Iran Red Crescent Med J. 2018 February; 20(2):e13773. doi: 10.5812/ircmj.13773.

Published online 2018 February 12. **Research Article**

Adding Health Literacy to the Health Belief Model: Effectiveness of an Educational Intervention on Smoking Preventive Behaviors Among University Students

Rahman Panahi,[1] Ali Ramezankhani,[2] Mahmoud Tavousi,[3] and Shamsaddin Niknami[4,*]

[1]Ph.D. Candidate in Health Education and Promotion, School of Medical Sciences, Tarbiat Modares University, Tehran, IR Iran
[2]Professor, Department of Health Services, Shahid Beheshti University of Medical Sciences, Tehran, IR Iran
[3]Associate Professor, Health Metrics Research Center, Iranian Institute for Health Sciences Research, ACECR, Tehran, IR Iran
[4]Associate Professor, Department of Health Education and Health Promotion, Faculty of Medical Sciences, Tarbiat Modares University, Tehran, IR Iran

[*]*Corresponding author*: Shamsaddin Niknami, Associate Professor, Department of Health Education and Health Promotion, Faculty of Medical Sciences, Tarbiat Modares University, Tehran, IR Iran. E-mail: niknamis@modares.ac.ir

Received 2017 May 21; **Revised** 2017 June 18; **Accepted** 2017 August 23.

Abstract

Background: It is believed that smoking is the gateway to use substances and illicit drugs. Due to an increase in smoking among students, we thought there is a need for more efficient ways to prevent smoking among the young and adolescents.
Objectives: This study aimed to develop an extended version of the Health Belief Model (HBM) with elements of Health Literacy (HL) to assess whether an educational intervention could be effective in smoking prevention based on this new development in 2016.
Methods: This was a quasi-experimental study performed on 130 students living in dormitories of Shahid Beheshti University of Medical Sciences in Tehran, Iran, who were recruited and assigned to experimental and control groups (each containing 65 students). The experimental group received six electronic educational sessions via telegram application while the control group received no intervention. The data were collected using a questionnaire containing items on HBM, smoking preventive behaviors, and a measure of HL (the HL inventory for adults-HELIA). The questionnaire was completed at three time-points: before, immediately and three months after the intervention. Data analyses were done using analysis of variance, Friedman and Mann-Whitney U Tests. The significance level was set at 0.05.
Results: Before the intervention, there was no significant difference in the demographic and background variables, the underlying level of knowledge, preventive behaviors, HL, and all the constructs of the model between the groups ($P > 0.05$). After the intervention, comparing two groups showed that the mean scores of knowledge, preventive behaviors, HL, and all components of the model changed significantly in the experimental group compared to the control group ($P < 0.05$). The mean and standard deviation of adoption of smoking preventive behaviors at the beginning of the study in smoking and non-smoking students in the experimental group were 12.66 ± 1.24 and 8.66 ± 0.16, respectively. Then, after three months they changed to 22.32 ± 3.53 and 9.38 ± 0.33, respectively, which represents a significant increase in the adoption of behaviors in the experimental group ($p < 0.0001$), but no significant difference was observed in the adoption of smoking preventive behaviors in smoking and non-smoking students in the control group ($p > 0.05$).
Conclusions: This study showed that educational intervention by Telegram application based on HBM and HL was effective in promoting the adoption of smoking preventive behaviors among university students.

Keywords: Health Literacy, Smoking Prevention, University Students

1. Background

Smoking, especially cigarette smoking, can lead to many preventable deaths all over the world (1). It is predicted that by the end of 21st century, one billion people will die due to smoking Tobacco (2). There are several problems resulting from smoking at lower ages; for example, nicotine addiction is higher among smokers who started smoking at lower ages and accordingly there is less opportunity to quit smoking (3, 4). Research reports higher rates of smoking among young adults ranging from 14.2 to 39 around the world (5). It was noted that the growing trends of smoking among students were associated with several factors such as peer pressure, having problems in life, social acceptance, family history of smoking, low levels of parents' education, willingness to gain personality, gender (mostly men), high income, socialization with friends

who are smokers, earning prestige, academic years (third and fourth year students compared to junior students), smoking in times of depression or comfort, lack of emotional support, educational failure, unemployment, family quarrels, and disputes (6-8).

There is a significant relationship between health literacy (HL) and smoking status (9). The latest studies on this issue have concluded that low HL can act as an independent risk factor for the return of smoking, weaker results of smoking cessation and smoking (10-12).

According to the obtained results of studies about behavior change, now the successful preventive education will be done in accordance with the known patterns. In this respect, health belief model (HBM) is acceptable and efficient in the field of diseases prevention and behavioral problems (13). HBM can be a good model for predicting the behaviors associated with smoking among smokers, non-smokers, and former smokers. It is reported that a high level of perceived susceptibility and in parallel, high self-efficacy can reduce smoking among individuals. Researchers also found that perceived barriers could play an important role in predicting high-risk behaviors such as smoking among university students (14). Several researchers have suggested HBM application in their educational programs for smoking preventive behaviors (15-19).

HL has a potential effect on the constructs of HBM and it can be used as a moderator in the HBM instead of the knowledge variable. It is argued that this conceptual framework could provide a useful tool to interpret the ways in which HL affects the desired behavior (20). The framework assumes that HL affects the perceived threats, perceived benefits, perceived barriers, and perceived self-efficacy as a catalyst (Figure 1).

According to the opinions of some researchers, it is necessary to integrate HBM with other constructs for better understanding of the reasons for complex behaviors such as smoking (14), potential effect of HL on the constructs of the model (20), as well as the role of low HL in smoking (10), weaker results of smoking cessation (12), the return of smoking (11). Due to the increasing rate of smoking among students (5-8), we thought there is a need for more efficient ways to prevent smoking among the young population and adolescents.

2. Objectives

This study aimed to develop an extended version of the HBM with elements of HL to assess whether an educational intervention could be effective in smoking prevention based on this new development among dormitory students in Tehran, Iran, in 2016.

3. Materials and Methods

3.1. Design and Participants

This study was a quasi-experimental intervention that was performed on 130 male and female students from different cities living in dormitories of Shahid Beheshti University of Medical Sciences in Tehran, Iran, in 2016. First, a list of all dormitories was provided and two dormitories for girls and two dormitories for boys were randomly selected. Then, they were randomly allocated to experimental and control groups. The sample size was calculated based on a pilot study. Accordingly, to improve smoking preventive behaviors by 25% (P1 = 0.45 and P2 = 0.70), a study with a power of 80% and statistical confidence limits of 95% would require a sample of 57 participants in each group. Considering the possibility of 15% loss of sample, we included 65 students in each group. Inclusion criteria included students' desire to enter the study, being a second- or third-year undergraduate student, and living in the dormitories of Shahid Beheshti University of Medical Sciences. In addition, dissatisfaction with participating in the study and having an incomplete questionnaire were considered as the exclusion criteria.

