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Amin Ghanbarnejad

Hormozgan university of medical sciences

Atefeh Homayuni

Hormozgan university of medical sciences

Zahra Hosseini (✉ hosseinishirin@gmail.com)

Hormozgan University of Medical Sciences <https://orcid.org/0000-0002-8152-3174>

Abdolhossain Madani

Hormozgan university of medical sciences

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Smoking behavior among students: Using HBM and ZIOP model

Amin Ghanbarnejad, Atefeh Homayuni, Zahra Hosseini^{*}, Abdolhossain Madani

1. Instructor of Biostatistics, Department of Public Health, School of Health, Tobacco and Health Research Center. Hormozgan University of Medical Sciences, Bandar Abbas, Iran
2. Ph.D student of Health Promotion and Education, School of Health, Hormozgan University of Medical Sciences, Bandar Abbas, Iran
3. Associate Professor of Health Promotion and Education. Tobacco and Health Research Center, Hormozgan University of Medical Sciences, Bandar Abbas, Iran. Email: hosseinishirin@ymail.com
4. Associate Professor of Epidemiology, Department of Public Health, School of Health, Social Determinants in Health Promotion Research Center, Research Institute for Health. Hormozgan University of Medical Sciences. Bandar Abbas. Iran

***Corresponding Author**

Zahra Hosseini, associate professor of health promotion and education, Tobacco and Health Research Center, Hormozgan University of Medical Sciences, Bandar Abbas, Iran. Email: hosseinishirin@ymail.com

Tel: 07633336202 Fax: 07633338584

Email: hosseinishirin@ymail.com

Abstract

Background: The purpose of this study was to explore the predictors of smoking among high school students using health belief model (HBM).

Methods: In this cross-sectional study, participants were 425 boys (mean age was 16.7 ± 0.85 and ranged from 15 to 19 years) among high school students in Bandar-Abbas city. Data were collected using a researcher-made questionnaire consisted of two main sections: Socio-demographic characteristics and HBM constructs. The zero-inflated ordered probit (ZIOP) model was used for investigating the association between health belief model constructs and smoking behavior.

Results: Results indicated that 82% of participants never smoked cigarette at all. The results of ZIOP model showed that knowledge, susceptibility, severity, benefits and cues to action had significant effect ($P < 0.05$) on smoking cigarette after adjusting for other covariates (i.e age, parents' education, losing one of the parents). Moreover, having a smoker friend was an inflation factor ($P < 0.001$). Adolescents with smoking friends are 44% less likely not to smoke at all.

Conclusion: Based on these findings, having a smoker friend, knowledge, susceptibility, severity, benefits and cues to action have a key role in predicting smoking and should be considered in designing educational programs aiming at reducing smoking initiation among adolescents.

Keywords: Adolescents, Health belief mode, smoking, Students, ZIOP model

Background

Smoking is the first preventable cause of death in the world (Slama 2004). 6 million people die due to tobacco smoking every year; over 600 thousand of whom are passive smokers who do not smoke cigarettes and over 5 million people of whom are those who smoke tobacco (WHO, 2015). Cigarette smoking causes 90% of lung cancers, 30% of deaths between the ages of 30-50, and 12% of all kinds of death (Haenle et al. 2006).

It has been estimated that one billion of younger adults will start smoking by 2030. The prevalence of daily cigarette smoking in Iran is roughly 12.5% (23.4% for men and 1.4% for women) and the average number is 13.7 cigarettes a day (Meysamie et al. 2010).

Various studies have indicated that the prevalence of cigarette smoking is increasing among adolescents and young adults (Griesbach et al. 2003). In the last two decades, the adolescents have been more exposed to tobacco advertisement and marketing and most smokers have reported that they started smoking before the age of 18 (Al-Zalabani and Kasim 2015). Studies conducted on the assessment of the behavioral consequences of smoking among young adults indicated that there is a significant relationship between adolescents' smoking and frequent smoking in early adulthood (Harakeh et al. 2004).

