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# Effect of education based on health belief model on observation of standard precautions by dental students in Rafsanjan in 2019

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## Abstract:

**INTRODUCTION:** It is vital importance to observe standard precautions (SPs) in dentistry to prevent the transfer and spread of blood-borne diseases in the community. The aim of the present study was to evaluate the effect of educational intervention using health belief model (HBM) on the observation of SPs by dental students in 2019.

**MATERIALS AND METHODS:** Eighty-seven dental preclinical students were included in the present quasi-experimental study. The students were randomly assigned to two groups, and data were collected using a questionnaire designed based on HBM. Educational intervention was carried out after the pretest analysis in four 60-min sessions. Data were analyzed with independent *t*-test and paired *t*-test using SPSS 16 at a significance level of  $P < 0.05$ .

**RESULTS:** After the educational intervention, the mean score of awareness ( $P = 0.001$ ), perceived susceptibility ( $P = 0.01$ ), perceived severity ( $P = 0.02$ ), perceived benefits ( $P < 0.001$ ), cues to action ( $P = 0.006$ ), self-efficacy ( $P = 0.002$ ), and behavior (0.03) in the intervention group was significantly increased.

**CONCLUSION:** Despite the effect of education on increasing the students' scores in HBM constructs and observation of SPs, the most important barriers to the adoption of precautionary behaviors were deficiencies in protective tools and aids.

## Keywords:

Dental students, educational intervention, health belief model, standard precautions

## Introduction

Blood-borne infections are still a general health concern in different countries. The most important blood-borne infections are hepatitis B and C and HIV/AIDS.<sup>[1]</sup> Based on global statistics, there were approximately 38 million people across the globe with HIV/AIDS in 2019. Of these, 36.2 million were adults and 1.8 million were children (<15 years old).<sup>[2]</sup> and hepatitis C caused 1.34 million deaths worldwide in 2015.<sup>[3]</sup> To date, 38,439 patients with AIDS have been identified in Iran, 24,840 of which

are still alive.<sup>[4]</sup> About 1,400,000 individuals have hepatitis B and 186,000 have hepatitis C.<sup>[5]</sup> Therefore, health-care professionals are directly at risk for such conditions because they are exposed to blood and contact with other body fluids, increasing the risk of occupational infections. This holds true for dental students and dental health-care professionals<sup>[6]</sup> because studies have shown that approximately 73% of dental students have at least once been injured with sharp and cutting instruments during dental procedures.<sup>[7]</sup> Based on the WHO report, 2.5% of HIV cases and 40% of hepatitis B virus (HBV) and hepatitis C virus (HCV)

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cases are transmitted through occupational contacts.<sup>[8]</sup> Approximately 14.4 and 1.4% of HBV and HCV infections have been reported in health-care workers, respectively, the highest prevalence being among dentists, nursing staff, dialysis unit staff, laboratory staff, and physicians. Dentists are more prone to different infections. Health-care centers such as dental clinics lack effective infection control practices.<sup>[9,10]</sup>

Transmission of infections in dentistry might occur during the use of dental tools and instruments through contaminated aerosols, blood, saliva, and instruments contaminated with body fluids and secretions.<sup>[11]</sup> On the other hand, contact with blood and other potentially contaminated biologic materials that are rich in pathogenic organisms, occurring as a result of occupational incidents, is a threat to the dental profession and might result in morbidity and even mortality.<sup>[12]</sup>

Infection control is one of the most important priorities in dental facilities due to continual contact with oral secretion and blood-contaminated secretions of patients. Therefore, all the dental health professionals should be aware of the mechanisms involved in the transmission of these conditions and occupational safety standards to decrease the risk of exposure to pathogenic agents of the patients.<sup>[13]</sup> It appears that dental students are at a higher risk for infection due to their low skill and experience. Therefore, it is necessary to intercept all the contact and transmission cycles with the use of different infection control techniques. Therefore, the Centers for Disease Control and Prevention has issued guidelines to decrease the load of infections through infection control techniques and observation of standard precautions (SPs). These include the use of hand hygiene, personal protective equipment, respiratory hygiene measures, environmental controls for cleaning and disinfection, waste management, and prevention of injuries resulting from sharp and cutting instruments and needles in the dental operator and in other occupations. The aim of these guidelines is to provide a safe work environment and prevent transmission of potential occupational and nosocomial infections to the dental personnel and patients.<sup>[14]</sup>

