

# Investigating the factors of hookah smoking before and during the COVID-19 pandemic: Application of Protection Motivation Theory

Saeed Bashirian<sup>1</sup>, Hossein Effatpanah<sup>2</sup>, Majid Barati<sup>1</sup>, Salman Khazaei<sup>3</sup>, Abdollah Farhadinasab<sup>4</sup>, Mojdeh shokri<sup>5</sup>, Ali Poormohammadi<sup>6</sup>, Elahe Ezati<sup>7</sup>

## ABSTRACT

**INTRODUCTION** In recent decades, hookah use has been considered a common method of smoking. Since hookah use is one of the factors exacerbating the coronavirus disease, COVID-19, the present study aimed to determine the factors affecting hookah smoking during the COVID-19 pandemic using protection motivation theory (PMT).

**METHODS** This is a cross-sectional study and conducted on 560 people aged  $\geq 13$  years living in Hamedan. Data were collected electronically using a researcher-made questionnaire consisting of three parts. The first, second, and third parts included demographic information, questions about hookah use, and information about the constructs of PMT, respectively. Data were analyzed using SPSS 22 software.

**RESULTS** The mean age of the participants was  $28.8 \pm 9.6$  years. In the regression analysis of perceived reward structures ( $\beta=0.378$ ), perception sensitivity ( $\beta=0.208$ ), self-efficacy ( $\beta=0.0166$ ) were respectively the important predictors for the intention of hookah use behavior. Overall, the constructs of the PMT explain 71% of the variance of the changes in the behavioral intention construct in the participants. No significant relationship was observed between self-efficacy constructs ( $r=0.039$ ) and perceived cost. The prevalence of hookah use before the COVID-19 pandemic in participants was 41.8%, which decreased to 35% during the COVID-19 pandemic.

**CONCLUSIONS** A greater correlation between the constructs of the PMT concerning protective behaviors against COVID-19 emphasizes designing educational programs based on this theory and the role of media to increase people's knowledge in preventive behaviors.

## AFFILIATION

**1** Social Determinants of Health Research Center, Hamedan University of Medical Sciences, Hamedan, Iran

**2** Department of Public Health, School of Allied Medical Sciences, Asadabad Faculty of Medical Sciences, Asadabad, Iran

**3** Department of Epidemiology, School of Health, Health Sciences Research Center Health Sciences & Technology Research Institute, Hamedan University of Medical Sciences, Hamedan, Iran

**4** Department of Psychiatry, School of Medicine, Ayatollah Taleghani Hospital, Shahid Beheshti University of Medical Sciences, Tehran, Iran

**5** People's Aid Institute, Bo Ali Sina University, Hamadan, Iran

**6** Occupational Health and Safety Research Center Health Sciences & Technology Research Institute, Hamedan University of Medical Science, Hamedan, Iran

**7** Health Education and Promotion, Asadabad School of Medical Sciences, Asadabad, Iran

## CORRESPONDENCE TO

Elahe Ezati. Department of Health Education and Promotion, Asadabad School of Medical Sciences, Asadabad, Iran.

E-mail: [elahe.ezati@gmail.com](mailto:elahe.ezati@gmail.com)

ORCID ID: <https://orcid.org/0000-0002-6590-3249>

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## INTRODUCTION

Tobacco use is one of the most important causes of disease, disability, and early death worldwide. According to the WHO report, deaths caused by smoking will rise to 8 million by 2030, which will be worse in developing countries. Hookah smoking in the Middle East is known as a traditional way of consuming tobacco, and its consumption has increased significantly in recent years<sup>1,2</sup>. Smoking has emerged as an independent risk not only for transmission but also for severity of COVID-19<sup>2</sup>. Dating back to more than 400 years ago, hookah is an old and traditional method of smoking, which is used with aromatic tobacco. In different regions,

hookah is known by various names such as narghile, argihile, waterpipe, dokha, and shisha<sup>3,4</sup>.

