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# Steps toward community health promotion: Application of transtheoretical model to predict stage transition regarding smoking

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## Abstract:

**BACKGROUND:** Recently, the Iranian Ministry of Health estimated about 750,000 deaths are attributed smoking complications. The aim of this study was to apply the transtheoretical model (TTM) on general population of Mashhad city to evaluate the stages of change and possible cultural factors regarding smoking cessation.

**METHODS:** This descriptive, cross-sectional population-based study was conducted in Mashhad, Iran. A total number of 562 participants selected by multistage sampling. They were asked about stages of change for smoking cessation for both hookah and cigarette smoking. Stages of change refer to an orderly sequence of changes in smoking behavior that people progress through according to the TTM. Its six stages are as follows: precontemplation (PC) (no intention to quit smoking within 6 months), contemplation (planning to quit smoking in the following 6 months), preparation (planning to stop smoking within 1 month), action (quit smoking for <6 months), maintenance (stopped smoking for 6 months or more), and termination (will never smoke again). Data were analyzed using tests such as Chi-square, Kruskal–Wallis, and logistic regression by SPSS 11.5.

**RESULTS:** About 18% and 19% of people in this study were regular hookah and cigarette smokers, respectively. There was significant difference between cigarette smoking and sex ( $P < 0.001$ ) and marital status ( $P = 0.01$ ). There was a statistically significant difference between stages of change in men and women from the point of cigarette smoking ( $P < 0.001$ ). Male sex, hookah smoking, and alcohol abuse were predictors of PC, and age was the only predictor of termination stage for cigarette smoking. Sex did not have any role in hookah smoking.

**CONCLUSION:** Targeted education based on gender and marital status warrant attention. Community-wide education and interventions such as increasing the price of cigarettes are desired.

## Keywords:

Health promotion, Iran, smoking, tobacco, transtheoretical model

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## Introduction

Smoking is a negative health behavior with large influences economically.<sup>[1]</sup> It also increases the risk of physical impairment.<sup>[2]</sup> Cigarette smoking is the largest preventable cause of death in the world.

The WHO reported that death due to tobacco were five million people in the year

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2008 and would be about eight million a year by 2030.<sup>[3,4]</sup> Nowadays, almost one-third of the world population are smokers.<sup>[5]</sup> Around 35% of males and 22% of females in developed countries and about 50% of males and 9% of females in developing countries smoke.<sup>[6]</sup> Although it is reported that the prevalence of smoking is reduced in developed countries, this issue is now more highlighted in some developing countries. In Iran, the prevalence of smoking has

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raised from 12.6% in 2000 to 14.3% in 2004.<sup>[7]</sup> The Iranian Ministry of Health estimated about 750,000 of Iranians died from smoking-associated complications in 2006 and 15% of men (older than 15) currently smoke in this country.<sup>[8,9]</sup>

The transtheoretical model (TTM) was first introduced by Prochaska and DiClemente.<sup>[10]</sup> This is a model of intentional change with special attention to the decision-making capacities of the people rather than the social effects on behavior. This model covers different behaviors in the various populations. The behavioral change includes six stages (precontemplation [PC], contemplation, preparation, action, maintenance, and termination). People need stage-targeted programs to progress through the stages successfully.<sup>[10-13]</sup> The TTM enables the use of suitable interventions for each stage.<sup>[14]</sup> Behaviors that have been studied using this model include quitting smoking and cocaine, weight control, safer sex and condom use, sunscreen use, exercise acquisition, and mammography screening.<sup>[13]</sup> The model was found to be effective in research studies of smoking cessation.<sup>[11]</sup> The TTM has been widely accepted by both clinicians and scientists working in the field of public health.<sup>[14]</sup> Although this model is practical for any health behavior, it has been used most in the field of smoking cessation.<sup>[15]</sup>

The main goal of the current study was to assess the usage of the TTM to evaluate the stages of change and possible culturally important factors regarding smoking cessation.

