

The Effect of Education Based on Health Belief Model on Hand Hygiene Behavior in the Staff of Tehran Dentistry Centers

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Research Article

Keywords: Health Belief Model, Hand Hygiene, Education, Staff of Dentistry Centers

Posted Date: February 14th, 2022

DOI: <https://doi.org/10.21203/rs.3.rs-1318851/v1>

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Abstract

Background and Objectives: Considering the increasing prevalence of dental services in the community and the impossibility of identifying each infected patient, hand sanitation is the most critical factor in controlling infection in these centers. Therefore, this study aimed to determine the effect of educational intervention on the hand health behavior of the staff of Tehran dentistry clinics based on the Health Belief Model.

Materials and methods: In this quasi-experimental study, 128 employees of the health centers were selected through multistage sampling method and they were placed in two groups of intervention and control (every 64 people). The data was collected using a questionnaire devised by the researcher. The validity and reliability of the questionnaire were determined. The questionnaire consisted of demographics, knowledge, structures of the health belief model, and behavior variables. Then, the intervention was administered based on the health belief method. Data were analyzed by SPSS16 and independent t-test, Man Whitney, Chi-square, and variance analysis tests.

Results: Before the intervention, the two intervention and control groups did not differ significantly in terms of demographic variables, mean score of knowledge, constructs of health belief model, and behavior scores ($P>0.05$) while the intervention group was scored higher significantly compared to the control one after the intervention ($P<0.001$).

Conclusion: According to the findings, the health belief model can be used as a framework for designing educational interventions to improve the health behavior of the hand to control infection in health centers.

Introduction

An infection that occurs during a patient's hospitalization or other medical procedure is called a care-related infection, which does not exist before hospitalization. The World Health Organization [WHO] provided a more comprehensive definition by defining them as healthcare-related infections, and introduced the slogan of "health care is clean care" in 2005 [1].

The mouth and throat in the gastrointestinal tract as well as the respiratory system and skin are the main sources of pathogenic species for hospital infections [2]. The use of rotating dentistry instruments and maxillofacial surgery produces visible droplets that mainly contain droplets of saliva, blood, microorganisms, and other infectious substances. In dentistry clinics, the staff and patients are exposed to a wide variety of microorganisms among which blood-oriented viruses and Mycobacterium tuberculosis are more important because they can cause severe and in some cases fatal diseases [3].

Due to the increasing of dentistry services in the community, which are generally outpatient [4] and considering that not all infectious diseases can be diagnosed based on history, examination, and laboratory tests [5] and given that 75% of people with hepatitis C and 66% of people with hepatitis B are asymptomatic and the incubation period of AIDS is also long and it is impossible to identify each

infected patient and many patients do not know or do not provide information about their diseases, all patients should be considered potentially infectious. Therefore, infection control has a special place in dentistry [6].

the possibility of transmitting pathogens to patients through dentists which could cause clinical infections were confirmed from the beginning of the last century [7], and in addition, it was proved that the staff could transmit these pathogens from the environment to the patients while caring for other patients [8].

According to the World Health Organization, 1.7 million hospital infections occur annually-one in 20 people is infected- which kills 99,000 people a year and costs \$ 26-32 billion. [9]. In developing countries, the risk of these infections is 2-20 times more than in developed ones and its incidence is up to 25% [10,11]. Moreover, the rate of these infections in medical units varies between 24 to 38% in Iran [12].

Among these, hand hygiene seemed to be the most effective method and the only effective tool to prevent infection caused by care. Promoting hand hygiene was the key factor that prevented hospital infections [13], which was emphasized by many studies [13-15] showing that hand hygiene in the staff could reduce infections by about 15 to 30% [16]. Despite the importance of hand hygiene in preventing these infections, it was undesirable [17] and some studies showed poor hand hygiene in health care workers [13-15].

Today, it is clear that prevention is much more important than treatment, and education has an important role in the prevention, it has a close and lasting relationship with health. In educational planning, the first step and one of the most important ones is to choose a model or theory based on the existing conditions, to recognize the problem and purpose of the desired educational program [18]. Studies showed that structured, model-based learning was more successful than traditional teaching. In fact, theory can serve as a unifying framework and a roadmap for the questions we are going to answer [19].

