

Predictors of hookah smoking frequency among women in the south of Iran: a cross-sectional study

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Abstract

Background: The prevalence of hookah smoking (HS) has grown over the past decades in Iran especially in the south of the country. This study aimed to determine the behavioral and socio-demographic predictors of the HS frequency among women in southern Iran.

Method: This research was conducted on 400 female hookah smokers selected through multi-stage sampling method. Data were collected from October 2018 to September 2019 using a questionnaire guided by literature. Ordinal logistic regression analysis was run to determine the influential behavioral and socio-demographic predictors involved in the frequency of HS. Variables with a P-value of less than 0.05 in the final fitting model were regarded to be associated with the outcome variable (frequency of HS per day).

Results: Women' age ranged between 15 and 85 years (mean=35±13 years). We found that the lowest age of beginning to smoke hookahs (SHs) ($p<.001$) of less than 15 years, 15-30 years ($p=.003$), longer duration of HS ($p<.001$), family usage of HS ($p<.001$), beginning to SHs with peers ($p<.001$), absence of either parent in family (single-parent families) ($p<.001$) and a lack of prior intention to cease smoking ($p=.p<.001$) predicted the frequency of HS. Also 35-50 age group ($p=.01$) and those above 50 years ($p=.02$), ever-married group ($p=.002$) and low socio-economic status (SES) ($p<.001$) predicted the frequency of HS.

Conclusion: To prevent the behavior and make effective interventions to reduce HS, policy-makers should stay focused on factors other than internal motivations. Encouraging the social unacceptance of hookahs, focus on those surrounding women smokers, quitting the habit of HS and effective interventions to decrease one's intention to SHs can help to reduce such unhealthy behaviors.

Background

HS is a key global health issue which is on the rise in different parts of the world. The rate of HS among adults in the East Mediterranean, European and American geographical areas is reported to be 2.5-37.2, 2.2-22.7 and 1-11.4%, respectively [1]. According to the World Health Organization, it is estimated that tobacco consumption can annually induce a mortality rate of eight million people at a global scale [2]. The third international conference on water pipe tobacco smoking research *Moving toward Action*, held in Beirut in 2017, announced that smoking would soon become the primary cause of mortality worldwide [3]. Moreover, the United States Center for Diseases Control and Prevention (CDC) announced that reduced cigarette smoking was associated with the rapid increase in the use of other types of tobacco including hookahs [4].

Similarly, in Iran, the prevalence of HS has grown over the past two decades, especially in the south of Iran. In fact, Hormozgan Province ranks third in the country in terms of HS among women [5]. The results of an extensive survey in Iran in 2007 revealed that from among tobacco products (hookah, cigarette and pipe), 82.6% of women preferred hookahs. In fact, HS is highly prevalent and popular among Iranian

women [6]. In an epidemiologic study, the prevalence of HS among women in Hormozgan Province was found to be 10.3%, which is several times as high as other provinces [5]. Moreover, the 2-3-fold rate of HS among Iranian women was reported in comparison with the East Mediterranean, Lebanese and Pakistani women [7-9]. It seems that HS among women has had an increasing rate too, as women perceived HS better and more socially acceptable than cigarettes [10]. Iranian women were more restricted in smoking cigarettes than hookahs [11]. Moreover, women had a more positive attitude to and more dependence on HS than men [12, 13]. In fact, global statistics point to the more increasing rate of HS among women than men [14-16].

Several systematic studies and meta-analyses pointed to the correlation of the diseases induced by HS (e.g. leukemia, gastric cancer, lung cancer, oral cancer, cardiovascular diseases, respiratory diseases and low birth weight) and HS [1, 17]. Alberg et al [18]. found a higher rate of affliction with lung cancer among women than men due to inhaling the cancerous content of tobacco smoke. Salameh et al [13] also found that the side effects of HS on women exceeded those on men. HS in women is accompanied by premature menopause, reduced bone mineral density, infertility, ectopic pregnancy, neonate disease or mortality, intrauterine growth restriction and more chromosome malformation [19, 20].

With the high prevalence of HS among women being accompanied by certain adverse effects, it is essential to take effective measures to reduce the rate of such unhealthy behaviors. An effective measure prior to any intervention is to diagnose and concentrate on the risk predictors of HS. As reported in a study, before developing and performing any intervention, it is essential to conduct epidemiological research to diagnose the risk factors involved in HS [21].

Although a limited body of research has extracted the predictors of HS (22-25), these limited studies extracted the predictors more among university students (male and female). Moreover, the above-mentioned body of literature did not exclusively deal with HS predictors. They investigated the mixed effect of hookah and cigarette. Besides, in these works of research, no exclusive attempt has been made to address psycho-demographic and behavioral predictors of the frequency of HS among women.

Thus, inspired by the high prevalence of HS among women and the concomitant adverse effects [10, 20], the present research aimed to determine the behavioral and socio-demographic predictors of HS frequency among women hookah smokers living in Bandar Abbas, Hormozgan. The present research hopes to pave the way for developing effective interventions for this vulnerable population.

Methods

Study design and setting

This cross-sectional study was conducted in 2018-19 in Bandar Abbas in southern Iran. It is located 27.19 latitude and 56.28 longitude and it is situated at the elevation of 9 meters above the sea level. Bandar Abbas has a population of 352,173 making it the largest city in Hormozgan.

Sample size

To decide on the sample size, following the related literature [26], $p=.31$, $\alpha=.05$, $\beta=.2$, 80%

Confidence interval [CI] and effect size=.08, the sample size was set at 331 and with an attrition rate of 15%, it was estimated at 400.