3.2. The Questionnaires

Four questionnaires were used to collect the data.

1. Demographic and background information that included questions about age, gender, marital status, education level, experience of probation, the amount of physical activity per week, parents' education, parents' occupation, birth rank in the family, family size, monthly family income, having a smoker in the family, having close friends who smoke, having a history of smoking related death in the family or close relatives, and determining the status of the individuals in terms of smoking (smoker, the consumption experience even for once, and non-smoker).

2. HL Inventory for Adults (HELIA) that was used to measure HL. This questionnaire includes 33 items measuring 6 major dimensions including reading, access, understanding, appraisal, decision-making, and behavior. The score on each dimension or the total score of the questionnaire range from 0 to 100 where the higher scores indicate better conditions. The scores 0 - 50 were considered as inadequate, 50.1 - 66 as problematic, 66.1 - 84.0 as sufficient, and 84.1 - 100 as excellent HL. The psychometric properties of the questionnaire are well-documented (21).

3. A designed questionnaire containing 46 items on the constructs of the HBM that was used to assess perceived susceptibility (four items with scores ranging from four to 20), perceived severity (six items with scores ranging from six to 30), perceived barriers (six items with scores ranging from six to 30), perceived benefits (seven items with

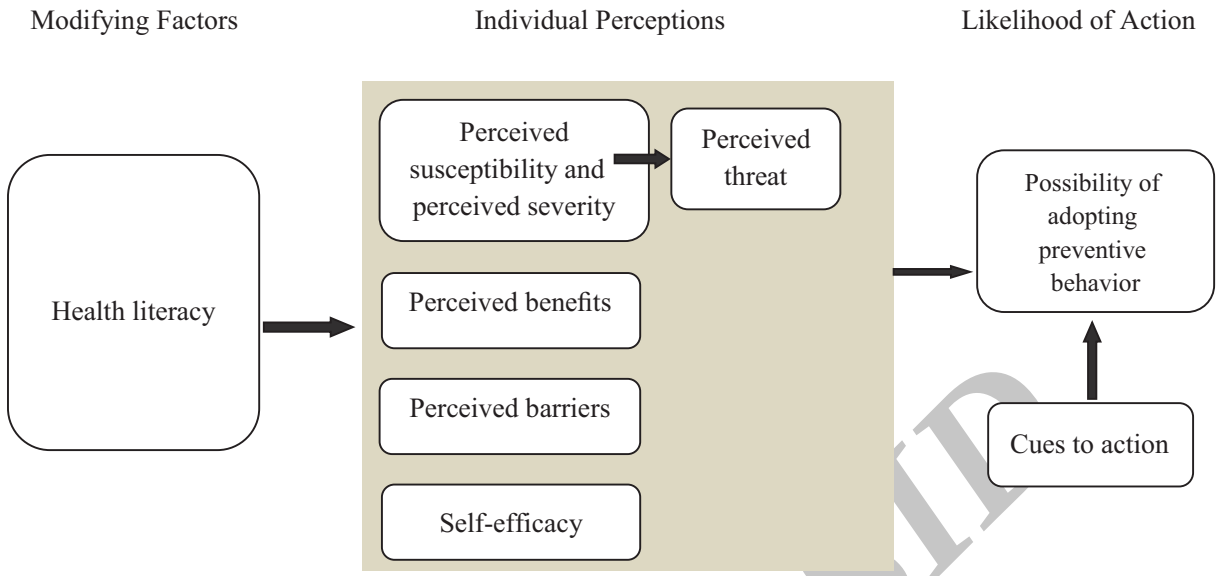

Figure 1. Integration of Health Literacy with Health Belief Model (20)

scores ranging from five to 35), self-efficacy (six items with scores ranging from six to 30), cues to action (two items), and smoking preventive behaviors (15 items with scores ranging from 0 to 30 for smokers and six items with scores ranging from 0 to 12 for non-smokers). All the items, except for those related to cues to action, rated on a 5-point Likert scale (from strongly agree with score of 5 to strongly disagree with score of 1). Two questions related to cues to action were to assess sources of information about health advice against smoking.

4. An eight-item questionnaire that was used to assess knowledge about smoking and its adverse effects. The total score ranged from eight to 24 where a higher score indicated a better condition.

To determine CVR and CVI, the HBM questionnaire was provided to a handful of professors and experts and their comments were considered to modify or delete questions. The reliability was also assessed in a pilot study (on 30 students) and the following results were obtained: perceived susceptibility (CVR = 0.88, CVI = 0.90, Cronbach's alpha = 0.85), perceived severity (CVR = 0.97, CVI = 0.99, Cronbach's alpha = 0.70), perceived barriers (CVR = 0.84, CVI = 0.93, Cronbach's alpha = 0.81), perceived benefits (CVR = 0.79, CVI = 0.91, Cronbach's alpha = 0.90), perceived self-efficacy (CVR = 0.89, CVI = 0.96, Cronbach's alpha = 0.83), knowledge (CVR = 0.91, CVI = 0.94, Cronbach's alpha = 0.75), and smoking preventive behaviors (CVR = 0.91, CVI = 0.90, Cronbach's alpha = 0.85). Validity and reliability of the questions related to cues to action were not calculated because they were in the objective form and they were not to measure the comprehension ability of students. For the HELIA questionnaire, the alpha coefficient for the area of reading was calculated as 0.84, gain access as 0.85, understanding as 0.90, appraisal as 0.77, decision making and use of health information as 0.86, and for the whole questionnaire as 0.94.

3.3. Intervention

The intervention contained educational materials based on HBM and health literacy. We used Telegram as a communication medium and students were approached at six time-points in order to send materials on perceived susceptibility, severity, perceived benefits, perceived barriers, self-efficacy, smoking harms, and benefits of physical activity. We thought a social medium such as Telegram is appealing for young students and could work better than traditional teaching methods (22-24). The control group received no intervention.

3.4. Data Collection

All students in both groups were asked to complete the study questionnaires before and immediately after the intervention as well as at three months follow-up. All the students were asked to answer questions honestly. The questionnaires were completed at dormitories. Once they were collected, the data were entered into the SPSS version16 (IL.Chicago.USA) software for analysis.