There is not a single reason for starting smoking among adolescents. Cigarette smoking is a complex behavior related to psychosocial, economic, and cultural factors. Different risk factors have been mentioned in various scientific sources for predicting smoking among adolescents such as lack of awareness about addictiveness of cigarette smoking and its impact on health, perceived social acceptance due to smoking, life problems, peer pressure, socioeconomic condition, family history of tobacco use, tobacco advertisement, smoking friends, stressful life events, dysfunctional family and weak parent-child relationship, low self-esteem, high level of negative emotion, weak problem-solving skill, low self-efficacy,

depression, anxiety, weak self-control, low psychological well-being, and risk-taking tendency. (Al-Zalabani and Kasim 2015; Mohammadkhani and Rezaei 2016; Schaefer et al. 2012; Tjora et al. 2011).

The identification of contextual factors resulting in tendency to cigarette smoking is regarded as an important step toward designing interventional programs so as to prevent smoking. Researchers in developed countries have constantly emphasized the significance of preventing cigarette smoking among adolescents. Furthermore, some programs have been developed and implemented to prevent cigarette smoking among adolescents. The goal of these programs included increasing awareness, changing attitude, and affecting students' behavior; some of these programs have been successful to some extent (Ayatollahi et al. 2005). Literature review shows that the health belief model (HBM) has been effective on improving the adoption of behaviors that prevent cigarette smoking. According to this model, to adopt the behaviors preventing smoking, the individuals need to first feel threatened (perceived susceptibility) against the problem (infected with cigarette smoking or exposure to its smoke), and then, to perceive the depth of this danger and seriousness of its various physical, social, mental, and economic side effects (perceived severity), believe that the smoking prevention program is beneficial and executable (perceived benefits) by receiving positive signs from the surrounding environment or their internal environment (cues to action), find out that the factors preventing this action are less expensive than its benefits (perceived barriers), and feel adequate and strong enough against the barriers of the behavior (self-efficacy) so that they can finally follow the preventive behaviors toward smoking (Sharifi-rad et al. 2007). The results show that a high level of perceived susceptibility and high self-efficacy can reduce smoking among individuals. Moreover, perceived barriers and self-efficacy can play an important role in predicting health behaviors including preventing smoking among university students (Li and Kay 2009).

Regarding the increasing rate of smoking among students and its impacts on their physical and mental health, this study aimed at exploring the predictors of smoking among high school students in Bandar Abbas city using health belief model.

Material and Methods

Participants

In this cross-sectional study, 425 boys among high school students were selected through the stratified sampling design. The study region was Bandar-Abbas city located in south of Iran and is the provincial capital of Hormozgan province. This city is divided by two educational wards by administrative division. In each ward, we selected four boyish schools by random sampling to sample from them. And finally in each schools we selected students according to the number of students in the schools. Participants were explained about how the plan was carried out and the confidentiality of the information, as well as the purpose of the plan, and entered the study if they wished.

Questionnaire

The researcher-made questionnaire were used to assess smoking behavior and HBM constructs. The questionnaire consists of two main sections: Socio-demographic characteristics and HBM constructs. The HBM constructs were as followed: knowledge about consequences of smoking (10 questions), perceived susceptibility (7 questions), perceived severity (9 questions), perceived barriers (5 questions), Perceived benefits (5 questions), cues to action (4 questions) and self-efficacy in combating the temptation of smoking (6 questions).

The knowledge questions were scored on binary scale: 1 as correct answer and 0 as wrong answer. Other constructs' questions were scored on five point Likert scale from 1 as strongly disagree to 5 as strongly

agree. Therefore, the scoring range of perceived susceptibility, perceived severity, perceived benefits, perceived barriers, cues to action and self-efficacy were 7-35, 9-45, 5-25, 5-25, 4-20 and 6-30, respectively. The questionnaire was designed using the sources and articles, and then validity of questions were assessed by expert panel. The reliability were examined by Cronbach's alpha and test-retest method. Cronbach's alpha for was 0.83 and ICC for test-retest was 0.78.

