

Effects of a multi-level intervention on hookah smoking frequency and duration among Iranian adults: An application of Socio-ecological Model

Fatemeh Bakhtari

Tabriz University of Medical Sciences

Nader Alizadeh

Tabriz University of Medical Sciences

Haidar Nadrian

Tabriz University of Medical Sciences

Christoph Augner

Salzburg university of medical sciences

Asghar Mohammadpoorasl (✉ ampoorasl@gmail.com)

Tabriz University of Medical Sciences

Research article

Keywords: Water-pipe, Tobacco smoking, Socio-ecological model, Multi-level intervention.

Posted Date: September 29th, 2020

DOI: <https://doi.org/10.21203/rs.3.rs-42202/v1>

License:   This work is licensed under a Creative Commons Attribution 4.0 International License.

[Read Full License](#)

Version of Record: A version of this preprint was published on January 21st, 2021. See the published version at <https://doi.org/10.1186/s12889-021-10219-8>.

Abstract

Background

The aim of the present study was to investigate the effects of a multi-level intervention based on the social ecological model on the frequency and duration of hookah smoking among a sample of Iranian adults.

Methods

In this study, two comparable cities in Iran were selected to participate in an intervention program based on a social ecological model (SEM). In each city, 133 hookah smokers in coffee houses were selected. Environmental changes in coffee houses such as serving light foods and games were conducted. A virtual group named "no hookah" was established on the Telegram application to train participants in the intervention group. Messages, pictures and short videos were sent to the participants through that virtual network. The frequency and duration of hookah consumption were assessed in both groups at baseline and after the intervention.

Results

The frequency of hookah consumption decreased in 72.6% of participants in the intervention group (vs. 6.3% in the control group); and the duration of hookah consumption per session decreased in 39.5% of participants in the intervention group (vs. 5.5% in the control group).

Conclusions

Using multi-level interventions through a social ecological model can reduce hookah consumption in young people.

Background

Several studies show that the harmful effects of smoking hookahs are even more serious than the disadvantages of smoking cigarettes. Research indicates that smoking hookah can result in health problems such as lung cancer, pulmonary diseases, oral cancers like lip, tongue and cheek cancers, cardiovascular diseases, high blood pressure and chronic respiratory diseases [1].

The prevalence of hookah smoking across Iran has been reported to be between 3.5% [2–4] and 8.2% [5]. In many in the Eastern Mediterranean Region (EMRO) countries, smoking hookah has reached 20 to 30 percent among adults and its consumption rate among younger individuals is increasing [6, 7].

As far as we know, the evaluation of interventions carried out for reducing hookah smoking include a study conducted by Huang et al on the peers influence and the effects of online and offline networks of friends on using narcotics[8, 9], a study by Haddad on increasing knowledge through a web-based method[10, 11] and Lipkus et al's study on the effect of receiving information on the perception of risk and increase in concern about the harmful effects of smoking hookah[12], as well as educational behavioral interventions and bupropion use in the countries of Egypt, Pakistan and the United States[12–14]. In all the studies mentioned above, more intervention studies are suggested. Recent researches have focused more on individual behavior and have neglected environmental and social variables. However, recent evidence from Iran shows that environmental and social factors might affect individual's behavior and their choice to smoke hookahs. Such factors include having a friend who smokes hookah, low social support for the individual[4, 15], an environment that encourages people to smoke hookahs, lack of healthy entertainment for the youth that can be an alternative to drug consumption, common use of hookahs among families and groups of friends and its being a norm in the public culture[16]. In addition, due to increase of smoking hookahs it seems necessary to apply appropriate intervention in order to reduce hookah consumption[17]. In the field of public health, ecological models describe people's interactions with their physical and socio-cultural surroundings[18]. Socio-ecological model (SEM) examines the health issue and its determinants with a multilevel approach, from individual and interpersonal levels to organizational and political levels[19]. In Iran, the SEM frameworks have widely been used to treat different health problems[18, 20].

Since the smoking of hookahs has increased among the Iranian youth[4, 16] and because a behavior such as smoking hookahs should be considered in a social context, the best way to reduce the spread of using hookahs in the society appears to be the application of widespread social programs as well as the formation of multiple channels of control[21, 22].

Up to now, no multi-level interventions have been conducted using SEM analysis. Therefore, in this intervention research study, we aimed to study (1) the conditions of smoking hookahs and (2) to design, apply and evaluate a low cost and multi-faceted intervention program based on a SEM in order to reduce hookah smoking among young adults.

