




# Relationship and the Effect of Different Variables on Smoking Prevention Behaviors among Students: The Regression Analysis

Simin Geravandi<sup>1</sup>, Mohammad Javad Mohammadi<sup>2,3</sup>, Akbar Babaei Heydarabadi<sup>4</sup>, Saeed Ghanbari<sup>5</sup>, Nasser Hatamzadeh<sup>4</sup>

<sup>1</sup>Student Research Committee, Ahvaz Jundishapur University of Medical Sciences, Ahvaz, Iran

<sup>2</sup>Environmental Technologies Research Center, Medical Basic Sciences Research Institute, Ahvaz Jundishapur University of Medical Sciences, Ahvaz, Iran

<sup>3</sup>Department of Environmental Health, School of Health, Air Pollution and Respiratory Diseases Research Center, Medical Basic Sciences Research Institute, Ahvaz Jundishapur University of Medical Sciences, Ahvaz, Iran

<sup>4</sup>Department of Health Promotion and Education, School of Health and Social Determinants of Health Research Center, Ahvaz Jundishapur University of Medical Sciences, Ahvaz, Iran

<sup>5</sup>Department of Biostatistics and Epidemiology, School of Health, Ahvaz Jundishapur University of Medical Sciences, Ahvaz, Iran

## Abstract

**Background & Aims:** The burden of tobacco smoking is known worldwide. In a high percentage of preventable cancers, respiratory diseases are attributed to smoking. This study aimed to investigate the relationship and the effect of different variables on smoking prevention behaviors among students in southwest Iran in 2022 by the regression analysis.

**Materials and Methods:** The current study is a descriptive-analytical study that was conducted in two phases. In the first phase of the study, demographic and contextual information questionnaires, a questionnaire based on the health belief model, and a questionnaire related to smoking prevention behaviors were used to collect data. To this end, 120 students from different undergraduate programs at Payame Noor University in Ahvaz were randomly selected. Data were analyzed by SPSS statistical software version 16 via central indicators, dispersion, and multiple linear regression tests.

**Results:** The results showed that the perceived barriers dimension ( $\beta=0.168$ ,  $P$  value=0.038) and action guide ( $\beta=0.235$ ,  $P$  value<0.001) have a significant effect on prevention behaviors. According to the reported coefficients, a one-unit increase in perceived barriers and action guidelines, 0.168 and 0.235 units, respectively, increased the number of prevention behaviors.

**Conclusion:** It is possible to exert a positive effect on the prevention of smoking among students by properly educating students' parents. Paying attention to these recommendations can increase the probability of students' understanding of the prevention of smoking.

**Keywords:** Smoking, Students, Behavior, Prevention and control, Regression analysis

Received: October 5, 2023, Accepted: October 15, 2023 ePublished: December 29, 2023

## 1. Introduction

Health is a multidimensional issue that includes physical, mental, social, and spiritual health [1]. Smoking is one of the important factors that threaten the health of people, especially young people, and one of the priorities of public health to reduce the prevalence of smoking is to prevent young people from becoming smokers [2,3].

Compared to drugs, smoking is a substance that is easily available to the public and its social stigma is low. Therefore, people, especially young people, easily turn to smoking and become addicted to it as a result of continued use. In addition to having physical and psychological effects on the individual, smoking addiction also threatens the health of society from a cultural, social, economic, and political point of view [2,4]. According to the information provided by the United States Centers for Disease Control and Prevention (CDC), smoking is the most important and preventable cause of death in the United States. In this country, 443 000 people die every

year due to smoking [5]. If current patterns of tobacco use in the United States continue, about 5 million people under the age of 18 will die prematurely from smoking-related diseases [6]. The World Health Organization (WHO) has estimated that in the 20th century, about 100 million people died due to smoking, most of whom were in rich countries [7,8]. According to the estimate by the WHO, the number of deaths caused by smoking will reach more than 10 million people in 2030 [9]. Smoking in Iran among people over 15 years old is 13.2 cigarettes (12.7% in the city and 11.9% in the village) [10]. The International Burden of Disease Study has estimated the number of deaths caused by tobacco to be higher than the WHO. According to this study, 8.7 million people die every year due to smoking. Unfortunately, the prevalence of smoking in the world has doubled in the last twenty years, and the annual number of deaths caused by smoking is growing [8]. The prevalence of smoking among young people has increased, especially among people in the age



\*Corresponding Author: Nasser Hatamzadeh, Email: [hatamzadeh\\_n@ajums.ac.ir](mailto:hatamzadeh_n@ajums.ac.ir)

© 2023 The Author(s); This is an open-access article distributed under the terms of the Creative Commons Attribution License (<https://creativecommons.org/licenses/by/4.0/>), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

group of 18-24 years old which is mainly constituted of students [11].

Exposure to secondhand smoke has immediate and long-term health effects. Exposure to cigarette smoke occurs in different environments such as home, workplace, and public environments [12]. Exposure at home and work may be particularly harmful because many people spend most of their time at home and work [12,13]. Exposure to cigarette smoke increases the angiotensin-converting enzyme (ACE2) receptor in the respiratory tract [14]. Furthermore, smoking and exposure to secondhand smoke mostly lead to heart, liver, and lung diseases. Moreover, smoking is the main risk factor for diseases such as heart attack, stroke, chronic obstructive pulmonary diseases (e.g., emphysema and chronic bronchitis), and cancer, especially lung cancer, larynx cancer, and pancreatic cancer [15-17].