Statistical analysis

Demographic characteristic of participants such as age, parents' education, parents' job and death of parents were examined in the study.

The response variable is smoking behavior categorized in 5 ordered groups: 0: Non-smoker, 1: once in lifetime, 2: ex-smoker, 3: once per month, 4: once per week.

Variables considered in the modelling as covariates were knowledge, susceptibility, severity, barriers, benefits, self-efficacy and cues to action, the constructs of the HBM.

Descriptive statistics are reported as mean $\pm$ SD for quantitative variables and count and percent for categorical variables.

The one-way ANOVA were used to compare the mean of each constructs among response variable categories for univariate analysis.

The approach to modeling the data is zero-inflated ordered probit (ZIOP) model. The ZIOP model is a two-component mixture model consisting of a binary probit regression at zero mixed with an ordered probit regression. The part of binary probit regression is used to identify the smokers from the non-smokers. And the ordered probit regression is used to model the level of smoking count among the smokers. Let $c_i = 1$ if the i -th adolescent belongs to the smoker group or let $c_i = 0$ otherwise. c_i is related to a latent variable c_i^* through the following conditions: $c_i = 0$ for $c_i^* < 0$ and $c_i = 1$ for $c_i^* > 0$. The latent variable c^* characterizes the propensity of adolescent's smoking and is determined by

$$c_i^* = \mathbf{x}_i^T \boldsymbol{\beta} + \varepsilon_i, \quad i = 1, 2, \dots, n$$

Where $\mathbf{x}_i^T = (x_{i1}, x_{i2}, \dots, x_{ik})^T$ represents the vector of k covariates affecting the propensity of adolescent's smoking and the coefficients vector is represented by $\boldsymbol{\beta} = (\beta_1, \dots, \beta_k)^T$.

The error term ε_i are independent identically distributed as standard normal distribution. The probability of an adolescent smoking cigarette is determined by:

$$\Pr(c_i = 1 | \mathbf{x}_i) = \Pr(c_i^* > 0 | \mathbf{x}_i) = \Phi(\mathbf{x}_i^T \boldsymbol{\beta})$$

$\Phi(\cdot)$ represents the standard normal distribution function. Next, conditioning on $c_i = 1$, the observed smoking levels y_i' are modeled using an ordered probit model; these levels may also include 0. y_i' is linked to a latent variable y_i^* through a function $f(y_i^*)$. y_i^* is given by

$$y_i^* = \mathbf{z}_i^T \boldsymbol{\theta} + u_i, \quad i = 1, 2, \dots, n$$

Where $\mathbf{z}_i^T = (z_{i1}, z_{i2}, \dots, z_{ij})^T$ represents j covariates in ordered probit regression part of the model with the associated coefficients of $\boldsymbol{\theta} = (\theta_1, \dots, \theta_j)^T$; $\mathbf{x}_i$ and $\mathbf{z}_i$ could be different from each other. The random error term u_i are distributed as standard normal. The connection between y_i' and y_i^* is obtained by

$$y_i' = f(y_i^*) = \begin{cases} 0, & \text{if } y_i^* \leq 0 \\ 1, & \text{if } \mu_0 < y_i^* \leq \mu_1 \\ 2, & \text{if } \mu_1 < y_i^* \leq \mu_2 \\ 3, & \text{if } \mu_2 < y_i^* \leq \mu_3 \\ 4, & \text{if } y_i^* > \mu_3 \end{cases}$$

Where μ are boundary parameters that must be estimated together with the parameters vector θ . Under this model, the probability of five smoking levels is written as follow:

$$\Pr(y_i' = s | \mathbf{z}) = \Phi(\mu_s - \mathbf{z}_i^T \theta) - \Phi(\mu_{s-1} - \mathbf{z}_i^T \theta)$$

The observed response variable is $y_i = y_i' \times c_i$. Thus, the zero observation occurs when $c_i = 0$ (the adolescent has a strong sense to never smoker in the life, belongs to always-zero group) or occurs when $c_i = 1$ and $y_i' = 0$ (the adolescent is non-smoker only during research period).

