Journal of Holistic Nursing and Midwifery

April 2022, Volume 32, Number 2

Original Paper

Nurses' Compliance With Standard Precautions Based on Health Belief Model in Emergency Departments

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Citation Mehravar A, Mokhtari Lakeh N, Emami Sigaroudi AH, Maroufizadeh S. Nurses' Compliance With Standard Precautions Based on Health Belief Model in Emergency Departments. J Holist Nurs Midwifery. 2022; 32(2):135-143. https://doi.org/10.32598/jhnm.32.2.2188

Running Title Nurses' Compliance with Standard Precautions

https://doi.org/10.32598/jhnm.32.2.2188

Article info:
Received: 30/01/2021
Accepted: 03/01/2022
Available Online: 01/04/2022

Keywords:
Universal Precaution, Emergency service, Nurse, Health belief model

ABSTRACT

Introduction: Nurses' compliance with standard precautions is a viable tool for decreasing health hazards in health centers.

Objective: This study aimed to identify factors affecting compliance with Standard Precautions (SPs) of infection control based on the Health Belief Model (HBM) among emergency department nurses employed in the educational-therapeutic centers affiliated with Guilan University Medical Sciences in Rasht City, Iran.

Materials and Methods: This cross-sectional study included 252 nurses working in the emergency departments of hospitals in Rasht City. The study samples were recruited using the convenience sampling method from September to October 2020. Nurses completed questionnaires, including demographics data, HBM constructs, knowledge, and compliance with standard precautions. A hierarchical multiple linear regression analysis was used to identify factors related to compliance with SPs.

Results: The Mean±SD age of the nurses was 32.77±7.05 years, and the majority of them were females (88.9%). Their Mean±SD score for compliance with SPs was 63.2±16.0 (out of 100). The multivariable analysis results showed that the knowledge (β=0.47, 95%CI; 0.30-0.64, P=0.001), perceived benefits (β=0.19, 95%CI; 0.03-0.36, P=0.022) and perceived susceptibility (β=0.25, 95%CI; 0.13-0.36, P=0.001) constructs of HBM were positively correlated with the compliance with SPs. Furthermore, the level of education was significantly related to the compliance with SPs (β=9.51, 95%CI; 0.02-18.99, P=0.049). The final model accounted for 39.8% of the variance in compliance with SPs.

Conclusion: Results indicated improvement in activity and safety level of the healthcare workers and also an increase in the overall level of compliance among nurses through education, regular training, and use of encouragement and punishment policies. It is suggested to follow the World Health Organization protocols. Also, the support management could have a better effect on perceived benefits and cues to action.

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Highlights

• Overall, nurses' compliance with Standard Precautions (SPs) was intermediate.

• The nurse's knowledge was at an intermediate level.

• The relationship between compliance with SPs and nurses' demographic characteristics was significant with regard to working experience, education, and occupational status.

• This study showed that the variables of education, knowledge, perceived benefits, and cue to action constructs were positively correlated to compliance with SPs.

Plain Language Summary

This study aimed to identify significant factors in observing Standard Precautions (SPs) for infection control among nurses of the emergency department. There was a significant relationship between compliance with SPs and working experience, education, and occupational status. Also, a positive correlation was shown between knowledge and HBM constructs with overall nurses' compliance with SPs. Results proved that the education, knowledge, perceived benefits, and cues to action constructs play a significant role in overall compliance with SPs. Considering the intermediate score of the overall compliance with SPs and nurses' knowledge, it seems necessary to develop more regular training for nurses. Also, the management should support the interests and remove the barriers to compliance with SPs to maintain a safe work environment for nurses working in emergency departments.

Introduction

Many reports indicate that health workers are at risk of getting infected with HBV, HCV, and HIV as they are exposed to blood, body fluids, and needle sticks [1-3]. Besides, due to the coronavirus outbreak, undivided attention is now paid to standard precautions protocols that encourage the use of gloves, hand washing, and masks. These protocols are thus effective in protecting health workers, and especially the nurses of Emergency Medical Service (EMS), against diseases and can decrease medical costs while reducing the spread of infection in communities and decreasing the need for the use of expensive devices such as ventilators in acute illnesses [4-6].

