ORIGINAL ARTICLE

Measuring the Structures of the Health Belief Model Integrated with Health Literacy in Predicting University Students' Adoption of Smoking Preventive Behaviors

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Key words

Health Belief Model • Health Literacy • Smoking • Preventive Behaviors

Summary

Objectives. *One of the priorities of public health in reducing smoking is to prevent young people from becoming smokers. Health literacy (HL), smoking, and preventive behaviors are related. Moreover, HL has a potential impact on strengthening the Health Belief Model (HBM). Considering the high prevalence of smoking among university students, the current study was conducted to measure the structures of the HBM integrated with HL in predicting university students' adoption of smoking preventive behaviors.*

Methods. *This was a cross-sectional descriptive study. Three hundred and forty dormitory students of Shahid Beheshti University of Medical Sciences (Teheran, Iran) in 2016, were selected through single-stage cluster sampling for the study. The data gathering tool was a researcher-made questionnaire based on the HBM and the HL inventory for adults (HELIA). The data were analyzed using the SPSS software version.16.*

Results. *The multiple regression analysis showed that the application of health information from five dimensions of HL, perceived susceptibility, self-efficacy, and decision-making dimensions were the predictors of smoking prevention. Also, the structures of this integrated model were able to anticipate 36.5% of the behavioral changes.*

Conclusion. *The HBM integrated with HL can be used as an appropriate framework for designing educational programs to encourage university students to adopt smoking preventive behaviors.*

Introduction

Smoking is one of the most important risk factors for chronic disease in the world and its use is growing rapidly among adolescents and youth [1]. It is estimated that the number of smokers enhanced from 1.3 billion to 1.6 billion people in 2025. Its mortality is estimated to increase to 8.3 million people in 2030 from 4.8 million in 2006 [2]. Various studies indicate that the prevalence of smoking among the students of some medical universities in Iran is more than 20% [3, 4].

The results of studies show that there is a significant association between HL and smoking status [5]. The studies on this issue have concluded that low HL could be considered as an independent risk factor for smoking [6-8], smoking recurrence [9], and weaker results of smoking cessation programs [10]. One of the latest study revealed that HL should be considered when developing targeted tobacco prevention strategies [11]. Also, Atri et al., concluded that improving the level of

HL can lead to change people's behavior in relation to smoking [12]. HL is a dynamic and multidimensional concept encompassing the ability of individuals to achieve the goal, communicate, and understand basic health information and services needed for proper decision-making in health care [13]. Benefiting from HL can enhance health behaviors and improve access to health care [14]. Regarding the level of HL among students, studies by Dehghankar et al. [15] and Sajadi et al. [16] showed that more than one-third of students had inadequate and problematic HL.

A review of previous studies has shown that the HBM is a good model for education regarding the prevention of smoking [17]. The HBM is an appropriate model for anticipating smoking-related behaviors; due to its inclusion of the two categories of health beliefs and social factors [18]. Glanz et al. believe that the dimensions of the HBM can be useful in understanding health behaviors in multicultural groups [19]. Having a high perceived self-efficacy and high perceived susceptibility can reduce smoking among people [18]. Various researchers have also suggested using the

HBM in educational programs to promote smoking preventive behaviors [20-22].

On the other hand, HL has a potential impact on strengthening the HBM. As the variable of knowledge and acting as a facilitating factor, it can enhance people's perception of susceptibility [20].

According to some researchers' views, to better understand the causes of complex behaviors such as smoking [17], the potential impact of HL on the structures of HBM [20], and the role of HL in smoking, poorer smoking cessation outcomes, and return to smoking [6-10], it seems that integrating the HBM with HL can help further enhance the success of this model in promoting the smoking prevention. Therefore, considering the increasing trend of smoking among university students [3, 4, 20], the current study was designed and implemented to measure the structures of the HBM integrated with HL in predicting the adoption of smoking preventive behaviors among university students.

