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Original Article

Predictive Factors of Stages of Change in Hookah Smoking Cessation Among Iranian Adults Based on the Transtheoretical Model

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Abstract

Background: Hookah, as a traditional method of smoking, is widely used in Iran, especially in Bushehr province. It is essential to identify the most important determinants of modifying hookah smoking behavior. This study aimed to investigate the predictors of the stages of change in quitting hookah smoking in 15-60-year-old individuals in Bushehr province, southern Iran, based on the transtheoretical model (TTM).

Methods: This descriptive-analytical study was conducted on 1173 Hookah smokers in Bushehr province. The samples were selected by two-stage random sampling from 10 cities. Data were collected using a valid and reliable questionnaire consisting of 5 sections (demographic characteristics, stages of change, processes of change, decisional balance, and self-efficacy). Data were analyzed by R version.3.3.1 using analysis of variance and ordinal logistic regression at a significant level of 0.05.

Findings: The data revealed 82% of the participants were in the preparatory phase (55.3% in pre-contemplation and 26.7% in contemplation stages). Marital status, family members smoking hookah, cigarette smoking, level of education, number of family members, number of quitting attempts, self-efficacy, self-reevaluation, counter-conditioning, reinforcement management, and stimulus control were predictors of quitting hookah smoking.

Conclusion: Given that most study participants were in the inactive stages of quitting hookah smoking, it seems necessary to design and implement behavioral interventions based on the predictive TTM constructs in this population.

Keywords: Transtheoretical model, Stage of change, Predictive factors, Hookah

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Introduction

Tobacco use is the cause of more than 20% of preventable deaths in developed countries, and according to World Health Organization (WHO), it causes an average of 5.4 million deaths per year worldwide.[1] According to the latest report on tobacco use worldwide by WHO, 17.5% of people older than 15 years were smoking in 2019.[2]

Hookah is a traditional method of tobacco smoking and has various names in different regions of the world including Hookah, Tobacco, Arghile, Narghile, and Waterpipe.[3] According to a meta-analysis in 2020, the prevalence of lifetime waterpipe smoking among Iranian university students was 25%, and in male and female subgroups was 37% and 17%, respectively.[4] Bushehr province is one of the four provinces with the highest rate of tobacco consumption and according to the available statistics, the prevalence of hookah smoking in Bushehr province is estimated to be 10.0% to 17.9%.[5,6]

Despite public perception that hookah is less harmful than cigarette smoking, evidence suggests that hookah smoke contains high carcinogenic concentrations like carbon monoxide, tar, nicotine, heavy metals, tobacco-specific nitrosamines, and polycyclic aromatic hydrocarbons.[7-10] Some studies found carcinogenic biomarkers in the blood and urine samples of hookah users even after a single smoking session.[8,11-13]

Research results indicated hookah smoking is associated with chronic obstructive pulmonary disease.[14] The results of a prospective study conducted in Bangladesh for 7 years also showed that hookah smoking is associated with the incidence of ischemic heart disease as well as cerebrovascular and cardiovascular disease.[15] Hookah smoking does not only affect smokers but also passive smokers who are exposed to hookah smoke.[16] WHO estimates that 1.2 million deaths from smoking are because of secondhand smoke.[17]

Given the unpleasant effects of hookah on people's health and according to the fact that hookah smoking can have many social consequences in addition to its effects on health, recognizing the most important determinants of hookah smoking and quitting behaviors is essential for developing effective interventions to create positive

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behavioral changes.[18] Transtheoretical model (TTM) is one of the most powerful models that can be used for predicting and manipulating behaviors, especially those related to addictive behaviors.[19] Stages of change (pre-contemplation, contemplation, preparation, action, and maintenance), processes of change, decisional balance, and self-efficacy are the main constructs of this model.[20]

