

# Waterpipe Tobacco Smoking in Three Israeli Adult Populations

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**ABSTRACT:** **Background:** Waterpipe tobacco smoking (WTS) is common in some populations and may add increased risk for tobacco-related diseases.

**Objectives:** To assess the rates of WTS and risk practices associated with WTS in three distinct populations in Israel: long-term Jewish residents (LTJR), immigrants from the former Soviet Union (fSU), and Arabs.

**Methods:** We conducted a cross-sectional survey of 899 randomly selected participants, age 30–65 years, using face-to-face interviews with subjects from the three population groups in Israel. Respondents reported WTS, cigarette smoking, alcohol consumption, and socioeconomic characteristics.

**Results:** Among men, WTS at least once a week was reported by 4.8% of LTJR, 3.2% of fSU immigrants and 20.3% of Arabs. Lower rates were reported among women of all groups. The younger, less educated men and the younger unmarried women had higher odds of WTS. LTJR who smoked cigarettes and drank alcohol had higher odds of WTS [odds ratio (OR) 32.6, confidence interval (CI) 9.36–113.6; OR = 3.57, CI = 1.48–8.63, respectively], compared to non-smokers and non-drinkers. fSU immigrants who smoked cigarettes had higher odds of WTS (OR = 3.40, CI = 0.99–11.7) compared to non-smokers. Among Arabs, cigarette smoking and alcohol consumption were not associated with WTS.

**Conclusions:** Arabs are more likely than other Israeli populations to engage in WTS. This behavior may add to increased inequalities in rates of tobacco-induced diseases between Arabs and Jews in Israel. Including WTS in the policies for smoke-free public places is called for.

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**KEY WORDS:** hookah, waterpipe, cigarette smoking, alcohol, Arabs, Jews, Israel

of the culture in these countries [9,10]. Studies suggest that WTS could become a health epidemic, especially in the Arab world [9, 11]. WTS might lead to tobacco dependence and is associated with adverse health outcomes [12,13].

Israel is a unique setting in which various cultural groups reside in the same country. Three distinct large populations reside in Israel: long-term Jewish residents (LTJR), immigrants from the former Soviet Union (fSU), and Arabs. In 2012, about 20% of the Israeli population was Arabs. The immigrants from the fSU arrived after 1990 and comprise 17% of the total Israeli population. The remaining Israeli population (63%) constitutes long-term Jewish residents (LTJR). WTS was investigated in the last decade in Israel, but this related only to adolescents and young adults (students) and the rates ranged between 64% and 7% [14,15].

Studies suggest that tobacco use of any kind may promote other forms of smoking tobacco; those smoking a waterpipe had a higher chance of being cigarette smokers and vice versa. This relationship may differ between countries [5,8]. WTS was higher among those who reported use of other tobacco products, alcohol, marijuana and other drugs in the United States and Europe.

The purpose of the present study was twofold: to assess levels of WTS among adults (age 30–65 years) from three distinct population groups – LTJR, fSU immigrants and Arabs – and to measure the within-community and differential community associations between WTS and cigarette smoking, and between WTS and alcohol consumption in these three population groups.

## SUBJECTS AND METHODS

A secondary data analysis was conducted on data from a cross-sectional survey of 899 randomly selected participants interviewed face to face in Israel. The respondents were Israelis aged 30 to 65 years, and consisted of three groups: long-term Jewish residents (n=402) who were born in Israel or immigrated to Israel before 1990, immigrants from the former Soviet Union who immigrated after 1989 (n=201), and Arab Muslims (n=296) living in northern and central Israel. The study was conducted between June 2012 and March 2013 and was approved by the Ethics Review Board of the University of Haifa, Israel.

**W**aterpipe tobacco smoking (WTS) has been reported to be spreading worldwide [1-4]. Most studies on the subject investigated WTS among adolescents and young adults or students in the Middle East, Europe and America [4-6]. However, little is known regarding the prevalence of WTS among adults [7,8]. Studies from the Arab world suggest that the prevalence of WTS is comparatively high and is part

A multi-stage sampling process was employed by sampling towns and then households within the towns, taking into account the geographic area (north, center or south), the socioeconomic level of the town and its size. The towns were chosen randomly from a list of towns that were divided according to socioeconomic level. The samples were selected separately for LTJR, fSU immigrants and Arabs, and consisted of 12 Jewish towns, 12 Arab towns, and 9 towns with a high concentration of fSU immigrant residents. In each town the interviewers selected dwelling units at random. Interviews were performed during the early hours of the evening.