Methods

This study was a quazi-experimental field study with control group design conducted in the coffee shops of Hashtrud (intervention group) and Qarah-Aghaj (control group) counties in Eastern Azerbaijan province, Iran. The study was conducted in two phases. In the first phase (pre-test), the frequency and the determinants of hookah smoking behavior was investigated based on Socio-ecological model (SEM) to find the significant predictors of the behavior among the participants. Based on the results found at the pre-test phase, a health promotion intervention program was designed and implemented in Hashtrud County, as the setting of intervention. The underlying idea is that interventions should include multilevel strategies focusing on individual behavior, social and environmental levels[23]. Following aspects were emphasized during intervention group: individual (education based on telegram), social approaches

(create social network, social support of peers and reward to decrease hookah use) and environmental levels (changes in coffees).

Instrumentation

The instruments used in the present study included a demographic data form, three items about the frequency of hookah smoking, hookah use-related individual and social level factors questionnaires and an environmental level factors checklist. The questionnaires applied to assess the individual level factors and perceived rewards (from the social level factors) were developed and validated in a previous study [24].

To assess validity of the researcher-made instruments, a panel of 10 scholars (in the fields of health education and behavior, sociology, psychology and epidemiology) reviewed and assessed the items, orally, and evaluated the appropriateness and relevance of the items to the participants. They confirmed the items to be representative of the constructs in order to confirm content validity of the instruments. We used the experts' feedback on the instruments to revise and modify the items. Content Validity Ratio (CVR) with the feature of "necessity" and Content Validity Index (CVI) with two features of "relevance" and "sufficiency of each construct" were measured. In order to examine the utility of the scales and to identify the problems/benefits associated with the design, the instruments were pilot-tested by a sample of 30 hookah users not included in the final study. We used the data to estimate the internal consistency of the scales using Cronbach's Alpha coefficient. Following consultation with the multidisciplinary team, the first draft was prepared.

The demographic data form included age, level of education, marital status, employment status and level of income.

The frequency of smoking was investigated applying three researcher-made self-report items. The items were as follow: "In previous 3 months, how many times per week have you smoked hookah?", "How long is the duration of your hookah smoking per serving?" and "How many cigarettes have you smoked in previous seven days?" The CVI and CVR scores for the items of frequency of smoking were 91.0 and 86.6, respectively.

The scales of individual level factors included perceived sensitivity (5 items) and perceived severity (8 items). Examples of the items for perceived susceptibility and severity were "Using hookah will increase my chance for getting lung cancer", and "Smoking hookah will reduce my chance for getting a suitable job", respectively. Perceived internal and external rewards acquired from hookah use were also investigated applying a nine-item scale. One item, as an example, was "By smoking hookah, I feel that I am grown-up and feel like a man". The triple scales were rated based on a five-point Likert-type scaling (ranging from 1 = totally disagree to 5 = totally agree). The scores of the scales were then summed to acquire a total score. The maximum total score for perceived susceptibility, severity and rewards were 25, 40, and 45, respectively. The higher the scores in the triple scales indicated the higher levels of perceived susceptibility, severity and internal and external rewards among the individuals to smoke hookah. All

scales are developed and validated in a previous study in Iran {Sabzmakan, 2018 #1} {Ghasemi, 2015 #45; Sabzmakan, 2018 #152}.

Perceived social support questionnaire including 14 items was applied to assess the social level factors. Examples of the subjects presented in the items included “encouraged you not to go to the coffee shops to smoke hookah” and “encouraged you not to smoke hookah”. The response format was based on a 5-point Likert-type scale (from never [1] to always [5]). The total score was ranged from 14 to 70. The higher the score, the higher the level of social support was perceived by the individuals to smoke hookah. CVI and CVR values for the scale were 90.64 and 74.42, respectively, and the alpha Cronbach's coefficient was 0.72.

A researcher-made 11-item environmental checklist was used to assess the environmental level factors. A dichotomous Yes/No scale was considered as response format. An example of the items in the checklist was "Is there any game/ entertainment tool available in the coffee shop?"

Sampling and data collection

In order to conduct the study, Hashtrud County was considered as the setting to conduct the intervention. All coffee shops in Hashtrud (11 cases as intervention group) and Qarah-Aghaj (center of Charuymaq County) (7 cases as control group) were selected as the study centers. As primary coordination, the first researcher personally went to the coffee shops and explained to the administrators about the purpose of study and the way it would be conducted at the coffee shops. Then, the purpose of the study was explained to the hookah smokers in the coffee shops and they were invited to participate in the study. Informed consent was obtained from both the administrators and the hookah smokers accepted to participate in the study and all signed consent forms. They were also assured on the confidentiality of their information. Along with data collection, applying the SEM-based questionnaire, the environmental checklist was also filled out based on the observations conducted by the second author. In each County, 133 hookah smokers at the coffee shops were included in the study. The flowchart of the study is illustrated in Fig. 1.