Since some studies have shown a high risk of needlestick injuries in nurses because of low compliance with standard precautions in countries such as Iran [3], Indonesia [7], Brazilian [8], South Korea [9], Italy [10], and Saudi Arabia [11], it is necessary to pay more attention to increase adherence level following WHO (The World Health Organization) and CDC (Centers for Disease Control and Prevention) protocols [5, 12-14]. According to Zandiyeh et al.'s study, 3.6% of infections occur in Iran's healthcare centers. The researchers reported that 3% to 5% of the Iran population are contaminated with HBV and HCV viruses [15]. Unfortunately, there are a few reports on emergency department nurses who are infected with these viruses in Guilan Province in Iran [16]. The emergency department nurses are at risk as they are exposed to needle sticks, blood, and body fluids that are sources of dangerous pathogens [17].

One of the best models to evaluate behaviors of nurses and improve them for protection against infectious agents is the Health Belief Model (HBM). This model is well known to detect the preventive behaviors from infecting with hepatitis viruses and other pathogens such as coronavirus among emergency department nurses [18, 19]. This model has six constructs (perceived susceptibility, perceived severity, perceived benefits, perceived barriers, self-efficacy, and cues to action) that evaluate the healthcare workers in terms of their perceived sensitivity and severity in times of exposure to dangers. Besides reducing perceived barrier excite on health behaviors to obtain benefits of it's with self-judgment assessment by an individual to act the good hygiene behaviors. Furthermore, it provides the best information about the weak points in compliance with the precaution standard for the senior managers of health systems [16]. Recent studies revealed best regards from feedbacks results conducted in control of precaution standards related to safety work in the nurses [10, 20]. Therefore, this study was conducted to identify factors

affecting Standard Precautions (SPs) for infection control based on the HBM among the emergency nurses of the educational-therapeutic centers affiliated to Guilan University of Medical Sciences, Rasht City, Iran.

Materials and Methods

This cross-sectional study was conducted among the emergency nurses. The nurses were recruited from the emergency departments of eight educational hospitals in Rasht City, north of Iran, with 200 active emergency beds on 252 nurses. We intended to determine the factors related to Standard Precautions (SPs) for infection control based on the Health Belief Model (HBM). The study data were collected from September to October 2020.

The sample size calculation was performed using G*Power version 3.1.9.2. This size was determined for a multiple linear regression using a power of 0.8, an alpha value of 0.05, an effect size (f=0.10) based on a similar study [1], and 15 predictor variables. Applying these parameters resulted in a sample size of 201. Anticipating 20% potential dropout, the final required sample size was set at 252. The inclusion criteria were nurses with work experience in the emergency department, willingness to participate in the study, and completing the questionnaire.

A 4-part questionnaire was used in this study. The first part included demographic information such as age, sex, marital status, education, working experience, work shift, and continuous education. The second part of the questionnaire was based on the Khodaveisi et al. study [21] and designed to assess nurses' knowledge. The third part was based on HBM and evaluated perceived susceptibility, perceived severity, perceived benefits, perceived barriers, self-efficacy, and cues to action. Finally, the last section evaluated nurses' compliance with SPs. This questionnaire consisted of 63 items (24 items in the knowledge section and HBM constructs, including 5 items on perceived susceptibility, 6 items on perceived severity, 3 items on perceived benefits, 6 items on self-efficacy, 6 items on perceived barriers, 7 items on cues to action and 16 items on compliance with SPs. The items were scored on a 5-point Likert scale from 0 to 4 (0="complete agreed", 1="agreed", 2="not sure", 3="disagree", 4="complete disagree"). The total score of the 4-part questionnaire ranges from 0 to 100. The obtained score from each section was classified as follows: scores lower than 50, low compliance with SPs; between 50 and 75, average or intermediate compliance with SPs; and higher than 75, high levels in compliance with SPs.