The response rates were 42% among the LTJR, 73% among the fSU immigrants, and 83% among Arabs. The interviews were conducted in three languages – Hebrew, Russian and Arabic – by trained interviewers from each of the communities.

## MEASURES

The questionnaire included questions about health behaviors and socio-demographic characteristics. Cigarette smoking and WTS were assessed by two questions for each behavior: 1) “Have you ever in the past smoked a waterpipe (or cigarettes)” for which yes/no answers were available, and 2) “What is the current frequency of your smoking the waterpipe (or cigarettes)” for which the following options were: every day, at least once a week but not every day, less than once a week, and do not smoke. Former WTS or cigarette smoking was defined as those reporting smoking in the past but not at present.

Alcohol consumption was measured using two questions: 1) “Do you drink alcoholic beverages currently or in the past?” for which three options were available: drink currently, drank in the past, or never drank. Those reporting current alcohol consumption were asked: 2) “How often do you drink alcoholic beverages?” for which four options were available: once a month or less, 2–4 times a month, 2–3 times a week, and 4 times or more a week. The behaviors were coded as dichotomous for analysis: not smoking or drinking (0), and current smoking or drinking (1).

Participants reported their age and other demographic variables. Education was coded as: did not graduate high school (1), high school and professional certificate (2), and academic degrees (3). Employment was dichotomized as: employed (1) and unemployed (0). Income was measured by a three-level ordinal scale: lower than average Israeli income (1), average (2), and higher than average Israeli income (3). Marital status was reported as married or living with a spouse (1), and single, divorced or widowed (0). Participants were asked to self-define their degree of religiosity as: secular (not religious at all) (1), traditional (somewhat religious) (2), and religious or very religious (3). Participants were also asked to define their ethnicity as Jewish or Arab. Participants were asked to report their country of birth and year of immigration, if not born in Israel. A variable with the three population groups was formed. Gender was reported by the interviewers as male (1) or female (2).

## STATISTICAL ANALYSIS

To test bivariate differences between the population pairs, chi-square and ANOVA tests were performed. Multivariable logistic regression models were computed to estimate the odds of WTS and identify differences between the population groups, adjusting for demographic variables, cigarette smoking and alcohol consumption. Subsequent multivariable logistic models were computed to identify common and unique variables associated with WTS in each population group. Income and employment were included in the multivariable logistic regression models but were not significantly associated with WTS in men or women or in any of the population groups and, therefore, were excluded from final models. Age was included as a continuous variable. Population group, gender, education, marital status, religiosity, and risk behaviors were used as categorical variables. As the independent variables associated with WTS differed in the three populations and between men and women, a multivariable logistic regression model was computed separately for men and women and each population. An alpha level of  $< 0.05$  was adopted as the criterion for Type I error.

## RESULTS

Table 1 presents the socio-demographic characteristics of the three study populations. A significantly higher percent of fSU immigrants (33.8%) reported having an income lower than the average Israeli income compared to Arabs and LTJR (19.9%). The majority of the Arab participants were significantly younger, less educated, fewer of them were employed, a higher percent of them were religious, and a higher percent reported having an income above the average Israeli income, compared to the LTJR and fSU immigrants. Most of these differences are characteristic of the Israeli population except for the income measure.

WTS, cigarette smoking and alcohol consumption by gender and population group are presented in Table 2. WTS was reported mainly by men and less so by women. The percentage of Arab men reporting current WTS (30.4%) was significantly higher than LTJR men (18%) and fSU immigrants (14.9%) ( $P = 0.003$ ). Among LTJR and fSU immigrant men who reported current WTS, most of the respondents reported WTS less than once a week. Less than 5% of respondents reported WTS once a week or more. However, among Arabs, 20.3% of men reported smoking at least once a week. These differences in frequency of WTS between LTJR, fSU immigrants and Arabs were significant ( $P < 0.0001$ ) and suggest major differences in cultures associated with WTS.

