ORIGINAL ARTICLE

Received: December 2019
Accepted: January 2020

Socioeconomic inequality in prevalence of cigarette and Water-pipe smoking among Iranian adults: A blinder- Oaxaca decomposition Analysis

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BCCR
2019; 11(4):156-165
www.bccrjournal.com

ABSTRACT

Background: To assess the association between socioeconomic inequality and the prevalence of tobacco smoking among Iranian adults in 2010.

Methods: Data from the fifth national STEPS survey (WHO STEPwise approach to NCD Surveillance) were analyzed. A Blinder-Oaxaca decomposition method was applied to assess the association between socioeconomic inequality and the prevalence of daily cigarette and water pipe (WP) smoking among Iranian men and women.

Results: From 10,615 participants in the survey, 4,203 (39.5%) participants appeared to be in the first and fifth quintiles of socioeconomic status (SES). For men, the prevalence of daily cigarette smoking was higher among those with low SES (23.1%) than those with high SES (11.1%) (P<0.001). The observed difference was mainly attributed to the educational level (8.6%). We found no significant difference in high compared to low SES women for cigarette smoking (P value= 0.881). Although there was no difference between high and low SES men for daily WP smoking, low SES women had a higher prevalence of WP smoking (4.4%) than high SES women (1.3%) (P value=0.027). Education level was the major factor (3.3%) to explain the corresponding difference. The difference in WP smoking in high and low SES men was not statistically significant (P value= 0.199).

Conclusion: Cigarette smoking in men and WP smoking in women are associated with SES in Iran. Education was the main factor explaining the differences in the prevalence of cigarette and WP smoking in Iranian men and women. Results from this study must be considered as a pivotal basis for designing a tobacco control program at national and sub-national levels.

Keywords: Cigarette Smoking, Water Pipe Smoking, Socioeconomic Factors, Discrimination, Health Care Surveys

INTRODUCTION:

Tobacco use is one of the major modifiable risk factors for non-communicable diseases (NCDs) worldwide[1]. According to the World Health Organization (WHO), tobacco use causes about six million deaths annually, undertaking 10% of the total mortality worldwide[2]. The majority of these deaths currently occur in low- and middle-income countries (LMICs), where a combination of poor health system functions and poverty have left people especially vulnerable to the negative consequences of tobacco use[1]. For example, tobacco smoking is related to some diseases in which the presence of poverty and lack of appropriate medical care contribute to poorer health outcomes[3, 4].

In many countries, including the LMICs, tobacco smoking is more common among the lower social classes[5-7]. Higher prevalence of tobacco use and other disease risk factors in these populations can contribute to health inequalities[8-10].

However, the socioeconomic patterns of tobacco use can also vary substantially between countries and within the country. For example, water pipe (WP) smoking is more common among lower SES groups in Brazil and the United States[11, 12], but more common in higher SES groups in Libya[13], Saudi Arabia[14], and Lebanon[15]. Effective tobacco control programs require investigating the prevalence and predictors of tobacco smoking among different groups to optimize prevention strategies. Although the prevalence of tobacco smoking has already been reported in Iran frequently, little information exists on how tobacco use varies by different SES groups. Here, we determine the prevalence of tobacco use in Iran between socioeconomic groups in the nationally representative STEP survey and employ Oaxaca-Blinder decomposition to identify factors associated with observed differences in cigarette and WP smoking prevalence between SES groups.

METHODS:

Samples and data

We utilized data from the sixth round of the national survey of NCDs risk factors (so-called STEPS) in Iran, conducted in 2011 by applying a multi-stage sampling approach to enroll a representative sample of the population. The study recruited 10,615 individuals aged 15-70 years. The STEPS studies provide an efficient approach for the surveillance of common NCDs in the LMICs. Details of sampling units have been previously described elsewhere[16, 17].

Measurements

Manufactured cigarettes and WP are the most popular tobacco products used in Iran[18]. Therefore, daily cigarette smoking and daily WP use were the main two outcome measures of interest in the current study. Participants were asked if they were current daily manufactured cigarettes or WP smokers. To assess households' assets, individuals were asked whether they own any of the following properties: separate bathroom, separate kitchen, a vacuum cleaner, a refrigerator, a personal computer, a washing machine, and the size of accommodation. In addition, the survey collected information on education level, residential area (urban/rural), and exposure to cigarette and WP smoke, whether at home or at work.

