

Original Article

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

Saeed Nemati MSc^{1,2}, Ali Rafei MSc², Neal D. Freedman MPH PhD³, Akbar Fotouhi MD PhD¹, Fereshteh Asgary MD PhD⁴, Kazem Zendeheh MD PhD^{2,5}

Abstract

Objective: To assess the geographical distribution and time trends of manufactured cigarette and water-pipe use among Iranian adult population.

Method: Pooled data from four consecutive nationally and provincially representative STEPS surveys, 2006 – 2009, were analyzed. Prevalence of current daily manufactured cigarette smokers, current daily water-pipe and current daily dual users and associated 95% CIs were estimated using complex sample analysis techniques.

Results: Overall, the prevalence of current daily tobacco use, including cigarette and water-pipe, was estimated 23.7% for men and 3.0% for women, in which 20.2% of men and 0.8% of women were exclusively cigarette smokers, 2.7% and 2.2% were exclusively water-pipe users, and 0.6% and 0.01% smoked both cigarettes and water-pipes. The prevalence of cigarette smoking ranged from 12.3% to 27.7% in men and 0.1% to 1.8% in women, and was generally highest in the northwest of the country. Conversely, the prevalence of water-pipe smoking ranged from 1.7% to 10.9% in men and 0% to 16.8% in women, and was highest in the south and southeast. No secular trends were observed for daily cigarette smoking in either men ($P = 0.637$) or women ($P = 0.308$) from 2006 to 2009. However, the prevalence of water-pipe decreased slightly in women ($P = 0.012$) and men ($P = 0.055$), though the later was not statistically significant.

Conclusion: In Iran, widespread geographical variation in the use of different types of tobacco products should be taken into account when planning for tobacco prevention policies and programs. Iran may serve as an important setting for etiological studies to examine the effects of long-term water pipe use on diseases.

Keywords: Adult, cigarette, Iran, population, water-pipe

Cite this article as: Nemati S, Rafei A, Freedman ND, Fotouhi A, Asgary F, Zendeheh 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. *Arch Iran Med.* 2017; **20**(5): 295 – 301.

Introduction

Tobacco smoking is known as the global fourth leading cause of death due to risk factors, resulting in many types of non-communicable diseases, including chronic obstructive pulmonary diseases, cancers, stroke and ischemic heart diseases.¹ In addition to the direct effect of tobacco use on health, indirect second-hand exposure to smoking has significant health effects.² Without urgent effective actions, the attributable mortality will continue to grow globally and is expected to exceed one billion deaths in the 21st century, in addition to 600,000 deaths per year due to second-hand smoke alone.²

On May 21, 2003, the World Health Organization (WHO) adopted the “Frame-work Convention on Tobacco Control

Authors’ affiliations: ¹Department of Epidemiology and Biostatistics, School of Public Health, Tehran University of Medical Sciences, Tehran, I. R. of Iran, ²Cancer Research Center, Cancer Institute of Iran, Tehran University Medical of Sciences, Tehran, I. R. of Iran, ³Metabolic Epidemiology Branch, Division of Cancer Epidemiology and Genetics, National Cancer Institute, National Institute of Health, Rockville, Maryland, United States of America, ⁴Center for Non-communicable Diseases, Deputy of Health, Ministry of Health and Medical Education, I. R. of Iran, ⁵Cancer Biology Research Center, Cancer Institute of Iran, Tehran University Medical of Sciences, I. R. of Iran.

***Corresponding author and reprints:** Kazem Zendeheh MD PhD, Cancer Biology Research Center, Cancer Institute of Iran, Tehran University Medical of Sciences, Keshavarz Blvd, Tehran, P. O. Box: 1419733141, I. R. of Iran. Telefax: +98-21-66561638, E-mail: Kzendeheh@tums.ac.ir.

Accepted for publication: 12 April 2017

(FCTC)” and the Islamic Republic of Iran was one of the 168 signatory countries.³ The FCTC was established “to protect present and future generation from the devastating health, social, environmental and economic consequence of tobacco consumption and exposure to tobacco smoke ...”.^{4,5} Tobacco surveillance is critical for monitoring the changes in tobacco use over time and for reaching the FCTC goals in Iran and elsewhere. Previous studies have shown that despite serving as one of the FCTC members, the prevalence of cigarette smoking has remained unchanged over the past decade in Iran.^{6,7} Nevertheless, few studies have assessed the trends of tobacco smoking over time or the geographic distribution of tobacco product use.

To date, most studies have focused on cigarette smoking despite the long-standing popularity of water-pipe smoking in the country,⁶ and substantial differences in the pattern of cigarette and water-pipe use in Iranian men and women.⁸ To fill this gap, we analyzed data collected through the National Surveys of Risk Factor of Non-Communicable Diseases (STEPS) in 2006 – 2009.