In other words to observe a positive y_i it is required that $c_i = 1$ and $y_i' > 0$ jointly. This can be illustrated in the model below.

$$y_i = y_i' \times c_i = \begin{cases} 0, & \text{if } c_i = 0 \text{ or } y_i' = 0 \\ 1, & \text{if } c_i = 1 \text{ and } y_i' = 1 \\ 2, & \text{if } c_i = 1 \text{ and } y_i' = 2 \\ 3, & \text{if } c_i = 1 \text{ and } y_i' = 3 \\ 4, & \text{if } c_i = 1 \text{ and } y_i' = 4 \end{cases}$$

Therefore, the probabilities in the ZIOP model can be expressed as:

$$\begin{cases} \Pr(y_i = 0 | \mathbf{x}_i, \mathbf{z}_i) = [1 - \Phi(\mathbf{x}_i^T \beta)] + \Phi(\mathbf{x}_i^T \beta) \Phi(-\mathbf{z}_i^T \theta) \\ \Pr(y_i = s | \mathbf{x}_i, \mathbf{z}_i) = \Phi(\mathbf{x}_i^T \beta) [\Phi(\mu_s - \mathbf{z}_i^T \theta) - \Phi(\mu_{s-1} - \mathbf{z}_i^T \theta)] \end{cases}$$

Because zero outcomes are the summation of zero from the ordered probit model and zero from the probit model, the ZIOP model can constitute the large proportion of zeros. The ZIOP model was used for investigating the association between health belief model constructs and smoking behavior.

Analysis were performed in STATA 15 software.

Results

425 male adolescents participated in the research. They were fill the questionnaire. Demographic characteristics of participants are shown in Table 1. Mean age was 16.7 ± 0.85 and ranged from 15 to 19 years. The smoking behavior categories are presented in figure 1. Approximately, 82% of participants never smoked cigarette at all. Therefore we used zero-inflated ordinal model to analyze the data to accounting for excess zeros in outcome variable.

In the next step, we evaluated the normality of the HBM constructs through Shapiro-wilk test and all of the variables were normal at level 0.05.

Also, we reported the descriptive statistics of health belief model constructs among five categories of smoking behavior as well as the associated P-value from one-way ANOVA in table 2.

Because all the questions of health belief model constructs scored on Likert scale from 1 to 5, we calculated the score of each constructs by sum up the scores of items in that constructs. Then we calculated scaled score by dividing this summation by the number of items in each constructs to enable us for constructs comparison. Therefore we could present the scaled mean of each constructs among the smoking severity groups in one graph as seen in figure 2.

Table 1. Demographic characteristic of participants

Variable	Categories	No.	Percent
Father alive	no	18	4.2
	yes	407	95.8
Mother alive	no	12	2.8
	yes	413	97.2
Father's education	illiterate	15	3.6
	School education	132	31.7
	Diploma	152	36.5
	Associate Degree	60	14.4
	BSc and higher	58	13.9
Mother's education	illiterate	36	8.6
	School education	141	33.6
	Diploma	144	34.3
	Associate Degree	44	10.5
	BSc and higher	55	13.1
Father's Job	Unemployed	26	6.3
	Self-employed	184	44.7
	Employee	151	36.7
	retired	51	12.4
Mother's Job	Housewife	367	87.6
	employee	52	12.4

Figure 1. Distribution of smoking behavior among adolescents

Table 2. Univariate analysis of association between knowledge, HBM constructs and cigarette smoking behavior using ANOVA