There is no dominant theory or training program in health education today. Among these, one of the most useful models in prevention is the health belief model [20,21]. The philosophy of this model is that a person adopts preventive health behavior when he believes that he is at risk for the disease [perceived susceptibility] and that the disease can cause serious complications and consequences for him [perceived severity], some behaviors are effective in preventing the disease or reducing the severity or complications of it [perceived benefits], but there are physical, psychological or financial barriers to adopting these behaviors [perceived barriers], the person can understand and perform such behaviors [perceived self-efficacy], and finally, there are accelerating forces that make a person feel the need to perform these behaviors [cues to action] [22].

Although the studies based on the Health Belief Model to prevent Nosocomial infections are rare, in most studies the model was effective in promoting health behaviors, and its effect on planning health education interventions and prevention and promotion of health care was significant [23-25]. Since we couldn't find a study using the model in hand hygiene in dentistry centers, this study was designed to

determine the effect of education on hand health behavior of dentistry center staff based on the health belief model.

Methods

This was a quasi-experimental interventional study conducted on the staff of selected dentistry centers in Tehran in 2017. To determine the sample size, according to a similar study in Iran [26] in which the mean score of hand hygiene behavior after the intervention in the intervention and control groups were 20.42 ± 2.66 and 19.54 ± 2.90 , respectively, considering 95% confidence interval and statistical power of 80%, the sample size was estimated to be 53, which was increased to 64 considering the 20% of the participants might leave the study. Participants were selected by multi-stage sampling. First, two centers were selected from the dentistry centers in Tehran by simple random method. In the second stage, one center was randomly allocated to the intervention and the other one as the control group. In the third step, the participants were randomly allocated to both groups by equal distribution. All general dentists and specialists, oral and dental health care staff, and dentists' assistants working in those centers who worked at least for one continuous year entered the study with written consent. None left the study.

Since there was not a valid questionnaire, one was developed by the researchers which included 59 items in 9 sections using the sources and reference books and the opinion of technical professors. The first part was the questions related to demographic and general characteristics [8 items] and the second part was the items related to knowledge assessment [7 items] whose score ranged from zero to 35. The third part was related to measuring the constructs of the health belief model, which included the structures of perceived susceptibility [5 items], perceived severity [4 items], perceived benefits [5 items], perceived barriers [5 items], and self-efficacy [9 items] for which a Likert scale with five options [strongly agree, agree, have no opinion, disagree and strongly disagree] was used. The range of the scores for perceived severity, perceived benefit, perceived barrier, self-efficacy scores were between 4 and 20, 5 and 25, 5 and 25, and 9 and 45 respectively. The items related to measuring cues to action [3 items] were based on a Likert scale with 5 options [very much, much, little, very little, and not at all] which was between 3 and 15. The fourth part was the behavior assessment items [13 items] based on a Likert scale with 4 options "always, most of the time, rarely and never" which ranged from 13 to 52.

To evaluate the validity of the content, a panel consisting of 10 professors in the field of health education and promotion, dentists, infectious disease specialists, microbiologists, and epidemiologists, examined the validity of the content in qualitative and quantitative ways. Qualitatively, experts were asked to review the tool based on the criteria of grammar, use of appropriate words, placing the items in the right place, and proper scoring, and they provided the necessary feedback. For the content validity, the content validity ratio (CVR) and content validity index (CVI) were determined quantitatively. Experts were consulted to determine the necessity or non-necessity of each item to determine the CVR. The CVR values above 62 % were considered acceptable [27]. At this stage, one item of knowledge assessment, one for perceived intensity, two for action guide, and one for self-efficacy were removed from the questionnaire. In the CVI review, experts evaluated each item in terms of relevance, clarity, and simplicity, and values above

0.79 were considered acceptable [27]. None of the items were omitted in the CVI review, and the content validity ratio to the total number of items was 0.95.

In the second stage, a modified questionnaire was given to 10 members of the target group to assess its face validity. According to the suggestions of the target group and their understanding of the simplicity and ability to understand the items, the final necessary changes were made to the questionnaire. It is worth noting that these individuals were not included in the study.

