

Effect of Health Belief Model-Based Education on Infection Control Standard Precautions in Prehospital Emergency Staff: A Clinical Trial Study

Abstract

Background: Standard precautions are a basic strategy to prevent occupational exposure in prehospital emergency staff. The Health Belief Model (HBM)-based education can be used to promote and educate health behavior. The aim of this study was to investigate the effect of the HBM-based education on infection control standard precautions in prehospital emergency technicians. **Materials and Methods:** This clinical trial study was conducted on 84 prehospital emergency staff of Hamadan who were randomly assigned to two groups: Experimental ($n: 42$) and control ($n: 42$) using a cluster method. The data were collected by a researcher-developed questionnaire. Before education, the questionnaires were completed by both groups, and then three educational sessions were held for the experimental group within one month. Two months after the intervention, the two groups completed the questionnaire and the data were analyzed by SPSS 21 software. **Results:** Before education, there was no significant difference in the mean scores on HBM constructs and performance between the two groups ($p > 0.05$). The results of the Analysis of Covariance (ANCOVA) after educational intervention showed there was a significant difference in the mean scores of all constructs and performance between the two groups ($p < 0.05$). **Conclusions:** HBM-based educational intervention could affect the scores of the model's constructs and improve the use of standard precautions in emergency medical technicians. In-service training is recommended to be developed for the staff based on HBM.

Keywords: Emergency medical technician, health belief model, infection control, universal precautions

Introduction

As the prehospital emergency system makes the first contact with patients, emergency medical centers or prehospital emergency centers are among the most important pillars of provision of healthcare services worldwide.^[1] Prehospital emergency staff are abundantly exposed to blood, secretions, excretion, and body fluids containing various pathogenic bacteria and viruses, and are therefore at risk of exposure to blood-borne infections, as well as respiratory and breathing infections.^[2] Furthermore, they are in contact with the community and health centers and hospitals, and this communication, as a route of transmission, can lead to the spread of infectious diseases.^[3] Thus, infection control programs are critical and essential for the health of prehospital emergency staff, patients, and other community members.^[4]

The World Health Organization and the Center for the Control of Infectious Diseases have developed regulations as standard precautions,^[5] which include hand hygiene, the use of personal protective equipment, respiratory health, environmental controls (cleansing and disinfection), waste management, and prevention of needle stick and sharps injuries.^[6] Standard precautions are a safe way to prevent infections in occupational exposure.^[7] Some international studies report that the status of standard precautions is poor in health care workers, such as prehospital emergency staff.^[5,8] Thus, preventive educational programs should be developed to increase their adherence to standard precautions.^[9] It is documented that the educational programs based on health education models could be more

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effective on the behaviors related to compliance with the standard precautions and the resulting consequences.^[10]

In this regard, the Health Belief Model (HBM) is the most practical sociobehavioral and psychosocial model usually used on preventive health-related behaviors.^[11] HBM was established as a behavioral theory in the late 1950s. This model evaluates why people do not apply preventive health behaviors.^[10,12] This model explains and predicts health behaviors by focusing on attitudes and beliefs of individuals.^[13] HBM has been a positive tool, and can almost certainly be used to imply a more significant future effect on health behavior change.^[11] It consists of several constructs, including perceived susceptibility, perceived severity, perceived benefits, perceived barriers, cues to action, and health actions or behaviors.^[10] Based on this model, people respond appropriately to health and disease prevention messages when they feel they are exposed to a real danger (perceived sensitivity) and the risk is extremely serious (perceived severity), and when they feel that behavior change has many benefits (perceived benefits) and that they are able to eliminate barriers to doing health behaviors (perceived barriers), they are more likely to do the behavior. Self-efficacy refers to individuals' judgments of their own abilities to perform an action and can lead them toward adopting health-promoting behaviors and quitting negative health behaviors.^[14] Cues to action are stimuli that influence the individuals, leading them to do health behaviors,^[10] i.e., standard precautions.

In some international studies, most prehospital emergency staff have reported low infection control standard precautions,^[2,15] and their knowledge and practice of standard precautions was found to be inadequate.^[16] In Iran, prehospital emergency staff are at higher risk of occupational injuries, i.e., blood-borne infections,^[17] and most of them do not have good knowledge and practice about the principles of infection prevention.^[18] Therefore, educational approach must be considered to increase knowledge and practices of prehospital emergency staff about standard precautions. Although the HBM-based education affected knowledge, attitude, self-efficacy, and performance in studies other than infection control,^[10,13] HBM-based education has not yet been done to improve infection control in Iran's emergency staff. Moreover, various studies have been conducted on standard precautions in nursing students/staff^[19,20] and dental health care personnel.^[11] However, no study has still been conducted on infection control standard precautions using HBM in prehospital emergency staff. Therefore, the present study aimed to investigate the effect of HBM-based education on infection control standard precautions in emergency medical technicians.