Material and Methods

Data source

We pooled the data obtained from four consecutive rounds of national STEPS survey conducted between 2006 and 2009 (Table 1) in Iran. Each survey investigated about 30,000 non-hospitalized

Table 1. General information for the four included National Surveys of Risk Factor of Non-Communicable Diseases (STEPS) conducted from 2006–2009 in I. R. of Iran

Survey Year	Sample size	Cigarette Design Effect	Water-pipe Design Effect	Age, year, mean (SD)	Urban, No. (%)	Rural, No. (%)	Male, No. (%)	Female, No. (%)	No. of Variables	Sampling Design
2006	29,857	1.89	6.21	39.5 (14.3)	18,558 (62.1)	11,299 (37.8)	14,903 (49.9)	14,954 (50.0)	69	Provincial
2007	29,944	2.54	5.42	39.5 (14.2)	17,698 (59.1)	12,244 (40.8)	14,955 (49.9)	14,989 (50.0)	69	Provincial
2008	29,775	1.95	3.78	39.5 (14.3)	18,419 (61.8)	11,355 (38.1)	14,933 (50.1)	14,842 (49.8)	69	Provincial
2009	29,887	2.45	5.41	39.5 (14.2)	16,239 (54.3)	13,648 (45.6)	14,940 (49.9)	14,948 (50.0)	70	Provincial

Table 2. Prevalence of tobacco use stratified by cigarette and water-pipe use in Iranian adults according to the national STEPS surveys conducted in 2006–2009 in I. R. of Iran.

Characteristics	Tobacco Use			Cigarette Only			Water-pip Only			Dual use	
	n (%)	n (%)	n (%)	Number of Cigarette use per day (SD)	Duration, year (SD)	Starting age, year (SD)	n (%)	n (%)	n (%)	n (%)	n (%)
Both Sexes	119,460	17893 (13.5)	14274 (10.6)	11.8 (30.7)	14.8 (37.0)	21.5 (26.0)	3155 (2.4)		363 (0.3)		
Age Groups											
15–24	24,188 (20.2)	1201 (6.1)	643 (3.0)	9.6 (10.2)	5.0 (3.6)	17.4 (4.9)	494 (2.7)		52 (0.2)		
25–34	23,931 (20.0)	3253 (14.3)	2673 (11.8)	11.0 (23.1)	9.8 (12.7)	21.4 (19.3)	447 (1.9)		106 (0.5)		
35–44	23,959 (20.0)	4668 (20.4)	3901 (17.6)	13.6 (39.6)	18.0 (26.1)	22.5 (26.2)	654 (2.5)		86 (0.3)		
45–54	24,028 (20.1)	4823 (20.7)	3967 (18.0)	14.3 (44.9)	25.8 (37.9)	24.1 (39.1)	768 (2.5)		68 (0.2)		
55–64	23,358 (19.5)	3949 (16.8)	3090 (13.9)	13.0 (51.8)	32.9 (65.2)	26.8 (65.6)	792 (2.7)		51 (0.2)		
Residential area											
Rural	48,546 (40.6)	7698 (14.0)	5823 (10.7)	11.1 (33.0)	14.7 (38.7)	21.8 (28.6)	1657 (2.9)		167 (0.3)		
Urban	70,914 (59.3)	10195 (13.3)	8450 (10.6)	12.2 (29.3)	14.9 (36.0)	21.3 (24.4)	1498 (2.2)		196 (0.3)		
Men	59,728	15498 (23.7)	13726 (20.2)	12.8 (39.3)	14.8 (47.3)	19.7 (24.5)	1332 (2.7)		346 (0.6)		
Age Groups											
15–24	12,087 (20.2)	1063 (10.5)	629 (5.2)	9.6 (12.4)	5.3 (4.5)	17.6 (5.9)	373 (4.0)		49 (0.5)		
25–34	11,951 (20.0)	2990 (26.0)	2633 (22.7)	12.1 (30.0)	10.6 (16.9)	19.7 (16.3)	227 (2.1)		104 (1.0)		
35–44	12,008 (20.1)	4114 (35.8)	3811 (33.4)	14.9 (47.4)	19.5 (32.4)	20.5 (30.4)	193 (1.6)		84 (0.6)		
45–54	12,003 (20.1)	4129 (36.0)	3792 (33.6)	16.8 (62.4)	27.8 (44.4)	21.8 (43.3)	257 (1.8)		63 (0.4)		
55–64	11,682 (19.5)	3203 (28.0)	2861 (25.7)	16.5 (73.9)	35.7 (68.5)	23.3 (65.6)	282 (2.6)		46 (0.4)		
Residential area											
Rural	24,211 (40.5)	6411 (23.8)	5574 (20.4)	13.0 (44.1)	14.4 (50.7)	19.6 (27.2)	630 (2.6)		162 (0.6)		
Urban	35,517 (59.4)	9087 (23.6)	8151 (20.1)	12.7 (36.8)	14.9 (45.3)	19.8 (23.1)	702 (2.7)		184 (0.6)		
Women	59,732	2395 (3.0)	548 (0.8)	10.5 (9.0)	14.9 (11.0)	23.8 (9.4)	1823 (2.2)		17 (0.01)		
Age Groups											
15–24	12,101 (20.2)	138 (1.6)	14 (0.2)	9.2 (2.5)	4.4 (0.7)	16.9 (1.1)	121 (1.3)		3 (0.01)		
25–34	11,980 (20.0)	263 (2.3)	40 (0.6)	9.5 (4.1)	8.8 (2.0)	23.7 (4.6)	220 (1.6)		2 (0.02)		
35–44	11,951 (20.0)	554 (4.5)	90 (1.1)	12.2 (9.5)	16.3 (5.8)	24.7 (6.0)	461 (3.4)		2 (0.0)		
45–54	12,025 (20.1)	694 (5.1)	175 (1.9)	11.7 (12.0)	23.8 (12.1)	26.5 (12.8)	511 (3.1)		5 (0.05)		
55–64	11,676 (19.5)	746 (6.0)	229 (2.4)	9.7 (16.0)	30.2 (27.4)	30.2 (28.0)	510 (3.5)		5 (0.05)		
Residential area											
Rural	24,335 (40.7)	1287 (4.0)	249 (0.7)	8.8 (9.2)	15.0 (1.5)	24.4 (10.5)	1027 (3.1)		5 (0.0)		
Urban	35,397 (59.2)	1108 (2.6)	299 (0.9)	11.5 (8.7)	14.9 (1.3)	23.5 (8.9)	796 (1.6)		12 (0.02)		