3.5. Data Analysis

The normality of data distribution was studied using the Kolmogorov-Smirnov test. The results showed that the data distribution in the constructs of perceived susceptibility, self-efficacy, and behavior was non-normal and in the other constructs was normal. In cases where the distribution was non-normal, data distribution was normalized by using the square root or logarithm conversion. Then the appropriate test was conducted according to the data. Within-group differences were assessed using the repeated measures analysis. In addition, analysis of variance was carried out for between-group comparisons (for normal data). In some instances, Friedman test and Mann-Whitney test were used (for nonparametric data). The significance level was set at 0.05.

3.6. Ethics

Ethical approval was received from the ethics committee of Tarbiat Modares University (ID: IR.TMU.REC.1394.172, Date: December 19, 2015). The aims and procedures of the study were explained to the participants. The anonymity and confidentiality of the study were assured and then the participants signed informed consent letters. The investigators guaranteed that there were no conflicts of interest.

4. Results

A total of 130 students were enrolled. After the intervention, five participants from the control group (three due to failure to complete the questionnaire and two due to an unwillingness to continue with the study), and three participants from the experimental group (due to an unwillingness to continue the participation in the study) were excluded (Figure 2). The final analysis was performed on 122 cases (62 in the experimental group and 60 in the control group). The Chi-square test showed no statistically significant differences between two groups in terms of demographic profiles and background variables ($P > 0.05$). The results are shown in Table 1.

Before the intervention, there were no significant differences between the two groups in terms of knowledge, HBM constructs, HL, and the adoption of smoking preventive behaviors ($P > 0.05$). However, the results indicated that after the intervention, the scores of knowledge, HBM constructs, HL, as well as the scores of adoption of smoking preventive behaviors significantly improved in the experimental group while in the control group, only a significant change was observed in the knowledge score.

Comparing changes in the mean scores of all the constructs including perceived susceptibility, perceived severity, perceived barriers, perceived benefits, perceived self-efficacy as well as knowledge and HL represents a significant difference between the two groups ($P < 0.05$). The study findings are shown in Table 2. The scores of adoption of smoking preventive behaviors in smoking and non-smoking students in the control and experimental groups, before, immediately and three months after the intervention are shown in Figures 3 and 4. The results showed after the intervention, there was a significant difference between the two groups in terms of adoption of smoking preventive behaviors ($P < 0.0001$).

5. Discussion

This study aimed to determine the effect of an educational intervention based on HBM and HL on smoking preventive behaviors among university students. The results showed that the intervention using a social medium (telegram) increased knowledge, HL, and adoption of smoking preventive behaviors.

After the educational intervention, the mean score of knowledge increased significantly in the experimental group. These results showed that education has a positive effect on the promotion of knowledge of the students about the adverse effects of smoking while enhancing knowledge can be the first step to adopt smoking preventive behaviors. According to a statistically significant relationship between knowledge and HL (25-30), we can say that one of the reasons for increasing knowledge score of students in the experimental group has been the improvement of their HL. This is consistent with the findings of studies conducted by Setoudeh et al. (15), Gharlipour et al. (31), Renoka and Pushpanjali (16), Atabila and Eleanor (17), Wan et al. (32), Hanewinkel et al. (33), and Chi et al. (19). Similarly, in the present study, a significant increase was seen in the mean scores of knowledge in the control group while the increase in the experimental group was not. One of the possible reasons for this finding is that subjects of the control group completed the questionnaires three times and this can enhance their knowledge. Another possible reason can be the higher media advertising for cigarettes than for other drugs and high access of students to information about cigarettes compared to other people. This finding is consistent with the results of a study by Setoudeh et al. (15).

In the case of perceived susceptibility, its mean score in the experimental group after implementing the educational program showed a significant reduction and there was a significant difference between the two groups in terms of this construct. Since perceived susceptibility has a powerful cognitive component and it partly depends on knowledge of people, it can be said that education by enhancing knowledge on the harms of smok-