According to this model, in the pre-contemplation stage, an individual is not yet considering making any changes to their current behavior at least for the next 6 months, and may not even be aware that a problem exists. At the contemplation stage, one thinks about changing the behavior over the next six months but is not yet ready. In the preparation phase, the individual plans to achieve behavioral goals, during which he/she collects and organizes information accurately and intends to make a change in the near future (typically next month). In the action phase, the individual has made the change in their lifestyle over the past 6 months, and in the maintenance phase, which is a longer period of posture and behavioral change, the person is involved for a longer period (over 6 months).[20]

Processes of change include activities, strategies, or processes that help a person move through the stages of change. The processes are classified into two categories of cognitive and behavioral processes. Cognitive processes include consciousness raising, dramatic relief, environmental reevaluation, social liberation, and self-reevaluation. Behavioral processes include counter-conditioning, stimulus control, helping relationships, and reinforcement management.[20]

The decisional balance construct in this model is adopted from Janis and Mann's decision model and is defined as the evaluation of the benefits and costs of changing behavior.[21] This construct focuses on the importance of perceived benefits and disadvantages of outcomes or behavior change. It is assumed that a person will not change his/her behavior unless he/she realizes that the benefits of behavior change outweigh the disadvantages.[22] Besides, self-efficacy has been defined as a person's belief in their ability to perform tasks successfully.[23]

Considering the growing statistics on tobacco use, and in particular, the use of hookah in Iran, especially in Bushehr province, and given that this behavior today has become a health problem that could seriously affect the health of individuals and populations, a detailed understanding of consumer behavior characteristics and factors influencing hookah smoking behavior seems necessary. Although the TTM has been used to identify the determinants of smoking behavior, to the best of the researcher's knowledge, this study is the first to examine the determinants of hookah behavior based on this model. Therefore, the purpose of this study was to determine the predictors of the stages of change in smoking habits of adults in Bushehr province based on the TTM.

Methods

This cross-sectional descriptive-analytical study was conducted in Bushehr province, southern Iran, on 1173 adults aged 15-60 years who were hookah users or had a history of hookah smoking. It should be noted that 6138 households were contacted to reach the sample size) response rate:19.11%). The sample size was calculated as $r = 0.1$ according to the correlation coefficient of self-efficacy and the stages of change of behavior, taking into account the probability of first- and second-type errors of $\alpha = 0.05$ and $\beta = 0.2$ using PASS software version 11. The inclusion criteria were being a resident of Bushehr province, having an electronic health record in the Iranian Integrated Health System (SIB), being between 15 and 60 years old, and smoking hookah during life (at least 6 months continuously and at least one session per week). Two-stage random sampling was used. At first, the sample size for each of the 86 comprehensive health services centers of Bushehr province was determined. Then, based on the data from the Household Electronic Record, several households were randomly assigned to obtain the sample size required for each center. Then, if the household met the inclusion criteria, they were invited to the health care center via a phone call to complete the survey questionnaires. If one household did not meet the inclusion criteria, another household was selected at random. If the invited person did not come to the health center, the questioner) a specifically trained healthcare provider) visited them at their home or workplace for completion of the survey. All questionnaires were completed through face-to-face interviews.

Data were collected through a researcher-made questionnaire consisting of 5 sections including demographic information (age, gender, marital status, level of education, spouse's education, job status, economic status, having a specific illness, preferred hookah smoking location, type of hookah consumed, attending a hookah quitting class, friends smoking hookah, family members smoking hookah, smoking cigarette simultaneously, having a history of cigarette consumption, number of household members, number of days in week smoking hookah, number of hookahs per day, number of attempts to quit, number of cigarettes per day, duration of smoking in days, age of onset of smoking); stages of change (5 items); processes of change (50 items) including consciousness raising (6 items), dramatic relief (7 items), environmental reevaluation (4 items), self-reevaluation (5 items), social liberation (6 items), self-liberation (5 items), counter-conditioning (4 items), stimulus control (5 items), reinforcement management (4 items), and helping relationships (4 items); decisional balance (8 items) including benefits (4 items) and barriers (4 items); and Self-efficacy (8 items). Each item (except those in the demographic section) was rated on a 5-point Likert scale including strongly agree (1), agree (2), neutral (3),