SD = Standard Deviation

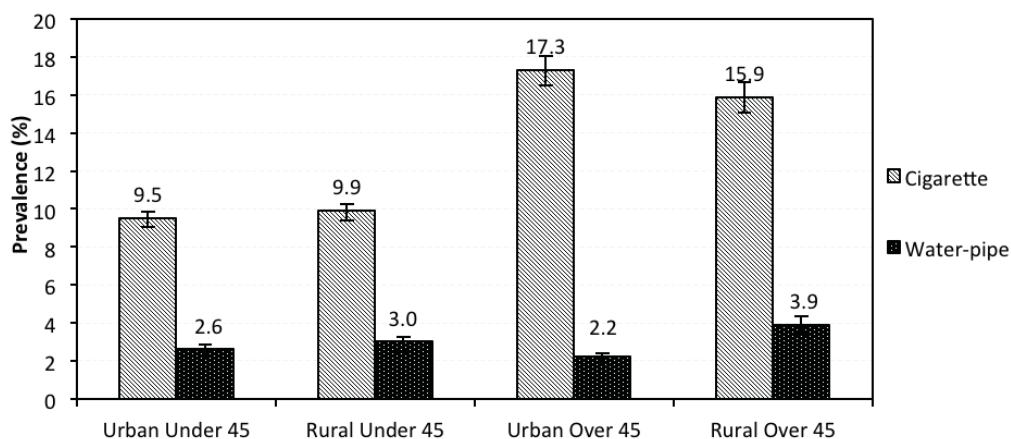


Figure 1. Prevalence of cigarette and water-pipe smoking among Iranian adults by age groups and residential area: Analysis of National STEPS Surveys in 2006 – 2009

Iranian individuals aged 15 to 64 years. Subjects were selected using a stratified cluster random sampling technique, where the provinces were defined as strata and a sample of size 1000 was drawn from each province. The Primary Sampling Units (PSU) were assumed as blocks of buildings in both rural and urban areas, and were chosen randomly from the list of postal codes based on a proportional-to-size systematic sampling scheme. A cluster consisted of 20 individuals, two samples in each gender-age groups, and households in each block were interviewed until each cluster was completed. Smoking status, type of tobacco products used, and frequency of use were assessed via a standard in-person interview by trained staff. Further details about survey methodology have been described previously.⁹

Measurements

Cigarette and water-pipe are the two main tobacco products used by Iranians. Consequently, daily cigarette smoking and daily water-pipe use were the key measures of the current study. Study participants were asked if they currently smoke at least 1 cigarette or water-pipe on a daily basis. Those participants who smoked cigarette on a daily basis but did not report daily water-pipe use were categorized as exclusive daily cigarette smokers and vice versa. In this scale, dual smokers were those who reported concurrent daily cigarette smoking and daily water-pipe use.