Constructs	Non-smoker (Mean ±SD)	once in lifetime (Mean ±SD)	ex-smoker (Mean ±SD)	once per month (Mean ±SD)	once per week (Mean ±SD)	Total (Mean ±SD)	P-value
knowledge	8.79 ± 1.75	8.21 ± 1.74	8.89 ± 1.36	7.88 ± 2.10	5.38 ± 2.56	8.64 ± 1.83	<0.001
Susceptibility	29.11 ± 4.96	24.87 ± 5.49	23.11 ± 5.99	18.75 ± 5.47	19.13 ± 5.22	28.08 ± 5.58	<0.001
Severity	37.10 ± 6.52	34.37 ± 6.18	34.56 ± 4.45	30.88 ± 5.11	30.00 ± 8.45	36.46 ± 6.61	<0.001
Barriers	7.54 ± 3.53	8.90 ± 3.24	8.78 ± 3.99	10.00 ± 3.51	8.25 ± 3.20	7.79 ± 3.53	0.001
Benefits	20.66 ± 3.78	19.29 ± 4.96	18.56 ± 3.91	15.88 ± 5.3	13.50 ± 3.38	20.22 ± 4.14	<0.001
Self-efficacy	25.28 ± 4.59	23.15 ± 4.37	25.00 ± 5.03	23.38 ± 6.19	19.88 ± 4.16	24.88 ± 4.69	<0.001
cues	15.16 ± 4.68	13.46 ± 3.04	13.44 ± 3.13	12.88 ± 3.31	11.63 ± 3.34	14.80 ± 4.49	0.002

Figure 2. Mean score of HBM constructs in different smoking behavior categories

We investigated the association of HBM constructs, knowledge and cigarette smoking behavior by ZIOP model adjusting for age, parents' education, losing one of the parents. The Young test z statistics was 2.67 ($P=0.004$), therefore it was reasonable to use ZIOP model rather than the Ordinal Probit model. The results of this model are presented in Table 3. As seen in the Table 3, knowledge, susceptibility, severity, benefits and cues to action had significant effect ($P<0.05$) on smoking cigarette after adjusting for other covariates. Also it is mentionable that having a smoker friend was an inflation factor ($P<0.001$). Coefficients can be difficult to interpret.

On average in the data, those whose friends are smokers are about 44% less likely to be never-smokers than those whose friends did not smoke. We obtained the 44% by using margins effect.

Table 3. Results if parameter estimates of ZIOP model

Variable	category	Coefficient	Standard Deviation	P-value	95 % confidence interval	
age		-0.153	0.184	0.401	-0.514	0.206
Father alive	No ^a					
	Yes	1.106	0.984	0.261	-0.823	3.034

Mother alive	No ^a					
	Yes	1.049	1.128	0.352	-1.162	3.261
Father's education	Illiterate ^a					
	School education	-0.747	0.732	0.308	-2.182	0.689
	Diploma	-1.072	0.732	0.143	-2.507	0.362
	Associate Degree	-1.005	0.797	0.207	-2.568	0.557
	BSc and higher	-1.901	0.842	0.024	-3.550	-0.251
Mother's education	Illiterate ^a					
	School education	-0.525	0.490	0.284	-1.485	0.435
	Diploma	0.016	0.492	0.975	-0.948	0.980
	Associate Degree	-0.070	0.605	0.907	-1.257	1.116
	BSc and higher	-1.036	0.585	0.077	-2.183	0.111
knowledge		-0.171	0.077	0.026	-0.321	-0.021
Susceptibility		-0.164	0.030	<0.001	-0.222	-0.105
Severity		-0.067	0.032	0.035	-0.129	-0.004
Barriers		0.001	0.047	0.978	-0.090	0.093
Benefits		-0.100	0.034	0.004	-0.167	-0.032
Self-efficacy		-0.028	0.033	0.405	-0.037	0.092
Cues to action		-0.124	0.053	0.019	-0.228	-0.020
Inflation part of the model						
Have a smoker friend	No ^a					
	Yes	1.183	0.236	<0.001	0.721	1.646
constant		-0.808	0.200	<0.001	-1.200	-0.020

^a: reference category

Discussion

The objective of the present study was to predict cigarette smoking among high school students in Bandar Abbas city based on the constructs of the health belief model. According to the results, about 81.8 percent of the participants did not smoke cigarettes. Despite the high percentage of nonsmokers, using common models like logistic regression or the ordinal regression model did not present correct results. Therefore, the ZIOP model was used in this study.