Several studies have shown low levels of awareness, attitudes, and performance in health-care professionals and dental personnel in relation to infection control and SPs.<sup>[15,16]</sup> In Hedayati *et al.*, study factors of poor SP adherence were lack of knowledge and technical difficulties, lack of facilities, heavy workload, patient expectations, interprofessional conflicts, and lack of good role models, financial issues, and unsupportive organizational culture.<sup>[17]</sup>

To increase the success of education interventions for changing behaviors, it has been suggested that

preparation and designing of interventions should be based on understating of the principles of decision-making process for implementing a specific behavior in a specific situation; in other words, only model- and framework-based educations are successful.<sup>[18]</sup> One of the theories in this context is the health belief model (HBM), which is one of the most commonly used models by health-care instructors to predict health behaviors based on personal beliefs and perceptions and to prevent and avoid diseases.<sup>[19]</sup>

This model is used due to its motivational nature and its application in preventive health behaviors. It shows the relationship between beliefs and behaviors and is based on the assumption that personal belief-based behavior consists of the individual's susceptibility to disease (vulnerability to disease), the effect of disease incidence on the individual's life, and the effect of health-related measures on decreasing the susceptibility to and severity of disease.<sup>[20]</sup> HBM shows why preventive health behaviors including behaviors that result in the transmission of HIV are implemented or not.<sup>[18,21]</sup> Therefore, due to the importance of the use of SPs to control infection in dentistry and its effect on the individual's and community's health, the present study was undertaken to determine the effect of educational intervention with the use of HBM on the observation of SPs by dental students in 2019.

## Materials and Methods

The present before-and-after quasi-experimental interventional study was designed based on HBM. The individuals consisted of all the dental students in the clinical period (4<sup>th</sup>, 5<sup>th</sup>, and 6<sup>th</sup> grades) in 2019. These students have completed their theoretical courses and are undergoing a clinical course. Both the groups have passed the infection control lesson in the second year.

The inclusion criteria consisted of all the students in the clinical period of their studies and submission of an informed consent form. The exclusion criteria consisted of unwillingness to take part in the study, failure in the basic sciences examination, guest students from other universities, and repetition of the preclinical period. A total of 13 students were excluded from the study based on exclusion criteria, and finally, 87 students (40 in the intervention group and 47 in the control group) were evaluated. The students were randomly assigned to the intervention and control groups.

The data collection tool was a researcher-made questionnaire based on HBM constructs and standard precautionary behaviors, which was prepared based on a literature review and scientific sources such

as studies by Eghbal *et al.*,<sup>[22]</sup> Peymani *et al.*,<sup>[23]</sup> and Mohseni *et al.*<sup>[18]</sup>

The validity [content validity index (CVI) and content validity ratio (CVR)] of the questionnaire was evaluated and confirmed by 12 experts in dentistry, health education, and health promotion. Also, the reliability of the questionnaire was measured by Cronbach's alpha coefficient using information obtained from 15 students. The validity and reliability results were as follows: awareness ( $\alpha = 0.75$ , CVI = 0.77, CVR = 0.87, ICC = 0.91), perceived susceptibility ( $\alpha = 0.88$ , CVI = 0.93, CVR = 0.90), perceived severity ( $\alpha = 0.83$ , CVI = 0.92, CVR = 0.69), perceived benefits ( $\alpha = 0.83$ , CVI = 0.97, CVR = 0.89), perceived barriers ( $\alpha = 0.86$ , CVI = 0.88, CVR = 0.84), self-efficacy ( $\alpha = 0.86$ , CVI = 0.98, CVR = 0.86), cues to action ( $\alpha = 0.81$ , CVI = 0.98, CVR = 0.86), and behavior ( $\alpha = 0.76$ , CVI = 0.99, CVR = 0.94) constructs.