## Methods

This was a descriptive, cross-sectional population-based study conducted in Mashhad, Iran. Mashhad, with the population of more than three million, is located in the north east of Iran. This city is the capital of Razavi Khorasan Province and is also one of the largest religious cities in the world and the second largest metropolis in Iran.<sup>[16-18]</sup>

In this survey, a total number of 562 participants were enrolled. Multistage sampling was allied. At first step according to municipal maps, public centers randomly selected from all over the city. Public transport stations, public parking lots, shopping centers, banks, and universities all around the city were assigned for collecting data. In each sampling unit, the researchers tried not to miss any city district and cover all districts and crowded parts of the city. The survey was conducted using a checklist including sociodemographic characteristics, factors related to smoking behavior, and stages of change.<sup>[19]</sup> Stages of change refer to an orderly sequence of changes in smoking behavior that

people pass through based on the TTM. Due to this model, individuals in PC stage have no intention to quit smoking within 6 months. A contemplator is a person who smokes, but is planning to quit in the following 6 months. Someone in preparation stage is planning to stop smoking within 1 month and has done some initial practices toward it. A person is in action when he/she has quit smoking for <6 months. Those in maintenance phase have stopped smoking for 6 months or more, and finally, individuals in termination stage will never smoke again.<sup>[19,20]</sup>

The Ethics Committee of Mashhad University of Medical Sciences approved the study (IR.MUMS.fm.REC.1395.443). The interviewers described the research goals to participants. Participants were assured about the privacy of their individual information, and once they consented, then they completed the checklist.

We used SPSS 11.5 software (SPSS Inc., Chicago, Illinois, USA) for all statistical analyses. Descriptive statistics were used to describe the pattern of the data. Chi-square test was applied to test the statistical significance of the association between categorical data. The Kruskal–Wallis test was used in nonnormal distributions. Logistic regressions were used to predict factors influence on PC and termination stages. All tests were two-tailed, and  $P < 0.05$  was considered statistically significant.

## Results

A total of 562 persons enrolled in this survey. The youngest participant was 11 and the oldest was 84 years old. About 50% of participants were under 28. Table 1 shows participants' characteristics in detail for men and women separately. About 45% of participants were single, 44% of men and 66% of women were married. We divided job status into four groups: self-employed, employee, jobless, and students. About 61% of participants had academic degree or studied at university, whereas only 0.5% of participants were illiterate.

It is shown that 10.5% of participants consumed alcohol. The frequencies of smoking hookah and cigarette were 18% and 19%, respectively.

The median age of smokers and nonsmokers was 31 and 28, respectively ( $P = 0.018$ ). All cigarette smokers smoked hookah too. There was a significant difference in cigarette smoking by gender ( $P < 0.001$ ). About 86.9% of smokers were male. 56% of cigarette smokers were single and about one-fourth were students (24.5%). Significant difference was found in cigarette smoking by marital status ( $P = 0.01$ ), but Chi-square test did not indicate any significant difference in smoking by educational level ( $P = 0.4$ ).

**Table 1: Demographic characteristics of participants by gender**

Variable	Men (n=316), n (%)	Women (n=246), n (%)	P
Age (median) years	26	30	0.04 <sup>a</sup>
Marital status			
Single	175 (55.4)	80 (32.5)	<0.001 <sup>b</sup>
Married	140 (44.3)	162 (65.8)	
Occupation			
Self employed	90 (72.6)	34 (27.4)	<0.001 <sup>b</sup>
Employee	59 (55.7)	47 (44.3)	
Jobless/housekeeper	34 (25)	102 (75)	
Student	100 (72.5)	38 (27.5)	
Education			
Nonacademic	126 (59.4)	86 (40.6)	0.19 <sup>b</sup>
Academic	183 (53.8)	157 (46.2)	
Medical history			
Diabetes	12 (60)	8 (40)	0.73 <sup>b</sup>
CVD	18 (66.7)	9 (33.3)	0.26 <sup>b</sup>
Hepatobiliary system	8 (66.7)	4 (33.3)	0.46 <sup>b</sup>
Respiratory	10 (66.7)	5 (33.3)	0.41 <sup>b</sup>
Cancer	1 (20)	4 (80)	0.10 <sup>b</sup>
BMI (median) (mg/m <sup>2</sup> )	23.87	23.51	0.72 <sup>a</sup>
Cigarette smoking	93 (29.4)	14 (5.7)	<0.001 <sup>b</sup>
Hookah smoking	70 (22.1)	31 (12.6)	0.004 <sup>b</sup>
Alcohol	43 (13.6)	16 (6.5)	0.007 <sup>b</sup>
Addiction	7 (2.2)	3 (1.2)	0.38 <sup>b</sup>

<sup>a</sup>Mann-Whitney test, <sup>b</sup>Chi-square test. BMI=Body mass index, CVD=Cardiovascular disease