disagree (4), and strongly disagree (5). Quantitative and qualitative methods were used to determine content validity. Quantitative content validity was assessed using the content validity ratio (CVR) and content validity index (CVI). The mean content validity index was calculated for questions of stages of change, self-efficacy, benefits of behavior (=1), barriers to behavior (=0.89), consciousness-raising (=0.83), dramatic relief (=0.90), environmental reevaluation (=0.89), self-reevaluation (=0.91), social liberation (=0.85), counter-conditioning, helping relationships, reinforcement management, self-liberation, and stimulus control (=1).

The reliability of the tool was assessed by a pilot study on 30 individuals aged 15-60 years in Bushehr province who met the inclusion criteria. The Cronbach's alpha coefficient was calculated for stages of change (0.83), self-efficacy (0.87), benefits of behavior (0.83), barriers to behavior (0.73), consciousness-raising (0.90), dramatic relief (0.90), environmental reevaluation (0.78), self-reevaluation (0.89), social liberation (0.72), counter-conditioning (0.89), helping relationships (0.75), reinforcement management (0.78), self-liberation (0.90), and stimulus control (0.87).

To collect data, the questionnaires were completed after informed consent was signed by the participants. The collected data were entered into R version 3.3.1. Frequency tables and statistical indices (mean and standard deviation) were used to extract descriptive data. Analysis of variance and the Bonferroni test were used for pairwise comparisons to determine the relationship between quantitative demographic characteristics and stages of change and the chi-square test was used to determine the relationship between qualitative demographic characteristics and stages of change. An ordinal logistic model was used to investigate the effects of predictors of stages of change in quitting hookah smoking. The significance level was considered at 0.05.

Results

The mean age of the participants was 42.74 ± 11.79 years, 55.8% of the participants were female, and 44.2% were male. Most of the participants (79%) were married, 87% smoked at home, 82.9% used natural tobacco, 89.9% had friends who used hookah, and at least one family member of 41.4% of the participants was a hookah user. Most of the participants (98.2%) had not participated in smoking cessation classes. The mean number of attempts for quitting smoking was 1.06 ± 2.08 (Table 1 and Table 2). Most of the participants in this study (82%) were in the preparatory phase (55.3% in the pre-contemplation and 26.7% in the contemplation stages) and a small number of participants (7.5%) were in the preparation phase. Other participants (10.5%) were in the post-preparation phase (2.3% in the action and 8.2% in the maintenance stages) (Table 2).

Tables 3 and 4 show the relationship between demographic variables and stages of change for quitting hookah smoking. Marital status ($P<0.001$), economic status ($P<0.001$), having a specific illness ($P<0.001$), hookah smoking location ($P<0.001$), attending a hookah quitting class ($P=0.014$), friends smoking hookah ($P=0.013$), family members smoking hookah ($P<0.001$), cigarette smoking simultaneously ($P=0.01$), age ($P<0.001$), education ($P<0.001$), spouse's education ($P=0.017$), family members ($P<0.001$), and the number of attempts to quit ($P<0.001$) were significantly related to the stages of change. Other demographic variables had no significant relationship with the stages of change ($P>0.05$).

As shown in Table 3, most of the participants with specific illnesses were in the maintenance phase. All participants whose friends were all hookah smokers were in the preparation phase. The mean age of the individuals in the preparatory phase was lower than those in the preparation and post-preparation phases. The number of family members in the post-preparation phase was on average less than in the preparatory and preparation phases. The mean year of education of participants and their spouses in the preparatory and preparation phases was higher than in the post-preparation phase. Furthermore, the number of attempts to quit in participants who were in the post-preparation phase was on average higher than those in the other two phases.

The results also indicated that the mean score of self-efficacy in the post-preparation phase was significantly higher than in the preparatory and readiness phases ($P<0.001$). The mean score of benefits of behavior (Pros) was significantly lower in the preparatory phase ($P<0.001$). The mean score of cognitive processes in the preparatory phase was significantly lower than in the readiness and post-preparation phases ($P<0.001$). The mean scores of behavioral processes were significantly higher in the preparatory and post-preparation phases ($P<0.001$) (Table 5).