Statistical Analyses

To analyze the data, we first computed the probability weights by inverting the product of the probabilities of selection at each sampling stage. Post-stratification weights were also obtained by dividing the population size by sample size in each province and gender-age groups. We also considered non-response adjustment in post-stratification weights. Assuming ultimate cluster design, we set PSUs as the only clustering stage, and estimated the standard errors of estimates using Taylor linearization technique. In addition, the following equation was applied to calculate reported design effects for each products in Table 1, in which, n is the average size of each cluster and δ represents interclass correlation for statistics.

$$DEFF = 1 + \delta (n - 1)$$

We then estimated the prevalence, means, and associated 95% CIs

of outcomes over time and provinces by demographic variables. To investigate trends, we used a binary logistic regression model to estimate Odds Ratio (OR) as a measure of association between the outcome and the year of study. All statistical analyses were performed with Stata (ver. 11, College Station, Texas, USA). Geographical maps were drawn by use of Arc Map ver. 10.3.

Results

After data cleaning, 111,464 subjects remained, of whom 49.4% were males and 60.1% were urban dwellers. The mean and standard deviation of the age of survey participants were estimated as 39.5 and 14.3 years, respectively (Table 1).

Overall, the prevalence of current daily tobacco use including cigarette and water-pipe in Iran was 13.5% (Table 2), with a prevalence of 23.7% in men and 3.0% in women ($P < 0.001$). No significant differences were observed between rural (14.0%) and urban (13.3%) residents ($P = 0.170$).

Prevalence of cigarette smoking

Totally, 10.9% of Iranian adults were exclusive daily cigarette smoker and this prevalence was reported considerably higher among Iranian men (20.2%) than women (0.8%), ($P < 0.001$). In general, the prevalence of cigarette smoking increased with age, with an observed peak among men aged 45 – 54 years (34.0%) and women aged 55 – 64 years (2.5%). Men tended to become daily cigarette smokers at an earlier age (mean age \pm SD = 19.7 \pm 24.5) compared to women (mean age \pm SD = 23.8 \pm 9.4) ($P < 0.001$). Among smokers, men also tended to smoke more cigarettes per day (12.8) than women (10.5) ($P = 0.017$) (Table 2).

The prevalence of cigarette smoking in men and women was generally similar across both urban and rural areas among those under 45 years of age, although the prevalence of cigarettes was slightly higher among urban areas than rural areas among those older than 45 years (Urban = 17.3, Rural 15.9) ($P = 0.003$), (Figure 1).

Prevalence of Water-pipe smoking

Overall, 2.4% of the population were exclusive daily water-pipe smokers, with an observed prevalence of 2.7% in men and 2.2% in women. The prevalence of exclusive water-pipe smoking varied by age, with the highest prevalence in men observed among

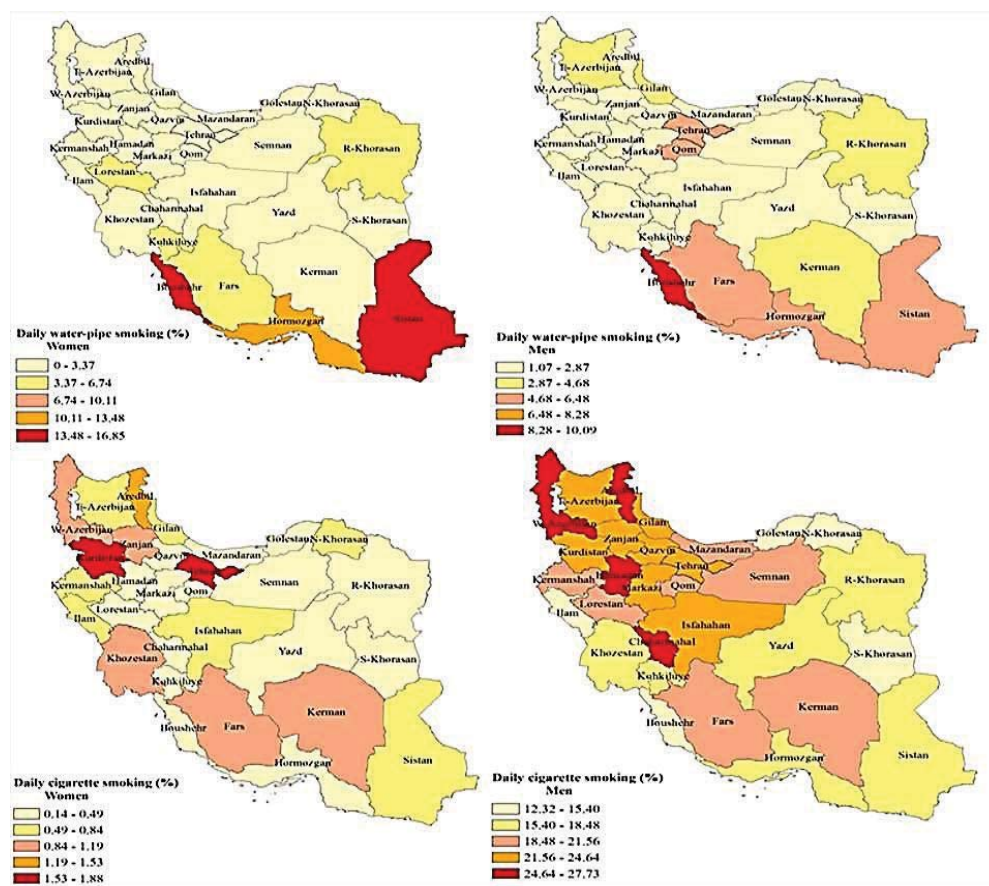


Figure 2. Geographical pattern of cigarette and water-pipe use among Iranian adults by sex: Analysis of National STEPS Surveys in 2006–2009