From the perspective of cigarette smoking TTM, we found that 53 (19.1%) of participants were in PC stage, 22 (7.9%) were in contemplation, 20 (7.2%) were in preparation, 4 (1.4%) were in action, 11 (4%) were in maintenance, and 168 (60.4%) were in termination stage of change. Stages of change for hookah smoking were also examined; 62 (22.3%) of participants were in PC stage, 12 (4.3%) were in contemplation, 17 (6.1%) were in preparation, 11 (4%) were in action, 14 (5%) were in maintenance, and 162 (53.8%) were in termination stage. Table 2 reveals the frequency of participants in each stage separated by gender [Note that discrepancies in numbers of smokers in Tables 1 and 2 arise from this point that some of smokers did not know exactly where they stay in stages of change, so their information is missed in Table 2]. As shown in Table 2, there was a statistically significant difference between males and females from the point of cigarette smoking ( $P < 0.001$ ), but there was no significant difference in hookah smoking ( $P = 0.27$ ).

Demographic characteristics are listed in Tables 3 and 4 by different stages of TTM in both cigarette and hookah smoking. Median age and marital status were significantly different between stages of change in cigarette smoking TTM. As shown in Tables 3 and 4, the median age in precontemplation and contemplation in cigarette smokers is higher than other stages.

To indicate predicted factors of PC and termination stages of both cigarette and hookah smoking, we

applied logistic regression analysis. The negative state of variables considered as reference. As shown in Table 5, male gender, hookah smoking, and alcohol abuse were predictors of PC ( $R^2 = 0.172$ ), and only male gender was predictor of termination stage ( $R^2 = 0.034$ ) for cigarette smoking. Gender did not have any role in hookah smoking, whereas alcohol abuse, addiction, and cigarette smoking were predictors of hookah smoking for both PC and termination stages [Table 5].

## Discussion

Smoking is a well-known risk factor for many noncommunicable diseases and a great health threat with increasing prevalence in developing countries. It is responsible for many premature deaths worldwide and has increased in recent years.<sup>[21-23]</sup>

To the best of our knowledge, the current study is the first conducted in Iran using TTM to describe both hookah and cigarette smoking patterns.

Near one-fifth of participants in this study reported smoking cigarettes. Reported prevalence of cigarette smoking is really wide across the world. Al-Zalabani and Kasim reported that smoking prevalence was about 16% in Medina, Saudi Arabia, whereas it was reported to be about 19% in Brazil.<sup>[21,24]</sup> The highest prevalence of smoking in the general population of North Africa was noted in Tunisia (about 25%).<sup>[25]</sup>

A recent meta-analysis conducted in Nigeria reported that the pooled prevalence of smoking is 10.4% and 17.7% for the current and ever smokers, respectively. This study indicated considerable variation across geographical areas, from 5.4% in North-west to 32.1% in North-East.<sup>[26]</sup> The range across Iran is also quite wide. A meta-analysis conducted by Moosazadeh in 2013 found that smoking prevalence was estimated to be 22.9 (20.6–25.2) in men

and 0.6 (0.3–0.9) in women. He also reported that more than one-fifth of men from 15 to 64-years-old from west of Iran smoked cigarettes.<sup>[27]</sup> Our result was higher than many studies previously conducted in Iran, for example, smoking prevalence in Shiraz and Shahrood were 9.7% and 11.3%, respectively. Likewise, Boskabady *et al.* found a 12.7% smoking prevalence in Mashhad in 2010.<sup>[28-30]</sup>

**Table 2: Stages of change for cigarette and hookah smoking by gender**

Variable	Men, n (%)	Women, n (%)	P
<b>Cigarette smoking</b>			
PC	45 (84.9)	8 (15.1)	<0.001 <sup>a</sup>
C	19 (86.4)	3 (13.6)	
P	18 (90)	2 (10)	
Smokers	82	13	
A	4 (100)	0 (0)	
M	10 (90.9)	1 (9.1)	
T	95 (56.9)	72 (43.1)	
Quitters	109	73	
<b>Hookah smoking</b>			
PC	41 (66.1)	21 (33.9)	0.27 <sup>a</sup>
C	9 (75)	3 (25)	
P	13 (76.5)	4 (23.5)	
Smokers	63	28	
A	10 (90.9)	1 (9.1)	
M	9 (64.3)	5 (35.7)	
T	97 (60.2)	64 (39.8)	
Quitters	116	70	

<sup>a</sup>Chi-square test. PC=Precontemplation, C=Contemplation, P=Preparation, A=Action, M=Maintenance, T=Termination