The intervention was performed in all Hashtrud coffee shops during eight weeks from January to March, 2017. Inclusion criteria were willingness to quit hookah smoking in the following 6 months, willingness not to refer to the usual coffee shop to smoke hookah in the following 6 months, older than 15 and younger than 35, daily using of Telegram virtual network, and having at least one year of hookah smoking history. Exclusion criteria were using drugs and narcotics other than cigarettes and the tobacco used in hookah, illiteracy, having plans to quit hookah smoking and suffering from psychological disorders or mental problems such as depression.

Interventional Program

Based on the pre-test data analyses, the problems and weak points at the individual, environmental and social level factors related to hookah smoking were identified. Therefore, the interventional program was

designed and implemented as follows: A virtual group named "No to hookah smoking" was established on the Telegram application to train the participants in the intervention group, informally. In order to promote their level of perceived sensitivity and severity, the participants were encouraged to share the group members with text messages, pictures and short videos regarding the outcomes of hookah smoking, health disadvantages of the behavior, the mechanisms via hookah smoking may damage human health, the ways and benefits of quitting hookah use and how to resolve the obstacles, how to alleviate and control the temptation to smoke hookah, and alternatives for hookah smoking in the coffee shops. We initiated a group discussion to talk about the contents. To promote internal and external rewards among the participants, potential alternative rewards that may be achieved by reducing or quitting hookah use were discussed among the group members. The group members were socially supported by the managers of the group and the peers. The members received a variety of informational, emotional, and instrumental support. Group members rewarded each other by verbal encouragements as well as low internet service charges.

The resources and costs needed to implement the program included the coffee shops, the cost of internet service provision and the time required to send messages. The key strategies applied to design the program were network-based education, consciousness raising, environmental reconstruction, environmental reevaluation, role modeling, and perceived threat rising. The main processes applied to implement the program were experimental informal teaching methods (incorporating in the virtual social network and discussing the messages in the virtual group and reaching census, problem-solving discussions), discussing the early negative consequences of hookah smoking (e.g., coughs early in the mornings), and revisiting the services provided to customers in the coffee shops.

The training team at the group consisted of a public health expert and two researchers of the study (an epidemiologist and a health educationist) who managed the virtual group with 614 members. Also, 11 individuals, who used to smoke hookah but have then managed to quit, were included in the group, as lay persons. They played the role of peers in the virtual group and discussed different ways of quitting hookah use with the group members.

In order to revise the services provided to customers in the coffee shops we conducted several changes. To help the participants in accessing healthy food choices in the coffee shops, the administrators were requested to have serving desserts and different kinds of drinks and healthy foods like lentil soup, omelet, ice-cream, figs and broad beans. The participants in the coffee shops were also provided with intellectual game accessories (like chess, mensh, and others) as alternative entertainment instruments. Moreover, hookah smoking-related posters and banners with specific focuses were installed in close to the coffee shops.

Two weeks after completing the implementation of program, the questionnaires were again completed by the participants in the experimental and control groups.

The protocol of the study was approved by Ethics Committee in an Iranian medical sciences university [Ethics code: IR.TBZMED.REC.1396.175].

Data analysis

SPSS version 23 was used to analyze the data. Descriptive statistics were calculated to determine mean and standard deviation in quantitative data and frequency and percentage in qualitative data. Independent t-test and Chi-square were used to compare the mean between the groups. Logistic models were used to evaluate the effect of multidimensional intervention on changes in the frequency and duration of hookah consumption by controlling for potential confounders. We used analysis of covariance test to compare the means after adjustment for the dependent variables and potential confounders.

Results

Participants' characteristics at baseline are shown in Table 1. We observed significant differences in some demographic aspects between intervention and control group.

Table 1: Participants' characteristics in the intervention and the control groups in the first phase of the study (Iran, 2017)

Characteristic	Intervention (n=133)	Control (n=133)	P-value
Age (years)	26.11± 4.99	31.55± 5.61	<0.001
Marital status			
Married	40 (30.1)	99 (74.4)	<0.001
Single	93 (69.9)	34 (25.6)	
Education level			
Middle school	9 (6.8)	9 (6.8)	0.520
High school	68 (51.1)	59 (44.3)	
Academic study	56 (42.1)	65 (48.9)	
Employment status			
Employed	100 (75.2)	125 (94.0)	<0.001
Unemployed	33 (24.8)	8 (6.0)	

Values are presented as number (%) or mean± standard deviation.

