scores indicating higher levels of that variable.

The questionnaire was prepared in print. One of the researchers distributed the questionnaire among the 300 nurses of mentioned hospitals in different shift works and days. Ultimately, after extensive follow-ups during three months, 250 completed questionnaires were received and analyzed.

# Validity and reliability

The research questionnaire was provided to five faculty members specialized in Knowledge and Information Science along with the five faculty members of Nursing in order to measure content and face validity. They were asked to evaluate the quality of the questionnaire items. After applying the opinions of experts in the initial questionnaire, it was modified and provided to the respondents.

For measuring the reliability of the questionnaire, in the pretest, the questionnaire was distributed across a group of 30 of nurses employed in healthcare centers affiliated with MUMS who did not belong to the sample. Using Cronbach alpha coefficient, the reliability coefficient of the total questionnaire was calculated 0.82. Moreover, the reliability of the knowledge management, knowledge about EBP, attitude about EBP, and formation of EBP questionnaire was obtained as 0.89, 0.80, 0.79, and 0.81, respectively.

# **Ethical considerations**

This research has been approved by Research Ethics Committees of Ferdowsi University of Mashhad with approval number IR.UM.REC.1401.212. All participants were fully informed about the research, including its purposes, methods, potential risks and benefits, and their right to withdraw at any time. Informed consent to participate was obtained from all of the participants and they voluntarily agreed to participate. The collected data were only used for the research purposes and were kept confidential.

# Data analysis

Statistical analysis was done using SPSS 25 and AMOS 24. Changes in the formation of EBP based on demographic characteristics were analyzed using a dependent t-test, as well as a one-way ANOVA followed by a Scheffe post hoc test.

The normality of the variables was examined based on the skewness and kurtosis. Multicollinearity was analyzed using tolerance, variance inflation factor (VIF), and Pearson correlation coefficient.

Normed  $\chi$ 2 absolute fitness, Tucker Lewis (TLI), goodness-of-fit index (GFI), normed fit index (NFI), comparative fit index (CFI), and root mean square error of approximation (RMSEA) were used to evaluate the validity and fitness of the hypothetical path model.

The normed  $\chi^2$  was set to 3 or lower, while TLI, GFI, NFI, and CFI were all 0.9 or higher. Meanwhile, RMSEA was 0.08 or lower [30]. To confirm the statistical significance of the path model, standardized regression weight ( $\beta$ ), confidence intervals (CIS), and p-values were used. The study also calculated the squared multiple correlations (SMC) of the research variables, which were used to estimate the direct, indirect, and total effects of the research variables on EBP formation. The researchers used the bootstrap method, with 1000 bootstraps, to estimate the standard errors of the estimates. Two-sided p-values of 0.05 or lower were considered statistically significant.

# Results

Table 1 depicts the participants' demographic characteristics and formation of EBP based on these characteristics. Around 68% of the participants were female; 62.4% of them were younger than 40 years; around 32% of them had higher education degrees, and 60% of them had a working background of 15 years or less. Further, there was no significant differences in the comparison of EBP based on demographic characteristics such as gender, age, level of education, and working background (p > 0.05).

Table 2 shows that the skewness and kurtosis have been -0.11 to 0.20 and -0.63 to -0.05 respectively in knowledge management, knowledge acquisition, knowledge sharing, knowledge application, acquiring knowledge about EBP, attitude about EBP, and forming EBP,

**Table 1** EBP formation based on participants' demographiccharacteristics (N = 250)

Variables Categories		n (%)	Forming EBP M±SD	t/F (p)		
Gender	Male	81(32.4)	$3.42 \pm 0.71$	0.11(0.913)		
	Female	169(67.6)	$3.41 \pm 0.65$			
Age	20–29	72(28.8)	$3.29 \pm 0.62$	1.24(0.294)		
	30–39	84(33.6)	$3.51 \pm 0.69$			
	40–49	61(24.4)	$3.42 \pm 0.67$			
	50-59	29(11.6)	$3.51 \pm 0.71$			
	≥60	4(1.6)	$3.30 \pm 0.29$			
Education	Bachelor's degree	171(68.4)	$3.56 \pm 0.59$	0.57(0.566)		
	Master's degree and PhD	79(31.6)	$3.43 \pm 0.66$			
Work experience (in years)	1–5	73(29.2)	3.31±0.62	1.002(0.417)		
	6–10	34(13.6)	$3.35\pm0.64$			
	11-15	43(17.2)	$3.57 \pm 0.76$			
	16–20	49(19.6)	$3.43\pm0.65$			
	21-25	19(7.6)	$3.49 \pm 0.79$			
	26-30	32(12.8)	347+060			