Study questionnaire validity was determined by 10 nursing and midwifery faculty members through assessing the Content Validity Index (CVI) and Content Validity Ratio (CVR). After examining the questionnaire items and making the necessary changes in two stages, the scores obtained for CVR and CVI were 0.99 and 0.91, respectively. To determine the internal consistency of the questionnaire, we used the Cronbach α coefficient after conducting a pilot study on 23 nurses. The α value for each section of the questionnaire was as follows: knowledge section, 0.61; perceived susceptibility, 0.66; perceived severity, 0.8; perceived benefits, 0.94; self-efficacy, 0.80; perceived barriers, 0.78; cues to action, 0.76; and compliance with SPs, 0.73.

After the approval of the study by the Ethics Committee of Guilan University of Medical Sciences, the researchers explained the study procedure to the participants. They were assured of observing anonymity before starting data gathering. The questionnaires were gathered at the end of morning and evening shifts.

In this study, continuous variables were expressed as Mean±SD and categorical variables as number (%). The Pearson correlation coefficient was used to examine the relationships among major variables. In univariate analysis, the relationship between compliance with SPs and demographic characteristics was examined using the Pearson correlation coefficient, independent t test, and 1-way ANOVA. Then, hierarchical multiple linear regressions were used to examine the relationship of 3 major factors with compliance with SPs: the demographic characteristics, knowledge, and HBM constructs. Three steps were conducted. The demographic variables were entered in the first step, while the knowledge and HBM constructs were entered in the second and third steps, respectively. Statistical analysis was performed using SPSS for Windows, version 16.0 (SPSS Inc., Chicago, IL, USA), and the level of significance was set at 0.05.

Results

The Mean±SD age of the nurses was 32.77±7.05 years, and their Mean±SD working experience was 8.15±6.77 years. The majority were female (88.9%), married (74.6%), had a bachlore in nursing degree (94.0%), and rotating shift work (80.2.%) (Table 1). Mean±SDs, and correlations for knowledge, HBM constructs, and compliance with SPs are presented in Table 2. The Mean±SD scores for knowledge and compliance with SPs were 58.5±10.5 and 63.2±16.0, respectively. The HBM constructs Mean±SD's ranged from 60.8±19.5 for the "cues to action" construct to 84.8±12.0 for the

Table 1. Demographic characteristics of the nurses (n=252)

Variables		Mean±SD/No.(%)
Age (Y)		32.77±7.05
Work experience (Y)		8.15±6.77
Sex	Male	28(11.1)
	Female	224(99.9)
Marital status	Single	64(25.4)
	Married	188(74.6)
Education	Diploma	9(3.6)
	Bachelor of Science in nursing	237(94.0)
	Master of Science in nursing	6(2.4)
Job title	Certified nursing assistant	9(3.6)
	Registered nurse	234(92.2)
	Head nurse	9(3.6)
Occupation status	Formal	60(23.8)
	Others	192(76.2)
Shift	Fix	50(29.8)
	Rotating	202(80.2)
Continuous education	No	21(8.3)
	Yes	231(91.7)

"perceived severity" construct. The compliance with SPs was positively correlated with knowledge (r=0.441, P=0.001) and HBM constructs (r ranging from 0.205 to 0.462, Ps<0.05). Knowledge was also positively correlated with the HBM constructs (r ranging from 0.162 to 0.272, Ps<0.05), except for perceived barriers (r=0.008, P=0.903). All correlations between the HBM constructs were positive, weak to strong in magnitude, and statistically significant (r ranging from 0.263 to 0.603, Ps<0.05).