Moreover, hookah use has acute and long-term detrimental effects on the respiratory and cardiovascular systems and increases the risk of diseases such as coronary artery disease and chronic obstructive pulmonary disease. In the use of hookah, tobacco is often used through a common path, including the mouth, hose, and chamber, in the hookah structure<sup>2,5</sup>. Additionally, there is a risk of survival of microorganisms transmitted from consumers in hookah pieces and outfits (including chambers and hoses). On the other hand, most consumers are reluctant to clean hookah

after each use because washing and cleaning pieces are very time-consuming<sup>6</sup>. These factors increase the potential for the transmission of infectious diseases, including COVID-19, among consumers. Evidence also suggests that hookah use increases the transmission risk of infectious agents, such as respiratory viruses, hepatitis C virus, Epstein-Barr virus (which can cause several types of cancer), herpes virus, tuberculosis, *Helicobacter pylori* (causative agent of stomach ulcers and gastrointestinal diseases), and a variety of pathogenic fungi<sup>7,8</sup>.

On the other hand, public environments provide adequate chance for the spread of COVID-19<sup>9</sup>. Hookah smoking is often a social activity<sup>2</sup>. This may involve close contact and sharing of mouthpieces with potentially infected people, both of which increase the possibility of acquiring COVID-19. The risk of transmission of infectious microbial agents through smoking hookah is high because smokers cough into hoses and moisture in tobacco smoke promotes the survival of microorganisms inside the hookah hose<sup>10</sup>.

Therefore, it is very important to identify factors affecting the reduction of hookah use during the COVID-19 pandemic. One of the important models in the identification and determination of factors affecting behavior is protection motivation theory (PMT), developed by Rogers (1975) based on the value expectation model to explain the effects of fear on health attitudes and behaviors. This model assumes that the acceptance of the recommended health behavior is a direct act of one's motivation to protect oneself<sup>11,12</sup>. According to this theory, when people are confronted with signals of fear, they are involved in two types of cognitive assessment: threat assessment and coping assessment<sup>12</sup>. Threat assessment evaluates maladaptive behaviors and includes rewards for misbehavior and perceived threat (severity and sensitivity)<sup>13</sup>.

Rewards for misbehavior increase the possibility of choosing maladaptive reactions while the threat reduces the possibility of choosing maladaptive reactions. Coping assessment of response effectiveness refers to one's assessment of the perceived effectiveness of the behavior recommended for preventing threats<sup>12,13</sup>. Rogers argued that fear affects the motivation of protection (the intention to involve in protective behavior against health hazards) through eight constructs, and that motivation of protection ultimately triggers health behavior. These eight constructs include: perceived self-efficacy, perceived response efficiency, perceived sensitivity, perceived intensity, perceived response costs, perceived reward, fear, motivation, and behavioral intention<sup>14,15</sup>. As a theoretical basis, this model has been used to determine factors affecting behavior for various health behaviors, including the prevention of high-risk behaviors in tobacco use<sup>16</sup>, alcohol consumption<sup>17</sup> and HIV/AIDS<sup>18</sup>.

Reducing hookah use during COVID-19 pandemic is one of the ways to reduce the damage caused by this disease and this issue is of special importance<sup>2</sup>. Therefore, it is essential to identify factors affecting hookah use during the COVID-19 pandemic, and the present study aimed to determine these factors in Hamedan City.

## METHODS

This is a cross-sectional study, and the study population consisted of the general population of Hamedan City. A sample size of 560 individuals was estimated using the prevalence of hookah use in studies<sup>19,20</sup> taking into account a confidence level of 95% and an accuracy of 3%. After determining the sample size, people were sampled conveniently and purposively by sending the link of the electronic questionnaire to the extensive virtual channels and networks in the city of Hamedan. Inclusion criteria were people aged  $\geq 13$  years who were literate and living in Hamedan city. In order to observe the ethical standards, the participants were briefed on the purpose of study, about informed consent, confidentiality of information, and their freedom to enter or leave the study. The names of the participants were not recorded in the questionnaire and other information was confidential and only for use in this study.

The data collection tool was a researcher-made questionnaire designed based on a comprehensive review of literature. The questionnaire included three general sections: demographic questions, questions of hookah use behavior, and a section on the PMT constructs. The formal and content validity of the questionnaire was assessed using the opinions of 10 specialists in health education and promotion. Content validity ratio (CVR) and content validity index (CVI) were extracted for each question and the questions were reviewed and modified according to the values tabulated in Lawshe<sup>21</sup>. In a pilot study, the reliability of the questionnaire was assessed by a questionnaire given to 20 participants who had similar characteristics to the main subjects, followed by calculation of Cronbach's alpha coefficient.