To evaluate the reliability of the questionnaire, Cronbach's alpha coefficient was used to determine the internal consistency of the subscales of the Health Belief Model Questionnaire and the values of 0.70 and above were accepted [27]. Therefore, the questionnaire was completed by 15 participants who met the criteria of the present study and had similar demographic characteristics to the study population. Cronbach's alpha for knowledge, perceived susceptibility, perceived severity, perceived benefit, perceived barriers, cues to action, self-efficacy, and behavior were 0.85, 0.75, 0.73, 0.91, 0.86, and 0.87, respectively.

Also, to measure reliability over time, the questionnaire was completed again after 2 weeks by 15 participants from the target population, and the correlation coefficient and ICC [intra-class correlation coefficient] were measured, which was 0.94 for knowledge, 0.96 for perceived susceptibility, 0.97 for perceived severity, 0.97 for perceived benefits, 0.85 for perceived barriers, 0.87 for cues to action, 0.96 for self-efficacy, and 0.89 for behavior assessment. It is worth noting that these individuals were not included in the study. Moreover, after careful studying reliable and relevant sources, the initial educational content was designed based on the health belief model and the data from the pre-test results based on which the most effective structures predicting hand health behavior were identified. In fact, perceived barriers and knowledge significantly predicted health behavior [28], and the lesson plan and teaching content were revised and adjusted based on all structures and with emphasis on these effective structures. Finally, it was given to the panel of experts to evaluate and give their comments. After correcting some parts, general goals, specific goals, and related behavioral goals were formulated based on the training program of each session. The training was held in three 90-minute sessions.

The questionnaires were completed as a self-report in 30 minutes. After explaining the study and its objectives, all participants were asked to complete the questionnaire with complete honesty, and they were assured that all the information requested in the questionnaire would be used confidentially. Before the study, written informed consent was obtained from all participants. The questionnaires were completed at the employees' workplace. Also, before starting the study, the ethics code with the number IR.SBMU.PHNS.REC.1396.3 was received from the research ethics committee of Shahid Beheshti University of Medical Sciences. Then, the data were analyzed using SPSS by independent t-test, Mann-Whitney, Chi-square, and repeated measures analysis of variance. In addition, the significance level was considered less than 0.05.

Results

128 health care staff-64 in the intervention and 64 in the control group- were included in the study (response rate: 100%). The mean age of the intervention and control groups were 34.57 ± 7.66 and 33.93 ± 6.28 respectively and the independent t-test did not show a significant difference between the two ($P=0.606$). Also, the mean years of work experience in the intervention and control groups were 10.46 ± 6.22 and 10.26 ± 4.94 respectively and the independent t-test did not show a significant difference between the two groups either ($P=0.707$).

Comparison of the frequency and percentage of people in the intervention and control groups in education level with Mann-Whitney test showed that there was no significant difference between the two groups ($P=0.373$). Also, comparing the qualitative demographic information of the two groups, which has been reported in frequency and percentage, and the results of the Chi-square test indicated that the two groups were not significantly different in sex ($P=0.845$) marital status ($P=0.052$), type of employment ($P=0.253$), type of job ($P=0.961$) and the unit they worked in ($P= 0.961$) (Table 1 here).

Table 1. Comparison of demographic information between intervention and control groups

Demographic information	Intervention group (n=64)	Control group (n=64)	P-value
	No. (%)	No. (%)	
Gender			0.845
Male	19 (29.7)	18 (28.1)	
Female	45 (70.3)	46 (71.9)	
Marital status			0.052
Single	25 (39.1)	36 (56.3)	
Married	39 (60.9)	28 (43.7)	
Type of employment			0.253
Permanent	23 (35.9)	17 (26.6)	
Contract	41 (64.1)	47 (73.4)	
Job			0.961
Dentist	20 (31.3)	20 (31.3)	
Health care worker	8 (12.5)	7 (10.9)	
Dentist assistant	36 (56.2)	37 (57.8)	
Education status			0.373
Diploma	31 (48.4)	24 (37.5)	
Above Diploma	10 (15.6)	11 (17.2)	
Bachelor	2 (3.2)	9 (14.1)	
Master of science	1 (1.6)	0 (0)	
General Dentist	13 (20.3)	13 (20.3)	
Specialist Dentist	7 (10.9)	7 (10.9)	
Work unit			0.961
Orthodontics	7 (10.9)	7 (10.9)	
Pediatrics	6 (9.4)	8 (12.5)	
Prosthesis	10 (15.6)	9 (14.1)	
Root canal treatment	11 (17.2)	11 (17.2)	
Gum surgery	8 (12.5)	8 (12.5)	
Restorative	9 (14.1)	9 (14.51)	