As presented in Table 3, the working experience was positively correlated with compliance with SPs (r=0.150, P=0.017), whereas age was not statistically associated with compliance. There was a positive relationship between the level of education and compliance with SPs (P=0.045). Nurses with a formal type of occupation reported higher compliance with SPs scores than other nurses (P=0.016). The mean compliance with SPs in nurses who had continuous education was higher than those with no such education, although this difference was not statistically significant (P=0.058). Other variables were not significantly correlated with compliance with SPs.

Hierarchical multiple linear regression analysis was conducted to identify the variables associated with compliance with SPs (Table 4). In step 1, among demographic variables, only the level of education had a statistically significant relationship. In contrast, age, sex, marital status, working experience, occupation status, shift, and continuous education were not significantly influential. When the demographic characteristics were included in the model, the model R2 was equal to 0.068, indicating that the demographic variables explained 6.8% of the variance in compliance with SPs. Regarding step 2, the knowledge score was positively correlated with compliance with SPs (B=0.63, P=0.001). Model 2 accounted for 22.0% of the variance in compliance with SPs. In step 3, among the HBM constructs, only perceived benefits (B=0.19, P=0.022) and perceived susceptibility (B=0.25, P=0.001) were positively correlated with

Table 2. Mean±SD and correlations among major variables (n=252)

Variables	1	2	3	4	5	6	7	8
1. Knowledge	1							
2. Perceived susceptibility	0.272***	1						
3. Perceived severity	0.243***	0.582***	1					
4. Perceived benefits	0.208***	0.398***	0.414***	1				
5. Perceived barriers	0.008*	0.317***	0.256***	0.398***	1			
6. Perceived self-efficacy	0.162*	0.311***	0.386***	0.376***	0.263***	1		
7. Cues to action	0.201**	0.322***	0.323***	0.444***	0.383***	0.603***	1	
8. Compliance with SPs	0.441***	0.240***	0.306***	0.378***	0.205**	0.367***	0.462***	1
Mean±SD	58.5±10.5	84.2±12.0	84.8±11.9	82.5±11.9	68.5±15.1	69.4±18.6	60.8±19.5	63.2±16.0

SD: Standard Deviation; SPs: Standard Precautions

*P<0.05; **P=0.01; ***P=0.001

Table 3. Relationship between compliance with standard precautions and demographic characteristics of nurses using univariate analysis

Variables		Mean±SD or r_p	P
Age (y)		0.098	0.120*
Working experience (y)		0.150	0.017*
Sex	Male	60.5±15.4	0.347**
	Female	63.5±16.0	
Marital status	Single	60.7±16.5	0.160**
	Married	64.0±15.8	
Education	Diploma	54.2±17.7	0.045***
	Bachelor of Science in nursing	63.2±15.8	
	Master of Science in Nursing	75.0±15.8	
Job title	Certified nursing assistant	54.2±17.7	0.056***
	Registered nurse	63.2±15.8	
	Head nurse	72.2±13.7	
Occupation status	Formal	67.5±13.2	0.016**
	Others	61.8±16.5	
Shift	Fix	64.8±13.2	0.435**
	Rotating	62.8±16.6	
Continuous education	No	56.8±14.2	0.058**
	Yes	63.7±16.0	

rp: Pearson correlation coefficient; * The Pearson correlation coefficient; ** The Independent t test;*** One-way ANOVA.

Table 4. Results of hierarchical multiple linear regression, including factors related to compliance with standard precautions among nurses