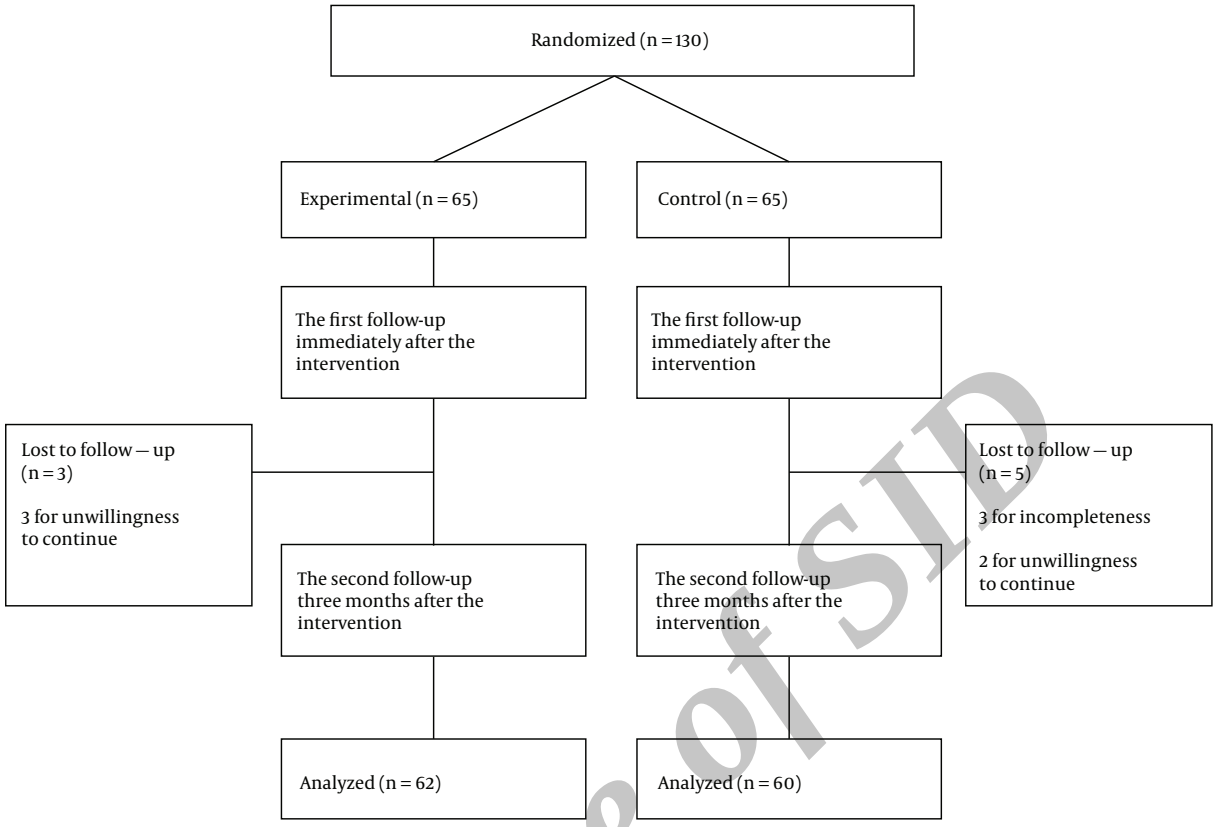

Figure 2. Flow Chart of the Study Like Consort

ing, increasing information about risks of being exposed to cigarette smoke, as well as increasing HL could increase perceived susceptibility in the students and consequently, they found themselves more susceptible to smoking-related diseases when compared to people in the control group. This is consistent with the findings of studies by Setoudeh et al. (15), Renoka and Pushpanjali (16), Kazemi et al. (18), and Chi et al. (19).

The results showed that after the intervention, the mean score of perceived severity significantly increased in the experimental group than in the control group. Since perceived severity partly depends on knowledge of people, we can say that enhancing knowledge led to the increased perceptions of people toward the severity of diseases related to smoking and consequences of being exposed to cigarette smoke such as lung diseases, cancers, heart attack, infertility, matt black teeth, and premature death, and could play an important role in the adoption of smoking preventive behaviors. Meantime, the other possible reason for the increased perceived severity can be the increased HL in the experimental group. This finding is consistent with the findings of studies by Setoudeh et al. (15), Renoka and Pushpanjali (16), Kazemi et al. (18), and Chi et al. (19).

Perceived barriers significantly reduced over time in the experimental group compared to the control group. The reduction of perceived barriers in the experimental group can be interpreted as increasing perceived severity through educational intervention can reduce perceived barriers indirectly (34). Therefore, in the present study, besides educational programs for reducing perceived barriers, parts of educational programs with the purpose of increasing perceive severity was possibly effective in moderating perceived barriers indirectly. On the other hand, self-efficacy influences the perceived barriers so that higher self-efficacy reduces perceived barriers to performing the behavior (35). Therefore, another reason for the reduction of perceived barriers scores in the experimental group in this study can be the increase of self- efficacy. It may be said that HL could be effective in reducing perceived barriers through increasing perceived severity and self-efficacy. This finding is consistent with the results of studies by Atabila and Eleanor (17) and Chi et al. (19). This finding is remarkably in contrast to the study findings of Kazemi et al.

Table 2. Comparison of the Mean Scores of Knowledge, HBM Constructs, Health Literacy, and Adoption of Smoking Preventive Behaviors During the Study Period in Both Groups[a]

		Before Intervention	Immediately After Intervention	Three Months After Intervention	P Value[b,c]
Knowledge	Experimental	18.723 ± 0.261	22.415 ± 0.223	21.492 ± 0.184	< 0.001
	Control	17.772 ± 0.310	20.789 ± 0.182	18.986 ± 0.152	0.03
P Value[d]		0.634	0.019	< 0.001	
Perceived susceptibility	Experimental	16.031 ± 0.395	12.646 ± 0.132	13.031 ± 0.315	< 0.001
	Control	16.123 ± 0.471	16.863 ± 0.136	15.860 ± 0.304	0.36
P Value[d]		0.811	< 0.0001	< 0.0001	
Perceived severity	Experimental	24.123 ± 0.419	28.677 ± 0.319	27.033 ± 0.315	< 0.001
	Control	25.842 ± 0.479	25.140 ± 0.216	24.860 ± 0.304	0.36
P Value[d]		0.247	0.01	0.024	
Perceived barriers	Experimental	21.969 ± 0.511	17.062 ± 0.286	18.123 ± 0.623	0.007
	Control	22.175 ± 0.565	23.877 ± 0.361	23.982 ± 0.416	0.26
P Value[d]		0.411	< 0.0001	< 0.0001	
Perceived benefits	Experimental	21.949 ± 0.511	27.400 ±0.509	27.123 ± 0.404	0.001
	Control	21.173 ± 0.565	21.509 ± 0.244	21.088 ± 0.371	0.116
P Value[d]		0.068	< 0.001	< 0.001	
Self-efficacy	Experimental	24.600 ± 0.537	30.338 ± 0.437	29.308 ± 0.262	0.015
	Control	24.772 ± 0.622	23.614 ± 0.354	23.025 ± 0.351	0.182
P Value[d]		0.49	< 0.0001	< 0.0001	
Health literacy	Experimental	56.910 ± 1.365	70.022 ± 0.812	63.554 ± 0.960	0.014
	Control	56.821 ± 1.362	57.449 ± 0.662	54.566 ± 0.762	0.063
P Value[d]		0.93	< 0.0001	< 0.0001	
Preventive behaviors in smokers	Experimental	12.662 ± 1.241	20.031 ± 2.156	22.325 ± 3.533	< 0.0001
	Control	11.228 ± 1.665	13.842 ± 1.632	15.135 ± 2.295	0.356
P Value[d]		0.462	< 0.0001	< 0.0001	
Preventive behaviors in non-smokers	Experimental	8.662 ± 0.161	11.836 ± 1.267	9.385 ± 0.333	< 0.0001
	Control	8.228 ± 0.851	7.32 ± 0.332	7.105 ± 1.445	0.557
P Value[d]		0.461	< 0.0001	< 0.0001	

[a] Values are expressed as mean ± standard deviation.
[b] Derived from repeated measures or Friedman test (within-group comparison).
[c] P < 0.05 is significant.
[d] Derived from t-test or Mann-Whitney test (between-group comparisons).

(18) in which perceived barriers did not have significant differences over time in the experimental group compared to the control group. There are several reasons behind this discrepancy including, among others, using different measurement tools, different follow-up periods, and no increase in self-efficacy (35) in the aforementioned study.