Among women, low frequencies of WTS were reported in all population groups. Only 3.9% of LTJR women, 3.8% of fSU women and 4.3% of Arab women reported WTS, and there was no significant difference between the groups. Smoking cigarettes was more common than WTS in this adult sample for both men and women. Arab men reported smoking ciga-

**Table 1.** Characteristics of the study population, percent, mean and standard deviation (chi-square and ANOVA significance tests)

		Long-term Jewish residents N=402 (%)	fSU immigrants N=201 (%)	Arabs N=296 (%)
Age*	Mean (SD)	46.3 (10.8)	47.1 (11.7)	42.9 (9.5)
	P	< 0.0001		
	30–39	32.8	35.3	42.9
	40–49	29.9	23.4	30.7
	50–65	37.3	41.3	26.4
	P	0.002		
Gender	Men	48.9	46.8	53.4
	Women	51.1	53.2	46.6
	P	0.3		
Education*	Did not graduate high school	16.3	15.6	37.2
	Graduated high school & professional certificate	52.4	60.3	29.7
	Academic degree	31.3	24.1	33.1
	P	< 0.0001		
	Employment*	Unemployed	11.7	14.9
	Employed	88.3	85.1	69.3
	P	< 0.0001		
Income*	Above average	36.0	24.4	48.7
	Average	44.2	41.8	31.4
	Lower than average	19.9	33.8	19.9
	P	< 0.0001		
Marital status	Single	18.9	19.4	13.5
	Married	81.1	80.6	86.5
	P	0.12		
Religiosity*	Secular	39.5	41.3	13.5
	Traditional	34.7	49.8	16.6
	Religious	25.8	9.0	69.9
	P	< 0.0001		

\*  $P < 0.05$

rettes more than Jewish and immigrant men; however, the significance was borderline ( $P = 0.08$ ).

Women reported smoking cigarettes less than men did. Arab women reported smoking cigarettes significantly less than LTJR and fSU immigrant women ( $P = 0.03$ ). Very few Arabs reported drinking alcohol (10% of men and less than 1% of women). In contrast, among the LTJR and fSU immigrants most respondents reported drinking alcohol. Most drank two to four times a month or less, and less than 10% reported drinking two to three times a week or more. A higher percent of fSU immigrants drank once a month or less compared to the LTJR.

In order to compare the three population groups, adjusting for demographics, and to identify independent variables associ-

**Table 2.** Waterpipe, cigarette and alcohol consumption by population group (% and chi-square tests)

	Men			Women		
	Long-term Jewish residents N=197 (%)	fSU immigrants N=94 (%)	Arabs N=158 (%)	Long-term Jewish residents N=206 (%)	fSU immigrants N=107 (%)	Arabs N=138 (%)
<b>Ever smoked waterpipe tobacco</b>						
Never smoked	72.6	74.5	57.0	88.3	86.9	91.3
Former smoker	9.4	10.6	12.6	7.8	9.3	4.4
Current smoker	18.0	14.9	30.4	3.9	3.8	4.3
P	0.003			0.97		
<b>Frequency of waterpipe smoking</b>						
Every day	2.0	1.1	7.6	0.5	0	0.7
At least once a week	2.8	2.1	12.7	0.5	1.9	0
Less than once a week	13.2	11.7	10.1	2.9	1.9	3.6
P	< 0.0001			0.6		
<b>Ever smoked cigarettes</b>						
Never smoked	38.6	46.8	41.8	62.1	60.7	85.5
Former smoker	19.3	18.1	8.8	17.5	10.3	2.9
Current smoker	42.1	35.1	49.4	20.4	29.0	11.6
P	0.08			< 0.0001		
<b>Frequency of cigarette smoking</b>						
Every day	31.0	28.7	39.9	16.0	22.4	8.7
At least once a week	8.1	4.3	4.4	3.9	4.7	1.4
Less than once a week	3.0	2.1	5.1	0.5	1.9	1.4
P	0.15			0.04		
<b>Ever drank alcohol</b>						
Never drinker	7.6	0	69.6	17.4	16.9	99.3
Former drinker	10.2	14.9	20.3	10.2	9.3	0
Drinker	82.2	86.1	10.1	72.4	73.8	0.7
P	< 0.0001			< 0.0001		
<b>Frequency of alcohol consumption</b>						
More than 4 times a week	1.0	1.1	0.6	0.5	0	0
2–3 times a week	7.6	7.4	0	3.4	0.9	0
2–4 times a month	40.1	20.2	3.8	34.0	10.3	0
Once a month or less	33.5	57.4	5.7	34.5	62.6	0.7
P	< 0.0001			< 0.0001		

