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Original Article

Factors Associated With Cigarette Smoking Based on the Integrated Model of Protection Motivation Theory With Health Literacy

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Abstract

Background: Although researchers have performed several smoking-related investigations, limited achievements have been found in decreasing rates of smoking because most of them were not implemented based on the appropriate theory. This study aimed to apply the structural equation modeling (SEM) method to examine the relationships between protection motivation theory (PMT) constructs, health literacy, and smoking behavior among university students.

Methods: In the current cross-sectional investigation, 542 students of Mashhad Universities of Applied Sciences were collected using cluster sampling on August 2022. The data collection tools were sociodemographic, PMT, and health literacy questionnaires. The collected data were analyzed using SPSS 24. Moreover, the SEM was implemented by applying Amos. Pearson correlation examination was performed to study the relationships between behavior and other variables. Moreover, SEM was performed using Amos 18, and several indexes were calculated, including chi-square/degrees of freedom (χ^2/df), goodness of fit index, root mean square error of approximation, comparative fit index, and Tucker Lewis index.

Results: The resulting of the smoking behavior model demonstrated an acceptable fit with the studied data. Smoking behavior was significantly associated with higher intention extrinsic and intrinsic rewards and the perceived cost and lower response efficacy, self-efficacy, and perceived vulnerability; nonetheless, intention and self-efficacy had more effects, respectively ($P<0.05$).

Conclusion: It can be more beneficial to increase the people's self-efficacy in order to further trust themselves so that they can successfully avoid smoking via reinforcement of the coping skills.

Keywords: Health literacy, Protection motivation theory, Smoking

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Introduction

Compared to a drug, a cigarette is the least invaluable material which has low social evil and is more accessible; this has led to considerable growth of cigarette smoking outbreak in most countries (1-3). Investigations around the world have shown that cigarette smoking is more common among 19-39-year-old young adults (4). This can be attributed to factors such as life problems, a history of family smoking, parents' low education, social acceptance, unemployment, friend pressure, socialization with smokers, and emotional support absence (4,5).

Although several smoking-related investigations have been conducted, limited achievements have been reported regarding the decreasing rates of smoking since most of them were not performed based on the appropriate theory or a conceptual framework (6,7). Among different theories that are often applied to various behavior investigations, protection motivation theory (PMT) may be particularly appropriate for assessing and understanding the behaviors of smoking (7). PMT is a structured conceptual model showing that two appraisal processes determine the behavioral intention (which is one of the most important factors of behavior predictor): 1. coping appraisal (including self-efficacy, response

efficacy, and response costs), assessing the capability of management and perceived danger avoidance, 2. threat appraisal (including intrinsic and extrinsic rewards, and perceived vulnerability and severity), maladaptive behaviors assessing (8).

Health literacy is the capability to acquire, understand, read, and use medical care information for following treatment instructions and making suitable decisions for healthy behaviors (9). A systematic review study indicated that Iranian health literacy included borderline and insufficient (10). Lower degrees of health literacy will enhance the possibility of experiencing negative health consequences to 1.5-3 times (11). The findings of various investigations demonstrated a significant association between health behaviors and health literacy (11). Moreover, recent research on smoking behavior has represented that lower level of health literacy is one of the serious risk factors to return to smoking (12). In this study, it is assumed that health literacy affects the coping and threat appraisal constructs, and smoking intention. Based on the suggestions of some investigations, it is required to integrate health behavior models such as PMT with other variables such as health literacy for better identification of the causes of following some unhealthy behaviors such as smoking (13). Considering the enhancement of smoking among university students (4), this study sought to apply the structural equation modeling (SEM) method to examine the relationships between PMT constructs, health literacy, and smoking behavior among university students.