Note: EBP, evidence-based practice; M, mean; SD, standard deviation; p-value, probability value

Table 2 Skewness and kurtosis of study variables (N = 250)

Variables	Standardized skewness	Standardized kurtosis
Knowledge management	0.20	-0.37
Knowledge acquisition	0.06	-0.54
Knowledge sharing	0.36	-0.16
Knowledge application	0.11	-0.63
Acquiring knowledge about EBP	0.01	-0.33
Generating attitudes about EBP	-0.11	-0.05
Forming EBP	-0.04	-0.25

Notes: EBP, evidence-based practice

indicating that the distribution of these variables has been normal.

Table 3 illustrates the study's inter-variable correlation coefficients. It shows that only the relationship between knowledge acquisition and EBP knowledge with EBP attitude has been insignificant (p > 0.05).

Evaluation of the conceptual model of the research showed that the fitness indices have lied within a suitable range: the  $\chi^2$  index was insignificant ( $\beta$ =9.048, df=8, p=0.338), the  $\chi^2$  to degrees of freedom ratio ( $\chi^2$ /df) was 1.131, the goodness-of-fit index (GFI) was 0.988, comparative fit index (CFI) was 0.993, incremental fit index (IFI) was 0.994, Tucker-Lewis's index (TLI) was 0.988, and RMSEA was 0.023, all indicating suitable fitness of the proposed model with the data. The model path diagram is presented in Fig. 2.

Figure 2 shows that the factor loads of the knowledge management indicators on the latent constructs have been larger than 0.50 and significant at the 0.01 level.

The regression standardized coefficients for the direct, indirect, and squared multiple correlation (SMC) effects are provided in Table 4.

Table 4 shows that knowledge management had a direct effect on knowledge about EBP ( $\beta = 0.325$ , p < 0.001, CI 95%=0.166 to 0.453), whereby the first hypothesis of the research is confirmed. Knowledge management also had a direct impact on forming EBP ( $\beta = 0.229$ , p < 0.007, CI 95%=0.075 to 0.383). Accordingly, the second hypothesis of the research is also confirmed. Knowledge management through knowledge about EBP showed an indirect effect on attitude about EBP ( $\beta = 0.083$ , p < 0.001, CI 95%=0.034 to 0.148), whereby the third hypothesis is also confirmed. Knowledge about EBP directly affected attitude about EBP ( $\beta = 0.254$ , p < 0.001, CI 95%=0.128 to 0.369), and as such the fourth hypothesis is also confirmed. Attitude about EBP directly affected the formation of EBP ( $\beta = 0.182$ , p < 0.004, CI 95%=0.060 to 0.286). Accordingly, the fifth hypothesis of the research is confirmed. Knowledge about EBP through attitude about EBP indirectly affected forming EBP ( $\beta = 0.046$ , p < 0.001, CI 95%=0.016 to 0.095), whereby the sixth hypothesis is also confirmed. Ultimately, knowledge management through knowledge about EBP and attitude about EBP indirectly influenced forming EBP ( $\beta = 0.015$ , p < 0.001, CI 95%=0.004 to 0.036), thereby confirming the seventh hypothesis of the research. Accordingly, the main hypothesis and sub hypotheses were confirmed.

The extent of inferred variance of forming EBP based on knowledge management, knowledge about EBP, and knowledge about EBP and attitude about EBP was 0.092. The effect size was  $f_2 = 0.107$ , which is considered a small effect size.