To prevent smoking, special attention should be paid to young people. Young people are more exposed to smoking due to social, demographic, environmental, and individual risk factors [18]. Social and demographic risk factors related to smoking include families with low social and economic status. Environmental risk factors include the availability of cigarettes, smoking by classmates and siblings, and parents' inattention to this issue [19]. Individual risk factors include the lack of self-confidence, the belief that smoking is beneficial, and inability to refuse tobacco use [18].

This study was to investigate the relationship and the effect of different variables on smoking prevention behaviors among the students of Payame Noor University of Ahvaz in southwest Iran in 2022 using regression analysis.

## 2. Materials and Methods

### 2.1. The study setting

This cross-sectional descriptive study was conducted in Ahvaz, located in southwest Iran in 2022 among the students of Payame Noor University (Figure 1). Ahvaz is located at 31 degrees and 30 minutes of latitude north and 48 degrees and 65 minutes of longitude east, in the plains of Khuzestan, 12 m above the sea level [20,21].

### 2.2. Method, data collection, and statistical analysis

This cross-sectional descriptive study was conducted to assess the relationship and the effect of different variables on smoking prevention behaviors among students using regression analysis. The tools used in this study included a demographic and background information questionnaire, a questionnaire based on the health belief model [22], and a questionnaire related to smoking prevention behaviors [23]. The statistical population of this study comprised the undergraduate students of Payame Noor University of Ahvaz, among whom 120 men and women were randomly selected. Thus, first,

a list of all undergraduate students of Payame Noor University, Ahvaz, was prepared and randomly selected from among these students. The inclusion criteria for this study included people's willingness to enter the study and studying at the undergraduate level (second or third year of study) at Payame Noor University. In addition, unwillingness to continue participating in the study and incomplete completion of questionnaires were considered as exclusion criteria.

It was decided to consider 120 students ( $P_2=7\%$ ) in this study according to the results obtained from the pilot study conducted on 30 students. Furthermore,  $P_1$  was set at 0.45 for smoking prevention behaviors, and Boccock's kappa formula was used considering the test power of 80% and the confidence level of 95% to enhance accuracy. Additionally, a 5% drop in samples was taken into account to address potential uncertainties [24].

$$n = \frac{(Z_{1-\frac{\alpha}{2}} + Z_{(1-\beta)})^2 \times (p_1q_1 + p_2q_2)}{(p_1 - p_2)^2} \quad (1)$$

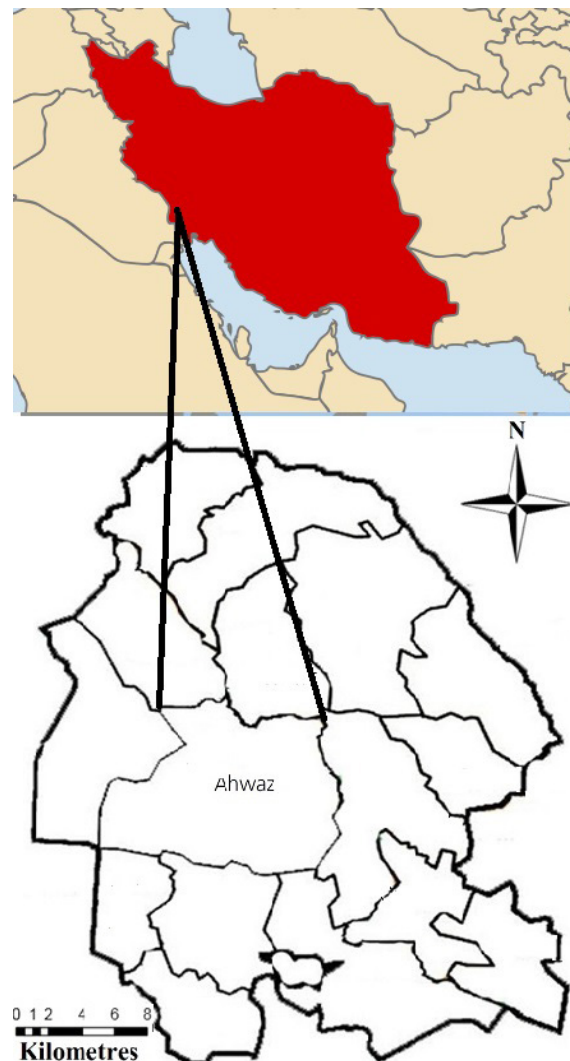


Figure 1. The location of the study areas

At this stage, sampling was randomly selected from among the different undergraduate programs at Payame Noor University involving both males and females.

### 2.3. Statistical analysis of data

In the section related to the cross-sectional study, central indices, dispersion, frequency, percentages, and analysis of variance were used to identify the difference between different variables related to the adoption of smoking prevention behaviors. Multiple linear regression test was also used to compare the predictive power of the health belief model. The data were then analyzed using SPSS version 16 statistical software.