The first section of the questionnaire evaluated the demographic data (age, gender, and educational level). The section of the questionnaire on awareness evaluated the students' awareness of blood-borne diseases and observation of SPs and consisted of 30 questions (21 three-choice questions and 9 four-choice questions). Each correct response was given a score of 1, and incorrect response and "I do not know" choice were given zero scores. The score range of this section was 0–30. A higher score indicated a higher level of observation of SP behaviors by students.

The third section of the questionnaire was designed based on HBM constructs and consisted of 9 questions on susceptibility, 8 questions on severity, 10 questions on benefits, 13 questions on perceived barriers, 9 questions on cues to action, and 6 questions on self-efficacy. Likert 5-scale construct (from strongly disagree, a score of 1, to strongly agree, a score of 5) was used for the responses. The calculations were carried out in reverse for the perceived barrier construct. In this study, 15 questions were used to evaluate standard precautionary behaviors with the use of a 4-scale Likert construct (from never, a score of zero to always, a score of 4).

After the analysis of pretests, determining educational needs, and writing lesson plans, educational intervention was implemented based on HBM constructs in four 60-min sessions (one session per week for a month) with the use of educational methods, such as: lectures, focus group discussion, questioning and answering, playing educational films, demonstration, and role playing based on educational aims in educational fields in groups of 12–15 students. In addition, a session was held with the relevant professors as a guideline for performance and external stimuli for adoption of behaviors in order to explain the aims of the study and the students'

educational needs to attract their support. Educational sessions were implemented by a health education and dentistry specialist (with 20 years of experience in the infection control unit of Tabriz School of Dentistry).

Due to the lack of another dental school and the number of clinical course samples, the control group was selected from the same faculty.

In order not to contact the control group with the intervention group, the research objectives were clearly stated before the intervention, and they were asked not to transfer the training information related to infection control to the control group during the implementation of the educational intervention.

In order to observe ethics in research, after conducting educational intervention and collecting posttest information, a training session was held with the presentation of educational media such as pamphlets and CDs for the control group. Table 1 presents the aims of educational sessions.

Posttest data were collected 1 month after the end of the educational intervention. Data were analyzed with SPSS 16 (SPSS Inc., Chicago, Illinois, United States), using independent t-test and paired t-test at the significance level of 0.05.

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## Results

The mean age of the students was  $23.51 \pm 2.53$  years (with a range of 20–35 years). Thirty-five students (40.2%) were male and 52 (59.8%) were female. The mean ages and standard deviations of the students before the educational interventions in the intervention and control groups were  $23.63 \pm 3.42$  and  $23.41 \pm 1.39$  years, respectively. Independent *t*-test showed no significant differences in age between the two groups ( $P = 0.7$ ,  $t = 0.38$ ). In addition, independent *t*-test and one-way ANOVA did not reveal any significant differences in gender and educational levels between the two groups ( $P < 0.05$ ).

Paired *t*-test showed significant increases in the mean scores and standard deviations of awareness ( $P = 0.001$ ), perceived susceptibility ( $P = 0.01$ ), perceived severity ( $P = 0.02$ ), perceived benefits ( $P < 0.001$ ), cues to action ( $P = 0.006$ ), self-efficacy ( $P = 0.002$ ), and behavior (0.03) of students in the intervention group in relation to the observation of SPs after the intervention.

However, the difference in the perceived barrier construct was not significant ( $P = 0.6$ ). However, independent  $t$ -test did not show any significant difference in the mean scores of awareness, susceptibility, severity, and perceived barriers between the two groups after the educational intervention ( $P > 0.05$ ) [Table 2].