ated with WTS, multivariable logistic regression models were computed separately for men and women and are presented in Table 3. The odds of WTS were three times higher among Arab men compared to LTJR [odds ratio (OR) 3.36, 95% confidence

interval (CI) 1.58–7.13]. There was no significant difference in the odds between LTJR and fSU immigrants. Among women, the ORs of WTS were not significantly different among the three population groups. Younger respondents had a higher OR of WTS compared to the older respondents in both men and women. Among men, the OR of WTS for the less educated was 2.55 compared to those respondents with an academic education (OR = 2.55, CI = 1.24–5.26). Married women had a lower OR for WTS compared to single women (OR = 0.30, CI = 0.09–1.00). Cigarette smoking was associated with WTS in both men and women (OR = 2.63, CI = 1.57–4.42, and OR = 26.9, CI = 7.11–101.5, respectively), as was alcohol consumption. However, among women, alcohol consumption did not reach significance.

Table 4 presents the socioeconomic factors and risk behaviors associated with current WTS by population group. In all groups, women reported less frequent WTS. Younger participants had a higher odds ratio of WTS compared to the older respondents; however, this was not significant among LTJR. Level of education and marital status did not reach significance in any of the population groups. This may be due to the small sample size and the fact that most respondents were married.

Level of religiosity was associated with WTS only among Arabs. Arabs defining themselves as traditional or religious had lower odds of WTS (OR = 0.22, CI = 0.06–0.75 and OR = 0.37, CI = 0.15–0.87 respectively).

Among LTJR, those smoking cigarettes and drinking alcohol reported WTS more often (OR = 32.6, CI = 9.36–114 and OR

**Table 3.** Socioeconomic factors and risk behaviors associated with waterpipe use by gender\*

	Men (N=449)			Women (N=451)		
	OR	CI	P	OR	CI	P
<b>Population group</b>						
Long-term Jewish residents	1.0	–	–	1.0	–	–
fSU immigrants	1.02	0.47–2.29	0.97	1.49	0.31–0.71	0.61
Arabs	3.36	1.58–7.13	0.002	2.88	0.45–18.2	0.26
Age	0.94	0.92–0.97	< 0.0001	0.92	0.86–0.99	0.03
<b>Education</b>						
Did not graduate high school	2.55	1.24–5.26	0.01	0.36	0.05–2.46	0.29
Graduated high school & professional certificate	1.90	0.98–3.68	0.06	0.92	0.28–3.04	0.89
Academic degree	1.0	–	–			
<b>Marital status</b>						
Single	1.00	–	–	1.0	–	–
Married	1.48	0.73-3.00	0.28	0.30	0.09-1.0	0.05
<b>Religiosity</b>						
Secular	1.00	–	–	1.00	–	–
Traditional	0.77	0.40–1.48	0.44	0.65	0.14–2.97	0.58
Religious	0.76	0.39–1.47	0.42	2.00	0.46–8.71	0.36
<b>Risk behaviors</b>						
Cigarette smoking	2.63	1.57–4.42	< 0.0001	26.9	7.11–101.5	< 0.0001
Alcohol consumption	2.75	1.42–5.33	< 0.0001	2.75	0.66–11.5	0.17

\*Logistic regression models, odds ratio (OR), confidence interval (CI), and P value