Moreover, as depicted in Table 5, the mean scores of self-efficacy, benefits, cognitive processes, and behavioral processes were significantly different in different stages of change ($P<0.001$) (Table 5). According to Bonferroni post hoc test, the mean score of self-efficacy in the post-preparation phase was significantly higher than in the preparatory ($P<0.001$) and preparation phases ($P=0.021$). The mean score of benefits of behavior was significantly lower in the preparatory phase ($P<0.001$). The mean score of cognitive processes in the preparatory phase was significantly lower than in the preparation and post-preparation phases ($P<0.001$). The mean scores of behavioral processes were significantly higher in the preparatory and post-preparation phases ($P<0.001$).

Based on the results of ordinal regression analysis with a stepwise variable selection procedure, family members smoking hookah ($P=0.001$, OR = 0.41), simultaneous

Table 1. Demographic characteristics of participants

	Variable	Frequency	Percent
Gender	Female	654	55.8
	Male	519	44.2
Marital status	Single	143	12.2
	Married	927	79
	Widow	103	8.8
Job status	Employee	131	11.2
	Self-employed	732	31.7
	Retired	81	6.9
	Unemployed & Student	589	50.2
The economic status	Poor	274	23.4
	Medium	644	51.1
	Good	218	21.5
Having a specific illness	No	948	80.8
	Yes	225	19.2
Current hookah smoking	No	123	10.5
	Yes	1050	89.5
Preferred hookah smoking location	Home	958	81.7
	Coffee shop	37	3.1
	Recreational center	178	15.2
Type of hookah smoked	Flavored	121	10.3
	Natural	973	82.9
	Both	79	6.7
Having attended a hookah quitting class	No	1152	98.2
	Yes	21	1.8
Number of friends smoking hookah	Nobody	91	7.8
	Some Friends	1055	89.9
	All of the friends	24	2.0
Having family members smoking hookah	No	687	58.6
	Yes	486	41.4
Current cigarette smoking	No	1052	89.7
	Yes	121	10.3
Past experience of cigarette smoking	No	1011	86.2
	Yes	162	13.8
Variable	**Minimum**	**Maximum**	**Average**
Age	15	60	42.7 ± 11.7
Number of years of education	0	18	7.4 ± 4.9
Number of years of education of spouse	0	18	5.2 ± 4.7
Number of household members	1	8	3.3 ± 1.4
Number of hookah smoking days per week	1	7	4.9 ± 2.1
Number of hookahs per day	0.5	10	1.9 ± 1.2
Number of attempts to quit	0	15	2.0 ±1.0
Number of cigarettes per day	0	20	8.5 ± 6.4
Duration of smoking (day)	2	15695	3767.0 ± 2291.3
Age of onset of smoking (year)	12	47	21.6 ± 5.1

cigarette smoking ($P = 0.02$, OR = 2.07), level of education ($P = 0.001$, OR = 0.9), number of family members ($P = 0.023$, OR = 0.85), number of attempts to quit smoking ($P < 0.001$, OR = 1.23), self-efficacy ($P = 0.035$, OR = 1.1), self-reevaluation ($P < 0.001$, OR = 2.81), counter-conditioning ($P = 0.003$, OR = 0.89), reinforcement

management ($P=0.001$, OR = 0.86), and stimulus control ($P=0.001$, OR = 1.16) were the predictors of the quitting hookah smoking behavior.

According to the results, the odds of single people being at higher stages of change were 5.65 times more than those married and 4.72 times more than widowed and separated individuals. Those with a hookah smoker in the family had lower odds of being in a higher stage than others (OR = 0.41, $P<0.001$).