Perceived benefits significantly increased after the educational intervention in the experimental group compared to the control group. Perceived benefits are a belief in the advantages of the proposed procedures to reduce the risk or severity of the adverse condition or harmful state of a particular behavior (34). In this study, the educational intervention could probably identify positive benefits resulting from the adoption of smoking preventive behaviors more than before through enhancing knowledge and HL, such as reducing the possible risk of cancers, lack of tendency toward addiction, and health promotion about self and family, in the experimental group. This finding is consistent with those of studies by Renoka and Pushpanjali (16), Setoudeh et al. (15), Kazemi et al. (18) and Chi et

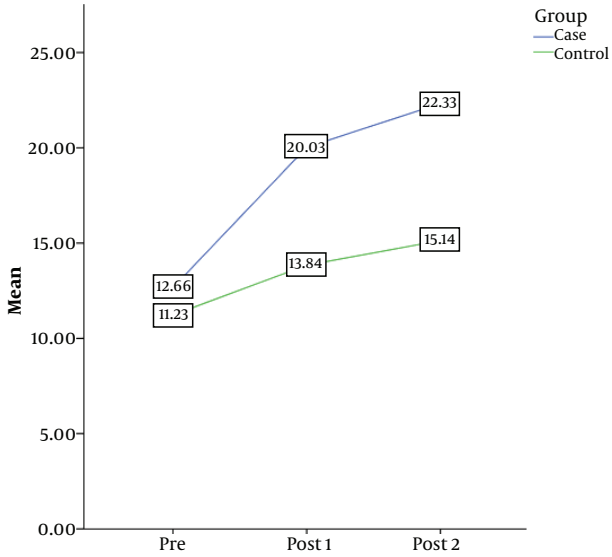

Figure 3. Comparison of the Mean of Adoption of Smoking Preventive Behaviors Scores in Smoking Students Before, Immediately and Three Months After the Intervention in the Control and Experimental Groups

al. (19).

Self-efficacy in the experimental group significantly increased in the adoption of smoking preventive behaviors. Self-efficacy is defined as the belief and confidence of a person in his/her abilities to perform a behavior successfully and is a much vital and effective construct in educational theories. Therefore, when designing educational programs, the specific and applicable role of this construct should be taken into account about habitual behaviors such as smoking behavior or smoking prevention behavior. The increased self-efficacy of people in the experimental group in this study may be due to the increased levels of HL because HL has a positive effect on self-efficacy (36, 37). Other possible reasons can be the enhancement of knowledge and reduction of perceived barriers. This finding is consistent with the results of studies by Renoka and Pushpanjali (16), Atabila and Eleanor (17), Setoudeh et al. (15) and Chi et al. (19). This finding is in striking contrast to the study findings of Kazemi et al. (18) in which, self-efficacy did not show significant differences over time in the experimental group compared to the control group. There are several reasons for this discrepancy including, among others, the use of different measurement tools, different follow-up periods, and no decrease in perceived barriers (35) in the aforementioned study.

The mean scores of HL significantly increased in the experimental group after the intervention and there was a significant difference between the two groups in terms of HL. This finding is consistent with the findings of studies by Ntiri and Stewart (38) and Zhuang et al. (39). These studies have shown that education can increase the mean scores of HL. These studies suggest that low HL is modifiable and can be strengthened by health education. Therefore, in the case of enhancing HL, we can say that one of the roles of HL among HBM constructs is creating appropriate knowledge about perceived susceptibility (40). Consequently, it can be said that educational intervention by enhancing knowledge has been able to improve the susceptibility of the subjects. As a result, subjects in the experimental group were more likely than before to care about issues like symptoms of disease, the time to visit doctor, how often they should check for symptoms of disease, how often they need to do periodic check-ups, how they should store and use their drugs, how to calculate their own BMI and keep it normal, and similar issues that all can be effective in enhancing their HL. Another possible reason for the enhancement of HL can be the enhancement of knowledge and self-efficacy of people; this is because there is a direct relationship between HL and knowledge and self-efficacy (25-30, 36, 37). According to the results of this study, it can be stated that HL helps people acquire, process, and understand health information easier. It also enables them to make informed decisions. Low HL can be a gap between educator and the audience. Consequently, before designing any educational program and during need assessments, it is necessary to evaluate HL of the target population with one of the available tools in order to formulate the educational content, select the education method, and implement the education process according to the levels of HL of people.

The mean scores of adoption of smoking preventive behaviors immediately and three months after the intervention increased than before and compared to the control group while there was no significant difference in the control group. This finding is consistent with the results of studies by Setoudeh et al. (15), Gharlipour et al. (31), Renoka and Pushpanjali (16), Atabila and Eleanor (17), Koumi and Tsintis (41), Kazemi et al. (18) and Chi et al. (19).

The main points of this study were taking advantage of the interest in media among subjects, using the telegram application for educational intervention given the level of HL in subjects, and designing an educational program tailored to their HL.

The limitations of this study were limited availibility of studies conducted on the combination of HL and the constructs of various models of health education and health promotion so that no study was found about educational intervention based on the integrated HBM and HL in order to enhance smoking preventive behaviors. It limited the comparison power of findings and decision making about