**Table 4.** Socioeconomic factors and risky behaviors associated with smoking the water pipe by population group\*

Variables	Long-term Jewish residents N=399			fSU Immigrants N=199			Arabs N=293		
	OR	CI	P	OR	CI	P	OR	CI	P
<b>Gender**</b>	0.33	0.13-0.86	0.02	0.24	0.07-0.87	0.03	0.11	0.04-0.28	< 0.0001
<b>Age</b>	0.97	0.93-1.02	0.19	0.92	0.86-0.98	0.009	0.94	0.91-0.99	0.01
<b>Education</b>									
Did not graduate high school	2.39	0.66-8.73	0.19	2.89	0.36-23.22	0.32	1.50	0.62-3.61	0.36
Graduated high school & professional certificate	1.10	0.41-3.02	0.85	3.32	0.60-18.23	0.17	1.17	0.48-2.81	0.73
Academic degrees	1.00	–	–	1.00	–	–	1.00	–	–
<b>Marital status</b>									
Single	1.00	–	–	1.00	–	–	1.00	–	–
Married	0.85	0.30-2.39	0.76	0.87	0.24-3.19	0.84	1.39	0.44-4.35	0.57
<b>Religiosity</b>									
Secular	1.00	–	–	1.00	–	–	1.00	–	–
Traditional	1.20	0.47-3.04	0.70	1.60	0.47-5.51	0.45	0.22	0.06-0.75	0.02
Religious	2.14	0.78-5.87	0.14	1.02	0.14-7.73	0.98	0.37	0.15-0.87	0.02
<b>Risk behaviors</b>									
Cigarette smoking	32.6	9.36-113.6	< 0.0001	3.40	0.99-11.7	0.05	1.34	0.64-2.80	0.43
Alcohol consumption	3.57	1.48-8.63	0.005	1.54	0.41-5.73	0.52	4.42	0.73-26.7	0.10

\*Logistic regression models, odds ratio (OR), P value and confidence interval (CI)

\*\*Men serve as the reference group

= 3.57, CI = 1.48–11.7 respectively). Among fSU immigrants, smoking cigarettes was associated with WTS but not alcohol consumption (OR = 3.40, CI = 0.99–11.7). Neither cigarettes nor alcohol consumption was associated with WTS among Arabs.

## DISCUSSION

This study is the first to assess WTS among Israeli adults aged 30 to 65 years. Israel serves as a unique setting for the study of adults since three different population groups live together with varying degrees of assimilation.

We found that WTS was a common behavior for men, while rates were lower among women in all three adult population groups. Similarly, other studies have shown that more men engage in WTS than do women [16]. There is evidence that WTS is more socially acceptable than cigarette smoking among women. However, in our study WTS was low in all three groups of women and much lower than cigarette smoking.

Our findings present evidence that WTS and cigarette smoking are more common among Arab men compared to LTJR and fSU immigrants. Other studies have shown that WTS is part of the cultural identity in Arab countries [17]. Therefore, cultural background may explain the difference in WTS use between the Arabs and Jews in Israel [10].

Venues for WTS (such as hookah lounges or narghile cafes) exist in many Arab towns in Israel and provide an environment for socialization where WTS is rewarded socially. These environments may increase WTS rates especially in the Arab community where they are situated. In Jewish towns, venues such as these are few and smoking generally is banned in restaurants and pubs. Not much is known about these venues and their role in society, therefore further investigation is needed. These WTS venues may be similar to the role of bars and pubs in Western society. As alcohol consumption is not socially acceptable in Muslim society, WTS may serve a similar social role as drinking alcohol in bars in non-Muslim societies.

WTS did not differ between LTJR and fSU immigrants. Immigrants from the former Soviet Union have been living in Israel for the last decade or two and have mostly assimilated into the Jewish Israeli culture [18]; therefore, we would expect the rates of these behaviors to be similar to those reported for alcohol consumption [19]. Immigrants and LTJR live in close contact in the same towns and have more social ties with each other compared to Arabs who live in mostly separate communities and have far fewer social ties with Jews – both LTJR and immigrants [20].