Comparison of the frequency of tobacco consumption among two groups in the two phases of the study is presented in Table 2. The frequency of hookah use and the duration of hookah consumption per serving in the second phase of the study compared to the first phase decreased significantly in the intervention group. There were no considerable changes in the control group. Although smoking cigarettes in both groups did not show any significant difference after the intervention. The end part of Table 2 represents comparison of the changes in the frequency and duration of hookah consumption among two intervention and control groups. As shown in this table, the frequency of hookah consumption decreased in 72.6% of participants in the intervention group (vs. 6.3% in the control group); and the duration of hookah consumption per serving decreased in 39.5% of participants in the intervention group (vs. 5.5% in the control group).

Table 2: Comparison of the frequency of tobacco consumption and its changes among two groups of the study (Iran, 2017)

Frequency of consumption	Intervention group		Control group	
	Phase 1	Phase 2	Phase 1	Phase 2
Frequency of hookah consumption				
Once a week or less	24 (18.1)	64 (51.6)	30 (22.6)	28 (21.9)
More than once a week	15 (11.3)	47 (37.9)	76 (57.1)	62 (48.4)
Once per day	68 (51.1)	8 (6.5)	18 (13.5)	21 (16.4)
More than once per day	26 (19.5)	5 (4.0)	9 (6.8)	17 (13.3)
P-value	<0.001		0.252	
Duration of hookah consumption per serving				
Less than 30 minutes	32 (24.1)	50 (40.3)	9 (6.8)	5 (3.9)
30-60 minutes	56 (42.1)	63 (50.8)	59 (44.4)	62 (48.4)
More than 60 minutes	45 (33.8)	11 (8.9)	65 (48.8)	61 (47.7)
P-value	<0.001		0.536	
Cigarette smoking status				
Never smoker	73 (54.8)	76 (58.5)	73 (54.9)	64 (50.0)
Less than 10 cigarette per week	34 (25.6)	19 (14.6)	19 (14.3)	24 (18.8)
10-20 cigarette per week	17 (12.8)	23 (17.7)	27 (20.3)	29 (22.7)
More than 20 cigarette per week	9 (6.8)	12 (9.2)	14 (10.5)	11 (8.6)
P-value	0.133		0.680	
Change in the frequency of hookah consumption				
Unchanged or increased	34 (27.4)		120 (93.8)	
Decreased	90 (72.6)		8 (6.3)	
P-value	<0.001			
Change in the duration of hookah consumption per serving				
Unchanged or increased	75 (60.5)		121 (94.5)	
Decreased	49 (39.5)		7 (5.5)	
P-value	<0.001			

Values are presented as number (%).

We used two logistic models to evaluate the effect of multidimensional intervention on the frequency and duration of hookah consumption by controlling for potential confounders (differences in the two groups at baseline: age, marital status and employment status). The results indicated that the being in the intervention group increased 72.1 (OR = 72.1, 95% CI: 23.0- 225.7, P < 0.001) and 24.1 (OR = 24.1, 95% CI: 7.5–77.4, P < 0.001) times the odds of decreasing in the frequency of hookah consumption and decreasing in the duration of hookah consumption per serving, respectively.

Mean scores according to SEM levels are given in Table 3. After adjustment for value of the dependent variable in the phase 1, age, marital status and employment status, at the individual level, the mean perceived sensitivity in the intervention group was higher at the end of the study compared to that of the control group. Moreover, the mean perceived severity in the intervention group was higher compared to its rate in the control group. As it is displayed in this table, after adjustment for value of the dependent variable in the phase 1, age, marital status and employment status, at the social level, the mean perceived reward was lower and the perceived social support was higher among intervention group in comparison to participants in control group.