those at the youngest (age 15 – 24: 4.0%) and oldest age ranges (age 55 – 64: 2.6%). In contrast, the highest observed prevalence in women was found among the older population: ages 55 – 64 (3.5%), 45 – 54 (3.1%), and 35 – 44 (3.4%), (Table 2).

Unlike cigarettes, daily water-pipe smoking was more common in rural (3.9%) than urban areas (2.2%) among those who were older than 45 years ($P < 0.001$). Similar patterns were observed among younger people, although this apparent difference was not statistically significant (Figure 2).

Prevalence of dual Use of cigarette and water-pipe

The prevalence of smoking both cigarettes and water-pipe daily was low (0.3% overall), although more common in men (0.6%) than women (0.01%), (Table 2).

Time trend

We found that the prevalence of daily cigarette use among Iranian adults remained constant from 2006 to 2009 for both men ($P = 0.637$) and women (P -value for trend = 0.308) (Table 3). Although, the prevalence of water-pipe smoking decreased over time in both men and women; this trend reached statistical significance only among women (OR = 0.8, $P = 0.012$), (Table 3).

Geographical pattern

Among men, cigarette smoking was more popular in the northwestern and central areas of the country, with the highest prevalence observed in the Western Azerbaijan province (27.7%),

followed by Hamadan (27.3%) and Chaharmahal (26.0%), and the lowest prevalence found in Boushehr (12.3%) and North Khorasan (12.9%) provinces. As with cigarette smoking overall, the prevalence in each province among women was low, ranging from 1.8% in Tehran and Kurdistan to 0.1% in Boushehr and Hormozgan provinces (Figure 2) (Table 4).

The geographic distribution of daily water-pipe use varied substantially from that of cigarettes. Among men, the prevalence tended to be highest among those living in Boushehr (10.0%), Tehran (5.4%), Qom (5.1%), Fars (5.0%), Sistan (4.9%) and Hormozgan (4.8%) regions in the southern and southeastern parts of the country, where the prevalence of cigarette smoking was low. In contrast, the prevalence of water-pipe use was lower in Ardebil (2.3%), West Azerbaijan (2.2%), Chaharmahal (2.0%) and Hamadan (1.7%) provinces which exhibited a high prevalence rate for cigarette smoking. Similar patterns were observed in women, where the prevalence of water-pipe use was high in Sistan (16.8%), Boushehr (14.8%) and Hormozgan (10.3%) in southern Iran and substantially lower in the provinces of West Azerbaijan (0.00%), East Azerbaijan (0.01%) and Kurdistan (0.04%), in the northwestern part of the country (Figure 2) (Table 4).

Discussion

We reported the prevalence of cigarette and water-pipe smoking in Iran and found substantial differences in men and women, by age-group, and by geographic region. Our key finding is the

Table 3. Time trends for prevalence of cigarette and water-pipe use among Iranian adults: Analysis of National STEPS Surveys in 2006–2009

Year	Men				Women			
	Cigarette		Water-pipe		Cigarette		Water-pipe	
	Prevalence	95% CI	Prevalence	95% CI	Prevalence	95% CI	Prevalence	95% CI
2006	20.8	19.9,21.8	3.7	3.1,4.4	0.8	0.6,1.1	2.8	2.3,3.5
2007	21.6	20.5,22.7	3.4	2.7,4.2	0.8	0.6,1.2	2.3	1.9,2.8
2008	21.2	20.3,22.4	3.5	2.9,4.2	0.8	0.6,1.0	1.7	1.3,2.0
2009	20.4	19.4,21.4	2.9	2.3,3.6	1.0	0.7,1.3	2.0	1.6,2.5

CI = confidence interval

Table 4. Cigarette and water-pipe use among Iranian adults by sex and geographic area: Analysis of National STEPS Surveys in 2006–2009