### Demographic variables

The first part of the questionnaire included questions on background and demographic information including age, marital status, education level, and occupation.

### Hookah smoking

The second part of the questionnaire included questions about hookah use, which included the history of hookah use in the period before COVID-19, the history of hookah use during the COVID-19 pandemic, and the frequency of hookah use. Besides, participants were asked three questions to obtain information about hookah use, COVID-19 and the source of information.

### Constructs of the PMT

The third part of the questionnaire included questions measuring the constructs of the PMT.

#### *Perceived sensitivity*

Perceived sensitivity to COVID-19 consisted of three questions, e.g. 'Does hookah use expose me to COVID-19?', measured on a 5-point Likert scale (strongly agree to strongly disagree). The scores ranged from 3 to 15. A Cronbach's alpha coefficient of 0.76 was obtained for this construct.

*Perceived severity*

The perceived severity of COVID-19 included three questions, e.g. ‘Developing COVID-19 is serious and disturbs my life’, measured on a 5-point Likert scale (strongly agree to strongly disagree). The scores ranged from 3 to 15, with a Cronbach alpha coefficient of 0.81.

*Fear*

Perceived fear of COVID-19 included three questions, e.g. ‘I feel awful about COVID-19’, which was assessed on a 5-point Likert scale (strongly agree to strongly disagree). The scores ranged from 3 to 15, with a Cronbach alpha coefficient of 0.81.

*Perceived cost*

The perceived cost of COVID-19 included three questions, e.g. ‘If I do not smoke hookah, my friends will make fun of me’, measured on a 5-point Likert scale (strongly agree to strongly disagree). The scores ranged from 3 to 15, with a Cronbach alpha coefficient of 0.86.

*Perceived self-efficacy*

Perceived self-efficacy about hookah use included three questions, e.g. ‘I can refuse to use hookah even if my companions disagree’, measured on a 5-point Likert scale (strongly agree to strongly disagree). The scores ranged from 3 to 15, with a Cronbach alpha coefficient of 0.76.

*Perceived response efficacy*

The perceived response efficacy to hookah use included three questions, e.g. ‘No use of hookah can reduce the risk of COVID-19 development’, measured on a 5-point Likert scale (strongly agree to strongly disagree). The scores ranged from 3 to 15, with a Cronbach alpha coefficient of 0.87.

*Perceived rewards*

The perceived reward for hookah use included three questions, e.g. ‘I feel I have done something useful by not smoking a hookah’, measured on a 5-point Likert scale (strongly agree to strongly disagree). The scores ranged from 3 to 15 with a Cronbach alpha coefficient of 0.91.

*Intention (motivation to protect)*

The intention (motivation to protect) to hookah use included three questions, e.g. ‘I decide not to think about hookah use until the end of COVID-19’, measured on a 5-point Likert scale (strongly agree to strongly disagree). The scores ranged from 3 to 15 with a Cronbach alpha coefficient of 0.81.

**Statistical analysis**

Data were analyzed using SPSS software (ver. 22 (Chicago, IL, USA), at a significance level of 0.05. Descriptive and inferential statistics (Pearson correlation coefficient and regression) were used to describe the data.

**RESULTS**

The mean age of the participants was 28.8 ± 9.6 years, 50.7% and 49.3% were male and female, respectively, 48.3% were married, and 49.5% had academic education. A history of hookah use was observed in 231 (41.1%) of participants

**Table 1. Demographic characteristics of the participants in the study**

Variable		n	%
Sex	Male	278	49.3
	Female	285	50.7
Marital status	Married	272	48.3
	Single	240	42.8
	Widow	50	8.9
Education level	Elementary	86	15.3
	Middle	38	6.7
	Diploma	160	28.5
	Academy	278	49.5
Employment	Housewife	145	25.8
	Employee	184	32.7
	Self-employed	161	28.6
	Student	72	12.8
History of hookah smoking before the COVID-19 pandemic	Yes	231	41.1
	No	331	58.9
History of hookah smoking during the COVID-19 pandemic	Yes	197	35
	No	365	65
Hearing information about hookah smoking and COVID-19	Radio and TV	193	34.4
	Physician and medical staff	95	16.8
	Family and friends	153	27.3
	Books, posters or pamphlets	121	21.6