## Discussion

Observation of infection control principles by dentists is one of the most important aims of infection control programs. In this context, it is necessary for dental

students to adopt precautionary behaviors based on standard guidelines.<sup>[24]</sup> In the present study, the mean awareness scores of students in the intervention group before the educational program were higher than the moderate level (approximately 20 out of 30). In addition, the mean awareness scores of the two groups were similar before the intervention with no significant difference. After the intervention, the mean awareness score in the intervention group increased approximately by 7 units, which was significant in this group after the intervention compared to the control group, indicating the positive effect of educational intervention. In a study

**Table 1: The educational aims and techniques in relation to the observation of standard precautions in dentistry**

Session	Aims	Educational method	Duration of the session (min)
Session 1	Promotion of dental students' awareness of the observation of SPs in dentistry	Lecture Questioning and answering	60
Session 2	Promotion of dental students' perceived susceptibility and severity in relation to the observation of SPs in dentistry	Lecture Questioning and answering Group discussion	60
Session 3	Promotion of dental students' perceived benefits and removal of perceived barriers in relation to the observation of SPs in dentistry	Short lecture Questioning and answering Group discussion	60
Session 4	Promotion of dental students' self-efficacy and behavioral skills in relation to the observation of SPs in dentistry	Questioning and answering Clarification of experiences Role playing	60

SP=Standard precaution

**Table 2: Comparison of the mean of scores of health belief constructs and behavior of dental students in relation to the observation of standard behaviors between the two groups before and after intervention**

Construct	Group	Mean±SD		P and paired t
		Before intervention	After intervention	
Awareness: 0-30	Intervention	19.75±3.63	26.26±3.07	<0.001
	Control	20.75±2.31	21.27±3.63	0.14
	P (independent t-test)	0.16	<0.001	
Perceived susceptibility: 9-45	Intervention	39.89±4.22	41.39±3.67	0.01
	Control	39.6±3.95	39.81±3.92	0.4
	P (independent t-test)	0.7	0.06	
Perceived severity: 8-40	Intervention	33.25±4.28	35.07±4.19	0.02
	Control	32.88±4.48	33.46±4.17	0.5
	P (independent t-test)	0.7	0.08	
Perceived benefits: 10-50	Intervention	39.3±4.88	42.52±5.35	<0.001
	Control	39.58±5.35	39.9±3.95	0.7
	P (independent t-test)	0.7	0.01	
Perceived barriers: 13-65	Intervention	48.1±8.8	46.71±8.23	0.6
	Control	45.29±6.52	45.29±6.24	0.8
	P (independent t-test)	0.3	0.09	
Cues to action: 9-45	Intervention	37.72±5.71	39.62±4.21	0.006
	Control	36.1±3.93	36.42±3.42	0.5
	P (independent t-test)	0.1	<0.001	
Self-efficacy: 6-30	Intervention	23.77±3.05	25.42±3.32	0.002
	Control	23.57±2.96	23.62±2.83	0.4
	P (independent t-test)	0.7	0.007	
Behavior: 15-60	Intervention	46.81±6.71	48.94±5.74	0.03
	Control	46.63±5.65	46.9±5.08	0.5
	P (independent t-test)	0.8	0.1	

SD=Standard deviation



by Amiri Siavashani *et al.* (2018), the mean awareness score of the students increased by approximately 3 units after the educational intervention, consistent with the results of the present study.<sup>[25]</sup> Similar results were achieved in other studies.<sup>[23,26]</sup> It should be pointed out that in a study by Alanazi *et al.* despite an increase in the students' awareness score in relation to infection control protocols, the lack of awareness was observed in some key points of these protocols after the study.<sup>[26]</sup>

When disease is discussed, the term and the concept involve a subjective perception of a danger that threatens health; therefore, it is possible to increase the susceptibility of dental students to the observation of SPs by highlighting the risk of blood-borne diseases.<sup>[19]</sup> Based on the results of the present study, the educational intervention resulted in an increase in the mean score of perceived susceptibility of the students in the intervention group compared to the control group. However, the difference was not significant. Kharazi and Peyman too reported that after the educational intervention, the perceived susceptibility of the students increased insignificantly compared to baseline, consistent with the results of the present study.<sup>[27]</sup> However, the results of the present study do not coincide with those of a descriptive/analytical study by Khodisiave *et al.*<sup>[14]</sup> and an interventional study by Mohseni *et al.*<sup>[18]</sup> Both these studies were carried out based on HBM. One of the reasons for the discrepancy might be the high sensitivity of students before the intervention. Another reason might be a lack of experience in dental students, resulting in a lack of a deep belief that they too are at a risk for blood-borne pathogens such as other health-care personnel. This in itself might explain why some of the students do not observe some SPs during practical courses, i.e., some of them do not believe that they are at risk for blood-borne diseases.