Statistical analysis

Principle Component Analysis (PCA) including asset variables plus the level of education and size of the accommodation was used to create the highest represented component. Then, subjects were categorized into five SES quintiles. Data from the first (2,114) and the last categories (2,089) were compared in terms of the prevalence of cigarette smoking and the percentage with daily WP use.

Next, a multiple logistic regression model was applied to find the most influential factors associated with to-

bacco use. Those variables with the Wald test P< 0.2 were entered into the Blinder-Oaxaca decomposition model. In this model, two groups are compared, here high and low SES groups. The variable y is the prevalence of the outcome of interest (tobacco smoking) in each comparison group, which can be determined through a vector of variables, x, based on a logistic regression model. Where x is the mean of the variables, and β denotes the vector of regression coefficients in high and low SES groups.

The observed gap in the Blinder-Oaxaca decomposition model originates from three sources, including the gap due to endowments (E), the gap due to coefficients (C), and the gap from interactions between endowments and their coefficients (CE). The E part of the model indicates how differences in the mean of a variable can affect outcomes in high and low SES groups. Whereas, the C part illustrates the effect of variations in the role of the independent variables on the desired outcome in the compared groups. Lastly, the interaction term CE reflects how the interaction of mean of variables and their coefficients can result in a gap in the outcome between high and low SES groups. The first part of equation 1 (Endowments) is known as the explained part of the decomposition model, whereas the next ones are referred to the unexplained part (C+CE). In both parts of the model, positive values are in favor of the high SES group, while the negatives values indicate the opposite[19].

$$y^{\text{High SES}} - y^{\text{Low SES}} = \Delta x\beta^{\text{High SES}} + \Delta\beta x^{\text{Low SES}} = E + (C + CE) \quad (1)$$

RESULTS:

Study participants

Women constituted 57.6% of the population; 68.9% were urban dwellers. The mean (±SD) age for men and women was 36.6 (18.3) and 38.6 (17.6) years, respectively. The response rate was estimated at 91%.

Daily cigarette smoking

In this population, men (19.1%) were far more likely to be cigarette smokers than women (0.6%). Among Iranian adult men, the odds of being daily cigarette smokers increased significantly with age, and the observed differences were statistically significant across all age groups **Table 1**.

As illustrated in Table 1, rural Iranian men were less likely to be daily cigarette smokers than urban men (OR= 0.7, 95% CI: 0.5, 0.9). In addition, we observed a negative association between the prevalence of daily cigarette smoking and education level. Among men, compared to university graduates, those with lower levels of education such as diplomas (OR= 1.9, 95% CI: 1.2, 3.2), high school (OR= 4.9, 95% CI: 3.1, 7.6), or elementary education (OR= 4.9, 95% CI: 3.0, 8.0), or being illiterate (OR= 2.9, 95% CI: 1.7, 4.9) had a higher odds of daily cigarette smoking. The observed differences were statistically significant (P value<0.05).

On the contrary, educated women were more likely to be smokers. Among women, the prevalence of cigarette smoking by age only differed for ages 45-55 (OR=14.8, 95% CI: 3.6, 60.9) and over 55 (OR= 29.1, 95% CI: 9.6, 88.4).

No association was observed between economic status and the prevalence of daily cigarette smoking in men, whereas the prevalence was higher among women of poor (OR=4.4, 95% CI: 1.0, 19.3) and poorest (OR=5.5, 95% CI: 1.1, 23.8) quintiles than the reference group (wealthiest quintile).

Furthermore, men (OR=2.1, 95% CI: 1.7, 2.6) and women (OR= 2.9, 95% CI: 1.1, 7.8) exposed to cigarette smoke at home/work were more likely to be daily smokers themselves (**Table 1**).

Socioeconomic inequality and daily cigarette smoking

As mentioned above, the prevalence of cigarette smok-

Table 1. The Association Between Cigarette Smoking and Studied Variables in the Study Population by Sex, 2011 Iran.