Materials and Methods

Study Participants and Sampling

This cross-sectional study was conducted on 542 students of Mashhad Universities of Applied Sciences, Iran. Participants were collected using cluster sampling on August 2022. For sampling, firsts, the desired university centers were randomly selected with the cluster sampling method, and then students are randomly chosen based on the list of students within the clusters. At the beginning of the research, informed consent was taken from all studied students. After getting informed consent, the paper questionnaires were given to the participants for completion as a self-report method in the university. The inclusion criteria for the present study included showing a willingness to enter the study, being a student, and having Iranian citizenship. On the other hand, lack of consent to participate in the study and incomplete completion of the questionnaires were considered as the exclusion criteria.

Data Collection Tool

Sociodemographic information such as participants' age, gender, marital status, education, mother's and father's education, father's and mother's smoking, and friend's smoking was assessed in the first section of the questionnaire.

The PMT questionnaire was developed based on former studies on smoking which had shown the acceptable psychometric properties of this tool (7,14). The content validity was applied to provide the scientific validity of tools, and they were given to eight experts in this field, and their opinions were used in the questionnaires. The Cronbach's alpha test method was used to measure the reliability on 30 students, and the values were 0.75, 0.80, 0.84, 0.86, 0.94, 0.80, and 0.91 for perceived severity, perceived vulnerability, intrinsic rewards, extrinsic rewards, self-efficacy, response efficacy, and perceived response costs, respectively.

The 3 items containing perceived severity determined the harmful outcomes of cigarettes (e.g., "Smokers are more likely to get the disease than non-smokers"). Further, 3 questions of the perceived vulnerability construct measured the possible impacts of smoking adverse outcomes (e.g., "if I smoke, I would become addicted"). In addition, 3 questions in the intrinsic rewards section included perceived beneficial results from smoking (e.g., "Smoking cigarette makes individuals feel better"). Furthermore, 3 questions of perceived extrinsic rewards assessed the psychosocial advantages of smoking (e.g., "Smokers look fashionable and cool") and 3 items of self-efficacy evaluated the participants' belief of their capability of smoking refusing (e.g., "Even if friends or relatives want me to smoke, I can refuse"). Additionally, 3 questions of response efficacy included participants' belief that non-smoking can be an efficient procedure for health (e.g., "Individuals will be less possible to get sick if they do not smoke"). Finally, 3 questions about perceived response costs assessed the social and psychological costs of non-smoking (e.g., "People will lose pleasure if they do not smoke"). A seven-point Likert-type scale was applied to score the items [1 = Definitely disagree to 7 = Definitely agree]. The variable intention to smoke was evaluated by applying the question "How likely are you to smoke cigarettes in the next year? [Very unlike (1) to very likely (4)]. The question "How many cigarettes did you smoke per day during the past 30 days" was used to measure the smoking behavior variable (0 cigarettes, 1 cigarette, 2-5 cigarettes, and more than 5 cigarettes).

The Iranian Adults' Health Literacy questionnaire was employed to measure health literacy (15). Montazeri et al tailored and psychometrically assessed this questionnaire; it had acceptable validity, and its Cronbach's alpha coefficient ranged from 0.72 to 0.89 (15). Moreover, Cronbach's alpha test method was utilized to measure the reliability of this tool, and the value was 0.94. It contained 33 questions about the health information availability, reading, understanding, evaluation, and intention of behavior. The total score of this variable was from 0 to 100.

Data Analysis

Data were analyzed by applying SPSS 24.0. Quantitative results were represented as the mean, standard deviation (SD), percentage, and frequency. Furthermore, Pearson correlation examination was performed to investigate

the relationships between behavior and other variables. Additionally, SEM was implemented by applying Amos 18, as well as computing several indexes such as Chi-squared/degrees of freedom (χ^2/df), the goodness of fit index (GFI), root mean square error of approximation (RMSEA), comparative fit index (CFI), and Tucker Lewis index (TLI).

Results

Table 1 presents the demographic characteristics of the participants. The results of Table 2 are related to the mean and SD of health literacy and the PMT constructs.