## Discussion

This research deals with investigating a model for the effect of knowledge management on the knowledge, attitude, and EBP of nurses. In the studies that had addressed knowledge management and EBP of nurses so far, no model exploring these relationships was found. The results indicated that knowledge management had a direct effect on the knowledge of nurses about EBP. In this regard, the results of Yun's study [33] also showed that in case nurses record and exchange knowledge with each other through knowledge management, their knowledge would be enhanced, which in turn is followed by increased quality of healthcare services. If nurses benefit from knowledge management systems, they can gain access to the useful data and information they require. Knowledge management by allotting proper and implicit knowledge of nurses as well as other healthcare

Variables	<i>r (p-</i> value) 95% Cl							VIF
	1	2	3	4	5	6		
1. Knowledge management	1						-	-
2. Knowledge acquisition	0.781(< 0.001) 0.728 to 0.825	1					0.716	1.396
3. Knowledge sharing	0.785(< 0.001) 0.732 to 0.828	0.410(< 0.001) 0.301 to 0.508	1				0.776	1.288
4. Knowledge application	0.758(< 0.001) 0.700 to 806	0.420(< 0.001) 0.312 to 0.517	0.373(< 0.001) 0.261 to 0.475	1			0.764	1.310
5. Acquiring knowledge about EBP	0.259(< 0.001) 0.139 to 0.371	0.269(< 0.001) 0.150 to 0.381	0.155(< 0.014) 0.32 to 0.274	0.181(< 0.004) 0.059 to 0.299	1		0.870	1.150
6. Generating attitudes about EBP	0.157(< 0.014) 0.034 to 0.276	0.068(< 0.286) - 0.057 to 0.190	0.139(< 0.028) 0.016 to 0.259	0.157(< 0.013) 0.034 to 0.276	0.254(< 0.001) 0.134 to 0.367	1	0.913	1.095
7. Forming EBP	0.225(< 0.001) 0.104 to 0.340	0.154(< 0.015) 0.031 to 0.273	0.208(< 0.001) 0.086 to 0.323	0.159(< 0.012) 0.035 to 0.277	0.093(< 0.145) - 0.032 to 0.214	0.214(<0.001) 0.093 to 0.330	-	-

**Table 3** The study's inter-variables correlation coefficients (N = 250)

Notes: KM, knowledge management; CI, confidence intervals; EBP, evidence-based practice; p-value, probability value; VIF, variance inflation factor



Fig. 2 Final path model. Note. EBP, evidence-based practice; e, error or residual of observed variable

specialists leads to enhanced level of knowledge among nurses. Further, knowledge management directly affected formation of EBP among nurses. In this respect, studies have shown that knowledge management affects the practice of nurses [34] as well as the patient safety plus quality and effectiveness of treatment [23]. Belay et al. [35] also reported that although knowledge management in the healthcare sector is in its early stages in Ethiopia, in case the knowledge management process gains predominance in hospitals and the staff begin knowledge sharing, use of EBP in clinical care would be enhanced among nurses. According to Lunden et al. [36] for providing EBP clinical care, a proper operational environment should exist for knowledge management in the organization. Thus, healthcare centers for enhancing the performance of nurses should try to understand knowledge and their experiences, and do their best to share knowledge among nurses [34]. Since in healthcare centers various individuals and specialists including nurses and physicians in various specialized areas are active along with radiologists, laboratory sciences specialists, etc., thus special systems are required that are able to document the knowledge of specialists in different areas and provide accessibility for others. Therefore, the advantages of establishing knowledge management systems in healthcare settings include enhanced quality of care, reduced medical errors,

Table 4 Standardized direct, indirect, and total effects and SMC of the	variables
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Endogenous	Exogenous	Direct effects		Indirect effects			Total effects			SMC	
variables	variables	β	<i>p</i> -Value	95% CI	β	<i>p</i> -Value	95% CI	β	<i>p</i> -Value	95% Cl	
Acquiring knowledge about EBP	Knowledge management	0.325	0.001	0.166 to 0.453	-	-	-	0.325	0.001	0.166 to 0.453	0.106
Generating attitudes about	Knowledge management	-	-	-	0.083	0.001	0.034 to 0.148	0.083	0.001	0.034 to 0.148	0.065
EBP	Acquiring knowledge about EBP	0.254	0.001	0.128 to 0.369	-	-	-	0.254	0.001	0.128 to 0.369	
Forming EBP	Knowledge management	0.229	0.007	0.075 to 0.383	0.015	0.001	0.004 to 0.036	0.244	0.003	0.093 to 0.392	0.092
	Acquiring knowledge about EBP	-	-	-	0.046	0.001	0.016 to 0.095	0.046	0.001	0.016 to 0.095	
	Generating attitudes about EBP	0.182	0.004	0.060 to 0.286	-	-	-	0.182	0.004	0.060 to 0.286	