	Variables	Model 1			Model 2			Model 3		
		B (SE)	95% CI Lower- Upper	P	B (SE)	95% CI Lower- Upper	P.	B (SE)	95% CI Lower- Upper	P
Step 1	Age	-0.10 (0.36)	-0.81- 0.62	0.793	-0.12 (0.33)	-0.78- 0.53	0.708	-0.12 (0.30)	-0.71- 0.47	0.691
	Sex (Female=0†)	0.62 (3.45)	-6.17- 7.42	0.857	1.94 (3.17)	-4.30- 8.17	0.541	-0.06 (2.85)	-5.67- 5.55	0.983
	Marital status (Single=0†)	0.35 (2.55)	-4.67- 5.37	0.891	0.16 (2.34)	-4.44- 4.76	0.945	2.02 (2.14)	-2.19- 6.23	0.346
	Working experience	0.56 (0.41)	-0.24- 1.36	0.166	0.22 (0.37)	-0.51- 0.96	0.550	0.08 (0.34)	-0.59- 0.74	0.821
	Education (Diploma=0†)	12.74 (5.75)	1.42- 24.07	0.028	6.39 (5.35)	-4.15- 16.93	0.234	9.51 (4.81)	0.02- 18.99	0.049
	Occupation status (Formal=0†)	-4.84 (3.21)	-11.16- 1.48	0.132	-3.67 (2.94)	-9.47- 2.13	0.214	-2.96 (2.64)	-8.16- 2.24	0.264
	Shift (Fix=0†)	6.87 (3.92)	-0.85- 14.58	0.081	2.79 (3.64)	-4.37- 9.95	0.444	-0.63 (3.39)	-7.31- 6.04	0.852
	Continuous education (No=0†)	5.80 (3.78)	-1.64- 13.24	0.126	6.79 (3.47)	-0.04- 13.61	0.051	3.70 (3.12)	-2.46, - 9.85	0.238
Step 2	Knowledge				0.63 (0.09)	0.45- 0.80	0.001	0.47 (0.09)	0.30- 0.64	0.001
	Perceived susceptibility							-0.12 (0.09)	-0.29- 0.06	0.192
	Perceived severity							0.11 (0.09)	-0.07- 0.29	0.226
	Perceived benefits							0.19 (0.08)	0.03- 0.36	0.022
Step 3	Perceived barriers							0.02 (0.06)	-0.11- 0.14	0.811
	Perceived self-efficacy							0.06 (0.06)	-0.06- 0.17	0.313
	Cues to action							0.25 (0.06)	0.13- 0.36	0.001
	Model characteristics									
	-	R^2=6.8%, R^2_{adj}=3.7%, F=2.22, P=0.027			R^2=22.0%, ΔR^2=15.2%, R^2_{adj}=19.1%, F=7.60, P=0.001			R^2=39.8%, ΔR^2=17.8%, R^2_{adj}=36.0%, F=10.42, P=0.001		

B: unstandardized coefficient, SE: Standard Error; CI: Confidence Interval; †Reference group.

compliance with SPs. When the HBM constructs were added to the model, there was a considerable improvement (ΔR^2=17.8%). Overall, the independent variables explained 39.8% of the variance in compliance with SPs.

Discussion

This study has identified factors affecting SPs for infection control based on HBM among emergency nurses. The result indicated that overall compliance with SPs among nurses is average. This finding was in agreement with the results of a study that showed compliance with SPs among nurses was at an intermediate level [22]. The overall compliance with SPs is essential to protect nurses against needlestick injuries, pathogens, etc. Also, considering the prevalence of coronavirus, it is necessary to pay more attention to this issue. Furthermore, many studies emphasized that nurses with low to average compliances with SPs were more at risk of needlestick injuries and contamination with infectious pathogens [3, 7]. Subsequently, our study results indicated that the rate of compliance with SPs was at an average level. So emergency departments nurses do not have sufficient protection against contamination and its risks.

Because of many factors affecting the overall compliance with SPs among nurses, this study examined the effectiveness of demographic characteristics and HBM constructs in the nurses' compliance. The results showed that working experience, education, and occupation status were significant factors in overall compliance with PS among nurses. These findings agree with

other studies that reported that working experience and education had the most effect on overall compliance with SPs [23, 24]. Furthermore, the result about occupational status in health workers with high experience was in line with previous studies [2, 25]. Study results showed that work experience has a key role in preventing work accidents and compliance with SPs. Although a significant difference was not observed between nurses with or without continuous education, education increases health belief. The emergency department nurses should provide care service without delay. As they must confront a high risk of hazard induced by pathogens, it is recommended to have health workers with high experience.