## 3. Results

This study included 120 students of Payame Noor University of Ahvaz in 1400. The results of the survey of the research subjects were investigated using a demographic and background information questionnaire and a questionnaire based on the health belief model related to smoking prevention behaviors. The following table presents the results of the frequency of qualitative demographic variables (Table 1).

Table 1 depicts that the studied subjects were female (70%), and the average age of people is 68.23 with a standard deviation of 57.3. The results of this study showed that the average age group of the participants is 68.23, most of the participants (80%) are single, and 36.7 are in the sixth semester of study. Moreover, a higher percentage (23.3%) of the participating students were studying in the field of medical engineering, most of whom (43.3%) lived in a family with 5-6 people, and 8.3% of students had a family with 3 people.

Table 2 illustrates the results of the descriptive indicators of different dimensions of the questionnaire. The results showed an average score of 10.917 out of 20 scores for the structure of perceived sensitivity, an average score of 12.717 out of 30 scores for the structure of perceived intensity, an average score of 14.917 out of 30 scores for the structure of perceived obstacles, and the average score of 18.542 out of 35 scores for the structure of perceived benefits for preventive behaviors. Moreover, an average score of 18.100 out of 36 scores for the action guide structure, an average score of 17.213 out of 30 scores for the self-efficacy structure, and an average score of 6.892 out of 18 scores were obtained for preventive behaviors (Table 2).

Table 3 shows the results of the relationship and the effect of different variables on prevention behaviors using regression analysis. The results indicated that the perceived barriers dimension ( $\beta=0.168$ ,  $P$  value=0.038) and action guide ( $\beta=0.235$ ,  $P$  value<0.001) have a significant effect on prevention behaviors. According to the reported coefficients, a one-unit increase in perceived barriers and action guidelines,

0.168 and 0.235 units, respectively, increased the number of prevention behaviors (Table 3). The effect of each variable on the distribution charts is also intuitively presented in Figure 2.

The results of the regression analysis revealed the relationship and the effect of different variables on prevention behaviors, as depicted in Figure 2a-d. The results showed that the perceived barriers dimension ( $\beta=0.168$ ,  $P$  value=0.038) and action guide ( $\beta=0.235$ ,  $P$  value<0.001) have a significant effect on prevention behaviors. According to the reported coefficients, a one-unit increase in perceived barriers and action guidelines, 0.168 and 0.235 units, respectively, increased the number of prevention behaviors. The effect of each variable on the distribution charts is also intuitively shown in Figure 2a-d.

## 4. Discussion

The current study is a descriptive-analytical study that was conducted to assess the relationship and the effect of different variables on smoking prevention behaviors among students in southwest Iran in 2022 by the regression analysis. In the first phase of the study, 120 students of Payame Noor University of Ahvaz were examined.

In terms of gender, most of the studied subjects were female (70%). The results of this study showed that the average age group of the participants is 68.23, most of the participants (80%) were single, and 36.7 were in the sixth semester of the study. A higher percentage (23.3%) of the participating students were studying in the field of medical engineering. Most of them (43.3%) lived in a family with 5-6 people, and 8.3% of students had a family with 3 people. In the current study, 18% of the students had a smoking father, and 11% of the students were in a family with more than 2 smokers. Moreover, 10.8% of students had smoking friends, while 87% did not have any smoking friends.

Smoking among the participants of this study was 15%. In a large systematic review and meta-analysis study conducted on 99 studies by Aryaie et al and indexed by the WHO website, the prevalence of smoking among high school students was 13% for girls and 23% for boys [25]. Furthermore, a meta-analysis which was conducted on 46 studies in the population of Iranian students showed that the prevalence of smoking among female and male students was 11% and 33%, respectively [25]. Moreover, a meta-analysis of 37 studies in Iran that included a total of 16937 female students and 25647 male students reported the prevalence of smoking among male and female students to be 22% on average [25]. The figure for the prevalence of smoking obtained in our study (15%) is relatively lower than that reported in this meta-analysis (22%), which is due to the higher prevalence of smoking in males than in females, and one of the reasons for this