According to the results presented in Table 6, those who already were cigarette smokers were 2.27 times more likely to be in higher stages of change ($P=0.02$ OR = 2.07). By increasing the level of education ($P=0.001$, OR = 0.9) and the number of family members ($P=0.02$, OR = 0.85), the odds of entities being in higher stages of change decreased. Besides, the greater the number of attempts to quit hookah smoking, the increase in chances of switching to higher stages ($P<0.001$, OR = 1.23). By one-unit increase in self-efficacy ($P<0.001$, OR = 2.81) and self-reevaluation ($P=0.035$, OR = 1.1) scores, the odds of individuals being in higher stages of change were 2.81 and 1.1 times greater. A one-unit increase in the stimulus control score also increased the odds of individuals being in the higher stages of change by 1.16 times ($P=0.001$, OR = 1.16). A one-unit increase in counter-conditioning ($P=0.003$, OR = 0.89) and reinforcement management

Table 2. Hookah smoking cessation behavior according to the stage of change

	Stage of change	Frequency	Percent
Preparatory	Precontemplation	649	55.3
	Contemplation	313	26.7
Preparation	Preparation	88	7.5
Post-preparation	Action	27	2.3
	Maintenance	96	8.2

Table 3. The relationship between demographic variables and stages of change in hookah smoking and quitting behavior

Variable		Preparatory No. (%)	Preparation No. (%)	Post-preparation No. (%)	*P* value
Gender	Female	427 (82.3)	43 (8.3)	49 (9.4)	0.419
	Male	535 (81.8)	45 (6.9)	74 (11.3)	
Marital status	Single	116 (81.1)	11 (7.7)	16 (11.2)	<0.001
	Married	772 (83.3)	75 (8.1)	80 (8.6)	
	Widow	74 (71.8)	2 (1.9)	27 (26.2)	
Job	Employee	113 (86.3)	10 (7.6)	8 (6.1)	0.298
	Self-employed	297 (79.8)	30 (8.1)	45 (12.1)	
	Retired	66 (59.3)	3 (3.7)	12 (14.8)	
	Unemployed & student	486 (82.5)	45 (7.6)	58 (9.8)	
Economic status	Poor	212 (77.4)	25 (9.1)	37 (13.5)	<0.001
	Medium	527 (81.8)	42 (6.5)	75 (11.6)	
	Good	222 (88.4)	21 (8.4)	8 (3.2)	
Having a specific illness	No	803 (84.7)	64 (6.8)	81 (8.5)	<0.001
	Yes	159 (70.7)	24 (10.7)	42 (18.7)	
Hookah location	Home	792 (82.7)	73 (7.6)	93 (9.7)	<0.001
	Coffee shop & terrace	20 (54.1)	6 (16.2)	11 (29.7)	
	Recreational center	150 (84.3)	9 (5.1)	19 (10.7)	
Type of hookah smoked	Flavored	107 (88.4)	1 (0.8)	13 (10.7)	0.061
	Natural	789 (81.1)	81 (8.3)	103 (10.6)	
	Both	66 (83.5)	6 (7.6)	7 (8.9)	
Having attended a hookah quitting class	No	947 (82.8)	88 (7.6)	117 (10.2)	0.014
	Yes	15 (71.4)	0 (0)	6 (28.6)	
Number of friends smoking hookah	Nobody	65 (71.4)	11 (12.1)	15 (16.5)	0.013
	Some Friends	873 (82.7)	74 (7.0)	108 (10.2)	
	All of the friends	24 (100)	0 (0)	0 (0)	
Having family members smoking hookah	No	538 (78.3)	49 (7.1)	100 (14.6)	<0.001
	Yes	424 (87.2)	39 (8.0)	23 (4.7)	
Current cigarette smoking	No	869 (82.6)	82 (7.8)	101 (9.6)	0.010
	Yes	93 (76.9)	6 (5.0)	22 (18.2)	

Table 4. The relationship between quantitative demographic variables and stages of change