Province	Men				Women			
	Cigarette		Water-pipe		Cigarette		Water-pipe	
	Prevalence	CI 95%	Prevalence	CI 95%	Prevalence	CI 95%	Prevalence	CI 95%
E. Azerbaijan	23.7	21.7,25.8	3.2	2.4,4.4	0.7	0.4,1.1	0.01	0.01,0.1
W. Azerbaijan	27.7	25.4,30.1	2.2	1.9,3.3	0.9	0.6,1.4	0	0
Isfahan	23.8	21.6,26.0	2.7	1.8,3.8	0.5	0.2,1.0	0.6	0.3,1.1
Ilam	12.4	10.8,14.3	1.0	0.5,1.9	0.6	0.3,1.0	0.06	0.02,0.2
Kermanshah	19.9	18.1,21.8	2.2	1.4,3.2	0.7	0.5,1.1	0.1	0.05,0.5
Boushehr	12.3	10.7,14.0	10.0	8.5,11.8	0.1	0.05,0.3	14.8	13.0,16.7
Tehran	23.4	21.4,25.5	5.4	4.1,7.0	1.8	1.3,2.6	1.4	0.8,2.4
Chaharmahal	26.0	23.9,28.3	2.0	1.3,3.2	0.2	0.1,0.5	0.3	0.1,0.7
R-Khorasan	16.0	14.4,17.7	3.1	2.3,4.3	0.4	0.2,0.7	5.9	4.6,7.4
Khuzestan	17.3	15.5,19.3	2.2	1.5,3.2	1.0	0.7,1.6	0.8	0.4,1.3
Zanjan	22.3	20.4,24.5	1.0	0.6,1.7	0.8	0.5,1.4	0.1	0.03,0.5
Semnan	19.0	16.9,21.3	2.4	1.7,3.3	0.2	0.1,0.4	0.3	0.1,0.6
Sistan	15.7	14.0,17.6	4.9	3.7,6.4	0.5	0.1,1.5	16.8	14.2,19.8
Fars	19.5	17.8,21.3	5.0	3.9,6.2	0.9	0.6,1.4	5.3	4.1,6.8
Kurdistan	22.6	20.6,24.8	1.8	1.1,2.9	1.8	1.4,2.5	0.04	0.006,0.3
Kerman	21.1	19.2,23.2	2.8	2.0,4.0	0.8	0.5,1.3	1.0	0.6,1.9
Kohkiluye	17.0	15.0,19.2	2.1	1.5,2.9	0.2	0.1,0.4	4.4	3.5,5.5
Gilan	23.8	22.0,25.7	3.6	2.6,5.0	0.5	0.3,0.9	0.3	0.1,1.0
Lorestan	21.0	19.2,22.8	1.7	1.1,2.6	0.4	0.2,0.7	3.7	2.8,4.9
Mazandaran	20.5	18.8,22.4	2.3	1.6,3.3	0.3	0.1,0.7	0.1	0.03,0.4
Markazi	20.4	22.5,26.5	1.6	1.0,2.5	0.2	0.1,0.5	0.4	0.2,0.9
Hormozgan	16.0	14.5,18.0	4.8	3.6,6.4	0.1	0.08,0.4	10.3	8.5,12.4
Hamadan	27.3	25.3,29.4	1.7	1.1,2.7	0.3	0.1,0.6	0.2	0.1,0.6
Yazd	15.4	13.9,17.3	2.7	1.9,3.8	0.2	0.08,0.6	0.3	0.1,0.8
Ardebil	25.0	23.1,27.1	2.3	1.6,3.4	1.2	0.8,1.7	0.2	0.1,0.6
Golestan	13.3	11.7,15.0	2.0	1.3,3.1	0.4	0.2,0.8	0.4	0.2,0.7
Qom	19.5	17.5,21.6	5.1	3.9,6.6	0.4	0.2,0.7	0.7	0.4,1.2
Qazvin	22.3	20.1,24.5	2.1	1.3,3.4	0.2	0.1,0.5	0.2	0.1,0.6
N. Khorasan	12.9	11.4,14.6	1.5	0.9,2.5	0.5	0.3,0.9	0.6	0.3,1.0
S. Khorasan	14.1	12.5,15.8	1.3	0.8,2.0	0.4	0.2,0.8	2.0	1.4,3.0

substantial geographic variation in the prevalence of cigarette and water-pipe smoking. The northwestern and central parts of Iran had a high prevalence of cigarette smoking and a low prevalence of water-pipe smoking, whereas the south and southeastern areas had a high prevalence of daily water-pipe smoking and a low prevalence of cigarette smoking. Reflecting these differences,

only a very small proportion of men and even fewer women used both types of tobacco products.

Furthermore, the patterns of cigarette and water-pipe smoking varied by age and urban/rural area. Among those over 45 years of age, daily water-pipe smoking was more popular among the rural than the urban populations, whereas cigarette smoking was more

popular among the urban population. However, under the age of 45 years, we observed no statistically significant differences between urban or rural areas. Altogether, these data indicate substantial differences in patterns of water-pipe and cigarette smoking over the country.