Participants & Sampling procedure

The target population consisted of women who SHs on a daily basis. The sampling method was multi-stage and the data were collected at women' homes. The study region had 20 health centers which cover the whole city and each center covers households in a district. At the first stage, we chose 10 centers from all health centers and in from covered area of selected center, we randomly selected a street on a map. At the second stage, we investigated households in the street for 40 eligible women to be included in the sample. Finally, the researcher completed the questionnaire for every woman.

Data collection

The required data were collected using a questionnaire. To this end, the researcher obtained a formal recommendation letter from the university deputy of research and then referred to a city councillor to whom the content and purpose of research were explained. He agreed to accompany the researcher to the neighborhood. Prior to data collection, the researcher introduced himself in full terms and explained the purpose of research for the target women in simple and comprehensible words. Then, the women signed a letter of consent and voluntarily entered the study. They were ensured of the confidentiality of the information they provided. Accordingly, the questionnaires were completed in the presence of the first author who was both trained and native to the area and was well acquainted with the data collection procedure. Each questionnaire took ten minutes to fill out. Women who were able to read and write completed the questionnaires at home and returned them later. For the illiterate, the items were read out without any bias or attempt to affect their perception. Regarding the qualified women who were not present at home, the researcher revisited them at a later time. In case of a person who could not be reached for three times, the data collection would proceed with the next neighboring houses. This process continued until the required data were satiated. This research was confirmed by Nimad National Institute for Medical Research Development (IR.NIMAD.REC.1398.281).

The inclusion criteria include daily hookah consumption for a minimum of 6 months [27, 28], being native to Bandar Abbas and signing an informed consent to participate in the research. The exclusion criteria were the following: a history of psychological disorder as reported by women, addiction to any drug other than hookahs and self-reported pregnant women.

Measurement

The data collection instrument was a questionnaire developed by the researcher in light of an extensive review of the related literature, which included the demographic information of behaviors related to HS.

The instrument consisted of 2 sections: demographic information and HS-related behaviors. The first section included age (in years, divided into four categories), marital status (ever or never married), schooling level (illiterate, below diploma, diploma, academic), professional activity (working outside home, not working), history of poor care taking at four categories (two-parent households, father households, mother households, individuals other than the parents) and then at two categories (two-parent households, others), SES based on the distribution of the household crowding index (person/room ratio), and decreasing crowdedness levels categorized as upper, middle or lower SES (crowding index <1, 1-2 and >3 people per room) [15, 29] .

The second section of the questionnaire included behaviors related to HS including the age of SHs commencement (in years, divided into three categories), duration of SHs (in years, divided in three categories), the first company in SHs (friends, relatives or family members), the first place of SHs commencement (family and relatives, friends' homes, amusement places, beach), SHs among other family members (yes/no), type of tobacco consumed (local, fruit flavor, both), intention to cease SHs (yes/no), frequency of SHs per day.

To verify the content validity of the questionnaire, it was given to a panel of 5 experts in health education, practitioners trained in cessation programs and clinical psychologists. Their comments helped revise the questionnaire. To check the reliability of the instrument, the test-retest method was employed with 20 women and a 20-day interval. The instrument was considered reliable if the correlation between the first and second administration was above .7 [30].

Data analysis

Stata.11 (College Station, TX: Stata Corp LP) was used to analyze the data. Descriptive statistics were reported as mean and standard deviation for quantitative variables and frequency and percentage for categorical variables. The main variable, HS, was defined as the frequency of smoking hookahs per day and was rated at four levels (1=once a day, 2=twice a day, 3=three times a day, 4=more than three times a day). Ordinal logistic regression analysis was run to determine the influential behavioral and socio-demographic predictors involved in HS. Socio-demographic Covariates included age, marital status, schooling level, professional activity and socio-Economic status. Behavioral covariates included age beginning to smoke, duration of smoking hookahs, the first company in smoking, smoking hookahs among family members, caretakers and current intention to cease smoking. Before running the multivariate analysis, we performed a univariate analysis to choose the variable for the following step with $P < 0.2$ as the threshold level. Since all the covariates were significant at level 0.2 in univariate analysis, we included all of them in multivariate analyses.

Results

A total of 502 women were interviewed in this research; 400 women entered the statistical analysis phase (9 individuals did not meet the inclusion criteria; 38 did not submit their informed consent; 55 were not able to or were not willing to participate).

Descriptive phase: Socio-demographic characteristics

women's age in the present research ranged between 15 and 85 years (mean=35±13 years). As many as 303 women (75.8%) belonged to the ever-married category; 179 (44.8%) had a schooling level below diploma; 324 (81%) worked outside home and 155 (38.8%) had a middle SES. Other demographic information is summarized in Table 1.

Table 1: Demographic characteristics among women (n=400)

Variables	Categories	Number (%)
Age(years)	<20	59(14.8)
	20-35	169(42.2)
	35-50	114(28.5)
	>50	58(14.5)
Marital status	never married	97(24.2)
	ever married	303 (75.8)
schooling level	illiterate	35(8.8)
	below diploma	179(44.7)
	diploma	118(29.5)
	academic	68(17)
Professional activity	Working outside home	76(19)
	Not working	324(81)
history of care taking	Two parents	265(66.3)
	Others	135(33.7)
Socio-Economic status	Upper	133(33.3)
	Middle	155(38.7)
	Lower	112(28)

Family and relatives' home was the first place women experienced HS. Other places are depicted in Figure1.