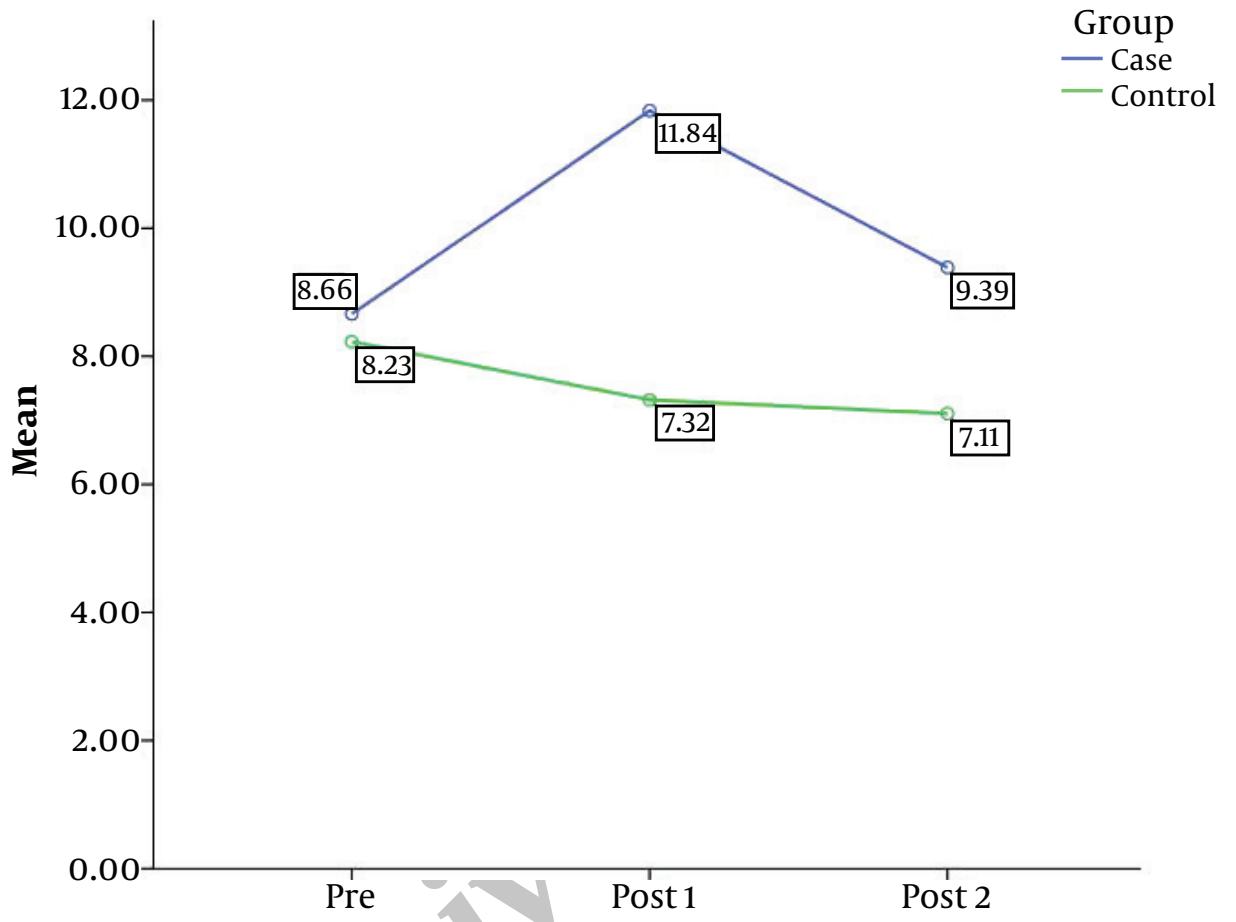

Figure 4. Comparison of the Mean of Adoption of Smoking Preventive Behaviors Scores in Non-Smoking Students Before, Immediately and Three Months After the Intervention in the Control and Experimental Groups

the effectiveness of education. Therefore, it emphasized the necessity of conducting more studies in this regard. Another limitation was the lack of specific tools to measure HL about smoking. The other limitation was related to the target group in this study that consisted of undergraduate students living in dormitories who were in the second or third year of their study. Therefore, the results of this study cannot be generalized to other age and student groups. Hence, conducting other studies is recommended using this model in various populations and groups (in terms of age, education level, and place of residence). The method of data collection was self-report and this was another limitation of the current study.

5.1. Conclusions

The results showed that the educational content based on HBM and HL using telegram application could enhance knowledge, change attitudes, and increase application and adoption of smoking preventive behaviors among University students. It seems that social networks such as telegram can be effective by involving people in the adoption of smoking preventive behaviors thanks to their popularity and widespread use.

Acknowledgments

This article is the final report of a Ph.D. dissertation, school of medicine, Tarbiat Modarres University (number 6599). Hereby we appreciate the cooperation of all participating students and respected authorities of dormitories supervised by Shahid Beheshti University of Medical Sciences in Tehran, Iran.

Footnotes

Authors' Contribution: Rahman Panahi participated in all parts of the study; Shamsaddin Niknami participated in designing the study; Ali Ramezankhani participated in designing the study and collecting data; Mahmoud Tavousi participated in analyzing data; all of the authors participated in writing the manuscript.

Funding/Support: This study was supported by the school of medicine, Tarbiat Modarres University.