**Table 2. Evaluation of hookah use before and during the COVID-19 pandemic**

Variable	Frequency of hookah use				p*
	During		Before		
	%	n	%	n	
Once every few months	39.5	78	37.6	87	0.001
Once a month	25.8	51	26.4	61	
Once every few weeks	10.6	21	11.3	26	
Every week	12.1	24	12.2	28	
Every day	11.1	22	12.5	29	

\*p<0.05

**Table 3. Correlation between the constructs of protection motivation theory and hookah use behavior during the COVID-19 pandemic**

Constructs	Perceived susceptibility	Perceived severity	Fear	Perceived self-efficiency	Perceived costs	Perceived rewards	Perceived response efficiency	Intention
Perceived susceptibility	1							
Perceived severity	0.342**	1						
Fear	0.395**	0.609	1					
Perceived self-efficiency	0.396**	0.322**	0.314**	1				
Perceived costs	0.017	0.081	0.609	0.039	1			
Perceived rewards	0.351**	0.291**	0.319**	0.382**	0.291**	1		
Perceived response efficiency	0.542**	0.376**	0.360**	0.305**	0.112**	0.517**	1	
Intention	0.521**	0.321**	0.410**	0.456**	0.043	0.565**	0.542**	1

\*\*Correlation is significant at the 0.01 level (2-tailed); p<0.05.

**Table 4. Linear regression analysis of constructs of protection motivation theory for hookah use intention during the COVID-19 pandemic**

Variable	β	B	SE	Sig	R <sup>2</sup>
Perceived susceptibility	0.208	0.237	0.054	0.001	0.71
Perceived severity	0.057	0.076	0.066	0.256	
Fear	0.138	0.155	0.055	0.005	
Perceived self-efficiency	0.166	0.197	0.052	0.001	
Perceived costs	0.112	-0.107	0.039	0.006	
Perceived rewards	0.378	0.505	0.066	0.001	
Perceived response efficiency	0.144	0.152	0.054	0.006	

B: unstandardized regression coefficient. SE: standard error.

before COVID-19, which decreased to 197 (35%) individuals during the COVID-19 pandemic. Other details are shown in Table 1.

Table 2 compares the hookah use before and during the COVID-19 pandemic using the chi-squared test, indicating a significant difference in the frequency of hookah use before and during the COVID-19 pandemic (p=0.001). In fact, 34 participants reported daily use of hookah before the COVID-19 pandemic, while 26 individuals mentioned daily use of hookah during the COVID-19 pandemic.

The results of using Pearson correlation coefficient (Table 3) show a direct and positive relationship between perceived severity (r=0.321) and perceived sensitivity (r=0.521) with behavioral intention. There is a negative and inverse relationship between perceived cost (r= 0.043) and behavioral intention. No significant relationship was observed between self-efficacy constructs (r=0.039) and perceived cost.

According to the linear regression to determine the predictability of the PMT constructs, the intention (protection

motivation) of hookah use (Table 4), perceived reward constructs (β=0.378), perceived sensitivity (β=0.208), and self-efficacy (β=0.0166) are the important predictors of hookah use behavior. Overall, the PMT constructs explain 71% of the variance of changes in the behavioral intention construct in the participants of this study.

## DISCUSSION

This study aimed to determine the factors affecting hookah use during the COVID-19 pandemic in Hamedan city. The results showed that there was a significant difference between the prevalence of hookah use among the participants before and during the COVID-19 pandemic. Since hookah use is typically an activity performed in groups and gatherings, it increases the risk of COVID-19 transmission and the risk increases in closed environments. This can be an important factor in the acceleration and intensification of the transmission cycle of COVID-19 in public environments and gatherings. Therefore, the Ministry of Health, Treatment, and Medical Education in Iran

announced a ban on hookah use in public places in the early part of the COVID-19 pandemic, which in turn could be one of the reasons for the decline in the prevalence of hookah use among people during the COVID-19 pandemic<sup>22,23</sup>.