Figure 1: The first place women experienced hookah smoking

Descriptive statistics of behavioral predictors in hookah smoking

The beginning age of HS ranged between 7 and 56 years (mean=21±8 yrs.) and the history of HS ranged between 1 and 68 years (mean=13±12 yrs.). Two hundred fifty-one women (62.8%) had HS family members; 229 (57.3%) smoked local tobacco; 235 (58.8%) had no intention to cease smoking and 242 women (60.5%) made no attempts to cease HS. The frequency of HS ranged between 1 and 20 times a day (mean=3.10±3.6) and 155 women (38.8%) SHs more than 4 times a day. The other relevant behavioral predictors are summarized in Table 2. A total of 316 (79%) women had their first personal experience of HS with a friend and 81 (21%) in the family.

Table 2: Behavioral risk factors characteristics among women (n=400)

Variables	Categories	Number (%)
Beginning age of smoking (year)	>15	82(20.5)
	15-30	280(70.0)
	>30	38(9.5)
Duration of smoking(year)	<5	143(35.8)
	5-15	120 (30)
	>15	137(34.3)
Hookah smoking by other family members	Yes	251(62.8)
	No	149(37.3)
Type of tobacco smoked	local	229(57.3)
	Fruity	109(27.3)
	Local/fruity	62(15.5)
Current intention to cease smoking	Yes	165(41.3)
	No	235(58.8)
Current intention to cease smoking	Yes	165(41.3)
	No	235(58.8)
Frequency of smoking per day	1	124(31)
	2	80(20)
	3	41(10.3)
	≥4	155(38.8)

Inferential statistics of demographic predictors in hookah smoking

Ordinal regression analysis of the demographic predictors involved in HS showed that the age group 35-50 years and the age above 50 years significantly predicted the higher frequency of HS among women. Compared to the reference group (i.e., the age group < 20 years), women in the age group of 20-35 years had a similar tendency to SHs. The ever-married SHs about three times as frequently as the reference group (i.e., the never-married individuals). Women of a low SES tended to SHs 6.5 times as much as the high SES peers. A higher schooling level was accompanied by a similar tendency to SHs, as compared to the reference group (i.e., the illiterate). Table 3 demonstrates other relevant information.

Table 3: Ordinal Regression: HS and Demographic Predictors (n=400)

Variable	Categories	Coefficient	Standard Error (SE)	AOR (95% CI)	P-value
Age (years)	<20 ^a			1.00	
	20-34	0.38	0.33	1.47 (0.75-2.85)	0.225
	35-50	1.31	0.39	2.73 (1.26-5.86)	0.01 *
	>50	1.20	0.51	3.32 (1.20-9.13)	0.02 *
Marital status	never married ^a			1.00	
	ever married	1.5	0.34	2.86 (1.47-5.59)	0.002 *
Schooling level	Illiterate ^a			1.00	
	below diploma	-0.0057	0.47	0.99 (0.39-2.51)	0.990
	diploma	-0.61	0.51	0.53 (0.19-1.48)	0.231
	academic	-0.39	0.55	0.67 (0.22-1.99)	0.479
Professional activity	Not working ^a			1.00	
	Working outside home	-0.40	0.28	0.66 (0.38-1.16)	0.154
Socio-Economic status	Upper ^a			1.00	
	Middle	0.84	0.22	2.32 (1.48-3.63)	<0.001*
	Lower	1.87	0.28	6.52(3.73-11.4)	<0.001*

CI: confidence interval, AOR: adjusted odds ratio. ^a :Reference group, *p<0.05

Inferential statistics of behavioral factors and hookah smoking

Ordinal regression analysis of the behavioral predictors correlated with HS which showed that a lower age of beginning to smoke was accompanied by a higher frequency of HS among women. Individuals who began to smoke at an age below 15 years and those beginning to smoke between 15-30 years of age, respectively, SHs more frequently than the reference group (>30 years). Moreover, a longer history of HS showed to be followed by a stronger tendency to SHs. participants with 5-15 years of HS experience or those with more than 15 years of HS in their background SHs more significantly than the reference group (<5 years). Women not intending to cease HS were more likely to SHs compared to those intending to quit (Table 4)."

Table 4: Ordinal Regression: HS and Behavioral Predictors (n=400)

Variable	Ref Category	Coefficient	Std. Error	AOR (95% CI)	P-value
Age beginning to smoke(years)	<15	1.25	0.41	4 (2.01 - 5.9)	<0.001*
	15-30	1.23	0.27	3.5 (1.55 - 7.9)	0.003*
	>30 ^a			1	
Duration of smoking hookahs(years)	<5 ^a			1.00	
	5 -15	1.33	0.31	3.76 (2.04- 6.92)	<0.001*
	>15	2.7	0.71	14.3 (3.49 - 58.52)	<0.001*
First company in smoking	family ^a			1.00	
	friend	0.98	0.28	2.67(1.54 - 4.59)	<0.001*
Smoking hookahs among family members	No ^a			1.00	
	yes	0.86	0.22	2.37 (1.52 - 3.41)	<0.001*
Caretaker	two parents ^a			1.00	
	Others	1.80	0.25	6.07 (3.68 - 10.00)	<0.001*
Current intention to cease smoking	Yes ^a			1.00	
	No	.91	.21	2.48 (1.64 - 3.75)	<0.001*

CI: confidence interval, AOR: adjusted odds ratio. ^a :Reference group, *p<0.05

Discussion

The present research, as compared to the related literature, shows a worrying rate of HS among women. It seems that HS is commonplace among women as women have a more positive attitude toward HS than

men. Also, as mentioned in a work of research, tobacco flavors attract women in particular (31). These can explain why quitting HS is hard for women. In their research, Danaei et al. (32) found that the majority of men intended to quit HS while the majority of women intended to continue. Considering the adverse effects of HS on women, it requires immediate measures by policy makers and local health authorities.