**Table 1.** Frequency of qualitative demographic variables

Variables	Qualitative Demographic	Number	Percent	Valid Percentage	The Cumulative Percentage
Gender	Female	84	70	70	70
	Male	36	30	30	100
Field of study	Biomedical engineering	28	23.3	23.3	23.3
	Computer	11	9.2	9.2	32.5
	Rights	13	10.8	10.8	43.3
	Business management	1	0.8	0.8	44.2
	Electricity	9	7.5	7.5	51.7
	Psychology	23	19.2	19.2	70.8
	IT	2	1.7	1.7	72.5
	Counseling	6	5	5	77.5
	Accounting	13	10.8	10.8	88.3
	Instrumentation	1	0.8	0.8	89.2
	Physics	1	0.8	0.8	90
	Construction	1	0.8	0.8	90.8
	English language	2	1.7	1.7	92.5
	Metallurgy	2	1.7	1.7	94.2
Semester	Architecture	1	0.8	0.8	95
	Industry	1	0.8	0.8	95.8
	Agriculture	1	0.8	0.8	96.7
	Physical Education	3	2.5	2.5	99.2
Semester	Literature	1	0.8	0/8	100
	5	39	32.5	32.5	32.5
	6	44	36.7	36.7	69.2
	7	18	15	15	84.2
Marital status	8	19	15.8	15.8	100
	Single	96	80	80	80
	Married	23	19.2	19.2	99.2
Job	Divorced	1	0.8	0.8	100
	No	71	59.2	59.2	59.2
Constitutional record	Yes	49	40.8	40.8	100
	No	107	89.2	89.2	89.2
Sports activity	Yes	13	10.8	10.8	100
	Never	12	10	10	10
	Sometimes	52	43.3	43.3	53.3
	Once a month	5	4.2	4.2	57.5
	Once a week	16	13.3	13.3	70.8
Father's education	Three times a week	35	29.2	29.2	100
	Illiterate	6	5	5	5
	High school	43	35.8	35/8	40/8
	Diploma	41	34.2	34/2	75
	Bachelor's degree	22	18.3	18/3	93/3
Mother's education	Master's degree	8	6.7	6.7	100
	Illiterate	11	9.2	9.2	9.2
	High school	40	33.3	33.3	42.5
	Diploma	51	42.5	42.5	85
	Bachelor's degree	15	12.5	12.5	97.5
	Master's degree	3	2.5	2.5	100

Table 1. Continued

Variables	Qualitative Demographic	Number	Percent	Valid Percentage	The Cumulative Percentage
The number of children	The first	45	37.5	37.5	37.5
	The second	28	23.3	23.3	60.8
	The third	23	19.2	19.2	80
	The fourth	7	5.8	5.8	85.8
	The fifth	17	14.2	14.2	100
The number of family members	3 persons	10	8.3	8.3	8.3
	4 persons	36	30	30	38.3
	5 or 6 people	52	43.3	43.3	81.7
	7 or more	22	18.3	18.3	100
Which members of your family smoke?	Father	18	15	15	15
	Brother	4	3.3	3.3	18.3
	Grandfather	7	5.8	5.8	24.2
	Grandmother	1	0.8	0.8	25
	Other	79	65.8	65.8	90.8
	More than 2 people	11	9.2	9.2	100
How many of your friends smoke?	None	87	72.5	72.5	72.5
	1 person	10	8.3	8.3	80.8
	2 persons	5	4.2	4.2	85
	3 persons	5	4.2	4.2	89.2
	More than 3	13	10.8	10.8	100
Has there ever been a history of death due to the effects of smoking in your family or close relatives?	No	104	86.7	86.7	86.7
	Yes	16	13.3	13.3	100
Have you ever smoked (even once)?	No	102	85	85	85
	Yes	18	15	15	100
Who suggested smoking your first cigarette?	Nobody	29	24.2	24.2	24.2
	Friends	5	4.2	4.2	28.4
	Brother	3	2.5	2.5	30.9
	Other relatives	3	2.5	2.5	33.4
Missing	System	80	66.7	66.7	66.7
At what age did you smoke your first cigarette?	Less than 10	5	4.2	4.2	4.2
	10 or 14	3	2.5	2.5	6.7
	15 or 19	8	6.7	6.7	13.4
	Above 20	9	7.5	7.5	20.9
Missing	System	95	79.2	79.2	79.2
Do you currently smoke?	No	34	28.3	28.3	28.3
	Yes	5	4.2	4.2	32.5
Missing	System	81	67.5	67.5	67.5
What is your current smoking status?	1 cigarette	7	5.8	5.8	5.8
	2 to 3	1	0.8	0.8	6.6
	4 to 10	1	0.8	0.8	7.4
	16 to 20	2	1.7	1.7	9.1
	Missing	System	109	90.8	90.8
If you smoke every day, how many cigarettes do you smoke every night?	Less than 10 years old	3	2.5	2.5	2.5
	10 to 14	2	1.7	1.7	4.2
	15 to 19 years old	3	2.5	2.5	6.7
	Above 20 years old	3	2.5	2.5	9.2

Table 1. Continued

Variables	Qualitative Demographic	Number	Percent	Valid Percentage	The Cumulative Percentage
Missing	System	109	90.8		
	No	18	15	69.2	69.2
	Sometimes	4	3.3	15.4	84.6
	Each month	1	0.8	3.8	88.5
How old have you been smoking regularly?	Every week	2	1.7	7.7	96.2
	Everyday	1	0.8	3/8	100
	Missing	System	94	78.3	
Does smoking shorten human life?	No	30	25.0	25.0	25.0
	Yes	90	75.0	75.0	100.0
Is there dependence (addiction) in smoking?	No	20	16.7	16.7	16.7
	Yes	100	83.3	83.3	100.0
Can smoking cause cancer?	No	17	14.2	14.2	14.2
	Yes	103	85.8	85.8	100.0
What is the most common cancer caused by smoking?	Cannot	19	15.8	15.8	15.8
	Leukemia	2	1.7	1.7	17.5
	Lung cancer	99	82.5	82.5	100.0
Does quitting smoking reduce the risk of most diseases caused by smoking?	No	34	28.3	28.3	28.3
	Yes	86	71.7	71.7	100.0
Which sentence below is correct?	I do not know	17	14.2	14.2	14.2
	Hookah is more dangerous than cigarettes.	97	80.8	80.8	95.0
	Smoking is more dangerous than hookah.	5	4.2	4.2	99.2
	Both are the same.	1	0.8	0.8	100.0
Can being exposed to cigarette smoke be dangerous for a person?	No	14	11.7	11.7	11.7
	Yes	106	88.3	88.3	100.0
Father's job	Employee	28	23.3	23.3	23.3
	Manual worker	12	10	10	33.3
	Self-employed	43	35.8	35.8	69.2
	Retired	34	28.3	28.3	97.5
	Other	3	2.5	2.5	100
Mother's job	Housewife	105	87.5	87.5	87.5
	Employee	12	10	10	97.5
	Self-employed	3	2.5	2.5	100
Total		120	100		
		<b>Mean</b>	<b>SD</b>	<b>The least</b>	<b>The most</b>
Age		68.23	3.57	19	43