Method

This study was a cross-sectional descriptive-analytical study that was conducted on the dormitory students of Shahid Beheshti University of Medical Sciences (SBMU) in 2016. In this study, 355 students were selected through a single-stage random cluster sampling method. At first, a list of all the 14 dormitories where students from different medical sciences were living was prepared. Then, 4 dormitories (2 dormitories for girls and 2 dormitories for boys) were selected randomly and all the students residing in them were enrolled on the condition that they had the inclusion criteria.

The sample size estimation was done based on Cochran's sample size formula. The sample size was estimated to be 322 people according to a review of previous studies [23] and considering P = 0.30 for smoking preventive behaviors and d = 0.05. 355 subjects were included in the study based on the opinion of a statistics expert and a 10% probability of falling.

The inclusion criteria were the tendency of the subjects for inclusion, being a student, Iranian citizenship, studying at the undergraduate grade, being in the second or third year of study, and living in the dormitories of SBMU. In addition, unwillingness to continue participating in the study and not completing the questionnaire was considered as the exclusion criteria. It is noteworthy that the data of 15 students were omitted because they did not complete the questionnaire and the final analysis was performed on 340 questionnaires (response rate: 95.8%). In this study, the students were contractually considered to have the experience of smoking if they had smoked at least one cigarette during their lifetime. A student who smoked daily or occasionally at the time of the study was also referred to as a smoker. A student who did not have a history of smoking even a single cigarette during the time of the research was referred to as a non-smoker [3].The data gathering tool was a questionnaire with 4 parts: A) the first part was about some demographic and background characteristics and determining the smoking or nonsmoking status of the students. B) the secondt was a researcher-made questionnaire that was used to measure the HBM constructs regarding smoking and its risks. This questionnaire included perceived susceptibility (n: 4 questions), perceived severity (n: 6 questions), perceived barriers (n: 6 questions), perceived benefits (n: 7 questions), perceived self-efficacy (n: 6 questions), and cues to action (n: 2 questions). In the section on the HBM constructs, the Likert scale was used with 5 choices of strongly agree (5 points), agree (4 points), no comment (3 points), disagree (2 points), and strongly disagree (1 point). It should be noted that among the questions of perceived susceptibility, only the first question followed the above rule, and the other questions were reversely scored. In the section related to cues to action, the students were asked about the ways they used to obtain information about the dangers of smoking and the benefits of preventing smoking and their responses were calculated by frequency. C) The third part was related to the questions measuring the rate of adoption of smoking preventive behaviors (n: 15 questions). The scoring method in the behavior questions gave the score of 2 points to the best answer, the score of zero points to the worst answer, and the score of one point to the intermediate answer. According to previous researches, the preventive behaviors were classified into three levels of poor (with the score of below 50% of the total score), moderate (with the score of 50-75% of the total score), and good (with the score of over 75% of the total score) [24]. D) The fourth part was related to the HL questionnaire of Iranian urban population aged 18-65 (HELIA). This questionnaire included 33 questions measuring five major dimensions including reading, gain access, understanding, appraisal, health information decision-making and application. The scores on the total questionnaire ranged from 0 to 100 where higher scores indicated better conditions. The scores between 0-50, 50.1-66, 66.1-84.0, and 84.1-100 were considered as inadequate HL, problematic HL, sufficient HL, and excellent HL, respectively. The psychometric properties of the questionnaire were well documented [25]. Furthermore, in the study of Panahi et al., the validity and reliability of the aforementioned questionnaire were tested in a sample of university students. Drawing on the results of confirmatory factor analysis, this questionnaire was a desirable fit. Furthermore, in the study, Cronbach's alpha coefficient was desirable. Overall, the results of the study showed that the HELIA questionnaire could be used for university students [26].