The perceived severity is another factor that affects the behavior modification process; based on the model used, it refers to an individual's abstract belief in relation to the severity of the injury that might result from a disease or a detrimental situation from a disease or a due to a specific behavior. Such perception is different from one individual to another.<sup>[19]</sup> The results of the present study showed that the mean score of perceived severity of the students in the intervention group was 35 out of 40 after the intervention, which was significantly higher than that before the intervention. However, the difference in score changes between the two groups was not significant after the intervention, which might be attributed to the high perceived severity of the students before the educational intervention. Sim *et al.* carried out a literature review on HBM in Singapore and reported that the perceived severity was not a significant predictor for wearing face masks, which was attributed to the belief by the students

that disease was not a significant phenomenon and could not become a worldwide epidemic.<sup>[28]</sup> However, the results of the present study are different from those of a study by Rostamzadeh *et al.* on awareness, attitudes, and performance of dentists in relation to hepatitis B, hepatitis C, HIV, and AIDS in Sanadaj<sup>[10]</sup> and an interventional study by Peymani *et al.* on the effect of educational intervention on the prevention of blood-borne diseases and awareness and attitudes of dental students.<sup>[23]</sup> One of the reasons is the high severity of students' comprehension before the program.

The mean score of perceived benefits of the students in the intervention group increased after the educational intervention, which was significantly based on the results of independent *t*-test. The results of the present study in this field are consistent with those of studies by Amiri Siavashani *et al.*<sup>[25]</sup> and Barzegar Mahmudi *et al.*<sup>[29]</sup> However, were different from the Masoudy *et al.* study in Zahedan, which showed no significant relationship between performance and perceived benefits in relation to the prevention of hepatitis B and C and AIDS.<sup>[30]</sup> One of the reasons for such discrepancy might be differences in the study population, the type of educational intervention, and the educational method to present the subject matter, which result in an increase in perceived benefits in relation to the observation of SPs.

One of the constructs of HBM is the perceived barriers, which refers to beliefs in relation to the real and perceived costs of adopting new behaviors. In other words, the individual believes that although a specific behavior decreases the sensitivity and severity of a disease for them, adoption of such a behavior is costly, difficult, unpleasant, painful, or annoying.<sup>[31]</sup> After the educational intervention, no significant differences were observed between the two groups. A study by Halboub *et al.* in Sana, Yemen, to evaluate knowledge, attitudes, and practice of dental students (2014) showed poor observation of infection control principles, including inadequate use of face masks and goggles to protect the eyes and deficiency in antiseptics, washing the hands at proper time, and location during the procedural steps. They attributed such shortcomings to the possibility of shortages in materials and inadequate facilities to implement caution behaviors.<sup>[32]</sup>

The perceived barriers in the present study might include deficiencies in some tools (such as insufficient number of handpieces, film processing units, and personal protection tools), facilities (such as alcohol-based hand rub, availability of laundry within the faculty to avoid sending the gowns out of the faculty and lack of serologic tests for hepatitis B and C and HIV, and if indicated, free vaccination for hepatitis B), pressed daily timetables for practical and theoretical lessons,

and makeup classes, resulting in fatigue and stress. All the above factors might be considered barriers to the observation of SPs.