Table 2. Descriptive indicators of different dimensions of the examined questionnaire

Dimensions	Mean	Middle	Standard Deviation	The least	The most
Perceived sensitivity	10.917	12	4.477	0	16
Perceived intensity	12.717	13	5.552	0	24
Perceived barriers	14.917	15/5	6.165	0	24
Perceived benefits	18.542	21	7.558	0	28
Action guide	18.100	17	5.073	11	33
Efficacy	17.213	18	3.524	6	28
Prevention behaviors	6.892	6/5	2.875	1	13

may be due to the higher percentage of girls in our study compared to the study by Aryaie et al [25]. In their study, they showed that male students have a higher percentage (60%) of the population, and the number of males in the meta-analysis is 1.5 times the number of females [25].

In the study by Panahi et al on the population of students living in the dormitory of Shahid Beheshti University of Medical Sciences, the average age of the students was 22.93, and 60% of the female population, 40% of the male population, and 17.1% of the students were smokers. A possible reason for the higher prevalence of smoking in Panahi and colleagues' study compared to our study is



**Table 3.** Regression analysis of overestimation of prevention behaviors in the health belief model

Prevention behaviors	Coefficients	Standard deviation	Standard coefficients	t-statistic	P value	R-square
Constant	2.646	1.048	0.138	2.525	0.013	0.413 <sup>a</sup>
Perceived sensitivity	-0.020	0.070	-0.032	-0.289	0.773	
Perceived intensity	-0.021	0.059	-0.040	-0.352	0.726	
Perceived barriers	0.168	0.054	0.158	3.111	0.038	
Perceived benefits	0.004	0.049	0.010	0.080	0.936	
Action guide	0.235	0.051	0.415	4.609	<0.001	