Materials and Methods

This clinical trial study (IRCT2017021317449N2) was conducted on all urban and road bases of Hamadan Emergency Center with 84 medical emergency technicians

in 2018. The inclusion criteria were: providing emergency services in urban and road bases, willingness of medical emergency technicians to participate in training sessions, having a diploma or a higher degree in emergency medicine, and not attending formal infection control education sessions before the intervention. Exclusion criteria were: Not attending more than one session and transference to another emergency center. The sample size was calculated according to Khodaveisi *et al.*'s^[13] study, and considering the power of 80% and $\alpha = 0.05$, 42 medical emergency technicians were selected for each of the intervention and control groups and a total of 84 emergency technicians were recruited. There are 14 emergency bases in Hamadan city. For sampling, all 14 medical emergency bases were selected. Then, 7 bases were randomly assigned to the experimental group and the other 7 bases to the control group. Finally, 42 medical emergency technicians were selected using a convenience sampling method for each of the experimental and control group. Thus, the emergency bases were separate for the experimental and control groups.

The data collection tool was a researcher-developed questionnaire consisting of three sections: Demographic characteristics (education level, place of service, marital status, medical history, history of needle stick, hepatitis B vaccine, the frequency of exposure to blood and secretion per month, and information about antibody status), HBM constructs (perceived susceptibility, perceived severity, perceived benefit, perceived barrier, cues to action, and perceived self-efficacy), and performance. The items on the perceived sensitivity and cues to action constructs ($n: 7$) are rated on a 5-point Likert scale ranging from 0 (Never) to 4 (Always) (minimum and maximum possible scores of 0 and 28, respectively). Items on perceived sensitivity ($n: 7$) (0–28), perceived benefits ($n: 6$) (0–24) and perceived self-efficacy ($n: 10$) (0–40) were rated on a 5-point Likert scale from 0 (Absolutely disagree) to 4 (Absolutely agree). And items on perceived barriers ($n: 8$) (0–32) were rated on a 5-point Likert scale from 0 (Absolutely agree) to 4 (Absolutely disagree); for all constructs, the higher the score, the better the status. The maximum attainable score on this construct was 100. The performance construct was examined by 12 two-choice items, with Yes scored 1 and No scored 0 (range: 0–12). Performance questions were in the areas of handwashing, use of gloves, masks, and disinfectants, and how to work with needles and sharp tools. The maximum attainable score on the performance was 100. The performance of medical emergency technicians was assessed through a self-reported questionnaire. After collecting the questionnaires using references and articles,^[2,3,9,15] the validity of the questions was examined using face validity and qualitative content validity method, and a survey was conducted to elicit the viewpoints of 12 experts. The experts included 6 emergency medical instructors, 3 infection control instructors, and 3

emergency medical experts. Reliability was also measured by internal consistency (Cronbach's alpha coefficient) in a pilot study with 15 prehospital emergency staff. The alpha coefficient for perceived sensitivity, perceived severity, perceived benefits, perceived self-efficacy, perceived barriers, cues to action, and performance was 0.80, 0.77, 0.96, 0.81, 0.72, 0.71, and 0.71, respectively.

At the beginning of the study, the self-reported questionnaires were completed by an experimental and a control group. Then, intervention for the experimental group was conducted in three educational sessions of 30 minutes in each of the 7 emergency bases. Educational methods consisted of face-to-face group discussion, question and answer, educational booklet and pamphlet in groups of 5 to 7 emergency technicians, with 10-day intervals.^[21] In the first session, the general principles of standard precautions for infection control, susceptibility, seriousness, and in-depth understanding of the risk were presented. In the second session, the benefits of following standard infection control precautions and ways to remove barriers were presented. In the third session, increasing self-efficacy and safety guide protocol, social attitude, and behavior change were presented. Educational intervention was provided on the basis of the latest scientific materials. Finally, two months after the post-intervention,^[21] data were recollected from two groups for final evaluation. The data were analyzed by the SPSS software (version 16, SPSS Inc., Chicago, IL, USA) using the Kolmogorov-Smirnov test, Chi-squared test, independent *t*-test, paired *t*-test, and Analysis of Covariance (ANCOVA).