Variable	Stage of change			*P* value
	Post-preparation	Preparation	Preparatory	
Age	45.72 ± 11.64	45.19 ± 11.67	42.13 ± 11.74	0.001
Education	5.81 ± 4.98	6.20 ± 5.57	7.71 ± 4.78	<0.001
Education of spouse	4.60 ± 3.45	5.84 ± 4.81	5.22 ± 4.87	0.017
Family members	2.64 ± 1.55	3.49 ± 1.30	3.38 ± 1.40	<0.001
Number of attempts to quit	1.92 ± 1.51	2.68 ± 1.77	2.05 ± 0.89	<0.001

Table 5. The relationships of processes of change, decisional balance, and self-efficacy with stages of change for quitting hookah smoking

Variable	Stages of behavior change			*P* value
	Post-preparation	Preparation	Preparatory	
Self-efficacy	4.11 ± 0.49	3.81 ± 0.78	3.21 ± 0.83	<0.001
Pros	4.51 ± 0.60	4.34 ± 0.52	3.90 ± 0.76	<0.001
Cons	3.41 ± 0.82	2.91 ± 1.02	3.27 ± 0.82	<0.001
Processes of Change				
Cognitive Change Processes	3.59 ± 0.49	3.68 ± 0.69	2.89 ± 0.73	<0.001
Consciousness raising	2.64 ± 1.01	3.06 ± 1.01	2.20 ± 0.88	<0.001
Environmental reevaluation	3.99 ± 0.72	3.93 ± 0.83	3.25 ± 0.84	<0.001
Dramatic relief	3.80 ± 0.72	3.86 ± 0.99	2.98 ± 0.94	<0.001
Self-reevaluation	4.10 ± 0.61	3.97 ± 0.84	3.00 ± 1.07	<0.001
Social liberation	3.69 ± 0.65	3.71 ± 0.69	3.23 ± 0.73	<0.001
Behavioral Change Processes	3.59 ± 0.49	3.56 ± 0.83	2.81 ± 0.75	<0.001
Counter-conditioning	3.14 ± 0.87	3.30 ± 0.93	2.55 ± 0.99	<0.001
Helping relationships	3.35 ± 0.70	3.60 ± 0.92	3.00 ± 0.86	<0.001
Reinforcement management	3.59 ± 0.71	3.48 ± 0.99	2.95 ± 0.92	<0.001
Self-liberation	4.25 ± 0.68	4.08 ± 0.96	3.21 ± 0.95	<0.001
Stimulus control	3.52 ± 0.70	3.28 ± 1.08	2.36 ± 0.92	<0.001

($P = 0.001$, OR = 0.86) scores also increased the chances of individuals being in the higher stages of change by 0.89 and 0.86 times (Table 6).

Discussion

Hookah smoking, as a traditional method of tobacco use, has historical and cultural roots in the Middle East and Iran, particularly in Bushehr as a historical region of tobacco cultivation. Since hookah smoking can seriously affect the health of smokers and others exposed to the smoke, it is necessary to understand the most important determinants of smoking and quitting behavior.

The results of the present study showed that more than half of the people (82%) surveyed did not even think of quitting hookah smoking and they were in the precontemplation and contemplation stages. Only 18% of those surveyed were in the preparation, action, and maintenance stages and planning to quit smoking or attempted to quit shortly or quit smoking. Consistent with the results of the present study, in the study by Latifi et al conducted in 2017 on youth hookah smoking cessation, it was found that 77.4% of people were in the pre-contemplation, contemplation, and preparations stages, and 6% were in the action and maintenance stages, which is similar to the distribution of individuals at different stages in the present study.[24] Moreover, in a study by Kumar et al, conducted to assess smoking cessation readiness using the TTM, 27.33% of people were in pre-contemplation, 47% in contemplation, 22% in preparation, and just 3.67% in the action stage. Similar to the results of this study, most individuals were in the early stages and a limited number were in the higher stages.[25]