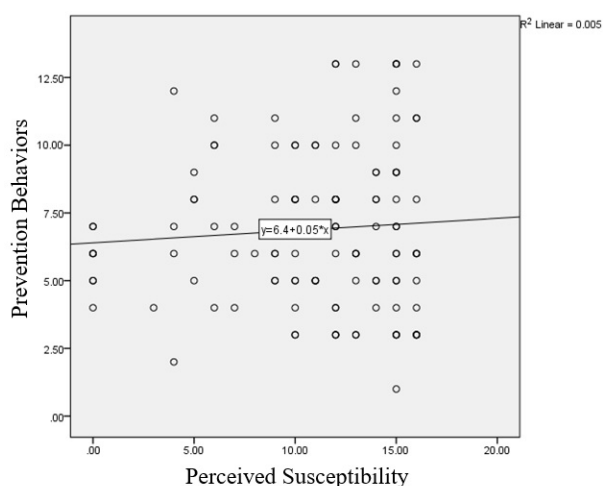


Figure 2-a

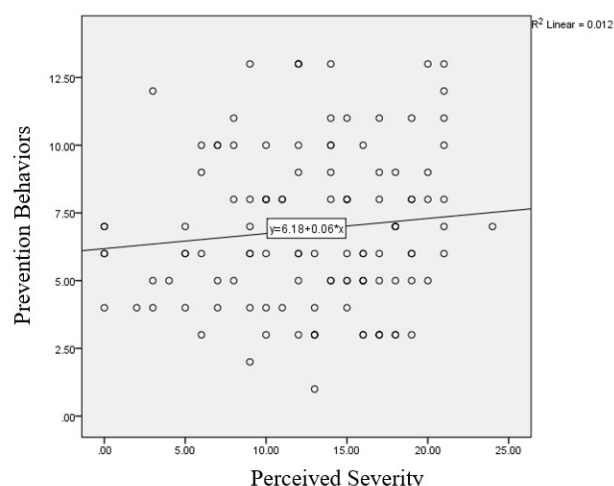


Figure 2-b

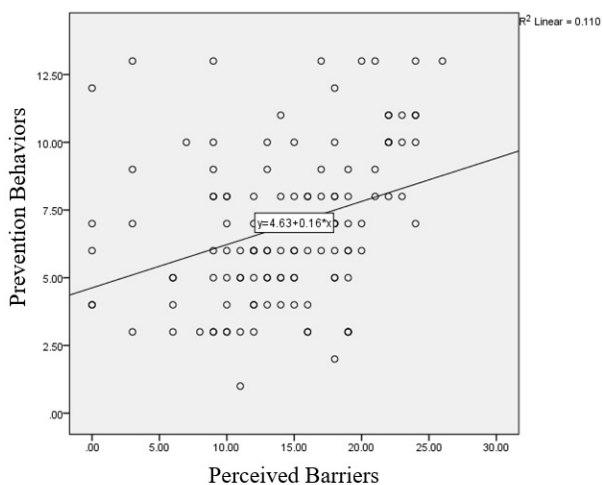


Figure 2-c

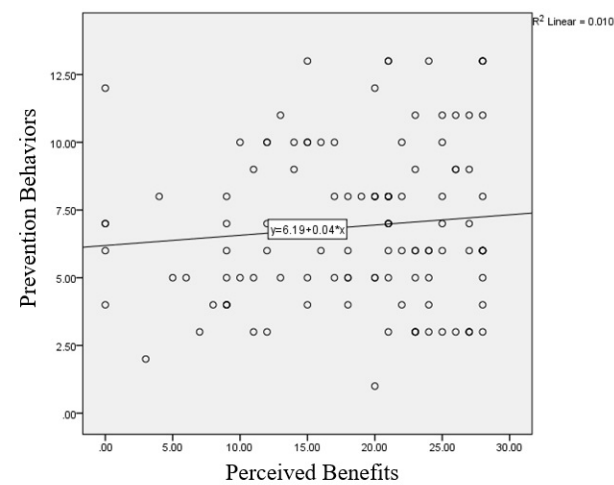


Figure 2-d

**Figure 2.** (a-d). Regression analysis test to consider the relationship between perceived susceptibility and prevention behaviors (fig 2a); the relationship between perceived severity and prevention behaviors (fig 2b); the relationship between perceived barriers and prevention behaviors (fig 2c); the relationship between perceived benefits and prevention behaviors (fig 2d).

that the entire sample population of their study lived in the dormitory [26].

Another study conducted among 130 students of Yazd University of Medical Sciences indicated that the prevalence of drug use among students who lived with their families is lower, and the students' perceived sensitivity, threat perceived barriers, and perceived benefits to drug use were greater among students in this study [27]. However, the study by Khazae-Pool et al in

Nowshahr, which investigated the effect of an educational intervention based on the health belief model in a sample of male students with an average age of 17, demonstrated that more than half of the students in the intervention group have a history of smoking [28].

In our study, the variables of gender, marital status, having a job, academic term, probation history, and sports activity status had no significant relationship with the dimensions of the health belief model, but

the Kruskal-Wallis test showed that the dimension of perceived benefits has a significant relationship with parents' education ( $P$  value=0.026,  $P$  value=0.013). Furthermore, the results suggested that the dimension of perceived benefits is the highest in people with a father's education level of diploma and post-diploma. In addition, the results revealed that the perceived benefits are the highest in people with a mother's education level of post-graduate and bachelor's degrees. This result is in line with the results obtained from previous studies in this field. Masodi et al in their study found a direct and significant relationship between the students' knowledge score regarding the factors related to the prevention of drug addiction and the education of their parents [29].

## 5. Conclusion

According to the results of this study, the dimension of perceived benefits had a significant and direct relationship with the education of students' parents. These results showed how much students will be influenced by their parents' knowledge and attitude. Therefore, it is possible to have a positive effect on students' prevention of smoking by properly educating students' parents.

In the present study, the results of the data analysis showed that the lower the number of existing obstacles, the higher the probability of preventive behaviors. Based on the results of this study, paying attention to the written recommendations in the educational package can increase the probability of students' understanding of the prevention of smoking. Therefore, using the results obtained in the present study can be extremely helpful for education and intervention in the field of health behaviors related to smoking among young people to reduce the current problems.

## Acknowledgments

This work was part of a funded M.S thesis by Simin Geravandi, a student at Ahvaz Jundishapur University of Medical Sciences, and the financial support of this study (SDH-0102) was provided by the Social Determinants of Health Research Center.

## Authors' Contribution

**Conceptualization:** Simin Geravandi, Mohammad Javad Mohammadi, Nasser Hatamzadeh.

**Data curation:** Simin Geravandi, Saeed Ghanbari.

**Formal analysis:** Akbar Babaei Heydarabadi, Saeed Ghanbari, Nasser Hatamzadeh.

**Funding acquisition:** Nasser Hatamzadeh.

**Investigation:** Simin Geravandi, Mohammad Javad Mohammadi, Nasser Hatamzadeh.

**Methodology:** Simin Geravandi, Akbar Babaei Heydarabadi, Saeed Ghanbari, Nasser Hatamzadeh.

**Project administration:** Mohammad Javad Mohammadi, Akbar Babaei Heydarabadi, Nasser Hatamzadeh.

**Resources:** Simin Geravandi, Mohammad Javad Mohammadi, Nasser Hatamzadeh.

**Software:** Saeed Ghanbari.

**Supervision:** Nasser Hatamzadeh.

**Validation:** Simin Geravandi, Akbar Babaei Heydarabadi, Saeed

Ghanbari, Nasser Hatamzadeh.

**Visualization:** Simin Geravandi, Mohammad Javad Mohammadi, Nasser Hatamzadeh.

**Writing—original draft:** Simin Geravandi, Mohammad Javad Mohammadi, Akbar Babaei Heydarabadi, Saeed Ghanbari, Nasser Hatamzadeh.