References

1. Ebrahimi H, Sahebihagh MH, Ghofranipour F, Sadegh Tabrizi J. Initiation and continuation of smoking in Iran, a qualitative content analysis. *Int J Community Based Nurs Midwifery*. 2014;**2**(4):220–30. [PubMed: 25349865].
2. Borgan SM, Jassim G, Marhoon ZA, Almuqamam MA, Ebrahim MA, Soliman PA. Prevalence of tobacco smoking among health-care physicians in Bahrain. *BMC Public Health*. 2014;**14**:931. doi: 10.1186/1471-2458-14-931. [PubMed: 25200373].
3. Reisi M, Javadzade SH, Shahnazi H, Sharifirad G, Charkazi A, Moodi M. Factors affecting cigarette smoking based on health-belief model structures in pre-university students in Isfahan, Iran. *J Educ Health Promot*. 2014;**3**:23. doi: 10.4103/2277-9531.127614. [PubMed: 24741663].
4. Dowdell EB, Santucci ME. Health risk behavior assessment: nutrition, weight, and tobacco use in one urban seventh-grade class. *Public Health Nurs*. 2004;**21**(2):128–36. doi: 10.1111/j.0737-1209.2004.021206.x. [PubMed: 14987212].
5. Jafarabadi MA, Allahverdipour H, Bashirian S, Jannati A. Modeling the underlying predicting factors of tobacco smoking among adolescents. *Iran J Public Health*. 2012;**41**(5):46–57. [PubMed: 23113177].
6. Mbatchou Ngahane BH, Luma H, Mapoure YN, Fotso ZM, Afane Ze E. Correlates of cigarette smoking among university students in Cameroon. *Int J Tuberc Lung Dis*. 2013;**17**(2):270–4. doi: 10.5588/ijtld.12.0377. [PubMed: 23317965].
7. Mumtaz B, Chaudhary IA, Arshad M.Samiullah. Comparison of smoking behaviour among medical and other college students in Rawalpindi. *J Coll Physicians Surg Pak*. 2009;**19**(1):7–10. [PubMed: 19149972].
8. Voigt K, Twork S, Mittag D, Göbel A, Voigt R, Klewer J, et al. Consumption of alcohol, cigarettes and illegal substances among physicians and medical students in Brandenburg and Saxony, (Germany). *BMC Health Serv Res*. 2009;**9**:219. doi: 10.1186/1472-6963-9-219. [PubMed: 19958534].
9. Liu YB, Liu L, Li YF, Chen YL. Relationship between health literacy, health related behaviors and health status, a survey of elderly Chinese. *Int J Environ Res Public Health*. 2015;**12**(8):9714–25. doi: 10.3390/ijerph120809714. [PubMed: 26295246].
10. Hoover DS, Vidrine JI, Shete S, Spears CA, Cano MA, Correa-Fernandez V, et al. Health Literacy, Smoking, and Health Indicators in African American Adults. *J Health Commun*. 2015;**20 Suppl 2**:24–33. doi: 10.1080/10810730.2015.1066465. [PubMed: 26513028].
11. Stewart DW, Cano MA, Correa Fernandez V, Spears CA, Li Y, Waters AJ, et al. Lower health literacy predicts smoking relapse among racially, ethnically diverse smokers with low socioeconomic status. *BMC Public Health*. 2014;**14**:716. doi: 10.1186/1471-2458-14-716. [PubMed: 25018151].
12. Stewart DW, Adams CE, Cano MA, Correa Fernandez V, Li Y, Waters AJ, et al. Associations between health literacy and established predictors of smoking cessation. *Am J Public Health*. 2013;**103**(7):43–9. doi: 10.2105/AJPH.2012.301062. [PubMed: 23678912].
13. Saffari M, Shojaeizadeh D. *Health education and promotion theories, models and methods*. **50**. Tehran, Iran: Sobhan Publication; 2010.
14. Li K, Kay NS. Correlates of cigarette smoking among male chinese college student in china, a preminary syudy. *Int Electron J Health Educ*. 2009;**12**:59–71.
15. Setoudeh A, Tahmasebi R, Noroozi A. Effect of education by health volunteers on reducing water pipe use among women in Bushehr, an application of health belief model. *Hayat*. 2016;**22**(1):50–64.
16. Renuka P, Pushpanjali K. Effective of health belief model in motivation for tobacco cessation and to improving knowledge, attitude and behavior of tobacco users. *J Cancer Res Clin Oncol*. 2014;**2**(4):43–50. doi: 10.13189/cor.2014.020401.
17. Atabila A, Eleanor C. Effect of a smoking prevention program on smoking related knowledge, refusal self efficacy, attitude, and intention of non smoking adolescents. *J Biol Agric Healthc*. 2013;**3**(7):26–31.
18. Kazemi A, Ehsanpour S, Nekoei-Zahraei NS. A randomized trial to promote health belief and to reduce environmental tobacco smoke exposure in pregnant women. *Health Educ Res*. 2012;**27**(1):151–9. doi: 10.1093/her/cyr102. [PubMed: 22052216].
19. Chi YC, Wu CL, Chen CY, Lyu SY, Lo FE, Morisky DE. Randomized trial of a secondhand smoke exposure reduction intervention among hospital-based pregnant women. *Addict Behav*. 2015;**41**:117–23. doi: 10.1016/j.addbeh.2014.10.001. [PubMed: 25452054].
20. Glashen MR, Stoodt G, Ferraro A, Rohrer J. *Health literacy and the level of hypertension in urban Latinos, (PhD thesis in Public Health)*. Washington, USA: Walden University; 2015.
21. Montazeri A, Tavousi M, Rakhshani F, Azin SA, Jahangiri K, Ebadi M. Health literacy for Iranian adults, (HELIA), development and psychometric properties. *Payesh*. 2014;**13**:589–99.
22. Baskerville NB, Azagba S, Norman C, McKeown K, Brown KS. Effect of a Digital Social Media Campaign on Young Adult Smoking Cessation. *Nicotine Tob Res*. 2016;**18**(3):351–60. doi: 10.1093/ntr/ntv119. [PubMed: 26045252].
23. Yoo W, Yang J, Cho E. How social media influence college students' smoking attitudes and intentions. *Comput Human Behav*. 2016;**64**:173–82. doi: 10.1016/j.chb.2016.06.061. [PubMed: 27956757].
24. Welch V, Petkovic J, Pardo Pardo J, Rader T, Tugwell P. Interactive social media interventions to promote health equity: an overview of reviews. *Health Promot Chronic Dis Prev Can*. 2016;**36**(4):63–75. [PubMed: 27077792].
25. Powell CK, Hill EG, Clancy DE. The relationship between health literacy and diabetes knowledge and readiness to take health actions. *Diabetes Educ*. 2007;**33**(1):144–51. doi: 10.1177/0145721706297452. [PubMed: 17272800].
26. McCleary-Jones V. Health literacy and its association with diabetes knowledge, self-efficacy and disease self-management among African Americans with diabetes mellitus. *ABNF J*. 2011;**22**(2):25–32. [PubMed: 21675666].
27. Bains SS, Egede LE. Associations between health literacy, diabetes knowledge, self-care behaviors, and glycemic control in a low income population with type 2 diabetes. *Diabetes Technol Ther*. 2011;**13**(3):335–41. doi: 10.1089/dia.2010.0160. [PubMed: 21299402].
28. Kandula NR, Nsiah-Kumi PA, Makoul G, Sager J, Zei CP, Glass S, et al. The relationship between health literacy and knowledge improvement after a multimedia type 2 diabetes education program. *Patient Educ Couns*. 2009;**75**(3):321–7. doi: 10.1016/j.pec.2009.04.001. [PubMed: 19395223].
29. Gazmararian JA, Williams MV, Peel J, Baker DW. Health literacy and knowledge of chronic disease. *Patient Educ Couns*. 2003;**51**(3):267–75. [PubMed: 14630383].
30. Mosher HJ, Lund BC, Kripalani S, Kaboli PJ. Association of health literacy with medication knowledge, adherence, and adverse drug events among elderly veterans. *J Health Commun*. 2012;**17 Suppl 3**:241–51. doi: 10.1080/10810730.2012.712611. [PubMed: 23030573].
31. Gharlipour Z, Hazavehei SM, Moeini B, Nazari M, Beigi AM, Tavassoli E, et al. Effectiveness of educational program on promotion of smoking