To determine Content Validity Ratio (CVR) and Content Validity Index (CVI), the HBM questionnaire was given to a handful of professors and experts and their ideas were considered in modifying or deleting the questions. Accordingly, reliability was calculated in the pilot study (which was conducted on 30 students) and the following results were finally obtained: perceived susceptibility (CVR = 0.88, CVI = 0.90, Cronbach's alpha = 0.85),

perceived severity (CVR = 0.97, CVI = 0.99, Cronbach's alpha = 0.70), perceived barriers (CVR = 0.84, CVI = 0.93, Cronbach's alpha = 0.81), perceived benefits (CVR = 0.79, CVI = 0.91, Cronbach's alpha = 0.90), perceived self-efficacy (CVR = 0.89, CVI = 0.96, Cronbach's alpha = 0.83), and smoking preventive behaviors (CVR = 0.91, CVI = 0.90, Cronbach's alpha = 0.85). Validity and reliability were not calculated for questions related to cues to action because they were in objective form and did not measure the students' ability to comprehend [20]. The alpha coefficients for the dimensions of reading, access, understanding, appraisal, decision making, and use of health information, and the whole HELIA questionnaire were 0.84, 0.85, 0.90, 0.77, 0.86, and 0.94, respectively.

After observing the ethical and research standards that included receiving an Ethics Code (IR.TMU. REC.1394.172) and obtaining consent from the participants, the questionnaires were given to the participants. The questionnaires were completed by self-report and took 45 minutes. After the nature of the study and its aims were described to the students, they were asked to answer the questionnaire questions with complete honesty and were assured that all the information requested in the questionnaire would be used confidentially. Furthermore, the questionnaires were completed in the students' dormitories and the presence of a researcher. After data collection, the data were analyzed using the SPSS software version.16, descriptive statistical, Pearson correlation coefficient, multiple regression, and independent T-test. The significance level in this study was considered less than 0.05.

Tab. I. The demographic and background information of the students participating in the study.

Variables		No. (%)
Gender	Female	204 (60)
	Male	134 (40)
Education years	Sophomore	139 (40.9)
	Junior	201 (59.1)
Marital status	Single	295 (86.8)
	Married	41 (12.1)
	Divorce or death of spouse	4 (1.2)
Having a smoker in the family	Yes	121 (35.6)
	No	219 (64.4)
Probation history	Yes	12 (3.5)
	No	328 (96.5)
Physical activity per week	Everyday	18 (5.3)
	Most days	41 (12.1)
	Sometimes	140 (41.2)
	Rarely	111 (32.6)
	Never	30 (8.8)
Father's job	Employee	73 (21.5)
	Worker	29 (8.5)
	Self-employed	131 (38.5)
	Retired	78 (23)
	Other	29 (8.5)
Mother's job	Housewife	269 (79.1)
	Employee	51 (15)
	Self-employed	4 (1.2)
	Worker	1 (0.3)
	Other	15 (4.4)
Education field	Health	74 (21.8)
	Nursing	63 (18.5)
	Nutrition	52 (15.3)
	Midwifery	21 (6.2)
	Optometry	20 (5.9)
	Physiotherapy	18 (5.3)
	Other fields	92 (27)
Having a friend who smokes	Yes	199 (58.5)
	No	141 (41.5)
The status of the individual in terms of smoking	Smoker	81 (23.8)
	Non-smoker	201 (59.1)
	Has experienced	58 (17.1)

Tab. II. The comparison of the mean and standard deviation of the constructs of the HBM integrated with HL and the adoption of smoking preventive behaviors among smoking and non-smoking students

Variables	Smokers		Non-smokers		Total		P-value
	Mean	Standard deviation	Mean	Standard deviation	Mean	Standard deviation	
Perceived susceptibility	13.64	4.673	17.46	2.782	16.55	3.70	0.000
Perceived severity	23.67	4.610	25.95	3.533	25.41	9.32	0.000
Perceived barriers	23.11	3.947	24	4.211	23.79	4.16	0.084
Perceived benefits	26.05	5.738	29.61	4.238	28.76	4.87	0.000
Self-efficacy	23.11	4.577	26.59	3.410	25.76	4.001	0.000
Health literacy	67.34	15.26	73.10	12.93	70.52	14.12	0.001
Preventive behaviors	37.90	22.41	39.36	19.16	39.01	19.96	0.036

Results

The mean (SD) of the participants' age was 22.93(4.05) years. Table I shows the other demographic and background information of the participating students.