**Writing—review & editing:** Simin Geravandi, Mohammad Javad Mohammadi, Akbar Babaei Heydarabadi, Saeed Ghanbari, Nasser Hatamzadeh.

## Competing Interests

The authors declare no competing interests.

## Consent for Publication

Not applicable.

## Data Availability Statement

The datasets generated and/or analyzed during the current study are available from the corresponding author upon reasonable request.

## Ethical Approval

The Ethics Committee of Ahvaz Jundishapur University of Medical Sciences approved the study protocol. This study was originally approved by the Ahvaz Jundishapur University of Medical Sciences with code IR.AJUMS.REC.1401.067.

## Funding

This work was part of a fund at the Ahvaz Jundishapur University of Medical Sciences (AJUMS), and the financial support of this study (IR.AJUMS.REC.1401.067) was provided by AJUMS.

## References

1. Fukai M, Kim S, Yun YH. Depression and suicidal ideation: association of physical, mental, social, and spiritual health status. *Qual Life Res.* 2020;29(10):2807-14. doi: 10.1007/s11136-020-02538-x.
2. GBD 2019 Tobacco Collaborators. Spatial, temporal, and demographic patterns in prevalence of smoking tobacco use and attributable disease burden in 204 countries and territories, 1990-2019: a systematic analysis from the Global Burden of Disease Study 2019. *Lancet.* 2021;397(10292):2337-60. doi: 10.1016/s0140-6736(21)01169-7.
3. Abbasi M, Dargahi S, Bagiyan Koole Marz MJ, Bakhti M, Dargahi A. Examining the role of difficulty in emotional self-regulation, impulsiveness and defensive mechanisms in discriminate smokers and non-smokers students. *Arch Hyg Sci.* 2014;3(2):59-69.
4. Arabshahi A, Mohebi S, Gharlipour Z. Perspectives and reasons for smoking tendency in youth. *Arch Hyg Sci.* 2021;20(3):189-200. doi: 10.32598/ahs.10.3.189.
5. World Health Organization (WHO). WHO Report on the Global Tobacco Epidemic, 2021: Addressing New and Emerging Products. WHO; 2021. Available from: <https://www.who.int/publications/i/item/9789240032095>.
6. Singh T, Arrazola RA, Corey CG, Husten CG, Neff LJ, Homa DM, et al. Tobacco use among middle and high school students--United States, 2011-2015. *MMWR Morb Mortal Wkly Rep.* 2016;65(14):361-7. doi: 10.15585/mmwr.mm6514a1.
7. Sharifirad G, Hazavei MM, Hasanzadeh A, Daneshamouz A. The effect of health education based on health belief model on preventive actions of smoking in grade one, middle school students. *J Arak Univ Med Sci.* 2007;10(1):79-86. [Persian].
8. Finkelstein E, Baid D, Almudarra S, Alqunaibet A, Msemburi W, Watkins D, et al. Calculating the economic burden of NCDs in Saudi Arabia: an application of three common