This study aimed to determine the behavioral and socio-demographic predictors of HS frequency among women in southern Iran. The present findings showed that almost 69% of women SHs more than twice a day. Contrary to this finding, another study found a smoking rate of 74.1% among women who SHs once a month [8]. Compared to the related literature, the rate of SHs was higher among women in the present research [5, 33]. These divergences can be due to the differing cultural backgrounds and geographies. It appears that HS in Bandar Abbas has cultural roots and has turned into a value among local residents. In a review study, cultural issues were referred to as the main motivator of HS among women [34]. As the researcher believes, women in Bandar Abbas perceive HS as positive and this attitude has affected their higher rate of smoking. Thus, society should take initiatives to turn the positive view of hookahs into a negative socially unacceptable behavior such as smoking cigarettes. Otherwise, when women hookah smokers perceive this behavior more acceptable than smoking cigarettes, they prefer to SHs more often.

The present research revealed that a longer duration of SHs was accompanied by a stronger tendency to SHs in women. This would point to the physical or psychological dependence on hookahs through time. In the previous body of research, physical and psychological dependence on hookah was mentioned as an underlying reason for HS [10, 35].

The present findings showed that more than half of the had a smoker family member. Moreover, women with a smoker family member tended to SHs 2.37 times as much as other women. It seems that the presence of a smoker in the family directed people more to SHs. In their research, Jamil et al. [36] included 245 white American adults who had at least one tobacco smoker in the family, which shows that this factor was a primary predictor of HS. Some other research indicated that HS among other family members was strongly correlated with HS by adolescents [37]. A body of research pointed out the effect of hookah smoker family members as a reason to begin to SHs by women [38, 39]. Thus, in developing interventions to reduce the rate of HS, besides focusing on women smokers, their families should be addressed too.

The present findings revealed that about half of women HSs experienced SHs for the first time with friends. Individual who experienced HS for the first time with friends tended to SHs twice as much as others. Concerning this, a body of research explored the effect of friends/peers on HS [40, 41]. Several studies reported drug abuse among peers as a key predictor of drug abuse among adolescents especially girls [42-44]. A study among female university students found peer pressure as the strongest predictor of tobacco consumption [45]. Some other research brought several reasons for continuing to smoke including inability to refuse friends' suggestion to smoke and inability to help smoking in recreational

places or among friends [46]. Thus, emphasis on avoiding smoker friends and empowering people to resist the suggestions of smoker friends can tremendously reduce the rate of HS.

According to the present findings, A single-parent women or women raised by someone other than their parents tended more to SHs. Zhang et al. [47], maintained that smoking rules at home differ between single-parent and two-parent families. In 1995-96, there was a rate of 46% of smoke-free homes for single-parent families and 63% for two-parent families. In 2006-7, these rates were respectively 75% and 8%. This finding can be explained as those who have lost a parent for some reason have been deprived of father's or mother's expression of emotions. Thus, they tend to find a way to compensate for that, for instance through smoking hookahs, Also, this finding is consistent with another study [48].

The present research revealed that intention was a predictor of HS among women. This finding has been consistent with another study that showed that HS is primarily motivated by prior intention [49]. The correlation between intention and behavior and more generally the effect of behavioral intention on the occurrence of high-risk behaviors has been proven in another study [50]. Similarly, another study found that women intending to SHs commenced HS seven times as frequently as others (women without any prior) [51]. The strong correlation between intention to SHs and the actual behavior indicates that preventive measures at this stage can lower the chance of beginning to SHs.

The present findings revealed that An increase in age is accompanied by a higher frequency of SHs among women above 30 years of age [8]. There are several other studies with similar findings [52, 53]. Guliani et al. [54] reported that the older age groups showed a higher tendency to SHs and quitting tobacco was hard for them. Contrary to the present study, some other research found that an increase in age was followed by a less tendency to HS among women [15]. These differences can be partly due to different cultural and geographical conditions. As an instance, more persistence of older people in SH can be explained by such factors as aimlessness, lower work load and duties, loneliness, more free time, positive attitude to HS and recurrent consumption over years.

The present results revealed that HS among the ever-married group was many times as frequent as the never-married. With this respect, some research found a higher rate of HS among widows and divorcees than the single individuals [55]. Some other research, however, reported that perceived family norms of the married people can influence their intention to ease smoking [56]. Besides, married women are more encouraged to stop smoking than the never married [57]. Such different findings can be explained by the target geography and dominant culture as well as the type of tobacco product consumed (cigarette/hookah), because the ever married (the divorcees and widows) might be more emotionally depleted due to the loss of their spouse; similarly, the married people confront more problems than single individuals. Thus, they might show more tendency to SHs in order to regain peace of mind. A review study showed that social and psychological gaps and the need for peace are among the key determiners of HS among women [10].

In light of the present findings, women with a lower SES, SHs more frequently than those of higher SES. With this concern, a study revealed that the rate of tobacco smoking in low- or middle-income countries is

higher than higher-income countries [58]. Contrary to the present finding, another study found that a high SES did not lead to a higher rate of SHs among women [55]. This difference can be partly explained by different target geographies involved, and as in the context of the present research tobacco was grown for years and made available to every household at a low price. Furthermore, people with financial problems might be unable to enjoy normal recreations, which are often more expensive, making them opt for cheaper recreations. A body of research also pinpointed the affordability of hookahs as a reason why it was prevalently used [59, 60].