In this study, the prevalence of hookah and cigarette smoking was approximately equal (18% vs. 19%). These rates were higher than the first study of prevalence in Mashhad which reported that hookah and cigarette smoking prevalence was about 8.6% and 12.7%, respectively.<sup>[29,31]</sup> Not only did the rate of hookah smoking double in the past 4 years in Mashhad, but also it was higher than that found in other studies in other parts of Iran. According to Iran's sixth national surveillance of risk factors of noncommunicable diseases (SuRFNCD-2011) on 10,572 individuals, the prevalence of hookah smoking was 3.4%.<sup>[32]</sup> It also has higher rates than in developed countries such as the United States and Britain.<sup>[28,30,33-36]</sup> These differences may be because of differences in study population, for example, Mohammadpoor and Rahman studies only included students. Our result is, however, much lower than Combrink *et al.*'s study in Johannesburg found the rate of hookah smoking was 60%.<sup>[37]</sup> Hoseainrezaee *et al.* also found the prevalence of 21.2% but they only included doctors and nurses.<sup>[38]</sup> In another study conducted by Maziak *et al.*, it is shown that Iran ranked the third among middle eastern countries in point of the prevalence of

**Table 3: Demographic characteristics by hookah smoking stage**

Variable	PC	C	P	A	M	T	P
Age (median)	28	23.5	24	28	26	27	0.77 <sup>a</sup>
<b>Marital status, n (%)</b>							
Single	34 (22.2)	8 (5.2)	10 (6.5)	7 (4.6)	8 (5.2)	86 (56.2)	0.92 <sup>b</sup>
Married	28 (22.4)	4 (3.2)	7 (5.6)	4 (3.2)	6 (4.8)	76 (60.8)	
<b>Education, n (%)</b>							
Nonacademic	28 (28.6)	7 (7.1)	3 (3.1)	3 (3.1)	3 (3.1)	54 (55.1)	0.11 <sup>b</sup>
Academic	34 (19.2)	5 (2.8)	13 (7.3)	8 (4.5)	11 (6.2)	106 (59.9)	
Sleep duration (median) (h/day)	8	8.5	7	7	7	8	0.23 <sup>a</sup>
BMI (median) (mg/m <sup>2</sup> )	24.15	24.05	25.52	24.8	24.87	23.45	0.61 <sup>a</sup>

<sup>a</sup>Kruskal-Wallis test, <sup>b</sup>Chi-square test. PC=Precontemplation, C=Contemplation, P=Preparation, A=Action, M=Maintenance, T=Termination, BMI=Body mass index

**Table 4: Demographic characteristics by cigarette smoking stage**

Variable	PC	C	P	A	M	T	P
Age (median)	32	42	23.5	22	30	27	<0.001 <sup>a</sup>
<b>Marital status, n (%)</b>							
Single	30 (20.3)	9 (6.1)	17 (11.5)	4 (2.7)	4 (2.7)	84 (56.8)	0.01 <sup>b</sup>
Married	23 (17.7)	13 (10)	3 (2.3)	0 (0)	7 (5.4)	84 (64.6)	
<b>Education, n (%)</b>							
Nonacademic	21 (20.8)	12 (11.9)	9 (8.9)	1 (1)	3 (3)	55 (54.5)	0.36 <sup>b</sup>
Academic	31 (17.8)	10 (5.7)	11 (6.3)	3 (1.7)	8 (4.6)	111 (63.8)	
Sleep duration (median) (h/day)	7	7	7	8	7	8	0.83 <sup>a</sup>
BMI (median) (mg/m <sup>2</sup> )	24.09	24.62	23.83	20.17	26.23	23.66	0.06 <sup>a</sup>

<sup>a</sup>Kruskal-Wallis test, <sup>b</sup>Chi-square test. PC=Precontemplation, C=Contemplation, P=Preparation, A=Action, M=Maintenance, T=Termination, BMI=Body mass index



**Table 5: Logistic predictors of precontemplation and termination stage in cigarette and hookah smoking**

Variable	B	SE	Wald	df	P	Exp(B)
<b>Cigarette smoking</b>						
PC <sup>a</sup>						
Male	1.488	0.542	7.541	1	0.006	4.427
Hookah	-0.885	0.402	4.856	1	0.028	0.413
Alcohol	-1.95	0.428	20.783	1	<0.001	0.142
Constant	-0.531	0.585	0.825	1	0.364	0.588
Termination <sup>b</sup>						
Male	-0.995	0.444	5.023	1	0.025	0.37
Constant	1.139	0.406	7.869	1	0.005	3.125
<b>Hookah smoking</b>						
PC <sup>c</sup>						
Alcohol	-1.241	0.432	8.242	1	0.004	0.289
Addiction	1.759	0.939	3.509	1	0.061	5.805
Cigarette smoking	-1.153	0.376	9.395	1	0.002	0.316
Constant	0.450	0.374	1.450	1	0.229	1.568
Termination <sup>d</sup>						
Alcohol	1.318	0.469	7.885	1	0.005	3.737
Addiction	-21.348	15324.637	<0.001	1	0.999	<0.001
Cigarette smoking	1.348	0.356	14.382	1	<0.001	3.851
Constant	-1.642	0.452	13.230	1	<0.001	0.194