Table 3: Personal, social and environmental level of SEM before and after of the multilevel intervention between the two groups (Iran, 2017).

level of SEM	Phase 1		Phase 2		Adjusted* mean for phase 2		P-value
	Intervention group	Control group	Intervention group	Control group	Intervention group	Control group	
Perceived sensitivity	11.7± 2.1	12.6± 2.4	16.2± 1.7	12.9± 2.1	16.5± 1.7	12.8± 2.2	<0.001
Perceived severity	25.9± 3.5	25.2± 3.1	30.6± 2.5	25.5± 3.0	30.5± 2.6	25.6± 3.1	<0.001
Perceived rewards	32.4± 5.6	35.1± 5.2	19.1± 5.2	34.5± 6.1	20.3± 5.1	33.8± 6.1	<0.001
Social support	35.7± 6.4	36.7± 4.0	43.6± 4.4	35.6± 3.6	43.9± 4.5	35.3± 3.6	<0.001

Values are presented as mean± standard deviation.

* Adjusted for value of the dependent variable in the phase 1, age, marital status and employment status

With regard to contextual changes in coffee houses, it should be noted that in the first phase of the study, from among the 7 coffee houses existing in QarahAghaj city (the control group), only two of them served food before the intervention. From the 11 coffee houses in the intervention group, 5 of them served light food and one had games like chess and mensch. One of the coffee houses in the intervention group was omitted from the study due to the owner's avoidance to cooperate with the researchers during the study. Before intervention, 9.1% of the coffee houses had games and entertainment facilities while such facilities were available in all the coffee houses after the intervention. At the beginning of the intervention, 83% of a total of 6 coffee house owners who provided customers with games and food were satisfied with the changes applied while after the intervention, 100% of the owners of 10 coffee houses were

satisfied with the changes. In addition, coffee house owners stated the changes had been effective in raising their income. Control group coffee houses did not show any changes in the level of owner satisfaction or income since environmental variables had remained intact.

Discussion

The purpose of this study was to determine the effect of an intervention based on an SEM model on reducing hookah use among the youth in the city of Hashtroud. The results indicate that the intervention reduced hookah smoking significantly. Moreover, frequency of hookah use and the duration of smoking hookah in one session showed significant decrease in the intervention group but not in the control group. The frequency of hookah consumption decreased in 72.6% of participants in the intervention group (vs. 6.3% in the control group); and the duration of hookah consumption per serving decreased in 39.5% of participants in the intervention group (vs. 5.5% in the control group). Evidence from other studies support our results. An intervention study conducted in Israel resulted in a reduction of hookah smoking of 22.2% [11]. In the Lipkus et al study [12], the effect of the intervention was a reduction of 62% which was almost similar to the result of the present study.

Most studies show, that individuals smoke hookah and cigarettes simultaneously [4, 25, 26]. According to the results of present study at baseline about 45% of hookah smokers in both groups were cigarette smoker as well. Thus, it can be stated, that interventions in tobacco use must be designed in a way that reduction in the use of one type of smoking would not lead to increase in the use of another. Consistent with the previous studies [11, 27, 28] there was no significant change in cigarette smoking status between two phases of study in intervention group.

The results of this study showed that after intervention, individual level factors in SEM (perceived severity and perceived sensitivity) in intervention group significantly were higher than control group by adjusting for their values in the baseline and potential confounders. Different studies showed that the higher the perceived sensitivity about a particular behavior, the more the individual considers him/herself exposed to illness and the more willingly takes action to create positive behavioral changes [25, 29, 30]. Moreover, the perceived intensity can make health problems caused by smoking serious in the eyes of the individuals regarding their physical, psychological and social effects [25]. Different studies show that perceived sensitivity and intensity are two of the most important predictors for conducting certain behavior or refraining from doing so [25, 29, 30].

At the social level, in comparison to control group, the adjusted mean of perceived reward in the intervention group considerably was low and the adjusted mean of social support in the intervention group considerably was high. Studies have indicated that the perceived reward gained from substance use including feelings of greatness, pride, etc. is one of the most important factors that predicts such behavior [4, 30]. On the same basis, messages whose content was positive perceived reward in order not to smoke hookahs, replaced negative rewards through the telegram virtual network. It may be concluded, that using social networks for sending messages to individuals with positive reward content can have a

significant effect on quitting smoking hookahs or reducing its use. Studies show that individuals smoke hookahs with their close friends[4] and behaviors are normally reinforced inside networks of friends. Moreover, cigarette and hookah users consider smoking an enjoyable social amusement which reinforces the feeling of togetherness among different individuals[31]. Interestingly, decision to quit smoking is usually not made individually but such decisions are often made by a group of individuals connected with each other directly or indirectly in a network [22].