In addition, our results showed the average knowledge of nurses about compliance with SPs that were in line with Parmeggiani et al.'s results [26]. Although the results of the present study confirmed the average knowledge of emergency nurses, the results of some studies have reported the frequency of injuries caused by careless nurses [27-29]. It can be deduced that the knowledge of healthcare workers for the risks related to needlestick injuries is insufficient and requires regular training among the health workers. This continuous education improves the cues to safety in the healthcare workers, which subsequently enhances the overall level of compliance with SPs among nurses.

Additionally, health belief constructs showed a positive correlation with compliance with SPs, as was established in many studies [11, 21]. The findings of Nicastro et al. showed a positive self-sensitivity by hand washing during the outbreak of SARS-CoV-2 on nurses' attitudes on compliance with SP [24]. Alhazmi et al. emphasized the impact of perceived severity, perceived susceptibility, perceived benefit, and cues to action on self-efficiency of the EMS health workers in compliance with SPs [30]. As mentioned above, the HBM constructs positively affected preventive protocols emphasized by WHO for health workers from the beginning of the outbreak of SARS-CoV-2 diseases [4, 19, 31]. On the other hand, in terms of the status of the constructs, the perceived susceptibility, perceived severity, perceived benefits had the highest scores with the overall compliance, indicating that the emergency department nurses take their health condition seriously. However, the average scores on the construct of perceived barriers, perceived self-efficacy, cues to action, and knowledge entail further attention to continuous and applied education.

The factors affecting the overall compliance with SPs were analyzed using hierarchical regression in three steps. The first step shows the effect of demographic characteristics in compliance with SPs, which is effectively boosted by the knowledge factor in the second step. When the health belief constructs were added to previous steps, the performance score significantly increased, which is in accordance with the results of Khodaveisi et al. [21]. Also, a similar study explained the most positive influence of the cues to action, knowledge, attitude, awareness, and health belief on the preventive behaviors [9].

Based on the HBM findings, we propose "knowledge" as the main solution to increase performance among EMS nurses as a low-cost and straight forward method, as mentioned by other researchers [24, 32]. Proper knowledge could improve using the HBM by highlighting the interests and removing the barriers through the proposition of viable solutions. It increases the perceived benefits and upgrades the cues to action, so better performance can be expected. Also, from a managerial viewpoint, supports like providing personal protector devices have an optimistic influence on them to observe and comply with SPs. Besides, the use of encouragement and punishment policies follows WHO protocols. Finally, it is recommended to use experienced nurses in EMS wards to reduce workplace risks.

The current study has some limitations, such as the inability to control and observe the standard precautions objectively. Therefore, for the investigation of the emergency department nurses' performance, the questionnaires were in the form of self-reports. Consequently, the results of this study must be used cautiously. For this purpose, we suggest a follow-up study using observation to confirm compliance with SPs.

Ethical Considerations

Compliance with ethical guidelines

The Ethics Committee of Guilan University of Medical Sciences, Rasht, Iran, approved this research study (Registration Number: IR.GUMS.REC.2020.264). All nurses gave their written informed consent to participate in this study.

Funding

This research was supported by Guilan University of Medical Sciences, Rasht, Iran.

Authors' contributions

Research concept and design: Nasrin Mokhtari Lakeh and Abdolhossien Emami Sigaroudi; Data acquisition and writing the manuscript: Ahdiyeh Mehravar; Statistical analysis and interpretation: Saman Maroufizadeh and Ahdiyeh Mehravar; Study supervision: Nasrin Mokhtari Lakeh; Approval of the final article: All authors.

Conflict of interest

The authors declared no conflict of interest.

Acknowledgments

We would like to thank the Faculty Members of the School of Nursing and Midwifery and research affairs at Guilan University of Medical Sciences and all the nurses who participated in this study.

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