Notes: CI, confidence intervals; EBP, evidence-based practice; β, standardized regression weight; p-value, probability value; SMC, squared multiple correlation

decreased healthcare costs, and enhanced cooperation among personnel. Usage of knowledge management systems in healthcare centers by applying up-to-date knowledge leads to evidence-based practice [37]. Furthermore, Knowledge management through knowledge about EBP indirectly influenced the attitude about EBP. Considering the importance of knowledge storage and organization in healthcare centers, in case knowledge is recorded in knowledge management systems, then nurses through acquiring this knowledge would have a better attitude about EBP. It can be inferred from the research findings that implementing knowledge management would enhance nurses' knowledge of EBP, which in turn positively affect their attitude towards it. Also, knowledge about EBP had a direct influence on attitude about EBP among nurses; this finding is logical based on the KAP theory. The results of this research concurred with the findings of Alqahtani et al. [38]. If nurses enjoy high level of knowledge about EBP, they would have better attitude about EBP. This positive attitude about EBP is crucial as it directly affected forming EBP. In this regard, Upton and Upton [39] have reported the nurses' attitude about EBP as one of the important factors in implementing evidence-based care, which confirms the results of the present research. Moreover, knowledge about EBP through attitude about EBP indirectly affected forming EBP. The results of Algahtani et al. [38] also showed that knowledge and attitude positively affect EBP. The results of most studies show that although most nurses have a positive attitude to EBP, their level of knowledge for implementing EBP is often low [40, 41]. The results of some studies suggest that those who received EBP training acquired higher scores of attitudes and implementation of EBP compared to non-trained individuals [42]. Thus, the knowledge gap resulting from low skills in retrieving research evidence, as well as evaluation and merging of these pieces of evidence in practice cause the low level of EBP [43]. Further, it is worth noting that knowledge management indirectly affected forming EBP through knowledge about EBP and attitude about EBP. This finding shows that KAP theory is validated for EBP of nurses.

#### Limitations

This research was done cross-sectionally, and the members of the sample were only chosen from nurses in four wards employed at two hospitals. Thus, lack of access to nurses of various wards of all hospitals has been one of the limitations. Also, the data were collected only through questionnaire. Meanwhile, Since the EBP and knowledge management were assessed with the selfadministered questionnaire, nurses' EBP and knowledge management may have been overestimated.

# Conclusions

The present study showed that knowledge management had both direct and indirect effects on EBP among nurses. Meanwhile, this study also found that if nurses begin to create, share, and apply their knowledge and experiences by adopting knowledge management, their knowledge about EBP would increase. If nurses have good knowledge about EBP, their attitude about EBP would also improve. When nurses have a good attitude about EBP, they would often be more successful in undertaking their tasks based on EBP. As such, based on the results of this research, knowledge management influences knowledge about EBP and in turn attitude about it, and ultimately promotion of EBP of nurses.

## Abbreviations

- B Standardized regression weight
- CFI Comparative fit index
- CIS Confidence intervals
- EBP Evidence-based practice
- GFI Goodness-of-fit index KAP Knowledge, attitude, and practice
- Knowledge, attitude, and plactic
- KM Knowledge management

MUMS NFI	Mashhad University of Medical Sciences Normed fit index
RMSEA	Root mean square error of approximation
SMC	Squared multiple correlations
TLI	Tucker Lewis
VIF	Variance inflation factor

#### Acknowledgements

The authors highly appreciate all nurses who generously dedicated their time to this research. In addition, the authors thank Ferdowsi University of Mashhad for its support.

# Author contributions

MT as corresponding author was involved in supervision and project administration, conceptualization, methodology, validation, visualization and writing – review & editing. NF was involved in conceptualization, investigation, methodology, visualization, data collection, writing original draft, and writing – review & editing. All authors approved the final version of the manuscript.

#### Funding

There is no financial support for this study.

#### Data availability

The data collected during the study are confidential and are not publicly available.

# Declarations

#### Ethics approval and consent to participate

Approvals for the study were obtained from the Research Ethics Committees of Ferdowsi University of Mashhad under reference number IR.UM. REC.1401.212. The study adhered to the ethical principles for research outlined in the Declaration of Helsinki. Informed consent was signed by all nurses prior to participation.

#### **Consent for publication**

Not applicable.

#### **Competing interests**

The authors declare no competing interests.

Received: 31 July 2024 / Accepted: 13 March 2025 Published online: 24 March 2025

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