It can be acknowledged that cigarette smokers and hookah users were more likely to be in the preparatory phase (pre-contemplation and contemplation stages) in the process of change, and in the mentioned studies, less than one-fifth of the total population was in the post-preparation phase (action and maintenance stages). Thus, it seems that most people who smoke, including hookah smokers, are not ready to change their behavior and a significant percentage of them do not even think about quitting smoking. This is much more important for the Bushehr province for a variety of reasons, including extensive traditional plantation of tobacco in most cities, the intertwining of tobacco and hookah with indigenous people's culture, and the lack of deterrent laws and

Table 6. Determining the predictors of the stages of change of hookah smoking

Variable	Standard coefficient estimation	OR	SE	Wald	CI 95%		*P* value
					Minimum	Maximum	
Marital status							
Single	-	-	-	-	-	-	-
Married	-0.73	0.177	0.303	32.419	-2.326	-1.135	<0.001
Widow	-0.75	0.212	0.435	12.621	-2.401	-0.649	<0.001
Having a specific illness							
No	-	-	-	-	-	-	-
Yes	0.29	1.19	0.223	0.606	-0.265	0.613	0.436
Having family members smoking hookah							
No	-	-	-	-	-	-	-
Yes	-0.73	0.411	0.205	18.758	-1.29	-0.486	<0.001
Current cigarette smoking							
No	-	-	-	-	-	-	-
Yes	0.25	2.077	0.314	5.403	0.115	1.347	0.020
Education	-0.18	0.9	0.021	24.215	-0.147	-0.063	<0.001
Family members	-0.41	0.851	0.071	5.138	-0.30	-0.022	0.023
Number of attempts to quit	0.92	1.234	0.038	30.537	0.666	1.402	<0.001
Self-efficacy	1.31	2.812	0.187	30.279	0.324-	0.392	<0.001
Pros	0.07	1.034	0.182	0.034	0.324-	0.392	0.853
Cons	-0.08	0.953	0.108	0.193	-0.261	0.165	0.661
Consciousness raising	0.09	1.014	0.020	0.488	0.025-	0.054	0.485
Dramatic relief	0.34	1.033	0.023	1.988	0.013-	0.079	0.159
Environmental reevaluation	0.47	1.082	0.044	3.125	0.009-	0.166	0.077
Self-reevaluation	0.75	1.099	0.045	4.468	0.007	0.184	0.035
Counter-conditioning	-0.59	0.894	0.036	9.133	-0.183	0.039	0.003
Helping relationships	-0.11	0.981	0.035	0.27	-0.089	0.051	0.603
Social support	-0.13	0.970	0.038	0.641	-0.105	0.044	0.424
Reinforcement Management	-1.12	0.862	0.042	12.069	-0.231	0.064	0.001
Self-liberation	0.48	1.067	0.334	3.778	0.001-	0.131	0.052
Stimulus control	1.22	1.168	0.031	23.927	0.094-	0.219	<0.001

policies against tobacco cultivation. The absence of public education and information system to inform people about the dangers of hookah smoking is also important. Thus, the critical role of public policy and community-based interventions to make hookah smokers ready to change their behavior is clear.

The results of regression analysis showed that marital status, family members smoking hookah, simultaneous cigarette smoking, level of education, number of family members, number of attempts to quit, self-efficacy, self-reevaluation, counter-conditioning, reinforcement management, and stimulus control were predictors of quitting hookah smoking. In the study by Carlson et al, aimed at predicting the effects of TTM constructs on smoking cessation behavior in a community-based cognitive-behavioral program, single, divorced, or widowed individuals were 1.43 times more likely to quit smoking than married people.[26] In Araban and colleagues' study in the south of Iran, having a smoker in the family predicted the smoking behavior of the studied population.[27] In the study by Athamneh et al, cigarette smoking history and smoking cessation efforts in the past seven days were the most important predictors of hookah smoking cessation intention.[28] In the study by Parashar et al, the level of education predicted the intention to quit cigarette smoking; unlike the present study, the intention to quit was increased with higher education level.[29] In the study by Abughosh et al, previous attempts to quit, the number of cigarettes consumed daily, education level, family members smoking, having a specific illness, and having smoker friends were predictors of smoking cessation.[30]