Oral and maxillofacial	7 (10.9)	6 (9.4)
Diagnosis	6 (9.4)	6 (9.4)

The results of Mann-Whitney and analysis of variance with repeated measures to test subjects' scores at intervals, immediately, and two months after the intervention in the two groups by controlling the effect of pre-test scores showed that knowledge, perceived susceptibility, perceived severity, perceived benefits, perceived barriers, cues to action, self-efficacy, and behavior mean scores significantly improved in the intervention group ($P < 0.001$).

Also, the results showed that the interaction of group and time on the mean scores of knowledge ($P = 0.214$), perceived susceptibility scores ($P = 0.561$), perceived severity ($P = 0.252$), perceived benefits ($P = 0.991$), cues to action ($P = 0.827$), self-efficacy ($P = 0.705$), and behavior ($P = 0.062$), at intervals immediately and two months after the intervention did not differ significantly in both groups, and only the mean scores of perceived barriers ($P = 0.030$) differed significantly due to the interaction of the group and time at the two times after the intervention in both groups. Also, the results showed the mean scores of knowledge ($P = 0.427$), the perceived severity ($P = 0.214$), perceived benefits ($P = 0.219$), perceived barriers ($P = 0.208$), cues to action ($P = 0.984$), self-efficacy ($P = 0.353$), and behavior ($P = 0.396$) did not differ significantly between the periods immediately and two months after the intervention, and only perceived susceptibility mean score ($P = 0.003$) showed a significant difference in these two times after the intervention (Table 2 here).

Table 2. Comparison of the mean scores of knowledge, Health Belief Model constructs, and behavior in the periods before, immediately, and 2 months after the educational intervention in the intervention and control groups

Variables	Group Time	Intervention		Control		P-value
		Mean	Standard deviation	Mean	Standard deviation	
Knowledge	Before intervention	21.71	6.05	22.03	5.32	0.984*
	Immediately after the intervention	30.62	5.00	22.42	5.70	** <0.001 ^α
	2 months after the intervention	30.93	4.70	22.34	5.34	0.214 ^β 0.427 ^δ
Perceived susceptibility	Before intervention	20.70	2.72	20.57	2.75	0.861*
	Immediately after the intervention	23.48	1.82	21.00	2.48	** <0.001 ^α
	2 months after the intervention	23.23	1.78	20.60	2.76	0.561 ^β 0.003 ^{δ□}
Perceived severity	Before intervention	16.39	2.20	16.20	3.42	0.669*
	Immediately after the intervention	18.29	1.71	16.48	3.23	** <0.001 ^α
	2 months after the intervention	18.25	1.55	16.25	3.41	0.252 ^β 0.214 ^δ
Perceived benefits	Before intervention	22.73	2.22	22.68	2.80	0.556*
	Immediately after the intervention	24.31	1.33	22.70	2.78	** <0.001 ^α
	2 months after the intervention	24.31	1.84	22.70	2.90	0.991 ^β 0.219 ^δ
Perceived barriers	Before intervention	19.51	4.20	19.31	4.68	0.797***
	Immediately after the intervention	21.39	3.77	19.29	4.65	** <0.001 ^α
	2 months after the intervention	21.31	3.68	19.50	4.66	0.030 ^β