		Men				Women			
Characteristics	**Sub groups**	**n**	**Prevalence (%)**	**OR**	**95%CI**	**n**	**Prevalence (%)**	**OR**	**95%CI**
Age groups	15-24	1,021	5.5	1		1,238	0.1	1	
	25-34	950	19.9	4.5	3.1, 6.3	1,389	0.4	2.9	0.5, 2.8
	35-44	595	31.4	7.6	4.8, 11.9	935	0.6	6.2	0.7, 49.8
	45-54	507	26.0	6.1	3.8, 9.8	969	1.2	14.8	3.6, 60.9
	Over 55	1,285	21.8	4.5	3.0, 6.9	1,685	1.5	29.1	9.6, 88.4
Residence area	Urban	3,111	19.4	1	0.5, 0.9	4,261	0.5	1	0.8, 5.3
	Rural	1,247	18.3	0.7		1,955	0.7	2.1	
Education level	University	719	7.1	1		736	2.3	1	
	Diploma	1,173	14.3	1.9	1.2, 3.2	1,391	0.9	1.2	0.8, 5.3
	Secondary	892	27.6	4.9	3.1, 7.6	909	0.7	0.7	0.5, 2.8
	Primary	934	27.9	4.9	3.0, 8.0	1,273	0.3	0.2	0.06, 1.3
	Illiterate	635	14.7	2.9	1.7, 4.9	1,906	0.3	0.2	0.04, 0.9
Asset	Richest	557	13.3	1		630	0.2	1	
	2nd	1,376	16.3	1.5	0.8, 1.6	1,646	0.9	5.2	1.2, 22.2
	3rd	786	21.9	1.3	0.9, 1.8	1,291	0.08	0.5	0.1, 1.9
	4th	805	22.8	1.3	0.8, 2.0	1,284	0.6	4.4	1.0, 19.3
	Poorest	813	21.3	1.2	0.8, 1.8	1,347	0.8	5.5	1.2,23.8
Expose to cigarette Smoking	No	2,266	13.5	1		3579	0.3	1	
	Yes	1,948	26.2	2.1	1.7, 2.6	2402	1.0	2.9	1.1,7.8
Total		4,358	19.1			6,216	0.6		

CI= Confidence interval
Significant at 0.05 level

ing was very low in women. We observed little difference between high (1.0%) and low (0.9%) SES groups (P=0.060). In men, the prevalence of cigarette smoking was higher among those with low SES (23.1%) than those with high SES (11.1%; P<0.001). About 10.6% of the total difference in cigarette smoking prevalence was related to factors in our decomposition model. Education level had the most significant contribution and was associated with 8.6% of the observed difference in daily cigarette smoking between high and low SES groups (P=0.001). Other sources of this inequality were exposure to tobacco at home/work (1.3%) and residen-

tial area (-2.7%). The negative sign of residential area implies that if the level of urbanization was constant across low and high SES groups, the prevalence of daily cigarette smoking among low SES would increase by 2.7% (**Table 2**).

The decomposition model could not explain about 1.3% of the difference in the prevalence of daily cigarette smoking among Iranian men. For the unexplained part of the model, the difference in coefficients of education was statistically significant (P=0.038), meaning that one level increase in education has a larger association with smoking prevalence among low SES groups than high SES groups. However, the coefficient of the variables for age, residential area, and contact with cigarette smokers at home/work were not statistically significant (**Table 2**).

Daily WP use

In this study, the odds of daily smoking WP fell with

Table 2: Blinder- Oaxaca Decomposition of the Gap in Prevalence of Daily Cigarette Smoking Between the Low and High Socioeconomic Groups and Explaining the Role of each Variable in Creating the Observed Gap by Sex, Iran 2011

	Women			Men		
	Prediction %	95%CI	P Value	Prediction %	95%CI	P Value
Prevalence in low SES group	1.0	0.2, 1.8	0.010	23.1	18.2, 27.9	<0.001
Prevalence in high SES group	0.9	-0.04,1.9	0.060	11.1	8.6, 13.6	<0.001
Differences	0.1	-1.2, 1.3	0.881	11.9	6.5,17.4	<0.001
Due to endowments (explained)						
Age	0.5	0.1,0.8	0.005	0.6	-0.03,1.2	0.064
Residential area	0.4	-0.1, 1.1	0.170	-2.7	-5.5,-0.03	0.047
Education	-1.0	-2.0, 0.02	0.055	8.6	3.6, 13.7	0.001
.Expose to cigarette smoking	0.1	-0.1, 0.4	0.240	1.3	0.1,2.4	0.027
Wealth index	0.1	-0.7, 1.0	0.712	2.7	-2.4,8.0	0.295
Total	0.2	-1.0, 1.5	0.678	10.6	5.8, 15.3	<0.001
Due to coefficients (Unexplained)						
Age	-0.2	-3.1, 2.7	0.893	2.3	-5.2, 9.8	0.538
Residential area	-1.7	-6.6, 3.2	0.487	-3.7	-18.8, 11.2	0.616
Education	1.0	-1.4, 3.4	0.403	-12.1	-23.6, -0.6	0.038
Expose to cigarette smoking	-0.3	-1.8, 1.0	0.608	2.1	-1.9, 6.2	0.299
Wealth index	2.5	-1.5, 6.5	0.213	2.8	-12.6, 18.2	0.717
Constant	-1.4	-6.6, 3.8	0.585	9.9	-12.7,32.6	0.382
Total	-0.1	-0.4, 0.1	0.260	1.3	-0.4, 3.0	0.137