Ethical considerations

The protocol of the study was approved by the Ethics Committee of the University (IR.UMSHA.REC.1395.488). All participants participated voluntarily in the study and signed informed consent to do that.

Results

In this study, 84 prehospital emergency staff, all of whom were male, were included. Based on the results, the mean (SD) age of the participants was 32.12 (8.10) years in the experimental group and 31.17 (6.61) years in the control group. Most subjects in the two groups had a bachelor's degree [Table 1]. The chi-squared test results did not show a significant difference in the distribution of education level, place of service, and marital status between the two groups ($p > 0.05$). Medical history of participants is listed in Table 1. Based on the chi-squared test results, the two groups were not significantly different with respect to the history of needle stick, hepatitis B vaccine, the frequency of exposure to blood and secretion per month, and information about antibody status ($p > 0.05$).

According to the ANCOVA results, the postintervention mean scores on perceived sensitivity, perceived severity, perceived barriers, perceived benefits, perceived self-efficacy

and cues to action, and ultimately performance, namely, compliance with the standard precautions, in the two groups were compared [Table 2]. The results indicated that the intervention's impact was significant on the HBM constructs and performance of the medical emergency technicians in compliance with the standard precautions in the experimental group. The results of paired *t*-test showed that there was a significant difference in the mean scores of HBM constructs, including perceived sensitivity ($t_{41} = -8.23$, $p = 0.01$), perceived severity ($t_{41} = -4.44$, $p = 0.01$), perceived barriers ($t_{41} = -4.67$, $p = 0.01$), perceived benefits ($t_{41} = -4.03$, $p = 0.01$), perceived self-efficacy ($t_{41} = -3.45$, $p = 0.01$) and cues to action ($t_{41} = -3.38$, $p = 0.01$), and total performance in compliance with the standard precautions ($t_{41} = -7.46$, $p = 0.01$) before and after intervention in the experimental group, but not in the control group ($p > 0.05$).

Discussion

The purpose of the current study was to investigate the effect of HBM-based education on HBM constructs and compliance with infection control standard precautions in prehospital emergency staff in Hamadan. One of the constructs of HBM is perceived sensitivity, which means one's perception of his/her exposure to the risk of acquiring infection.^[13] According to the results of this study, HBM-based educational intervention increased the scores of perceived sensitivities. These results are consistent with those of the study by Elgzar *et al.*^[22] who reported that HBM increases nursing students' perceived sensitivity. Another construct of HBM is perceived severity that refers to an individual's perception of the severity of the risk and potential resulting consequences.^[23] Our results showed that HBM-based educational intervention increased the perceived severity scores. This finding agrees with the result of the study by Sheppard and Thomas^[24] on applying the HBM to community pharmacists and communication in the time of COVID-19.

The third construct of HBM is perceived benefits referring to the individual's perception of the positive outcomes of the behavior.^[13] Based on the results of our study, HBM-based educational intervention increased the scores of perceived benefits. This finding is consistent with the results of the study by Khodaveisi *et al.*^[25] on the effect of education on nutritional behaviors in obese women. Another construct of the HBM is perceived barriers, which refers to the individual's assessment of preventing barriers to doing a certain behavior.^[26] The results of this study showed that HBM-based educational intervention increased the perceived barriers scores. The results of the study by Zeigheimat *et al.*^[27] on the effect of the HBM-based education on nurses' behaviors in preventing hospital infections are also consistent with our study.

Another construct of HBM is perceived self-efficacy, which means one's confidence in his/her ability to do a certain behavior.^[28] According to our results, HBM-based

Table 1: Sociodemographic characteristics of the experimental and control groups

Groups	Variable	Experimental n (%)	Control n (%)	χ^2	p
Education level	Diploma	1 (2.38)	2 (4.76)	0.32	0.35
	Technician	17 (40.47)	17 (40.47)		
	Bachelor	22 (52.39)	22 (52.39)		
	Master	2 (4.76)	1 (2.38)		
Marital status	Single	16 (38.10)	14 (33.33)	2.22	0.41
	Married	26 (61.90)	28 (66.67)		
Work place	Urban	32 (76.20)	33 (78.58)	2.22	0.41
	Road	7 (16.66)	9 (21.42)		
	Airy	3 (7.14)	0 (0.00)		
History of needle stick	Yes	14 (33.30)	15 (35.70)	0.32	0.363
	No	28 (66.70)	27 (64.30)		
History of hepatitis B vaccination	Yes	35 (83.30)	37 (88.10)	2.22	0.533
	No	7 (16.70)	5 (11.90)		
Monthly Exposure to blood and discharge	0-5	14 (33.34)	22 (52.39)	2.22	0.121
	5-10	9 (21.43)	4 (9.52)		
	11-15	9 (21.43)	4 (9.52)		
	More than 16	10 (23.80)	12 (28.57)		
Awareness of antibody status	Yes	14 (33.33)	15 (35.71)	2.22	0.818
	No	28 (66.67)	27 (64.29)		