As in our study, a substantially higher cigarette smoking prevalence has been reported in men relative to women in Iran and other Middle Eastern countries, including Kuwaiti (34.4% for men and 1.9% for women),¹⁰ Saudi Arabia (21.5% for men, 1.1% for women),¹¹ Oman and other countries of the region.¹²

The results for of prevalence of cigarette smoking in each age group in our study are generally consistent with previous analyses in Iran.^{13,14} However, few previous studies have examined water-pipe smoking. One previous report, published in 2007, reported an overall prevalence of 2.7% in Iran, with a prevalence of 3.5% in men and 1.9% in women.⁶ These data are similar to what we found. However, the prevalence of water-pipe use in other Middle Eastern countries, including Bahrain, Oman, Qatar, United Arab Emirates (UAE), Kuwait, Yemen, Lebanon and Syria, was higher and ranged from 9% to 15%.¹⁵⁻¹⁷ The prevalence rates of water-pipe use in the southern and southeastern parts of Iran were as high as those reported from neighboring Arab countries.¹⁵⁻¹⁷

We found distinct age patterns of water-pipe use in men and women in Iran. Among women, the highest prevalence of water-pipe use was observed among older age groups, whereas among men, the prevalence varied by age in a U-shape, with the highest prevalence observed among men aged 15 – 24 and 55 – 64 years. Although little other comparable data is available, our results do suggest that a substantial number of older people in Iran use water-pipes daily, when one might expect the physiological effects of regular water-pipe use to be strongest. These regions provide a great opportunity for assessing the long-term effects of water-pipe smoking on health and provide information about tobacco control efforts that may be used in other parts of the world.¹⁸

Our study had a number of advantages, including having a representative sample of the Iranian population, a large sample size, and use of a standard approach to determine the prevalence of cigarette and water-pipe smoking at the national and provincial levels and across key population sub-groups. The availability of pooled data as a result of identical sampling frame allowed examination of trends over time. Finally, we performed a robust and appropriate statistical analysis to provide valid estimates of tobacco product use at both national and provincial levels. However, our study had several limitations, including lack of detailed information on the pattern of lifelong use of cigarette and water-pipe, lack of information on occasional use, and reliance on self-report.

Cigarette and water-pipe smoking have different usage patterns. While cigarettes are often smoked individually and are typically considered unfavorable by the non-cigarette smoking population, water-pipes are most often used in social-settings, such as in cafés and other public places. Water-pipes are generally thought of positively by the public,¹⁹ who are often unaware of the harmful constituents in water-pipe smoke and also falsely believe water-pipes are less addictive than cigarettes.¹⁹⁻²¹ Furthermore, water-pipes have become fashionable and are considered more socially acceptable among women and youth and are often smoked in the presence of non-smoking friends and family.¹⁹⁻²¹ As such, daily water-pipe smoking has increased in popularity to become the most common form of tobacco use among youth and women in

many Middle Eastern countries.²²

In Iran, we observed that the prevalence of daily water-pipe smoking has decreased somewhat over recent years, although this trend was only statistically significant among women. This decrease may reflect the prohibition of tobacco advertising, advertising against water-pipe smoking in the media, increasing social awareness about harmful effects of water-pipe smoking on health in the country, and discussions of banning water-pipe use in public places. However, additional efforts are needed. Not only does water-pipe itself likely have substantial health effects,¹⁸ but recent studies indicate that water-pipe smoking can serve as a gateway for smoking cigarettes among the youth.²³ Therefore, it will be important to focus on the design and implementation of anti-water-pipe smoking programs for the younger audience.

The widespread variations in cigarette and water-pipe smoking that were observed in our study also suggest that public health efforts should tailor messages by age, sex, and province. Yet, despite a growing interest in the health effects of water-pipe use, it is also important to continue and expand public health efforts on cigarettes. Our data indicate that the prevalence of cigarette smoking among the adult Iranian population remained constant from 2006 – 2009, with the prevalence of cigarette smoking remaining especially high in several provinces. It is thus critical to focus on implementing vigorous anti-tobacco policies in these regions to reduce the prevalence of cigarette smoking.

Conflict of interests

The authors declare that they have no conflict of interest.

Author's Contribution

These authors contributed equally to this work.

Acknowledgments

This study was funded by the cancer research center of Iran cancer institute using the data from four rounds of non-communicable disease risk factor surveys in Iran that was performed by the Center for Control and Management of Disease (Ministry of Health, Iran) and as part of the first author's MSc thesis. The authors would like to thank all participants who gathered data.