						0.984 ^δ
Cues to action	Before intervention	12.31	1.85	12.26	1.90	0.938*
	Immediately after the intervention	13.42	1.65	12.10	2.00	**
	2 months after the intervention	13.40	1.60	12.12	1.69	<0.001 ^α
						0.827 ^β
						0.984 ^δ
Self-efficacy	Before intervention	38.85	4.15	38.50	4/50	0.639***
	Immediately after the intervention	42.06	2.97	38.96	4.25	**
	2 months after the intervention	41.92	3.21	38.70	4.46	<0.001 ^α
						0.705 ^β
						0.353 ^δ
Behavior	Before intervention	38.03	3.56	38.37	7.31	0.736***
	Immediately after the intervention	46.31	2.92	38.65	7.40	**
	2 months after the intervention	45.39	2.86	38.17	7.25	<0.001 ^α
						0.062 ^β
						0.396 ^δ

*: Mann-Whitney test

** : Repeated measures

***: Independent t-tests

α : the Effect of education, β : the interaction of group and time, δ : the effect of time.

Independent t-tests in table two showed that the two groups were not significantly different in their knowledge scores, health belief model constructs mean scores (perceived susceptibility, perceived severity, perceived benefits, perceived barriers, cues to action, and self-efficacy), and behavior mean scores before the intervention.

Discussion

The results of the present study on measuring the effect of health belief model-based education on hand health behavior showed a significant change in the mean scores of knowledge, all model constructs [perceived susceptibility, perceived severity, perceived benefits, perceived barriers, cues to action, and Self-efficacy], and behavior. The results of Ghanbari [29] also showed a significant relationship between knowledge and all constructs of the health belief model with health behavior after the intervention. Zeigheimat [26] also showed a significant relationship between the mean scores of knowledge and all model constructs [except self-efficacy] with the mean scores of health behavior. Zeigheimat [26] confirmed that the tendency of nurses to adopt the principles of infection control and preventive behaviors after being aware of the risks of infection transmission, which is consistent with the results of Kaewchana [30]. Although education can always increase the level of knowledge, changing attitudes is crucial to improving people's behavior. According to the health belief model, improving attitude factors [perceived susceptibility and perceived severity] will increase people's motivation to adopt and maintain preventive health behaviors such as hand hygiene [31].

The present study showed that education has significantly improved the mean scores of perceived benefits in the intervention group, which is consistent with the results of Ghanbari [29], Zeigheimat [26], Efstathiou [32], and Javaheri Tehrani [33]. Zeigheimat [26] also stated the improvement of perceived benefits and the reduction in perceived barriers as important factors influencing infection control. Shalansky [34] also showed that perceived barriers were the most important barriers to adopting a new behavior and could be emphasized more in education programs. It seemed that the mean scores of knowledge and perceived barriers were less than other constructs before the intervention which needs more attention in promoting healthy behavior.

Moreover, Efstathiou showed that education was able to affect the perceived barriers of individuals [32], which is consistent with Zeigheimat [26], Ghanbari [29], and the results of our study. Osborne [35] emphasized that the most important factor influencing hand hygiene is perceived barriers. Simbar [23] also showed that the health belief model could improve the behavior of midwives to control infection by reducing perceived barriers. Javaheri Tehrani showed that training was effective on all constructs of the model except perceived barriers [33]. A Korean study stated that due to the complexity of hand hygiene behavior and the role of various external factors on it, a delicate balance had to be between the evaluation of perceived barriers and benefits [36].

However, the results of different studies on the perceived barriers were different and in some cases contradictory, which could be attributed to the significant variety of perceived barriers [material, physical, psychological, environmental, and social barriers] and the different effects of education on these barriers in different communities. In our study, the structure of perceived barriers had the priority in predicting behavior, which indicates the special importance of perceived barriers in planning and compiling educational content and the need for qualitative research in this regard.