As the present results revealed, women with a lower schooling level have more tendency to SHs. With this respect, a related study maintained that lacking knowledge about the adverse effects of HS was a reason for SHs [41]. Majdzadeh et al. [61] showed that the increasing rate of HS was due to the lower awareness of its adverse effects. Contrary to the present findings, another study observed that education did not have any protective effect on the rate of HS [55]. This difference can be partly explained by the underlying features of the target group such as education and type of culture dominating the population.

The present research revealed that working women had a lower tendency to smoke than those not working outside home. It seems that the former had less spare time to spend on SHs. A review study also pointed out HS as a spare time activity [43].

As the results showed, about more than half women smokers had their first experience of HS inside the family and with relatives [39]. With this respect, some research revealed that young Iranian women SHs without any fear of the reaction of those around them in family gatherings [62]. Their family members were likely to have hookahs at home to use in the gatherings [63].

The present findings showed majority of women consumed local tobacco, but the type of tobacco did not predict the frequency of SHs. Similar to the present findings, other studies found no significant correlation between tobacco type (local/fruity) and the rate of dependence on nicotine [26, 64]. However, the findings by Griffiths et al. [65] on American adolescents showed that consuming fruit-flavored tobacco was due to its pleasant smell, lower perceived risk than conventional tobacco and lower perceived dependence. This divergence can be attributed to the traditional/conventional pattern of HS behavior, and as in the present research context, locally-produced tobacco is prevalently used as it is commonly cultivated in the area for years.

Strengths and limitations

The data were collected as self-rating information. There was a possibility of halo effect [66]. Yet, the researcher attempted to reduce this effect by ensuring respondents of the confidentiality of the information they produced. Moreover, this research was conducted on women in Bandar Abbas which can limit the generalizability of findings to other geographies and target populations. To increase generalizability, attempts were made to collect the required data from different groups of women selected from different parts of the city, with different demographic features.

Another limitation of the present research is not using the nicotine dependence scale. Yet, it was attempted to include women who regularly SHs on a daily basis. It is suggested that further research employ this instrument which enjoys a higher precision to measure dependence on nicotine.

The absence of a similar study with the same purpose and research population to compare the results can be mentioned as another limitation of the present research. Yet, it was attempted to include studies that explored the same tobacco type, women population, similar behavioral variables and demographic features.

Despite that, a strength of the present research was the inclusion of old hands in HS, which can provide a more realistic picture of the actual behavior. Moreover, the present research can provide useful information for health authorities to develop effective interventions in future.

Conclusion

This research showed that besides internal background features such as prolonged physical-psychological dependence on hookah from a lower age and less tendency to quit smoking, there is a set of external factors such as normalized HS in their geographical area and culture, defective parental role, being surrounded by hookah smokers and low socio-economic status can affect higher frequency of HS. In our qualitative research, previously published, all the above-mentioned factors were mentioned as effective determiners of HS (48). In another review study we conducted, majority of the above-mentioned factors showed to have been correlated with HS (10). Probably, reduced social acceptability through extensive enculturation, intervention and focus on the hookah smokers nearby including the target hookah smokers themselves, discovery of all factors involved in their physical and psychological dependence help to prevent and reduce HS. The relevant findings suggest that to take effective preventive and interventional measures aiming to reduce the rate of HS, policymakers need to focus on factors other than the intrapersonal. Further research is required to extensively take into account more extra-personal factors affecting HS to prevent and reduce the rate of HS. In this respect, a review study showed that besides intrapersonal factors affecting HS, external factors are also involved such as interpersonal factor (peer influence), community (availability, facile access to cafes, culture), institutional/organizational factors (media influence) and policy-making (control policies) (10).

Abbreviations

SES: socio-economic status

HS: hookah smoking

SHs: Smoke hookahs

Declarations

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Authors' contributions

Aghamolaei T, designed the study, collected data, analyzed the data and reviewed the manuscript.; dadipoor S, designed the study, supervised data collection, analyzed the data drafted the manuscript and critically reviewed the manuscript, heyrani a; designed the study, reviewed the manuscript., ghanbarnezhad A, analyzed the data and reviewed the manuscript, ghaffari M, shahsavari S, reviewed the manuscript, all authors read and approved the final manuscript.

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Conflict of interests: None to declare

Availability of data and materials

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

Ethics approval and consent to participate

Ethical approval was received for this study from the National Institute for Medical Research, (IR.NIMAD.REC.1398.21). Written consent was sought from each eligible respondent. The objectives of

the study and its benefits were explained in a language they can understand. Study participants were informed that the study would not have any risks.

Consent for publication

Not applicable.

Competing interests

The authors declare that there is no conflict of interest in this work.