According to the ecological approach to the creation of changes at individual and social levels, it is necessary to pave the way for environmental changes and establish such changes. This study showed that effective low cost changes can be made in coffee houses very easily. We conducted the study in Hashtroud and QarahAghaj – small towns with fewer leisure opportunities than larger cities. Thus, coffee houses are accessible and cheap options to be used as places for friendly get-togethers. In coffee houses, drinking tea and smoking hookah are common. The intervention in this study was able to reduce hookah use in the coffee houses an interesting aspect of this study was that changes took place at all levels simultaneously. At the individual level, the perceived sensitivity and intensity was increased. At the social level, the virtual network entitled "saying no to hookahs" was formed. Increase in relations among friends in order to reduce hookah use, change in perceived rewards, and creation of social support through social networks, sending messages and discussions by lay persons and participants in virtual groups simultaneous with environmental changes in coffee houses all resulted in a kind of aggregation in efforts to reduce hookah use. As can be seen in different studies simultaneous changes at different levels can be effective in increasing health behavior [23, 32, 33].

Conclusion

The present study was able to reduce hookah use by the creation of environmental changes in coffee houses as well as through the establishment and development of social networks and making use of virtual networks' capabilities to increase social support and perceived reward gained from quitting hookah use and sending messages to change the perceived sensitivity and intensity at the individual level. Therefore, it can be concluded that using multi-level strategy interventions would play a considerable role in reducing hookah use. The results of this study can be useful for policy-makers and consultants in the field of narcotics consumption control as well as researchers in this field.

Abbreviations

SEM
Social Ecological Model
EMRO
Eastern Mediterranean Region
CVR
Content Validity Ratio
CVI

Declarations

Ethics approval and consent to participate

Participants completed informed written consent. The protocol of the study was approved by Ethics Committee in an Iranian medical sciences university [Ethics code: IR.TBZMED.REC.1396.175].

Consent for publication

Not Applicable.

Availability of data and materials

The data collection tools and datasets generated and/or analyzed during the current study are available from the corresponding author on reasonable request.

Competing interests

The authors declare that they have no competing interests.

Funding

Tabriz University of Medical Sciences provided funding sources for this study. Employees of the funder (FBA, NA, HN, AS) participated as scientific collaborators in the study. The findings and conclusions in this paper are those of the authors and do not represent the views of the Tabriz University of Medical Sciences. The funding body has no any role in the design of the study and collection, analysis, interpretation of the data, in writing the manuscript and publication as well.

Authors' contributions

FBA and AM are the main investigator and were involved in the study Design. FBA, NA and AM were also involved in the data collection and analysis. FB, CA and HN contributed to the theory and design of the manuscript, and critically revised the final article. All authors read and approved the final manuscript.

Acknowledgements

The authors would like to greatly acknowledge financial support for this study from Tabriz University of Medical Sciences. They also wish to thank all the participants of this study for their valuable cooperation and participation.

References

1. Urkin J, Ochaion R, Peleg A. Hubble bubble equals trouble: the hazards of water pipe smoking. *The Scientific World Journal*. 2006;6:1990-7.
2. Alwan A. Global status report on noncommunicable diseases 2010: World Health Organization; 2011.
3. Aboaziza E, Eissenberg T. Waterpipe tobacco smoking: what is the evidence that it supports nicotine/tobacco dependence? *Tobacco control*. 2015;24(Suppl 1):i44-i53.
4. Bakhtari F, Mohammadpoorasl M, Nadrian H, Alizadeh N, Jahangiri L, Ponnet K. Determinants of hookah smoking among men in the coffee houses: an application of socio-ecological approach. *Substance abuse treatment, prevention, and policy*. 2020; 15 (62).
5. Fakhari A, Mohammadpoorasl A, Nedjat S, et al. Hookah smoking in high school students and its determinants in Iran: a longitudinal study. *American journal of men's health*. 2015;9(3):186-92.
6. Akl EA, Gaddam S, Gunukula SK, et al. The effects of waterpipe tobacco smoking on health outcomes: a systematic review. *International journal of epidemiology*. 2010;39(3):834-57.
7. Karimy M, Niknami S, Heidarnia A, et al. Assessment of knowledge, health belief and patterns of cigarette smoking among adolescents. *Journal of Fasa University of Medical Sciences*. 2011;1(3):142-8.
8. Huang GC, Unger JB, Soto D, et al. Peer influences: the impact of online and offline friendship networks on adolescent smoking and alcohol use. *Journal of Adolescent Health*. 2014;54(5):508-14.
9. Christakis NA, Fowler JH. The collective dynamics of smoking in a large social network. *New England journal of medicine*. 2008;358(21):2249-58.
10. Romano PS, Bloom J, Syme SL. Smoking, social support, and hassles in an urban African-American community. *American journal of public health*. 1991;81(11):1415-22.
11. Essa-Hadad J, Linn S, Rafaeli S. A web-based program to increase knowledge and reduce cigarette and nargila smoking among Arab university students in Israel: mixed-methods study to test acceptability. *Journal of medical Internet research*. 2015;17(2).
12. Lipkus IM, Eissenberg T, Schwartz-Bloom RD, et al. Affecting perceptions of harm and addiction among college waterpipe tobacco smokers. *Nicotine & Tobacco Research*. 2011;13(7):599-610.
13. Mohlman MK, Boulos DN, El Setouhy M, et al. A randomized, controlled community-wide intervention to reduce environmental tobacco smoke exposure. *nicotine & tobacco research*. 2013;15(8):1372-81.
14. Dogar O, Jawad M, Shah SK, et al. Effect of cessation interventions on hookah smoking: post-hoc analysis of a cluster-randomized controlled trial. *nicotine & tobacco research*. 2013;16(6):682-8.
15. Taraghi Jah S, Hamdiye M, Yaghubi M. Predictor factors of smoking and hookah use in governmental universities. *Journal of the Shaheed Beheshti University of Medical Sciences and Health Services*. 2011;34(4):249-56.
16. Jahanpour F, Vahedparast H, Ravanipour M, et al. The trend of hookah use among adolescents and youth: A qualitative study. *J Qual Res Health Sci*. 2015;3(4):340-8.