preventive behaviors in adolescences. *J Health Syst Res*. 2013;**9**(4):354–61. doi: 10.4103/2277-9531.151875. [PubMed: 25767815].
32. Wen X, Chen W, Gans KM, Colby SM, Lu C, Liang C, et al. Two-year effects of a school-based prevention programme on adolescent cigarette smoking in Guangzhou, China: a cluster randomized trial. *Int J Epidemiol*. 2010;**39**(3):860–76. doi: 10.1093/ije/dyq001. [PubMed: 20236984].
33. Hanewinkel R, Asshauer M. Fifteen-month follow-up results of a school-based life-skills approach to smoking prevention. *Health Educ Res*. 2004;**19**(2):125–37. doi: 10.1093/her/cyg018. [PubMed: 15031272].
34. Glanz K, Rimer BK, Lewis FM. *Health behavior and health education, theory, research, and practice*. 3rd Edition ed. San Francisco, California: Jossey Bass; 2008.
35. Pender NJ, Murdaugh CL, Parsons MA. *Health promotion in nursing practice*. Upper Saddle River, NJ: Parsons, Prentice Hall; 2006.
36. Donovan-Kicken E, Mackert M, Guinn TD, Tollison AC, Breckinridge B, Pont SJ. Health literacy, self-efficacy, and patients' assessment of medical disclosure and consent documentation. *Health Commun*. 2012;**27**(6):581–90. doi: 10.1080/10410236.2011.618434. [PubMed: 22107084].
37. Sarkar U, Fisher L, Schillinger D. Is self-efficacy associated with diabetes self-management across race/ethnicity and health literacy? *Diabetes Care*. 2006;**29**(4):823–9. [PubMed: 16567822].
38. Ntiri DW, Stewart M. Transformative learning intervention: effect on functional health literacy and diabetes knowledge in older African Americans. *Gerontol Geriatr Educ*. 2009;**30**(2):100–13. doi: 10.1080/02701960902911265. [PubMed: 19440898].
39. Zhuang R, Xiang Y, Han T, Yang GA, Zhang Y. Cell phone-based health education messaging improves health literacy. *Afr Health Sci*. 2016;**16**(1):311–8. doi: 10.4314/ahs.v16i1.41. [PubMed: 27358647].
40. Mackert M, Guadagno M. *Health literacy, developments, issues and outcomes*. The health belief model and health literacy, the case of perfect knowledge. In: Moore R, Perry D, editors. New York, United States: Nova Science Publishers; 2013. p. 225–32.
41. Koumi I, Tsiantis J. Smoking trends in adolescence: report on a Greek school-based, peer-led intervention aimed at prevention. *Health Promot Int*. 2001;**16**(1):65–72. [PubMed: 11257854].

Table 1. Demographic and Background Characteristics of Students in the Experimental and Control Groups[a]

	Experimental Group (n = 65)	Control Group (n = 65)	P Value[b,c]
Gender			1.0
Female	39 (60)	39 (60)	
Male	26 (40)	26 (40)	
Education years			0.723
Sophomore	38 (58.5)	36 (55.4)	
Third year student	27 (41.5)	29 (44.6)	
Marital status			0.753
Single	59 (90.8)	60 (92.3)	
Married	6 (9.2)	5 (7.7)	
Divorced or deceased spouse	0 (0)	0 (0)	
Probation history			0.074
Yes	4 (6.2)	0 (0)	
No	60 (92.3)	65 (100)	
Physical activity per week			0.412
Everyday	0 (0)	2 (3.1)	
Most days	13 (20)	17 (26.2)	
Sometimes	28 (43.1)	20 (30.8)	
Rarely	16 (24.6)	17 (26.2)	
Never	8 (12.3)	9 (13.8)	
Education of father			0.068
Illiterate	4 (6.2)	1 (1.5)	
High school	13 (20)	6 (9.2)	
Diploma	31 (47.7)	27 (41.5)	
Associate Degree and Bachelor's Degree	15 (23.1)	27 (41.5)	
Master's degree or higher	2 (3.1)	4 (6.2)	
Education of mother			0.094
Illiterate	7 (10.8)	4 (6.2)	
High school	15 (23.1)	10 (15.4)	
Diploma	32 (49.2)	26 (40)	
Associate Degree and Bachelor's Degree	10 (15.4)	22 (33.8)	
Master's degree or higher	1 (1.5)	3 (4.6)	
Father's job			0.328
Employee	16 (24.6)	27 (41.5)	
Worker	4 (6.2)	2 (3.1)	
Self-employed	30 (46.2)	23 (35.4)	
Retired	10 (15.4)	11 (16.9)	
Military	3 (4.6)	1 (1.5)	
Other	2 (3.1)	1 (1.5)	
Mother's job			0.447
Housewife	51 (78.5)	45 (69.2)	
Employee	12 (18.5)	14 (21.5)	
Self-employed	1 (1.5)	2 (3.1)	
Worker	1 (1.5)	4 (6.2)	
Birth rank in the family			0.127
First child	18 (27.7)	25 (38.5)	
Second child	25 (38.5)	25 (38.5)	
Third child	7 (10.8)	9 (13.8)	
Fourth child	7 (10.8)	5 (7.7)	
Fifth child and above	8 (12.3)	1 (1.5)	

Number of family members			0.385
3 people	3 (4.6)	5 (7.7)	
4 people	22 (33.8)	29 (44.6)	
5 - 6 people	31 (47.7)	26 (40)	
7 people and more	9 (13.8)	5 (7.7)	
Monthly income of family			0.06
Very low (poor)	8 (12.3)	1 (1.5)	
Low	28 (43.1)	29 (44.6)	
Low to moderate	22 (33.8)	22 (33.8)	
More than moderate	6 (9.2)	13 (20)	
Having a smoker in the family			0.379
Yes	22 (33.8)	26 (40)	
No	43 (66.2)	39 (60)	
Having a close friend who smokes			0.323
Yes	33 (50.8)	35 (53.8)	
No	32 (49.2)	30 (46.2)	
Death history in the family or relatives because of smoking			0.77
Yes	6 (9.2)	7 (10.8)	
No	59 (90.8)	58 (89.2)	
The status of the individual in terms of smoking			0.336
Non-smoking	40 (61.5)	34 (52.3)	
One experience	14 (21.5)	19 (29.2)	
Occasional consumption	5 (7.7)	9 (13.8)	
Daily (regularly) consumption	6 (9.2)	3 (4.6)	
First offering of cigarette			0.721
Friends	10 (40)	13 (41.9)	
Brother	0 (0)	1 (3.2)	
Other relatives	1 (4)	0 (0)	
Other people	3 (12)	4 (12.9)	
Nobody	11 (44)	13 (41.9)	
The age of the first smoking			0.198
Less than 10 years old	0 (0)	2 (6.5)	
10 - 14 years old	0 (0)	3 (9.7)	
15 - 19 years old	17 (68)	16 (51.6)	
20 years old or above	8 (32)	10 (32.3)	
Daily cigarette consumption of regular smokers			0.214
A cigarette	0 (0)	0 (0)	
2 - 3 cigarettes	2 (40)	2 (22.2)	
4 - 10 cigarettes	2 (40)	6 (66.7)	
11 - 15 cigarettes	0 (0)	1 (11.1)	
16 - 20 cigarettes	1 (20)	0 (0)	
The age at start of regular smoking			0.772
Less than 10 years old	0 (0)	0 (0)	
10 to 14 years old	0 (0)	0 (0)	
15 to 19 years old	5 (55.6)	5 (55.6)	
19 years old or above	4 (44.4)	4 (44.4)	

[a] Values are expressed as No. (%).
[b] Chi-square test.
[c] $P < 0.05$ was significant.