educational intervention increased perceived self-efficacy scores. A study by Ghanbary *et al.*^[29] on the effect of HBM-based education on self-efficacy of nurses regarding compliance with standard precautions showed that the education improved self-efficacy and compliance with the precautions in nurses, which is in agreement with the present study. The last HBM construct is cues to action that includes preparation strategies to deal with the disease through stimuli.^[30] This finding is consistent with the results of Khodaveisi *et al.*'s^[13] study on the effect of HBM-based education on preventive behaviors of hepatitis.

Finally, the performance of prehospital emergency staff regarding the standard infection control precautions was investigated in this study. Based on the results, the HBM-based education improved the performance of staff with regard to the standard infection control precautions. The results of our study are consistent with the study by Elgzar *et al.*^[22] who reported that HBM is effective in increasing nursing students' awareness regarding COVID-19. In general, the performance of health care staff, especially emergency medical technicians, was moderate to low with respect to compliance with the standard precautions and infection control standards, which leads to the transmission of infectious and life-threatening diseases from employees to patients, from patients to employees, and from employees

to employees, family, and community. Therefore, educational intervention improves the performance and health behaviors, as well as attention of emergency staff to their own and others' health. The reason for improving the performance of emergency staff was training based on HBM structures, such as perceived susceptibility, perceived severity, perceived benefits, perceived barriers, perceived self-efficacy, and cues to action. In fact, training based on HBM structures is a prerequisite for behavior change. One of the limitations to be considered in this study was the questionnaires completed in the form of self-report that may affect the findings. Calling for an emergency dispatch during some training sessions was another limitation of this study that may affect the quality of the training sessions.

Conclusion

According to the results, most prehospital emergency staff do not have a good performance regarding prevention behaviors, but training based on HBM strategies can have a positive effect on health behaviors associated with standard precautions or performance, and improve these behaviors. Therefore, it is recommended that health professionals seek more seriously to familiarize healthcare workers, especially prehospital emergency staff, and improve their level of knowledge and attitudes toward

Table 2: Comparison of the mean (standard deviation) scores on Health Belief Model constructs and performance in standard precautions before and after the intervention in the experimental and control groups

Constructs	Group	Mean (SD)		p*
		Before intervention	After intervention	
Perceived susceptibility	Experimental	21.25 (3.07)	25.10 (2.33)	<0.01
	Control	21.60 (3.54)	21.67 (3.34)	0.660
	p-value**	0.922*	<0.01**	
Perceived severity	Experimental	19.29 (2.99)	20.00 (2.88)	<0.01
	Control	18.98 (3.82)	19.10 (3.79)	0.133
	p-value**	0.681*	<0.01**	
Perceived benefits	Experimental	19.45 (2.64)	20.43 (2.15)	<0.01
	Control	19.88 (2.41)	19.62 (2.38)	0.173
	p-value**	0.440*	<0.01**	
Perceived barriers	Experimental	17.60 (7.46)	18.74 (4.80)	<0.01
	Control	16.24 (6.35)	16.45 (6.20)	0.248
	p-value**	0.271*	<0.01**	
Perceived self-efficacy	Experimental	27.90 (4.75)	28.90 (4.57)	<0.01
	Control	29.26 (3.76)	29.29 (3.52)	0.872
	p-value**	0.151*	<0.01**	
Cues to action	Experimental	18.45 (3.14)	19.43 (2.96)	<0.01
	Control	17.57 (3.27)	17.74 (3.20)	0.181
	p-value**	0.211*	<0.01**	
Performance in standard precautions	Experimental	53.97 (10.92)	70.23 (12.90)	<0.01
	Control	56.75 (13.30)	57.53 (12.85)	0.210
	p-value**	0.299*	<0.01**	

*p 0.05 (paired t-test)(ANCOVA). **p 0.05 (Independent t-test)(ANCOVA)

the infection control standard precautions in academic courses. They are also suggested design in-service training and improve current education programs through HBM and fulfill the need to enhance infection control units in emergency centers.

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Conflicts of interest

Nothing to declare.

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