17. Maziak W, Jawad M, Jawad S, et al. Interventions for waterpipe smoking cessation. The Cochrane Library. 2015.
18. Bakhtari Aghdam F, Moghaddam MHB, et al. Explaining the role of personal, social and physical environment factors on employed women's physical activity: a structural equation analysis. *Global journal of health science*. 2013;5(4):189.
19. Krug EG, Mercy JA, Dahlberg LL, et al. The world report on violence and health. *The lancet*. 2002;360(9339):1083-8.
20. Bakhtari F, Nadrian H, Matlabi H, et al. Personal, Interpersonal, and Organizational Predictors of the Mode of Delivery Among Urban Women: A Prospective Study With Socio-Ecological Approach. *Clinical nursing research*. 2017:1054773817740530.
21. Griffiths MA, Ford EW. Hookah smoking: behaviors and beliefs among young consumers in the United States. *Social work in public health*. 2014;29(1):17-26.
22. Smith KP, . CN. Social networks and health. . *Annu Rev Sociol*. 2008;34:405-29.
23. De Cocker KA, De Bourdeaudhuij IM, Cardon GM. The effect of a multi-strategy workplace physical activity intervention promoting pedometer use and step count increase. *Health education research*. 2009;25(4):608-19.
24. Sabzmakan L, Ghasemi M, Asghari M, Kamalikhah T, Chaleshgar M,. Factors Associated with Tobacco Use among Iranian Adolescents: An Application of Protection Motivation Theory. *Substance use & Misuse*. 2018;53(9):15111-18.
25. Williams T, White V. What Factors are Associated with Electronic Cigarette, Shisha-Tobacco and Conventional Cigarette Use? Findings from a Cross-Sectional Survey of Australian Adolescents? *Substance use & misuse*. 2018:1-11.
26. Aljarrah K, Ababneh ZQ, Al-Delaimy WK. Perceptions of hookah smoking harmfulness: predictors and characteristics among current hookah users. *Tobacco induced diseases*. 2009;5(1):16.
27. Jamil H, Janisse J, Elsouhag D, et al. Do household smoking behaviors constitute a risk factor for hookah use? *Nicotine & tobacco research*. 2011;13(5):384-8.
28. Davaji RBO, Shahamat YD, Davaji FH, et al. Patterns, Beliefs, Norms and Perceived Harms of Hookah Smoking in North Iran. *Asian Pacific journal of cancer prevention: APJCP*. 2017;18(3):823.
29. Sharifi RG, Charkazi A, Shahnazi H, et al. Smoking behavior among male students bases on trans-theoretical model.*journal of education and promotion health*. 2012; 1 (22).
30. Yan Y, Jacques-Tiura AJ, Chen X, et al. Application of the protection motivation theory in predicting cigarette smoking among adolescents in China. *Addictive behaviors*. 2014;39(1):181-8.
31. Roohafza H, Sadeghi M, Shahnam M, et al. Social norms of cigarette and hookah smokers in Iranian universities. *ARYA atherosclerosis*. 2013;9(1):45.
32. Akbari bayatiani A, Gangealivand N, et al. The Investigation of Relationship Between Social Network Size and Physical Health in Parents With Educable Mentally-Retarded Students. *Scientific Journal of Ilam University of Medical Sciences* 2013 21(5):34-43.