In the study by Narimani et al, self-efficacy also predicted the stages of smoking cessation in such a way that increasing self-efficacy led to a positive move through the stages of change.[31] Self-efficacy, as the most

important predictor of smoking cessation behavior, has also been reported in the study by Martinez et al.[32] Latifi et al, in line with the present study, showed self-efficacy was significantly correlated with stages of change such that the highest self-efficacy was in the maintenance stage and the lowest in the pre-contemplation stage.[24] In the study by Girma et al, individuals with a high level of self-reevaluation reported 2.6 times more intention to quit smoking cigarettes.[33] In addition, in the study by Wagner et al, the processes of change were significantly correlated with progress in the stages of change in cigarette smokers.[34] Carlson et al also indicated only partial reinforcement management was a predictor of smoking cessation behavior.[26] In the study by Ham and Lee, behavioral process and self-efficacy were predictors of the stages of change in the smoking cessation behavior of Korean adolescents.[35] Therefore, it can be concluded that single, isolated, or widowed individuals will be more likely to quit smoking hookah because it seems that hookah smoking is not a solitary behavior, and mainly hookah smokers smoke in groups. The acceptance of hookah smoking by the spouse and other family members may lead to less tendency to quit in married people and those in larger families, particularly when at least one member of the family is also a hookah smoker.

On the other hand, the use of hookah in the Bushehr province is a well-accepted behavior among families, hence affecting people's motivation to quit. This cultural phenomenon has led to a decrease in smoking cessation behavior with an increase in the number of years of education. Another probable reason for the inverse relationship between years of education and intention to quit hookah smoking may be the small number of well-educated people in this study. As the sampling method of the study was two-step randomized selection and people answered a phone call to assess their use of hookah in the first step, maybe educated people and those who had a government job hid the truth and did not enter the study by their choice. This is one of the limitations of the present study and future studies are recommended with a stratified sampling method to cover various socioeconomic groups of the population.

According to this study and other studies,[24,32,35-37] self-efficacy is a crucial factor in predicting whether someone will quit smoking. To increase self-efficacy and improve the chances of success, strategies such as gaining mastery, observing others' success, receiving encouragement, and managing emotions and physical sensations can be effective.

The healthcare system and public policymakers should consider self-evaluation, which involves assessing one's self-concept and adjusting behaviors, along with stimulus control, which involves changing the environment to reduce triggers for hookah use. This should be done to increase the success of hookah cessation efforts.

In the present study, the role of reinforcement management and counter-conditioning in predicting the hookah cessation stage was reversed revealing that fewer behavioral alternatives and rewards such as encouraging friends and relatives in case of hookah smoking were associated with higher levels of change. What should be considered about this result is the insignificance of the role of behavioral alternatives such as the use of other nutrients rather than the use of hookah, and also receiving rewards such as encouraging others to quit smoking. People who tend to quit smoking or have quit smoking seem to pay less attention to behavioral alternatives or external incentives.

Finally, it seems the role of individual factors such as one's perception and beliefs about himself after quitting hookah smoking as a more acceptable and livelier person and at the same time creating environmental changes that lead to thinking less about the hookah are important and should be targeted in smoking cessation interventions.

Conclusion

The results of this study showed that the majority of adults aged 15-60 years in Bushehr province are in the preparatory phase (pre-contemplation and contemplation stages) and are not even planning to quit smoking in the next six months. Therefore, it is necessary to implement individual and social interventions to enhance hookah smoking cessation behavior in Bushehr province. According to the predictors of hookah smoking behavior in this study, it is suggested that policymakers, authorities, and planners use strategies to enhance individual and social self-efficacy and focus on the structures of cognitive and behavioral change processes in implementing interventions to modify hookah smoking behavior.

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Competing Interests
The authors declared no conflict of interest.

Ethical Approval
This study was approved by the Ethics Committee of Bushehr University of Medical Sciences (Ethics No. IR.BPUMS.REC.1398.16).

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