The results of the study revealed that 18.2% of students had experienced smoking which is higher than that of other studies. The results of the study conducted by Al-Zalabani and Kasim (2015) on the students of Medina in Saudi Arabia showed that the prevalence of cigarette smoking among adolescents is 15.17%. It was significantly higher among male students (21.3%) and high school students (16.3%). The percentage of tobacco use was 4.7% in the study done by Ghaderi et al. (2016). 23.8% of the university students participating in the study conducted by Panahi et al. (2018) had smoked during the research period. Moreover, the results of the study done by Mohammadi et al. (2017) showed that 4.7% of the participants smoke cigarettes daily, about 6.4% of whom had smoked in last 30 days, and 34.7% of whom had experienced smoking at least once in their life. Some of the reasons for smoking among adolescents like students in the present study may be that smoking among adolescents is first for ostentation and then enjoyment. Curiosity about testing cigarettes which is often encouraged by friends and peers can be also an

excuse for smoking. Furthermore, some adolescents smoke to show disagreement with their family and eliminate humiliation; they want to boost their self-confidence in this way.

In the inflation part of the model due to marginal effect, it was made clear that adolescents with smoking friends are 44% less likely not to smoke at all. This finding is in line with the studies conducted by Mohammadi et al. (2017), Al-Zalabani and Kasim (2015), Karimi et al. (2013), Ghaderi et al. (2016), and Villanti et al. (2011). The results of Al-Zalabani and Kasim's study (2015) indicated that the risk of cigarette smoking among adolescents who all their friends or most of them were smokers, increased by 12.5 times; this risk increased by 5.7 times among the individuals some of their friends were smokers. In this age, adolescents are willing to make friends and engage with social networks with peers. It is expected that friendship pressure plays an important role in adolescents' behavior toward tobacco use, especially when it is along with lack of parental support and supervision, family problems, and the presence of a smoker family member (Schaefer et al. 2012; Kristjansson et al. 2008). Explaining drug abuse, Bandura's social learning theory emphasizes social and interpersonal factors. This theory believes that adolescents acquire their beliefs about drug abuse from the role patterns, especially from close friends and parents. Communication with parents and friends who use drugs, forms specific beliefs in the individual that causes drug abuse (Petraitis et al. 1995).

The results presented in figure 2 shows that the mean of perceived severity and perceived benefits among nonsmoking students was higher than the mean of these constructs among smokers because these nonsmoking students had understood the side effects and dangers caused by tobacco use as well as the benefits of not smoking more than the smoking students. Studies reveal that low self-efficacy is the cause of starting smoking, the rate of tobacco use, more problems in quitting smoking, and higher rates of relapse among adolescents (Engels et al. 2005). In line with other studies, the results of the present study also indicated that the highest mean of the scores of self-efficacy and cues to action was related to nonsmoking students and the lowest mean of the scores of these constructs was related to the students who smoked once a week.

The students who were aware of the risks and diseases caused by tobacco use, avoided using it. The mean of the perceived susceptibility among these students was higher compared to smoking students and ex-smokers. The lowest rate of the sense of danger was related to students who smoked once a month. Finally, the highest mean of the scores of perceived barriers was related to students who smoked once a month and the lowest mean in this regard was related to nonsmokers.