Some studies suggest that WTS may expose the smoker to similar or higher levels of carcinogens than cigarette smoking [21]. Since the rates of both cigarette smoking and WTS are much higher among Arab men compared to Jewish men, it is likely that Arab men suffer the long-latency illnesses associated with tobacco. Follow-up studies are warranted to estimate these effects. Epidemiological data from the last two decades regard-

ing cancer have shown that in Israel morbidity and mortality from lung cancer is higher among Arabs compared to Jews [22]. Previous reports suggested this was due to high rates of cigarette smoking among Arab men [23–25]. We suggest that waterpipe smoking may have contributed to these high rates too. In addition, mortality from heart disease is higher in Arab men than in Jewish men. The high levels of both cigarette and waterpipe smoking among Arabs compared to Jews may also contribute to the high levels of heart disease among Arabs since smoking is a well established risk factor for heart disease [22].

Substance use among adults and adolescents seems to follow a pattern: those using one substance have a higher chance of using another substance [5,8]. Similarly, in this study, men smoking cigarettes and/or drinking alcohol were more likely to report WTS. Among women, only cigarette smoking but not alcohol consumption was significantly associated with reported WTS. It is not clear why these gender differences exist; it may be due to low substance use in women, especially regarding alcohol among Arab women and the fact that WTS is not widely practiced by women.

Jewish cigarette smokers had a higher rate of WTS. The high odds ratio among LTJR (OR = 32.6) is due to the fact that only four male respondents reported not smoking cigarettes but smoked the waterpipe. However, among Arabs the association was not significant. This may be due to the fact that among Arab men WTS is a social norm and is not dependent on other behaviors. Jawad et al. [8] reported variations in the association between cigarette and waterpipe smoking in the various countries they studied.

Alcohol consumption seems to be the norm among Jews, both LTJR and immigrants, with more than three-quarters of them reporting current drinking. Since the fSU immigration to Israel, there has been a convergence in moderate drinking habits between the two populations [19]. LTJR have increased their alcohol consumption but immigrants have not decreased their consumption. Alcohol consumption was associated with WTS significantly only among LTJR. Among fSU immigrants the association was not significant, possibly due to limited variance, with most of the population reporting alcohol consumption.

The data suggest that use of the three substances is associated, i.e., using one might promote use of another. It may be that when unique cultural rules promote behavior (such as alcohol for fSU members) or forbids it (such as alcohol for Arab Muslims) the use is different by cultural group. Additional research is warranted to detect the types of social processes that may define contingencies for or against the use of cigarettes, alcohol and WTS; similarly, additional research is needed to understand how cultural contingencies may drift from one culture to another, as well as in the reverse direction when living in proximity.

Arabs who reported being religious or traditional also reported less WTS. Islam prohibits all substance use including tobacco, although cigarette smoking is prevalent among men. In

a previous study we found that both Jews and Arabs who defined themselves as religious reported less cigarette smoking. Therefore, WTS shares similar characteristics with cigarette smoking.

**STRENGTHS AND LIMITATIONS**

The strength of this study is the face-to-face methodology. There is evidence that face-to-face interviews are more effective in getting sincere responses, especially from women in the Arab community compared to telephone interviews.

The limitations of this study are in the self-reported data, especially among respondents from communities where the behaviors are not fully accepted. Among Arabs, the levels of alcohol consumption reported may be lower than actually consumed due to the fact that alcohol is not normative in Muslim communities. A similar bias may exist regarding smoking both the waterpipe and cigarettes among Arab women. In addition, in this study we did not assess the exact amount of WTS (duration, number of “heads” smoked). Another bias was seen regarding income: Arabs reported higher income levels, which do not match other data on Arab income; however, this variable was not associated with the dependent variable and therefore had no effect on the results. This bias may be due to the low reliability and validity of the question as Arabs may not feel free to report their real income in a face-to-face interview. Another limitation is the differential response rates in the three populations. However, we do not think response rates are associated with WTS or the other behaviors as respondents were not aware of these questions when asked to participate, and other socioeconomic variables were adjusted for.

**CONCLUSIONS**

WTS is a widespread behavior mainly among adult Arab men in Israel. This may have profound effects on health, especially among Arabs. Interventions are called for to lower the rates of WTS. Policies banning smoking in public places should include WTS and could be very effective. The social influence of the two major populations on each other should be followed to identify trends and if needed to try and prevent an increase of WTS in the Jewish population.

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