References

1. Mackay J, Eriksen MP. The tobacco atlas: World Health Organization; 2002.
2. Eriksen M, Mackay J, Ross H. *The tobacco atlas*: American Cancer Society and World Lung Foundation, 2012. 2013.
3. Sarrafzadegan N, Rabiei K, Mohaseli KF, Manzouri L, Roohafza H, Kelishadi R, et al. Do Iranian tobacco growers support the World Health Organization framework convention on tobacco control? *Journal of Education and Health Promotion*. 2014; 3(32): 1 – 5.
4. Hafez N, Ling PM. How Philip Morris built Marlboro into a global brand for young adults: implications for international tobacco control. *Tobacco Control*. 2005; 14(4): 262 – 271.
5. Park K, Kim DS, Park DJ, Lee SK. Tobacco control in Korea. *Medicine and Law*. 2004; 23(4): 759 – 780.
6. Meysamie A, Ghaletaki R, Haghazali M, Asgari F, Rashidi A, Khalilzadeh O, et al. Pattern of tobacco use among the Iranian adult population: results of the national Survey of Risk Factors of Non-Communicable Diseases (SuRFNCD-2007). *Tobacco Control*. 2010; 19(2): 125 – 128.
7. Mohammad K, Nourbala A, Madjdzadeh R, Karimlou M. Trend of

- smoking prevalence in Iran from 1991 to 1999 based on two national health survey. *Hakim Res J*. 2001; 4: 297 – 300.
8. Baheiraei A, Mirghafourvand M, Nedjat S, Mohammadi E, Mohammad-Alizadeh Charandabi S. Prevalence of water pipe use and its correlates in Iranian women of reproductive age in Tehran: A population-based study. *Medical Principles and Practice: International Journal of the Kuwait University, Health Science Centre*. 2012; 21(4): 340 – 344.
 9. Koochpayehzadeh J, Etemad K, Abbasi M, Meysamie A, Sheikhbahaei S, Asgari F, et al. Gender-specific changes in physical activity pattern in Iran: national surveillance of risk factors of non-communicable diseases (2007–2011). *International Journal of Public Health*. 2014; 59(2): 231 – 241.
 10. Memon A, Moody PM, Sugathan TN, el-Gerges N, al-Bustan M, al-Shatti A, et al. Epidemiology of smoking among Kuwaiti adults: prevalence, characteristics, and attitudes. *Bulletin of the World Health Organization*. 2000; 78(11): 1306 – 1315.
 11. Moradi-Lakeh M, El Bcheraoui C, Tuffaha M, Daoud F, Al Saeedi M, Basulaiman M, et al. Tobacco consumption in the Kingdom of Saudi Arabia, 2013: Findings from a national survey. *BMC Public Health*. 2015; 15: 611.
 12. Al Riyami AA, Afifi M. Smoking in Oman: Prevalence and characteristics of smokers. *Eastern Mediterranean Health Journal*. 2004; 10(4–5): 600 – 609.
 13. Mohammad K, Zali M, Masjedi M. Cigarette smoking in Iran based on a national health survey. *J Med Council I. R. of Iran*. 1998; 1: 33 – 37.
 14. Fotouhi A, Khabazkhoob M, Hashemi H, Mohammad K. The prevalence of cigarette smoking in residents of Tehran. *Arch Iran Med*. 2009; 12(4): 358 – 364.
 15. Maziak W, Ward KD, Mzayek F, Rastam S, Bachir ME, Fouad MF, et al. Mapping the health and environmental situation in informal zones in Aleppo, Syria: Report from the Aleppo household survey. *International Archives of Occupational and Environmental Health*. 2005; 78(7): 547 – 558.
 16. Maziak W, Nakkash R, Bahelah R, Husseini A, Fanous N, Eissenberg T. Tobacco in the Arab world: old and new epidemics amidst policy paralysis. *Health Policy and Planning*. 2014; 29(6): 784 – 794.
 17. Baddoura R, Wehbeh-Chidiac C. Prevalence of tobacco use among the adult Lebanese population. *Eastern Mediterranean Health Journal*. 2001; 7(4–5): 819 – 828.
 18. 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. *Int J Epidemiol*. 2016; doi: <https://doi.org/10.1093/ije/dyw021>.
 19. Maziak W, Taleb ZB, Bahelah R, Islam F, Jaber R, Auf R, et al. The global epidemiology of waterpipe smoking. *Tobacco Control*. 2015; 24 (Suppl 1): i3 – i12.
 20. Akl EA, Jawad M, Lam WY, Co CN, Obeid R, Irani J. Motives, beliefs and attitudes towards waterpipe tobacco smoking: a systematic review. *Harm Reduction Journal*. 2013; 10: 12.
 21. Kelishadi R, Mokhtari MR, Tavasoli AA, Khosravi A, Ahangar-Nazari I, Sabet B, et al. Determinants of tobacco use among youths in Isfahan, Iran. *International Journal of Public Health*. 2007; 52(3): 173 – 179.
 22. Moh'd Al-Mulla A, Abdou Helmy S, Al-Lawati J. Prevalence of tobacco use among students aged 13–15 years in Health Ministers' Council/Gulf Cooperation Council Member States, 2001–2004. *J Sch Health*. 2008; 78: 337 – 343.
 23. Mzayek F, Khader Y, Eissenberg T, Al Ali R, Ward KD, Maziak W. Patterns of water-pipe and cigarette smoking initiation in schoolchildren: Irbid longitudinal smoking study. *Nicotine & Tobacco Research*. 2012; 14(4): 448 – 454.