References

1. Jawad M, Charide R, Waziry R, Darzi A, Ballout RA, Akl EA: **The prevalence and trends of waterpipe tobacco smoking: A systematic review.** *PloS one* 2018, **13**(2):e0192191.
2. World Health Organization. Tobacco key facts. Geneva,Switzerland: World Health Organization; 2019. <https://www.who.int/news-room/fact-sheets/detail/tobacco>. Accessed 9 June 2019.
3. <https://website.aub.edu.lb/units/tcrp/conferences/Pages/Third-InternationalConference-on-Waterpipe-smoking-Research.aspx>.
4. Drop in cigarette consumption offset by increases in other forms of smoked tobacco [press release]. Atlanta, GA: Centers for Disease Control and Prevention; ,<https://patch.com/georgia/vahi/cdc-drop-in-cigarette-consumption-offset-by-increases000d88fca1> 2012.
5. Nemati S, Rafei A, Freedman ND, Fotouhi A, Asgari F, Zendehdel K: **Cigarette and water-pipe use in iran: Geographical Distribution and Time Trends among the Adult population; A Pooled Analysis of National STEPS Surveys, 2006-2009.** *Archives of Iranian Medicine (AIM)* 2017, **20**(5).
6. Meysamie A, Ghaletaki R, Haghazali M, Asgari F, Rashidi A, Khalilzadeh O, Esteghamati A, Abbasi M: **Pattern of tobacco use among Iranian adult population: results of the national Survey of Risk Factors of Non-Communicable Diseases (SuRFNCD-2007).** *Tobacco control* 2009;tc. 2009.030759.
7. Khan MT, Hashmi S, Zaheer S, Aslam SK, Khan NA, Aziz H, Rashid N, Shafique K: **Burden of waterpipe smoking and chewing tobacco use among women of reproductive age group using data from the 2012–13 Pakistan Demographic and Health Survey.** *BMC public health* 2015, **15**(1):1113.
8. Azab M, Khabour OF, Alzoubi KH, Anabtawi MM, Quttina M, Khader Y, Eissenberg T: **Exposure of pregnant women to waterpipe and cigarette smoke.** *Nicotine & Tobacco Research* 2012, **15**(1):231-237.
9. Chaaya M, Jabbour S, El-Roueiheb Z, Chemaitelly H: **Knowledge, attitudes, and practices of argileh (water pipe or hubble-bubble) and cigarette smoking among pregnant women in Lebanon.** *Addictive Behaviors* 2004, **29**(9):1821-1831.

10. Dadipoor S, Kok G, Aghamolaei T, Heyrani A, Ghaffari M, Ghanbarnezhad A: **Factors associated with hookah smoking among women: A systematic review.** *Tobacco prevention & cessation* 2019, **5**:26.
11. Baheiraei A, Sighaldeh SS, Ebadi A, Kelishadi R, Majdzadeh SR: **Psycho-social needs impact on hookah smoking initiation among women: A qualitative study from Iran.** *International journal of preventive medicine* 2015, **6**.
12. Eshah NF, Froelicher ES: **Knowledge, attitudes, beliefs and patterns of waterpipe use among Jordanian adults who exclusively smoke waterpipes.** *European Journal of Cardiovascular Nursing* 2018, **17**(1):85-92.
13. Salameh P, Khayat G, Waked M: **Lower prevalence of cigarette and waterpipe smoking, but a higher risk of waterpipe dependence in Lebanese adult women than in men.** *Women & health* 2012, **52**(2):135-150.
14. Villanti AC, Cobb CO, Cohn AM, Williams VF, Rath JM: **Correlates of hookah use and predictors of hookah trial in US young adults.** *American journal of preventive medicine* 2015, **48**(6):742-746.
15. Daou KN, Bou-Orm IR, Adib SM: **Factors associated with waterpipe tobacco smoking among Lebanese women.** *Women & health* 2018:1-11.
16. Shearston J, Park S, Lee L, Oshinsky C, Sherman S, Weitzman M: **Increasing hookah use among adolescent females in the US: analyses from the 2011-2014 National Youth Tobacco Survey (NYTS).** *Tobacco Prevention & Cessation* 2016, **2**.
17. Waziry R, Jawad M, Ballout RA, Al Akel M, Akl EA: **The effects of waterpipe tobacco smoking on health outcomes: an updated systematic review and meta-analysis.** *International Journal of Epidemiology* 2016, **46**(1):32-43.
18. Alberg AJ, Samet JM: **Epidemiology of lung cancer.** *Chest* 2003, **123**(1):21S-49S.
19. Tansaz M, Adhami S, Mokaberinejad R, Namavar Jahromi B, Atarzadeh F, Jaladat AM: **An overview of the causes and symptoms of male infertility from the perspective of traditional persian medicine.** *The Iranian Journal of Obstetrics, Gynecology and Infertility* 2016, **18**(182):11-17.
20. Sarokhani M, Veisani Y, Mohamadi A, Delpisheh A, Sayehmiri K, Direkvand-Moghadam A, Aryanpur M: **Association between cigarette smoking behavior and infertility in women: a case-control study.** *Biomedical Research and Therapy* 2017, **4**(10):1705-1715.
21. Barati M, Hidarnia A, Niknami S, Allahverdipour H: **Factors associated with tobacco smoking among male adolescents: The role of psychologic, behavioral, and demographic risk factors.** *Avicenna J Neuro Psych Physio* 2015, **2**(1):e27152.
22. Sahebihagh MH, Hajizadeh M, Ansari H, Lesani A, Fakhari A, Mohammadpoorasl A: **Modeling the underlying tobacco smoking predictors among 1st year university students in Iran.** *International journal of preventive medicine* 2017, **8**.
23. Abdollahifard G, Vakili V, Danaei M, Askarian M, Romito L, Palenik CJ: **Are the predictors of hookah smoking differ from those of cigarette smoking? Report of a population-based study in Shiraz, Iran, 2010.** *International journal of preventive medicine* 2013, **4**(4):459.