CI= Confidence interval
Significant at 0.05 level

increasing age in both men and women (**Table 3**). However, statistical significance was observed only in 35-44 (OR= 0.3, 95% CI: 0.1, 0.6), 45-55 (OR= 0.3, 95% CI: 0.2, 0.7) and over 55 (OR= 0.1, 95% CI: 0.07, 0.3) age groups of men. We also found a direct association between the daily water pipe smoking and level of education, which was somewhat stronger among women. Furthermore, we found that people who were exposed to water pipe smoke at home/work also tend to smoke more themselves and that this association was stronger in women (OR=8.7, 95% CI: 4.3, 17.4) than in men (OR=4.8, 95% CI: 3.1, 7.5).

Socioeconomic inequality and daily WP use

The prevalence of daily WP use was higher (4.4%)

Table 3: The Association Between Water Pipe Use and Studied Variables in the Study Population by Sex, 2011 Iran

		Men				Women			
Characteristics	**Sub groups**	**n**	**Prevalence (%)**	**OR**	**95%CI**	**n**	**Prevalence (%)**	**OR**	**95%CI**
Age groups	15-24	1,020	6.9	1		1,273	1.9	1	
	25-34	950	5.2	0.6	0.4, 1.0	1,388	2.0	1.0	0.4, 2.3
	35-44	595	3.5	0.3	0.1, 0.6	934	2.6	1.0	0.3, 3.2
	45-54	507	3.6	0.3	0.2, 0.7	967	2.5	0.7	0.2, 2.2
	Over 55	1,282	1.5	0.1	0.07, 0.3	1,682	3.2	0.8	0.2, 2.8
Residence area	Urban	3,109	5.1	1		4,257	2.0	1	
	Rural	1,245	3.9	0.7	0.4,1.1	1,951	3.1	1.1	0.6, 2.0
Education level	University	718	2.6	1		735	0.3	1	
	Diploma	1,173	4.7	1.8	1.0, 3.4	1,389	1.6	3.9	2.0, 7.8
	Secondary	892	5.5	2.4	1.2, 4.7	909	1.6	3.2	0.9, 10.9
	Primary	934	3.8	1.9	0.7, 4.6	1,273	2.6	5.9	2.9, 11.9
	Illiterate	632	3.0	3.7	1.5, 9.5	1,901	6.2	9.4	4.6, 19.4
Wealth Index	Richest	556	4.4	1		630	1.3	1	
	2nd	1,376	4.2	0.8	0.4, 1.5	1,644	2.3	1.6	0.6, 3.4
	3rd	785	5.8	1.1	0.6, 2.0	1,290	1.4	0.9	0.3, 2.6
	4th	894	3.7	0.6	0.3, 1.2	1,280	2.2	1.2	0.4,3.3
	Poorest	812	5.4	1.0	0.5, 2.0	1,346	3.9	1.7	0.6, 4.8
Expose to water pipe Smoking	No	2,958	2.2	1		4,511	0.8	1	
	Yes	1,221	10.7	4.8	3.1, 7.5	1,451	6.8	8.7	4.3,17.4
Overall		4,354	4.7			6,208	2.3		

CI= Confidence interval
Significant at 0.05 level

among low SES women than high SES women (1.3%) (P= 0.027). Education was the most essential variable, related to 3.3% of the difference between low and high SES groups for WP smoking, a difference reaching statistical significance (P=0.003). The unexplained part of the model was responsible for -0.4% of the observed difference. In the unexplained part of the model, the coefficient for having contact with a WP smoker at home/work was statistically significant (P=0.048), which suggests that the effect of this variable is more critical among high SES groups (**Table 4**).