The mean score of cues to action construct (i.e., the mechanism of presenting data, promotion of awareness, and use of a proper notification system)<sup>[19]</sup> in relation to standard precautionary behaviors increased 3 points in the intervention group after the educational intervention, which was significant compared to the control group. The results of the present study in this context are consistent with those of a study by Rahimi-Ghilchalan *et al.* (2017), in which there was a significant relationship between cues to action construct and preventive behaviors for hepatitis B.<sup>[33]</sup> However, Osta *et al.* did not report any change in cues to action construct scores in the intervention group compared to the control group in a study on the effect of HBM-based education on the observation of SPs among hospital operating room personnel in 2018.<sup>[34]</sup>

Another construct of the HBM is self-efficacy, which means implementation of recommended behaviors, determination of progressive aims, verbal reinforcement, expression of the intended behaviors, and decreasing anxieties.<sup>[19]</sup> In other words, self-efficacy is the result of making sure that an individual is able to follow a specific behavior.<sup>[31]</sup> The mean self-efficacy score of the students in the intervention group increased significantly compared to the control group, indicating an increase in the self-efficacy feeling in students after the educational intervention. In the study by Amiri Siavashani, the mean self-efficiency score of dental students in relation to infection control increased after the educational intervention compared to baseline.<sup>[25]</sup> Similar results were achieved in other studies.<sup>[18,34]</sup> However, the results of a study in Al-Farabi College in Riyadh (2014) showed that although the students had proper awareness and attitudes, they did not exhibit proper performance in relation to infection control.<sup>[35]</sup> All the discrepancies in the results can be attributed to a low level of perception for risk and danger in students in relation to the odds of contracting disease.

The mean score of standard precautionary behaviors in the intervention group increased after the intervention, but it was not significant compared to the control group. In other words, the students were aware that in the dental profession, the risk of exposure to sharp instruments is higher compared to other professions, and contact with blood and body fluids of patients might potentially put them at risk for hepatitis C. However, unfortunately, they had not realized the risk of exposure to these pathogens, which appears to be the reason for inadequate change in their behavior after the educational intervention. This

indicates the necessity of further theoretical and practical education in standard precautionary behaviors.

Some of the reasons for the insignificant differences between the two groups were: lack of sufficient facilities to implement precautionary behaviors, over-referral of patients, students' hurry to complete the patients' treatment procedures in a predetermined time interval in different wards, compressed curricula for practical and theoretical lessons, resulting in student fatigue, stress and inadequate supervision by professors and the relevant authorities.

The results of studies by Mohseni *et al.* and Osta *et al.* did not show that they were successful in promoting preventive behaviors for blood-borne infections. However, they attributed the lack of some of these behaviors to deficiencies in proper facilities, lack of continuous education in this field, and excessive practical work in a limited period of time.<sup>[18,34]</sup>

Finally, it can be pointed out that education and intervention have important roles in infection control and observation of SPs. However, in order to maintain information and sustainability in changing students' behavior, it is necessary to conduct retraining courses. Because behavior modifications can be implemented by education and repetition, through which infection can be prevented. Evaluation of the infection control status in dental schools which are successful in this respect in the country and in other countries shows the necessity of accurate supervision, implementation of infection control measures, and observation of the principles of infection control. Furthermore, considering the role of HBM structures in creating sensitivity and sustainable behavior toward the implementation of nonmodel training programs, it is recommended to use models of behavior change in design, implementation, and evaluation of interventions.

## Conclusion

The present study showed favorable results in relation to the students' performance based on HBM constructs in wearing gowns, masks, and gloves. However, in relation to the use of protective goggles, use of gowns during surgeries, infection control during radiographic techniques and cleaning of instruments and elimination of infected debris, and washing hands, the students exhibited some deficiencies. Overall, despite an increase in awareness of dental students in relation to the observation of SPs and the scores in some of the model constructs, their behavior did not change significantly. Some of the most important reasons for such a finding are students' perceived barriers such as deficiencies in

tools and instruments and some problems subsequent to their use, including perspiration and a feeling of heat.

One of the limitations of the present study was the short period of time available for the researchers to implement education due to the pressed daily educational programs of dental students' theoretical and practical lessons. It is believed that if there were adequate time, education would have been more effective and better. On the other hand, these problems cause the dental student to shift their priorities and consider the observation of SPs as their second priority. One of the strong points of this study was the designing of a questionnaire for observing SPs in dentistry based on HBM with adequate details in Farsi.

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### Conflicts of interest

There are no conflicts of interest.

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