The establishment of lockdown and physical distancing is an obstacle to some public behaviors such as hookah smoking but results of Carreras et al.<sup>24</sup> showed that during the quarantine period, cigarette smoking increased more than hookah. Therefore, stakeholders need to understand changes in behaviors that could result from a lockdown to design appropriate programs for discouraging unhealthy changes in behaviours<sup>24</sup>.

In addition, our results demonstrate that a positive relationship exists between the perceived response efficacy and perceived sensitivity, which is in line with Moeini et al.<sup>15</sup>. These results indicate that an increased understanding of vulnerability due to hookah use increases the perceived response efficacy in an individual. In the present study, a significant positive relationship was found between fear and the perceived response efficiency construct, which was confirmed in a study by Plotnikoff et al.<sup>25</sup>.

Our data indicate that a significant positive correlation exists between perceived vulnerability and the severity of COVID-19, in accordance with the study of Barati et al.<sup>26</sup>. According to the results of this study, a higher level of perceived vulnerability is needed to better understand the risks of this disease and therefore can strongly and positively affect the fear of COVID-19.

In the present study, there was a significant positive relationship between perceived response efficacy of preventive behaviors and perceived self-efficacy. In other words, a better understanding of the effect of perceived response efficacy is associated with increased levels of self-efficacy and vice versa<sup>27</sup>. Our findings highlight a negative correlation between self-efficacy and perceived cost, suggesting that perceived barriers and costs lead to lower self-efficacy<sup>28</sup>. This confirms the claim that researchers should focus more on interventions that examine predicted barriers for the improvement of self-efficacy<sup>29</sup>.

In this study, one of the strongest predictors of protection motivation was the perceived reward construct. Greening et al.<sup>30</sup> also reported that perceived reward could predict drunk driving intent<sup>3</sup>. Sadeghian et al.<sup>31</sup> also observed a greater effect of perceived vulnerability construct on predicting protective behavior than other constructs of the theory, which is in agreement with the present study.

Based on the results of the present study, self-efficacy is one of the most important predictors of behavioral motivation for hookah use. In fact, people who have a higher level of self-efficacy seem to consider their ability to be high to achieve success. Self-efficacy is an important construct that should be prioritized in educational interventions to increase people's motivation in health-related behaviors<sup>32</sup>. Overall, motivation protection theory constructs predict 71% of the variance of changes in the motivation construct to

perform a behavior in the participants. Kaviani et al.<sup>33</sup> also presented evidence that the PMT constructs were a good predictor of behavioral intention. As revealed by the results of the present study, media (radio and television) were the main sources of information about the threats of COVID-19 and the impact of hookah use on the exacerbation of disease; this shows the leading influence of media on the broadcast of information about the disease. Khazaei et al.<sup>34</sup> highlighted the role of social networks in the dissemination of information about COVID-19.

### Limitations

One of the limitations of the present study is that data collection was based on a self-reporting questionnaire, which may raise the possibility of response bias. In addition, other limitations of the study were that the history of cigarette smoking in individuals and family members and the psychological reasons for hookah use, were not examined.

### CONCLUSIONS

Self-efficacy is an important predictor of the PMT, which necessitates the design and implementation of comprehensive interventions by health planners to improve effective factors in preventing tobacco use, such as self-efficacy. The use of the PMT and the combination of this theory with other models of health education with an emphasis on the use of media seem to allow the formulation and design of important and practical intervention strategies to reduce and control high-risk behaviors.

### CONFLICTS OF INTEREST

The authors have completed and submitted the ICMJE Form for Disclosure of Potential Conflicts of Interest and none was reported.

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### ETHICAL APPROVAL AND INFORMED CONSENT

This research was approved by the ethics committee of Hamedan University of Medical Sciences (ID: IR.UMSHA.REC.1399.488). Written informed consent was obtained from participants aged  $\geq 16$  years, and from parents of adolescents under the age of 16 years.

### DATA AVAILABILITY

The data supporting this research are available from the authors on reasonable request.

### PROVENANCE AND PEER REVIEW

Not commissioned; externally peer reviewed.

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