According to the literature, this study focused on determining psychological factors that have a significant effect on people's threat appraisal, including extrinsic and intrinsic rewards, as well as perceived vulnerability and severity, and on coping appraisal, including response costs, response efficacy, and self-efficacy (5). Therefore, one of the hypotheses of this study indicated that perceived severity, vulnerability, self-efficacy, and response efficacy are negatively associated with smoking intention and behavior; in addition, response costs, along with extrinsic and intrinsic rewards, are positively associated with smoking intention and behavior. Likewise, previous studies demonstrated the direct relation between intention and behavior (6). Thus, the other hypothesis was that the intention can predict the smoking behavior. Further, health literacy has an important role in the prevention of non-communicable diseases (11), and its integration with PMT may improve and strengthen the performance of this model in predicting smoking-related behaviors. Therefore, we posited our final hypothesis to assign ways in which health literacy can influence PMT constructs and smoking intention (Figure 1).

The resulting model of smoking behavior is displayed in Figure 2. This model demonstrated an acceptable fit with the studied data (Table 3). The model fit is found accepted when X^2/df < 2-5, TLI, GFI, and CFI > 0.90, and RMSEA < 0.10 (16). The results revealed several significant predictors which are depicted as the values of standardized beta in Figure 2. The smoking intention was significantly associated with higher extrinsic and intrinsic rewards but lower health literacy, perceived vulnerability, response efficacy, and self-efficacy ($P < 0.05$). As shown in the model, self-efficacy and health literacy were the strongest smoking intention predictors. Smoking behavior was significantly associated with higher intention extrinsic and intrinsic rewards, as well as perceived cost and lower response efficacy, self-efficacy, and perceived vulnerability; nonetheless, intention and self-efficacy had more effect, respectively ($P < 0.05$).

Pearson correlation analysis indicated that all PMT constructs, intention, and health literacy were significantly correlated with smoking behavior (Table 4). Perceived vulnerability and severity, response efficacy, self-efficacy, and health literacy were negatively associated with the behavior of smoking ($P < 0.001$). However, extrinsic and intrinsic rewards, as well as perceived cost and smoking intention, were positively associated with smoking behavior ($P < 0.001$).

Table 1. Demographic Characteristics of the Participants

Variable	Value
Age (y), mean (Standard deviation)	21.64 (3.34)
Gender, number (%)	
Male	224 (41.3)
Female	318 (58.7)
Education, number (%)	
Associate degree	331 (61.1)
Bachelor science	211 (38.9)
Marital status, number (%)	
Married	155 (28.6)
Single	387 (71.4)
Father's education, number (%)	
Illiterate	49 (9.0)
Diploma and under diploma	280 (51.7)
Associate degree and bachelor science	175 (32.3)
Master's degree and higher	38 (7.0)
Mother's education, number (%)	
Illiterate	67 (12.4)
Diploma and under diploma	310 (57.2)
Associate degree and bachelor science	143 (26.4)
Master's degree and higher	22 (4.1)
Father's smoking, number (%)	
Yes	220 (40.6)
No	322 (59.4)
Mother's smoking, number (%)	
Yes	63 (11.6)
No	479 (88.4)
Friend's smoking, number (%)	
Yes	212 (39.1)
No	330 (60.9)

Table 2. Mean and Standard Deviation of Health Literacy and PMT Constructs

Variables	Mean	Standard Deviation	Range
Health literacy	70.13	9.52	0-100
Self-efficacy	12.77	2.94	3-21
Response efficacy	16.77	3.03	3-21
Perceived severity	13.87	2.98	3-21
Perceived vulnerability	15.48	3.28	3-21
Extrinsic rewards	10.85	2.57	3-21
Intrinsic rewards	12.70	2.51	3-21
Perceived cost	15.25	3.21	3-21
Smoking intention	2.64	0.97	1-4
Smoking behavior	1.85	0.84	1-4

Note. PMT: Protective motivation theory.