According to the results, there is a significantly negative relationship between awareness and smoking. In other words, students' knowledge and awareness of the health effects of smoking can lower the rate of smoking. This finding is in line with the results of the studies conducted by Karimi et al. (2013), Cheng et al. (2015), and Nasser and Zhang (2019); however, they are inconsistent with the results of Mohammadi et al.'s study (2017). Awareness of the side effects of smoking is a basic element for quitting and preventing smoking. According to the knowledge-attitude-behavior model, change in behavior includes acquiring the related knowledge, changing the related attitudes, and correcting practices (Cheng et al. 2015). Various studies conducted in Western countries have proven that smoking adolescents are generally of a lower level of awareness of the consequences and effects of smoking (Warren et al. 2009). The results of Islam and Johnson's study (2005) on the psychosocial correlates of smoking behavior among Egyptian adolescents indicated that knowledge of the short-term negative consequences of smoking was protective against susceptibility to smoking in the future for females.

The results showed that there is a significantly negative relationship between perceived susceptibility and smoking. This finding is in line with the results of the studies conducted by Mohammadi et al. (2017),

Tseng et al. (2018), and Ghasemi and Sabzmakan (2015); however, it is inconsistent with the results of Ghaderi et al.'s study (2016). Perceived susceptibility among adolescents is a powerful predictor of starting smoking in the future, experiencing it, and the current or permanent smoking (Carey et al. 2019). The results of Ghasemi and Sabzmakan's study (2015) indicated that perceived susceptibility and severity of the students who did not experience any kind of tobacco use was more than cigarette smokers and hookah consumers. These students perceived the risk of smoking-related illnesses and refused smoking. The most important perceptions related to perceived susceptibility among the smoking students in this study included non-addictive nature of smoking, occasional tobacco use, and low sense of danger associated with communication and companionship with consumers. One of the participants in Wolburg's study (2006) who did not intend to quit smoking and was not worried about smoking risks, said "nothing bad will happen to me, then why to bother myself?" In Ghaderi et al.'s study (2016), most of the students had a roughly low perceived susceptibility toward smoking behavior, too.

The results also indicated that there is a significantly negative relationship between perceived severity and smoking. This finding is in line with the result of Yan et al.'s study (2014) in which they showed that stronger intentions of smoking are significantly related to lower perceived severity. In the study of Ghasemi and Sabzmakan (2015), the students who did not smoke felt fear more than the smoking students. The most important perceptions related to perceived severity of the smoking and nonsmoking students included lack of acceptance by others, increased likelihood of premature death through smoking, addiction, spending a lot of money for treating diseases caused by tobacco use, inability to perform daily tasks, fearing from parents, family and social problems, harming others, and family's pessimism and lack of trust in the individual. On the contrary, Wolburg (2006) found out that many smokers who agree with some smoking-related risks, reduce the severity and significance of these risks and simply ignore the potential effect of these risks. Underestimation of smoking risks is also proven in the study conducted by Romer and Jamieson (2001). They found that 40% of the participants underestimated the average number of the years of life lost due to smoking. The high perceived severity in the present study may be because of the higher awareness of students toward smoking risks.

There was no significant relationship between perceived barriers and smoking behavior in the present study. This finding is inconsistent with the results of the studies conducted by Ghaderi et al. (2016) and Mohammadi et al. (2017). In Mohammadi et al.'s study (2017) on high school students, there was a weak correlation between smoking and perceived barriers. In Ghaderi et al.'s study (2016), the most important barriers perceived for not smoking included having smoking friends, easy access, parents' blame and lack of attention, and low price of cigarettes. The most important barrier in their study was "inability to say no" in responding the suggestion of friends and peers for smoking.