33. Baghianimoghaddam MH, Bakhtari F, et al. The effect of a pedometer-based program improvement of physical activity in Tabriz university employees. *International Journal of Preventive Medicine*. 2016;7(1):50.

Figures

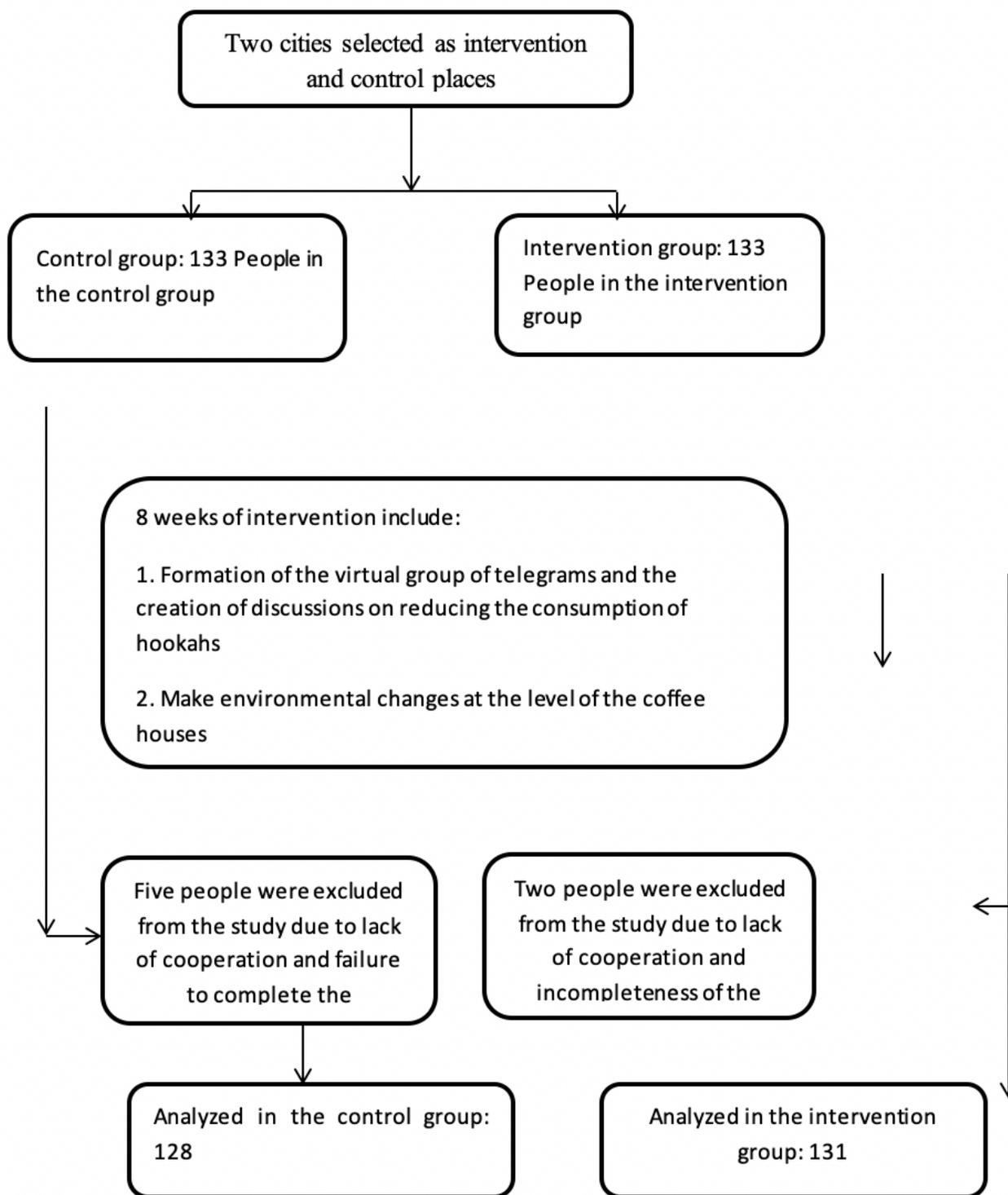


Figure 1

Flow chart of the study.

Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- [Additionalfile1.docx](#)
- [Additionalfile2.docx](#)
- [Additionalfile3.docx](#)