The results also showed that the intervention significantly improved the mean scores of cues to action, which is consistent with Ghanbari [29], Zeigheimat [26], Javaheri Tehrani [33], and Efstathiou [32]. Cues to

action had an independent relationship with improving hand health adoption, and practical guidelines such as placing health posters on alcoholic solutions or next to toilets could have a significant impact on hand hygiene behavior [31]. Also, a significant improvement in the mean scores of the health poster and its reading was shown after the intervention. A study conducted in India on internal medicine guidelines showed that nothing could be as important as work commitment in preventing hospital infections [37]. Conscientiousness and commitment are effective in adopting health-related behaviors through a variety of mechanisms [38]. In our study, the role of employees' sense of responsibility in adopting hand hygiene behavior was reported to be more than other internal and external cues to action, and this was promoted in the individuals to adopt hand hygiene behavior after training in the present study.

Moreover, O'Boyle assessed the role of intrinsic motivational factors in important hand health behavior and showed that people with high perceived self-efficacy had a greater commitment to taking appropriate action when a problem occurred and spent more time and effort on the desired behavior [39]. Also, the mean self-efficacy scores had a significant improvement after the educational intervention which was also consistent with Ghanbari [29], Efstathiou [32], and Javaheri Tehrani [33], although, in Zeigheimat [26], the educational intervention had no significant effect on self-efficacy.

The results also showed a significant improvement in the mean scores of hand health behavior which was consistent with the results of Ghanbari [29], Zeigheimat [26], and Barekati [40] which confirmed the positive of the intervention on hand health behavior.

The results of our study indicated that except for the perceived susceptibility, no significant difference was observed in the periods immediately and two months after the intervention in other constructs. In Bikmoradi [41] study, the mean scores of knowledge and attitude in the first month after training increased significantly, but in the third month after the intervention, there was a slight decrease compared to the first month which was not consistent with our study. The mean knowledge scores in the period of two months after the intervention compared to them immediately after the intervention increased which was not significant, but the results of attitude scores were consistent with the results of our study in which there was a slight decrease in mean scores of perceived susceptibility and severity in two months after the intervention compared to immediately after it. Also, the rate of nurses' adherence to hand hygiene behavior in Bakmoradi [41] in the third month compared to the first month increased, which was not consistent with this study. In fact, the mean scores of hand hygiene behavior in the second month after the intervention compared to the time immediately after the intervention decreased slightly which was not significant. Such a decrease in the scores could be related to various reasons such as forgetfulness through time, and it seemed that the need for reminder training and retraining had an effective role in sustaining the effect of training. On the other hand, several studies stated that improving adherence to hand hygiene after educational intervention by itself was temporary [42, 43].

The results of this study showed that education could improve hand hygiene behavior sustainably. Some of the known factors that were involved in studies on adherence to hand hygiene were: gender, hand washing habits formed in childhood, the presence of a supervisor who monitors hand hygiene,

appropriate patterns in medical wards, and absence of environmental barriers [44]. Also, the difference in time could be due to differences in educational content or methods used to perform interventions. The educational content designed in our study was modified according to the analysis of the results obtained from the pre-test; therefore, it was appropriate for the participants. Also, the content was presented in simple and attractive language with recommended scientific methods. The result of these training significantly improved the mean scores of knowledge, health belief model constructs, and the intervention group behavior.

Declarations

Ethics approval and consent to participate: All methods were carried out in accordance with relevant guidelines and regulations, and all experimental protocols were approved by the research ethics committee of Shahid Beheshti University of Medical Sciences (the ethics number is IR.SBMU.PHNS.REC.1396.3). Moreover, all participants gave written informed consent to take part in the study.

Consent for publication: not applicable.

Availability of data and materials: The datasets generated and/or analyzed during the current study are not publicly available due to not having a web link to the datasets, but they are available from the corresponding author on reasonable request.

Competing interests: There is no conflict of interests for the authors.

Funding: none. This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Authors contributions: R.K.: Investigation, Writing – Original Draft; M.A.: Data Curation, Investigation, Writing and translating the final draft; R.P.: Formal analysis& final draft; M.A.S.: Methodology, Writing – Review and Editing, Project administration; S.KH.: Data Curation, Investigation; A.R.: Conceptualization, Supervision, Writing – Review and Editing.

Acknowledgment: We would like to thank the managers of Shahid Beheshti University of Medical Sciences and Faculty of Health, the Dean of the Army Dentistry School and Nezaja Dentistry Center, and the staff who participated in this study.

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