Discussion

Overall, our findings approved the structural hypothesis

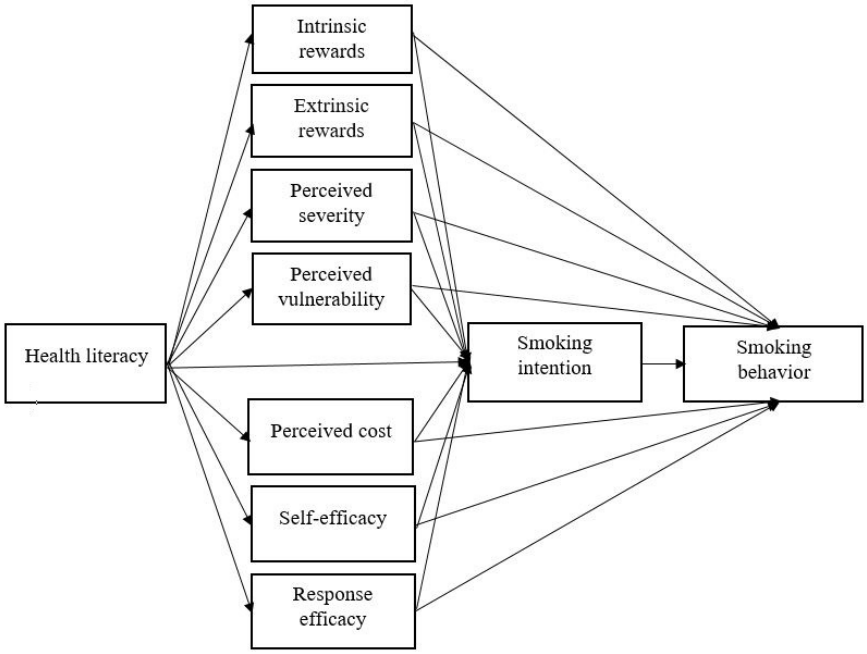

Figure 1. Graphical Representation of the Estimated Path Analysis Model

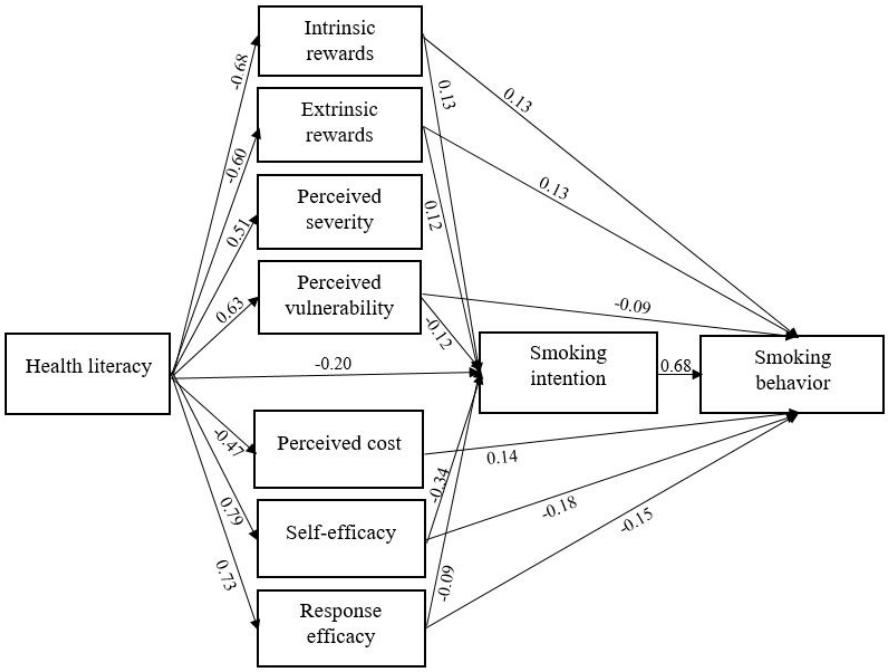

Figure 2. PMT Path Model Showing the Significant Standardized Beta Coefficients of Smoking Behavior. *Note*. The presented numbers represent the standardized beta. PMT: Protective motivation theory

Table 3. Goodness of Fit Indices for the Smoking Behavior Model Testing PMT

	P value	χ^2/df	CFI	GFI	TLI	RMSEA
Smoking behavior	0.06	2.88	0.99	0.99	0.98	0.06

Note. PMT: Protective motivation theory; X^2: Chi squared; df: Degree of freedom; CFI: Comparative fit index; GFI: Goodness of fit index; TLI: Tucker Lewis index; RMSEA: Root mean square error of approximation.

and PMT applicability for cigarette smoking-related behaviors in studied participants. Consistent with the results of other studies, not all PMT constructs had the similar strength for predicting cigarette smoking behavior and intention (8,17). Most PMT constructs were significantly associated with behavior and intention; however, the power of relationships was different for each PMT component.