The results revealed a significantly negative relationship between perceived benefits and smoking. This finding is in line with the results of the studies done by Ghaderi et al. (2016), Song et al. (2009), and Aryal and Bhatta (2015). The results of the study of Song et al. (2009) indicated that the adolescents who had the highest perceptions of the benefits related to smoking, were 3.31 times more likely to start smoking. The results of Aryal and Bhatta's study (2015) on university students showed that the current smoking behavior risk considerably increases in individuals who believed smoking is enjoyable, helps confront problems or stress, makes a comfortable atmosphere with friends, leads to feel calm, and is a practice that should be done when you are tired. The young adults who believed that smoking causes yellowish stains on the surface of teeth and nails and is harmful for their health, were considerably at a lower risk of starting smoking. In the opinion of the participants in the study of Wolburg (2006) and Balch (1998), the benefits of quitting smoking included financial profit due to not spending money on cigarettes, improved athletic performance,

better breathing, unstained fingers, and better smell of clothes. The students participating in the study of Ghasemi and Sabzmakan (2015) also believed that quitting tobacco use is effective on the reduction of the likelihood of being infected with lung cancer and cardiovascular diseases, better and easier breathing, save on daily expenses, educational and occupational success, and having a desirable public image.

The results indicated that there is not a significant relationship between self-efficacy and smoking. This finding is in line with the findings of the studies conducted by Kazemi et al. (2012) and Kear (2002). Kear (2002) conducted a study on Chinese students to detect the psychological factors related to smoking and showed that factors such as male gender, low social and economic situation of the family, smoking peers, and low perception of consumption harms have a direct relationship with smoking. However, there was not a statistically significant relationship between individuals' self-efficacy and smoking behavior. The findings of studies done by Ghasemi and Sabzmakan (2015), Yan et al. (2014), Panahi et al. (2018), Shahnazi et al. (2013), Ghaderi et al. (2016), Karimi et al. (2013), Von Ah et al. (2005), and Chang et al. (2006) in this regard revealed that the more people trust in their efficacy and ability for not using tobacco, the more they perform the intended behavior.

Finally, the results indicated that there is a significantly negative relationship between cues to action and smoking. In Mohammadi et al.'s study (2017), cues to action was an effective predictor of smoking behavior. In the study of Rudatsikira et al. (2009), anti-smoking advertisements such as health warning messages on cigarette packs reduced the risk of smoking among adolescents. The education presented by teachers, and broadcasting educational programs and contents in books are among the most important cues for not smoking in Ghaderi et al.'s study (2016).

Because the present study was only conducted on male high school students, the results cannot be generalized to other age groups and students. Therefore, it is suggested to conduct further studies using this model among different populations and groups in terms of age and gender. Data collection in this study was done by taking interviews, which is one of the advantages of this research.

Conclusion

According to the findings of this study and the effect of the health belief model constructs in predicting smoking, it is suggested to design educational programs aiming at increasing students' awareness of smoking losses and promoting their self-efficacy as well as holding workshops to improve social skills such as "saying no". Planning alternative activities to fill students' leisure time, increasing sports and recreational centers, monitoring the production, purchase, and consumption of cigarettes, and increasing counseling centers can be effective on the reduction of smoking. Finally, since young adults model each other in this age, it is very essential for parents to pay more attention to the communication and friendly relationships of their children.

List of Abbreviations

HBM: health belief model, ZIOP: zero-inflated ordered probit

Declarations

Ethics approval and consent to participate

Ethical approval was received for this study from the Ethics Committee of the Hormozgan University of Medical Sciences (IR.HUMS.REC.1395.122). Written informed consent was obtained from individuals who participated in this study.

Consent for publication

Not applicable.

Availability of data and materials

The datasets used analyzed during the current study are available from the corresponding author on reasonable request.

Competing interests

All the authors declare that they have no competing interests.

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Authors' contributions

AG and ZH conceptualized and designed the project. ZH,AH, AM led analysis of the transcripts and developed the manuscript. ZH and AG performed the critical review. All authors reviewed and approved the final version.

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Figures

Figure 1

Distribution of smoking behavior among adolescents

Figure 2

Mean score of HBM constructs in different smoking behavior categories