- approaches. In: *Noncommunicable Diseases in Saudi Arabia: Toward Effective Interventions for Prevention*. World Bank Publications; 2021. p. 65-77. doi: [10.1596/978-1-4648-1717-5\\_ch4](https://doi.org/10.1596/978-1-4648-1717-5_ch4).
9. Fan Z, Gong X, Xu H, Wang H, Zeng N, Li L, et al. Gender differences in the associations between tobacco smoke exposure and depressive symptoms among US adults: NHANES 2007-2018. *J Psychiatr Res*. 2022;146:249-57. doi: [10.1016/j.jpsychires.2021.11.013](https://doi.org/10.1016/j.jpsychires.2021.11.013).
  10. Meysamie A, Ghaletaki R, Zhand N, Abbasi M. Cigarette smoking in Iran. *Iran J Public Health*. 2012;41(2):1-14.
  11. Reitsma MB, Flor LS, Mullany EC, Gupta V, Hay SI, Gakidou E. Spatial, temporal, and demographic patterns in prevalence of smoking tobacco use and initiation among young people in 204 countries and territories, 1990-2019. *Lancet Public Health*. 2021;6(7):e472-81. doi: [10.1016/s2468-2667\(21\)00102-x](https://doi.org/10.1016/s2468-2667(21)00102-x).
  12. Rosen LJ, Lev E, Guttman N, Tillinger E, Rosenblat S, Zucker DM, et al. Parental perceptions and misconceptions of child tobacco smoke exposure. *Nicotine Tob Res*. 2018;20(11):1369-77. doi: [10.1093/ntr/ntx169](https://doi.org/10.1093/ntr/ntx169).
  13. Cho H, Lee K, Hwang Y, Richardson P, Bratset H, Teeters E, et al. Outdoor tobacco smoke exposure at the perimeter of a tobacco-free university. *J Air Waste Manag Assoc*. 2014;64(8):863-6. doi: [10.1080/10962247.2014.896295](https://doi.org/10.1080/10962247.2014.896295).
  14. Smith JC, Sausville EL, Girish V, Yuan ML, Vasudevan A, John KM, et al. Cigarette smoke exposure and inflammatory signaling increase the expression of the SARS-CoV-2 receptor ACE2 in the respiratory tract. *Dev Cell*. 2020;53(5):514-29. e3. doi: [10.1016/j.devcel.2020.05.012](https://doi.org/10.1016/j.devcel.2020.05.012).
  15. Lo Sasso G, Schlage WK, Boué S, Veljkovic E, Peitsch MC, Hoeng J. The Apoe(-/-) mouse model: a suitable model to study cardiovascular and respiratory diseases in the context of cigarette smoke exposure and harm reduction. *J Transl Med*. 2016;14(1):146. doi: [10.1186/s12967-016-0901-1](https://doi.org/10.1186/s12967-016-0901-1).
  16. Altamirano J, Bataller R. Cigarette smoking and chronic liver diseases. *Gut*. 2010;59(9):1159-62. doi: [10.1136/gut.2008.162453](https://doi.org/10.1136/gut.2008.162453).
  17. Lee HW, Park SH, Weng MW, Wang HT, Huang WC, Lepor H, et al. E-cigarette smoke damages DNA and reduces repair activity in mouse lung, heart, and bladder as well as in human lung and bladder cells. *Proc Natl Acad Sci U S A*. 2018;115(7):E1560-9. doi: [10.1073/pnas.1718185115](https://doi.org/10.1073/pnas.1718185115).
  18. Brinn MP, Carson KV, Esterman AJ, Chang AB, Smith BJ. Cochrane review: mass media interventions for preventing smoking in young people. *Evid Based Child Health*. 2012;7(1):86-144. doi: [10.1002/ebch.1808](https://doi.org/10.1002/ebch.1808).
  19. Olsson T, Barcellos LF, Alfredsson L. Interactions between genetic, lifestyle and environmental risk factors for multiple sclerosis. *Nat Rev Neurol*. 2017;13(1):25-36. doi: [10.1038/nrneurol.2016.187](https://doi.org/10.1038/nrneurol.2016.187).
  20. Goudarzi G, Geravandi S, Forouzandeh H, Babaei AA, Alavi N, Vosoughi Niri M, et al. Cardiovascular and respiratory mortality attributed to ground-level ozone in Ahvaz, Iran. *Environ Monit Assess*. 2015;187(8):487. doi: [10.1007/s10661-015-4674-4](https://doi.org/10.1007/s10661-015-4674-4).
  21. Bagherian Marzouni M, Moradi M, Zarasvandi A, Akbaripoor S, Hassanvand MS, Neisi A, et al. Health benefits of PM10 reduction in Iran. *Int J Biometeorol*. 2017;61(8):1389-401. doi: [10.1007/s00484-017-1316-2](https://doi.org/10.1007/s00484-017-1316-2).
  22. Mohammadi K, Tavafian SS. Effect of educational intervention based on health belief model on prevention of substance abuse among the students of Khatam Al-Nabieen University in Afghanistan. *Iran Red Crescent Med J*. 2020;22(5):e101935. doi: [10.5812/ircmj.101935](https://doi.org/10.5812/ircmj.101935).
  23. Fernandez DM, Larson JL, Zikmund-Fisher BJ. Associations between health literacy and preventive health behaviors among older adults: findings from the health and retirement study. *BMC Public Health*. 2016;16:596. doi: [10.1186/s12889-016-3267-7](https://doi.org/10.1186/s12889-016-3267-7).
  24. Ramezankhani A, Heidarnia A, Ghofrani Pour F. Effect of Education Based on Health Belief Model on Knowledge and Preventive Behavior of Cigarette Consumption [dissertation]. Tehran: Tarbiat Modares University; 2000.
  25. Aryaie M, Sharifi H, Khorrami Z, Ardalani G, Rajaei L, Heydari G, et al. Prevalence of cigarette smoking in Iranian adolescents and young adults: a systematic review and meta-analysis. *East Mediterr Health J*. 2021;27(6):612-28.
  26. Panahi R, Ramezankhani A, Tavousi M, Osmani F, Niknami S. Predictors of adoption of smoking preventive behaviors among university students: application of health belief model. *J Educ Community Health*. 2017;4(1):35-42. doi: [10.21859/jech.4.1.35](https://doi.org/10.21859/jech.4.1.35).
  27. Baghianimoghdam MH, Mazloomi Mahmoodabad SS, Mohammadi S, Baghianimoghdam B. Attitude towards and use of ecstasy in medical university interns' based on HBM. *J Prev Med Hyg*. 2009;50(4):241-5.
  28. Khazaei-Pool M, Zarei F, Pashaei T, Shojaeizadeh D. The effect of an educational intervention based on health belief model on improving smoking preventive behaviors among students. *Iran J Health Educ Health Promot*. 2017;4(4):300-8. doi: [10.18869/acadpub.ihepsaj.4.4.300](https://doi.org/10.18869/acadpub.ihepsaj.4.4.300). [Persian].
  29. Masoudi Boroujeni D, Baghianimoghdam MH, Sharifirad G, Fallahzadeh H. Evaluation of preventive behaviors of addiction based on health belief model (HBM) among male high school students in Boroujen, Iran. *J Health Syst Res*. 2012;8(2):237-46. [Persian].