The findings of the current study represented that smoking intention, response efficacy, self-efficacy,

Table 4. Correlation Matrix Among Correlations Among Variables

Variables	1	2	3	4	5	6	7	8	9	10
Smoking behavior	1	-0.65**	-0.73**	-0.78**	-0.53**	-0.71**	0.77**	0.77**	0.31**	0.85**
Health literacy		1	0.79**	0.73**	0.51**	0.63**	-0.60**	-0.67**	-0.47**	-0.80**
Self-efficacy			1	0.79**	0.59**	0.78**	-0.69**	-0.80**	-0.56**	-0.88**
Response efficacy				1	0.50**	-0.54**	-0.50**	-0.28**	-0.57**	0.50**
Perceived severity					1	-0.70**	-0.75**	-0.52**	-0.79**	-0.70**
Perceived vulnerability						1	0.80**	0.33**	0.77**	0.80**
Extrinsic rewards							1	0.19**	0.19**	0.19**
Intrinsic rewards								1	0.49**	0.82**
Perceived cost									1	0.51**
Smoking intention										1

Note. ** Correlation is significant at the 0.01 level (2-tailed).

perceived vulnerability, and extrinsic and intrinsic rewards could significantly predict behavior of smoking. Furthermore, our findings are in line with those of former studies, indicating that the coping appraisal, especially the self-efficacy factor, was the better behavior predictor than the threat appraisal; thus, probably the threat relationship had a less significant role on smoking behavior (8,18). A reduction in perceived costs, along with increased response efficiency and self-efficacy, enhances the probability of performing adaptive behaviors (14).

The current research revealed that the construct of self-efficacy is one of the principal and essential predictors of smoking intention and related behavior. Hence, when designing health interventions and health educational models, the applicable role of this efficient component must be taken into consideration for behaviors such as smoking or prevention of smoking behaviors. In the study by Yan et al, higher protection motivation of avoiding tobacco consumption was found among students with higher levels of self-efficacy (14). To increase self-efficacy, by conducting educational interventions, participants can be taught how to break down healthy behaviors into small activities in order to engage in them more easily. Sharing the experiences of individuals who had successfully overcome healthy lifestyle barriers, increasing persons' capability to overcome obstacles in order to perform healthy behaviors and highlighting the effects of performing prevention behaviors are the other methods that can be considered during educational programs to increase self-efficacy.

Additionally, the role of behavioral intention mediation between smoking behavior and self-efficacy was consistent with the theory of the protection motivation model. This result demonstrated that the higher trust of students in their capability to oppose smoking offers was correlated to the higher intention to refuse this offer, which was associated with the behavior. Moreover, similar to our research, previous investigations showed that intention was the strongest predictor of behavior (8,19). Numerous investigations have determined the relation between behavior and intention and the considerable role of the protection motivation of dangerous behavior formation (8,14). Similarly, researchers reported that a decrement in the intention variable as a prior step of behavior can be a remarkable smoking threat factor (20).

In this study, the lower levels of perceived rewards and the higher levels of perceived severity and vulnerability led to a lower probability of smoking behavior among students. According to the findings, perceived vulnerability and extrinsic and intrinsic rewards had a significant relationship with intention and smoking behavior, which conforms to the results of the previous investigation (21). Based on our results, the intrinsic reward was the strongest predictor for smoking intention among the other constructs of threat appraisal. The rewards consist of having a sense of comfort, enjoying the friend's company, and having a good feeling (7). Previous studies have also shown such a significant relationship between the construct of intrinsic rewards and smoking intention (14). The study by Yan et al among students showed that although they had enough awareness about the adverse consequences of smoking, they had not enough capability to stop cigarette smoking since the studied students really enjoyed smoking (14). Thus, smokers' encouragement to identify and modify the wrong perceptions of the perceived intrinsic rewards of cigarette smoking may have more efficient results in smoking quit compared with extrinsic rewards; this must be a priority duty for health education specialists. Moreover, this could be more beneficial and efficient than educating students on the possible damages from smoking.