<sup>a</sup>FP=0.172, <sup>b</sup>FP=0.034, <sup>c</sup>FP=0.13, dR2=0.188. SE=Standard error, PC=Precontemplation

waterpipe smoking (more than 25%), but this result only included data of 13–15 years old.<sup>[39]</sup>

We found that both hookah and cigarette smoking were more common among men than women especially cigarette smoking. This finding is consistent with other studies reporting that men smoke cigarettes at higher rates than women.<sup>[24,40-42]</sup> Cigarette smoking prevalence was six times higher in men compared to women whereas hookah smoking was about two times higher. This difference between genders in hookah smoking (compared with cigarette smoking) could be due to both the cultural acceptance of hookah in families and the hookah's lower stigma. In our study, the frequency of men in each stage of TTM for cigarette smoking was statistically significantly higher than women, whereas we did not find this pattern in hookah smoking. This point can also be explained by previous reason.

There was no significant relationship between educational level and smoking. This result replicated what Kaleta found in his study, but in many studies, we can see inverse relationship between educational attainment and smoking.<sup>[43-46]</sup> In the systematic review by Lu *et al.*, the pooled prevalence of current smoking among 68253 medical students was 10.93% which was lower than what found in Chinese undergraduates (22.8%). This study also showed that the rate of the current smoking in male medical students (24.09%) was higher than the estimated rates in Chinese adolescent males. It showed that the relation between education and smoking status was more complicated than what is thought.<sup>[47-49]</sup> Educational programs focusing on smoking

harm reduction for all educational levels would be of interest.

Just as observed earlier, in this study male gender was one of the predictors of cigarette smoking. Agrawal *et al.* found that gender was the strongest predictor for smoking. Other predictors in this study were area of residence, education and age. In another study conducted in India, poverty and poor education were strong risk factors for smoking.<sup>[46,50]</sup> In the study conducted by Coban *et al.* in the European Union, smoking onset in the younger age and lower academic achievement were related with nicotine dependence.<sup>[51]</sup> The same risk factors for both hookah and cigarette smoking reported.<sup>[52]</sup> Etter in the United States showed that higher prevalence of cigarette smoking was associated with lower intention to quit smoking.<sup>[53]</sup> Linde's study on the U. S. Air Force military recruits showed that hookah use was associated with cigarette smoking and ethnicity; and age and married status had inverse associations with hookah use.<sup>[54]</sup>

Our results indicated that about one-fourth of the current cigarette and hookah smokers have low or no intention to quit smoking (PC stage). While more than half of the smokers quit successfully (termination stage). This could relate to the current advertising bans and increasing the price of tobacco products after Iran's economic crash in 2012 results of Global sanctions. Previous studies showed price increase was the strongest predictor of smoking cessation as well.<sup>[55]</sup> Furthermore, the role of quit smoking campaigns and complete smoke-free home policy are indicated in some studies.<sup>[56,57]</sup> The Global

Adult Tobacco Survey (GATS) conducted from 2011 to 2017 in 20 low- and middle-income countries depicted that 15% of the participants were in PC and 5% were in preparation stage.<sup>[56]</sup>

The latest CDC report which analyzed GATS data of 28 countries between 2008 and 2016, reported the quit attempt of about 42% in the next 12 months.<sup>[58]</sup>

It is desirable to notice limitations of the present study in interpretations of results. Under-reporting of tobacco products use among our participants is possible. At first social desirability bias could not be avoided due to desire of people on being flawless and having an acceptable image in the community. Interviewer's bias may have occurred too. Finally, the whole lifestyle and socioeconomic factors which related to smoking could not be assessed; and this may reduce the power of the current survey. Mental health could be another area of attention in future studies because many studies showed the relationship between smoking and mental health. Designing longitudinal studies in Iran would be of interest in future.

## Conclusion

Due to the high affinity of smoking and also not wanting to quit it, policymakers should focus on preventing smoking and its predictors. Targeted education based on gender and marital status warrant attention. Community-wide education and interventions such as increasing the price of cigarettes are desired.

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## Conflicts of interest

There are no conflicts of interest.

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