Table II shows the scores obtained from the constructs of the HBM, HL, and the adoption of smoking preventive behaviors among smoking and non-smoking students. The results of this table show that the mean scores of all the integrated model constructs (except for the perceived barriers) and the adoption of smoking preventive behaviors were significantly higher in nonsmokers than in smokers. According to the results, the percentages of students with inadequate, problematic, adequate, and excellent HL levels were 9.2% (31 people), 28% (94 people), 43% (145 people), and 19.8% (67 people), respectively. The percentages of students with poor, moderate, and good smoking preventive behavior levels were 72% (245 people), 23.3% (79 people), and 4.7% (16 people), respectively. In addition, the dimensions of understanding and access had the highest mean scores, whereas the health information decision-making and application dimensions had the lowest mean scores among the five dimensions of HL.

The results showed that the internet (64.1%) and interaction with friends and acquaintances (38%) were the most important resources from which the participating students routinely obtained information about the dangers of smoking and the benefits of preventing it. Table III shows the correlation coefficients among the constructs of the HBM integrated with HL and the adoption of smoking preventive behaviors as

well as the correlation coefficients between the different constructs of this model. The results of this table showed that there was a significant and direct correlation among all the constructs of this model. The highest correlation was observed between self-efficacy and perceived benefits (r = 0.615), perceived benefits and perceived severity (r = 0.595), and perceived susceptibility and HL (r = 0.574). The results also demonstrated that the adoption of smoking preventive behaviors among students had a significant correlation only with perceived susceptibility (r = -0.102), perceived self-efficacy (r = 0.167), and the HL variable (r = 0.144) (P < 0.05).

Table IV shows the results of the multiple regression analysis in determining the predictors of the adoption of smoking preventive behaviors and the predictive level of behavior by these constructs in the integrated HBM. Overall, the results of this table show that the constructs of the HBM integrated with HL predicted 36.5% of the adoption of smoking preventive behaviors. Among the studied constructs, perceived susceptibility, perceived self-efficacy, and health information decision-making and application out of the five dimensions of HL were significantly predictive of behavior. Among these variables, perceived susceptibility was the strongest predictor of behavior. Perceived severity, perceived barriers, and perceived benefits, and the other four dimensions of HL were not significant predictors of behavior.

Discussion

The current study was designed and implemented to measure the structures of the HBM integrated with HL in

Tab. III. The correlation coefficient matrix of the constructs of the HBM integrated with HL and the adoption of smoking preventive behaviors

Variables	Perceived susceptibility	Perceived severity	Perceived barriers	Perceived benefits	Self-efficacy	Health literacy	Preventive behaviors
Perceived susceptibility	1						
Perceived severity	0.555*	1					
Perceived barriers	0.163*	0.433*	1				
Perceived benefits	0.515*	0.595*	0.447*	1			
Perceived self-efficacy	0.551*	0.382*	0.382*	0.615*	1		
Health literacy	0.574**	0.419*	0.158	0.357	0.418**	1	
Preventive behaviors	-0.102**	0.026*	-0.017	0.008	0.167**	0.144**	1

Significant correlation was less than 0.01. ** Significant correlation was less than 0.05.

Tab. IV. Multiple regression analysis: the predictors of the adoption of smoking preventive behaviors in the HBM integrated with HL.