A relatively low relation between perceived vulnerability and smoking behavior and no significant relationship between perceived severity and behavior were obtained in our study. These results are in conformity with those of other studies; for instance, Thrul et al concluded that perceived severity and vulnerability of adolescents did not have a significant association with behavioral intention and behavior of cigarette smoking (22). These findings provide more proof that transmission of negative information and fear to students as the means of smoking prevention could not be the most useful strategy, and more effective variables should receive further attention when designing health educational interventions to attain

better outcomes. For example, it can be more helpful to increase students' self-efficacy to keep from cigarette smoking through improving their skills of refusal using different methods such as interactive interventions.

The findings of our study represented that health literacy was significantly associated with all PMT constructs. The promotion of health literacy can be the first step to adopt to smoking-related preventive behaviors (23). Considering that health literacy had a significant association with the perceived threat, it can be mentioned that educational programs, by enhancing health literacy and increasing the awareness of smoking damages, could promote perceived vulnerability and severity among students; consequently, it will be more likely that they care more about the issues of smoking-related disease and adoption of smoking preventive behaviors. This is consistent with the findings of studies by Piddennavar and Krishnappa (24) and Chi et al (25). In this investigation, health literacy had the most effect on self-efficacy among the other constructs of coping appraisal. Panahi et al reported that the enhanced self-efficacy in the experimental group may be due to the promoted levels of health literacy after educational intervention (13). Health literacy helps individuals to make informed decisions. As a result, before planning any educational interventions and during requirement evaluations, it is essential to assess the levels of health literacy of the target population in order to apply appropriate educational and designing methods and implement the educational content based on the individuals' health literacy levels.

The current investigation has some strengths. To the best of our knowledge, this is one of the few theory-based investigations using the model of integrated PMT constructs and health literacy to predict smoking behavior among university students. Unlike previous PMT studies that have applied multiple regression or correlation analyses, our research evaluated the application of PMT with SEM to examine the model. Overall, our findings supported the applicability of the PMT model to predict smoking intention and related behaviors in university students. It provides a beneficial framework to understand smoking behavior among students and to design a more efficient strategy for smoking control.

Limitations of the Study

The limitations of this investigation were limited availability of research about the health literacy combination with the constructs of different models of health-related behaviors so that no study was found about applying the SEM method to examine the relationships between integrated PMT constructs and health literacy and smoking behavior. Furthermore, the data collection method was self-report, and this was another limitation of our study. Using a cross-sectional method was another limitation of this research. Longitudinal data results are also required to confirm the findings of such an investigation.

Conclusion

The resulting model of smoking behavior based on the integrated PMT constructs and health literacy demonstrated an acceptable fit with the studied data. Smoking behavior was significantly associated with higher intention extrinsic and intrinsic rewards, as well as perceived cost and lower response efficacy, self-efficacy, and perceived vulnerability; however, intention and self-efficacy had more effect, respectively. These findings provide more proof that transmission of negative information and fear to students as means of smoking prevention could not be the most useful strategy. Accordingly, more attention must be paid to more effective variables in designing health educational interventions to attain better results. For example, it can be more helpful to increase students' self-efficacy to keep from cigarette smoking through improving their skills of refusal using different methods such as interactive interventions.

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Authors' Contribution

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Writing–review & editing: Sahar Mohammadnabizadeh.

Competing Interests

The authors declare that they have no competing interests.

Ethical Approval

The study was approved by the ethics board of Mashhad University of Medical Sciences (Number IR.MUMS.FHMPM.REC.1401.035).

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