24. 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.
25. Fielder RL, Carey KB, Carey MP: **Predictors of initiation of hookah tobacco smoking: A one-year prospective study of first-year college women.** *Psychology of Addictive Behaviors* 2012, **26**(4):963.
26. Sotodeh A, Tahmasebi R, Noroozi A: **Application of health belief model to predict factors of nicotine dependence among water pipe smoking women in 2015.** *Journal of Health* 2016, **7**(4):425-434.
27. Mojahed K, Navidian A: **The effect of motivational interviewing on self-efficacy to quit hookah smoking in pregnant women.** *Journal of hayat* 2018, **24**(1):84-96.
28. Jabbour S, El-Roueiheb Z, Sibai A: **Nargileh (Water-Pipe) smoking and incident coronary heart disease: a case-control study.** *Annals of Epidemiology* 2003, **8**(13):570.
29. Melki I, Beydoun H, Khogali M, Tamim H, Yunis K: **Household crowding index: a correlate of socioeconomic status and inter-pregnancy spacing in an urban setting.** *Journal of Epidemiology & Community Health* 2004, **58**(6):476-480.
30. Taber KS: **The use of Cronbach's alpha when developing and reporting research instruments in science education.** *Research in Science Education* 2018, **48**(6):1273-1296.
31. Scott-Sheldon LA, Stroud LR: **Preferences and Perceptions of Flavored Hookah Tobacco among US Women.** *American journal of health behavior* 2018, **42**(3):37-46.
32. Danaei M, Jabbarinejad-Kermani A, Mohebbi E, Momeni M: **Waterpipe Tobacco Smoking Prevalence and Associated Factors in the Southeast of Iran.** *Addiction & health* 2017, **9**(2):72.
33. Robinson JN, Wang B, Jackson KJ, Donaldson EA, Ryant CA: **Characteristics of hookah tobacco smoking sessions and correlates of use frequency among US adults: findings from wave 1 of the Population Assessment of Tobacco and Health (PATH) study.** *Nicotine and Tobacco Research* 2017, **20**(6):731-740.
34. Akl EA, Jawad M, Lam WY, Obeid R, Irani J: **Motives, beliefs and attitudes towards waterpipe tobacco smoking: a systematic review.** *Harm reduction journal* 2013, **10**(1):12.
35. Afifi R, Khalil J, Fouad F, Hammal F, Jarallah Y, Farhat HA, Ayad M, Nakkash R: **Social norms and attitudes linked to waterpipe use in the Eastern Mediterranean Region.** *Social Science & Medicine* 2013, **98**:125-134.
36. Jamil H, Elsouhag D, Hiller S, Arnetz JE, Arnetz BB: **Sociodemographic risk indicators of hookah smoking among White Americans: a pilot study.** *Nicotine & Tobacco Research* 2010, **12**(5):525-529.
37. Rezaei F, Noroozi M, Mansourian M, Safari O, Jahangiry L: **the role of social and familial factors as predicting factors related to hookah and cigarette smoking among adolescents in Jahrom, South of Iran.** *International Journal of Pediatrics* 2017, **5**(5):4929-4937.
38. Baheiraei A, Hamzehgardeshi Z, Mohammadi MR, Nedjat S, Mohammadi E: **Personal and family factors affecting life time cigarette smoking among adolescents in Tehran (Iran): a Community Based Study.** *Oman medical journal* 2013, **28**(3):184.

39. Dar-Odeh N, Abu-Hammad O, Al-Abdalla M, Shakhatreh F, Al-Abedalla K, Khdairi N, Prime S: **Narghile smoking among Jordanian educated working women: attitudes and beliefs.** *Journal of Advances in Medicine and Medical Research* 2013;483-490.
40. Labib N, Radwan G, Mikhail N, Mohamed MK, El Setouhy M, Loffredo C, Israel E: **Comparison of cigarette and water pipe smoking among female university students in Egypt.** *Nicotine & tobacco research* 2007, **9**(5):591-596.
41. Sadeghi R, Mahmoodabad SSM, Fallahzadeh H, Rezaeian M, Bidaki R, Khanjani N: **Predictive factors for preventing hookah smoking and health promotion among young people based on the protection motivation theory.** *Journal of Education and Health Promotion* 2019, **8**(1):169.
42. Walters ST, Matson SA, Baer JS, Ziedonis DM: **Effectiveness of workshop training for psychosocial addiction treatments: a systematic review.** *Journal of Substance Abuse Treatment* 2005, **29**(4):283-293.
43. Momenabadi V, Hashemi SY, Borhaninejad VR: **Factors affecting hookah smoking trend in the society: A review article.** *Addiction & health* 2016, **8**(2):123.
44. Khor PY, Harun NB, Ishak FB, Anuar NAIM, Karim NA, Azman A, Mahmood TST: **Contributory factors to the smoking of shisha among teenagers in the Perak City of Ipoh: A preliminary qualitative survey.** *International Journal of Public Health Research* 2012, **2**(1):80-84.
45. Mandil A, BinSaeed A, Ahmad S, Al-Dabbagh R, Alsaadi M, Khan M: **Smoking among university students: a gender analysis.** *Journal of infection and public health* 2010, **3**(4):179-187.
46. Joveyni H, Dehdari T, Gohari Mr, Gharibnavaz H: **The survey of attitudes, subjective norms and perceived behavioral control of college students about hookah smoking cessation.** *Health system research* 2012, **8**(7 (supplement)):1311-1321.
47. Zhang X, Martinez-Donate AP, Kuo D, Jones NR, Palmersheim KA: **Trends in home smoking bans in the USA, 1995–2007: prevalence, discrepancies and disparities.** *Tobacco Control* 2012, **21**(3):330-336.
48. Dadipoor S, Kok G, Aghamolaei T, Ghaffari M, Heyrani A, Ghanbarnezhad A: **Explaining the determinants of hookah consumption among women in southern Iran: a qualitative study.** *BMC public health* 2019, **19**(1):1-13.
49. Makvandi Z, Sharifi M, Barati M: **Assessment of Factors Associated With Hookah Consumption Among College Students of Asad Abad City Base on The Theory of Planned Behavior (TPB) in 2015-2016.** *Iranian Journal of Health Education and Health Promotion* 2017, **5**(4):270-279.
50. Alami A, Rezaeian-Kochi M-H, Moshki M: **Application of Theory of Planned Behavior in Predicting Intention and Action of Preventing Tobacco Use among Students of Gonabad University of Medical Sciences.** *Iranian Journal of Health Education and Health Promotion* 2016, **3**(4):340-348.
51. Sidani JE, Shensa A, Naidu MR, Yabes JG, Primack BA: **Initiation, progression, and sustained waterpipe use: a nationally representative longitudinal study of US young adults.** *Cancer Epidemiology and Prevention Biomarkers* 2017, **26**(5):748-755.