Constructs	β	P-value Enter Method	F (P-value)	R (R²)
Perceived susceptibility	0.327	0.001	11.875 (0.001)	0.515 (0.365)
Perceived severity	-0.100	0.268		
Perceived barriers	-0.059	0.408		
Perceived benefits	0.150	0.084		
Self-efficacy	0.194	0.028		
Dimension of reading	-0.084	0.189		
Dimension of access	0.003	0.972		
Dimension of understanding	0.076	0.388		
Dimension of appraisal	-0.076	0.342		
Dimension of decision-making and use of health information	0.190	0.018		

predicting the adoption of smoking preventive behaviors among university students. Based on the results, the structures of the HBM integrated with HL, in general, predicted 36.5% of the adoption of smoking preventive behaviors. The structures of perceived susceptibility and self-efficacy were significant predictors of behavior. Also, among the five dimensions of HL, the dimension of health information decision-making and application significantly predicted behavior.

Based on the results of the studied constructs, perceived susceptibility was the strongest predictor of the adoption of smoking preventive behaviors. This finding was in line with the findings of the study by Boroujeni et al. [27]. Moreover, the findings of this section are in contrast to the findings of the studies of Lee et al. [18], Mokhtari Laleh et al. [17], and Mohammadi et al. [28]. For the contradiction between the results of these three studies and those of the present study, it can be said that in the first two studies only male students participated and it is conceivable that their sensitivity to smoking and exposure to cigarette smoke were lower than those of girls. A possible reason for the differences between the results of Mohammadi et al. and those of the present study could be the differences between the samples studied in the two studies because adolescents may be less sensitive than students to smoking and exposure to cigarette smoke because of their lower awareness. Regarding other reasons for the significance of perceived susceptibility in predicting the adoption of smoking preventive behaviors, the presence of HL can be mentioned because it can influence behavior by increasing the perceived susceptibility [20].

In this study, perceived self-efficacy was another important construct in predicting smoking prevention. These findings are in agreement with the findings of the studies by Boroujeni et al. [27] and Mohammadi et al. [28], while they are in contrast to the results of the studies by Lee et al. [18], and Mokhtari Laleh et al. [17]. One possible reason for this discrepancy is that in the studies of Lee et al. and Mokhtari Laleh et al., no self-efficacy construct was used among the questionnaire questions. Regarding other reasons for the significance of perceived self-efficacy in predicting the adoption of smoking preventive behaviors, the presence of HL in this study can be mentioned because

it can act as a mediator between self-efficacy and behavior change [20].

In this study, perceived barriers could not predict the adoption of preventive smoking behaviors. The findings of the present study are in contrast with the one of other studies such as Boroujeni et al. [27], Mohammadi et al. [28], Mokhtari Laleh et al. [17], and Lee et al. [18]. One might argue about this contradiction that some of the questions used to measure the structure of perceived barriers including such statements as "easy access to smoking can cause the beginning of smoking behaviour" were not considered by the students as barriers to the adoption of smoking preventive behaviors and the majority of these students cited such statements as "not having fun and leisure time can cause people to smoke" as barriers to the adoption of smoking preventive behaviors.

In this study, perceived benefits did not affect the adoption of smoking preventive behaviors. The results of this section are in line with the findings of studies by Boroujeni et al. [27], Mohammadi et al. [28], and Mokhtari Laleh et al. [17], whereas they contradict the results of a study by Lee et al. [18]. These differences appear to be due to the differences in the target groups and the tools used. Furthermore, the questions used to measure the constructs of perceived benefits in the current study may not fully represent all the benefits of the adoption of smoking preventive behaviors for health from the students' point of view and most of them cited the statement "not smoking reduces the risk of cancer" as an important benefit of the adoption of smoking preventive behaviors. Another possible reason could be the possible overlap of HL with the perceived benefits and its potential impact on this construct.