52. Dillon KA, Chase RA: **Secondhand smoke exposure, awareness, and prevention among African-born women.** *American journal of preventive medicine* 2010, **39**(6):S37-S43.
53. Mandil A, Hussein A, Omer H, Turki G, Gaber I: **Characteristics and risk factors of tobacco consumption among University of Sharjah students, 2005.** 2007.
54. Guliani H, Gamtessa S, Çule M: **Factors affecting tobacco smoking in Ethiopia: evidence from the demographic and health surveys.** *BMC public health* 2019, **19**(1):938.
55. Jawad M, Abdulrahim S, Daouk A: **The social patterning of tobacco use among women in Jordan: the protective effect of education on cigarette smoking and the deleterious effect of wealth on cigarette and waterpipe smoking.** *Nicotine & Tobacco Research* 2015, **18**(4):379-385.
56. Kim SS, Kim S, Seward G, Fortuna L, McKee SA: **Korean American women's experiences with smoking and factors associated with their quit intentions.** *ISRN Addiction* 2013, **2013**.
57. Jun H-J, Acevedo-Garcia D: **The effect of single motherhood on smoking by socioeconomic status and race/ethnicity.** *Social science & medicine* 2007, **65**(4):653-666.
58. Stone E, Peters M: **Young low and middle-income country (LMIC) smokers—implications for global tobacco control.** *Translational lung cancer research* 2017, **6**(Suppl 1):S44.
59. Baheiraei A, Sighaldehy SS, Ebadi A, Kelishadi R, Majdzadeh R: **Factors that contribute in the first hookah smoking trial by women: a qualitative study from Iran.** *Iranian journal of public health* 2015, **44**(1):100.
60. Nakkash RT, Khalil J, Afifi RA: **The rise in narghile (shisha, hookah) waterpipe tobacco smoking: a qualitative study of perceptions of smokers and non smokers.** *BMC public health* 2011, **11**(1):315.
61. Majdzade S: **Survey of tendency of Hormozgan people to using of Hubble-Bubble smoking.** *Hakim J* 2001, **4**(3):298-304.
62. Baheiraei A, Sighaldehy SS, Ebadi A, Kelishadi R, Majdzadeh R: **The role of family on hookah smoking initiation in women: a qualitative study.** *Global journal of health science* 2015, **7**(5):1.
63. Huang L-L, Sutfin EL, Kowitt S, Patel T, Ranney L, Goldstein AO: **Trends and correlates of hookah use among high school students in North Carolina.** *North Carolina medical journal* 2017, **78**(3):149-155.
64. Asfar T, Ward KD, Eissenberg T, Maziak W: **Comparison of patterns of use, beliefs, and attitudes related to waterpipe between beginning and established smokers.** *BMC public health* 2005, **5**(1):19.
65. 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.
66. Dodd-McCue D, Tartaglia A: **Self-report response bias: Learning how to live with its diagnosis in chaplaincy research.** *Chaplaincy Today* 2010, **26**(1):2-8.

Figures

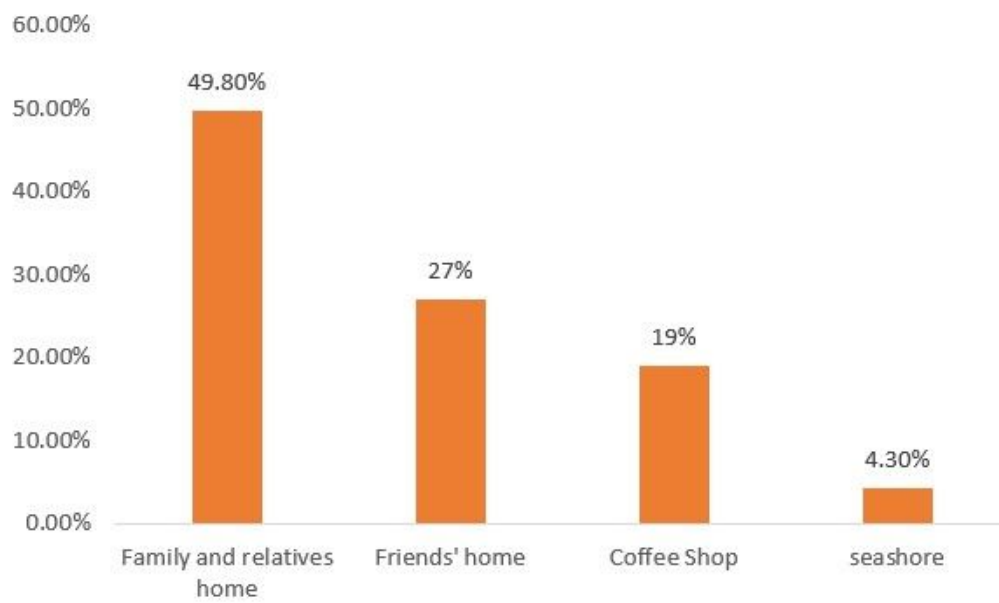


Figure 1

The first place women experienced hookah smoking