The results of the present study showed that perceived severity did not affect the adoption of smoking preventive behavior. These results are consistent with the findings of the studies by Boroujeni et al. [27], Mohammadi et al. [28], and Mokhtari Laleh et al. [17]. Regarding this case, the structure of perceived severity was influenced by medical information and knowledge. Since the participants in the study were medical students, the items in the structural assessment section were probably not comprehensible enough to represent all of the disabilities and diseases caused by smoking or exposure

to smoke. Concerning other reasons that perceived severity was not significant for predicting behavior, it is possible to overlap some of the HL questions used in this study (HELIA) with several questions related to the perceived severity construct.

The results also showed that among the dimensions of HL, only the dimension of decision making and the use of health information had an impact on the adoption of smoking preventive behaviors. This result was in line with the findings of the study of Martin et al. [29]. Concerning the reason for the effect of one of the five dimensions of HL on the adoption of smoking preventive behaviors, it can be said that probably the dimension of decision making and use of health information could be more related to the adoption of smoking preventive behaviors than the other dimensions of HL because this dimension is homogeneous with this behavior. In the study of Arabzadeh et al., the dimension of using health information had the highest relationship with the adoption of smoking preventive behaviors [30]. Another reason could be that the study population consisted of medical students. As stated earlier, the lowest mean score among the dimensions of HL was related to decision-making and the use of health information. Therefore, it can be said that the students may have had sufficient ability to read, gain access, understand, and evaluate health information but were not able to take appropriate action based on their abilities and knowledge.

The results of the correlation test reflected that there was a significant and direct correlation between all the structures of this model. The significant correlation between the model constructs in this study indicated that the sum of these constructs and dimensions together can constitute the attitudes and capacities necessary for the adoption of smoking preventive behaviors. These results are consistent with the results of the study by Boroujeni et al. [27] and Peyman et al. [31]. In addition, the results indicated that the adoption of smoking preventive behaviors among the students was significantly correlated only with perceived susceptibility and perceived self-efficacy. These findings are also consistent with the findings of the study of Boroujeni et al. [27]. Thus, it can be concluded that any intervention to increase perceived susceptibility and self-efficacy can also influence the adoption of smoking preventive behaviors.

There was also a significant but weak correlation between the adoption of smoking preventive behaviors and HL. These findings are in agreement with the findings of the studies by Peyman et al. [31], Panahi et al. [1, 13, 20, 32-35], Dehghankar et al. [36] and Arabzadeh et al. [30]. It can be added that although some of the studies have identified the association between HL and preventive behaviors [32], it is probably not possible to prove such a relationship for low levels of HL skills. Therefore, planning and designing communication interventions to improve these skills can lead to the establishment of the relationship between HL skills and the adoption of health behaviors.

Conclusion

Taken together, the results of this study suggest that the HBM integrated with HL can be used as an appropriate framework for designing educational programs to encourage students to adopt smoking preventive behaviors. However, among the constructs of the above model, perceived susceptibility, perceived self-efficacy, and the dimension of decision making and use of health information from the five dimensions of HL had the most impact on the adoption of smoking preventive behaviors and should be investigated further.

The present study was the first to evaluate the constructs of the HBM integrated with HL in predicting the adoption of smoking preventive behaviors. Given that this study was conducted only among undergraduate medical students and dormitory students, the findings of this study cannot be generalized to other age groups and students. Therefore, it is recommended that further studies be conducted on different populations and groups (in terms of age, education, and residence) using this model.

One limitation of the current study was the lack of studies on the integration of the HBM with the structures of different health education and health promotion models which limited the comparability of the findings and demonstrated the need for further studies in this area. The data were collected through self-reporting which was another limitation of this study.

Acknowledgments

Conflict of interest statement

There is no conflict of interest.

Authors' contributions

Rahman Panahi, Nooshin Hosseini: implementation and collection of data, content collection, and writing the paper. Ali Ramezankhani: advisor, contributing to writing the paper. Mohamad Anbari, Mohiadin Amjadian: contributing to writing the paper. Leila Dehghankar: contributing to writing the paper. Shamsaddin Niknami: supervisor, corresponding author.

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