The observed difference by SES for WP smoking in Iranian men was less than the marked difference for women (1.5%) and was not statistically significant (P=0.199; **Table 4**).

DISCUSSION

In this research, we attempted to investigate the effects of socioeconomic factors on tobacco use in Iran. In particular, we demonstrated substantial variations in

Table 4: Blinder-Oaxaca Decomposition of the Gap in Prevalence of Daily Water pipe Use Between the Low and High Socioeconomic Groups and Explaining the Role of each Variable in Creating the Observed Gap by Sex, Iran 2011

	Women			Men		
	Prediction %	95%CI	P Value	Prediction %	95%CI	P Value
Prevalence in low SES group	4.4	1.6, 7.2	0.002	5.5	3.5, 7.4	<0.001
Prevalence in high SES group	1.3	0.6, 2.1	0.001	3.9	2.4, 5.4	<0.001
Differences	3.1	0.3, 5.8	0.027	1.5	-0.8, 4.0	0.199
Due to endowments (explained)						
Age	-0.09	-0.4, 0.2	0.593	-0.1	-0.3, 0.05	0.151
Residential area	0.1	-1.3, 1.7	0.819	-1.0	-2.2, 0.2	0.105
Education	3.3	1.2, 5.4	0.003	0.9	-1.8, 3.7	0.518
.Expose to water pipe smoking	0.1	-0.6, 1.0	0.641	0.09	-0.5, 0.6	0.755
Wealth index	-0.03	-2.8, 2.8	0.982	1.6	-1.6, 4.9	0.316
Total	3.5	0.1, 7.0	0.043	1.4	-0.7, 3.7	0.197
Due to coefficients (Unexplained)						
Age	1.0	-2.8, 5.0	0.586	0.09	-5.0, 5.2	0.969
Residential area	2.6	-2.2,7.5	0.281	-2.6	-10.0, 4.7	0.478
Education	1.6	-8.7, 12.1	0.745	-3.0	-13.3, 7.2	0.557
Expose to water pipe smoking	2.2	0.01, 4.5	0.048	1.6	-0.6, 3.9	0.164
Wealth index	6.5	-0.7, 13.8	0.078	-3.6	-13.7, 6.3	0.467
Constant	-14.6	-32.1, 2.7	0.097	7.7	-5.6, 21.0	0.252
Total	-0.4	-2.0, 1.1	0.568	0.1	-0.9, 1.1	0.838

CI= Confidence interval
Significant at 0.05 level

cigarette and WP use by SES among men and women. Our main finding was that tobacco use was higher among Iranian people with lower SES. However, we observed differences between men and women. The most significant differences by SES were observed for cigarette smoking among men, whereas they were observed for WP use in women. Decomposition of the observed gaps in the prevalence of daily cigarette smoking showed that education level was the most important contributor to differences in the prevalence of daily cigarette smoking. Almost 72.6% of the total gap in the prevalence of daily cigarette smoking between high and low socioeconomic groups was attributable to differences in education level.

In contrast to the studies in other populations, little differences were observed for cigarette smoking prevalence for women by SES[7, 20-22]. However, the prevalence of cigarette smoking among women was very low in our population. Studies focused on other regions of the country with a higher cigarette smoking prevalence, such as Tehran[16], may differ.

Exposure to cigarette smoking was another contributor to the differences in smoking prevalence. Our results are consistent with recent studies in Iran and other countries that showed having cigarette smoker friends or family members is associated with a higher prevalence of cigarette smoking, particularly among youth[23-25].

The residential area is another important factor explaining 22.6% of the total gap. This is consistent with previously conducted studies in Iran[18]. It seems that the high SES group was more likely to live in urban settings in which the prevalence of daily cigarette smoking is higher[7]. Nevertheless, the overall prevalence of daily cigarette smoking was lower among higher SES people. Decomposition analysis demonstrated that differences in education level are the most important contributors to observed differences in both cigarette and WP use between low and high SES groups. Previous studies in other populations have also demonstrated differences by SES. However, the direction of the association seems to vary by country. Studies in Iran[26], Brazil[11], and the United States of America[12] observed a similar association to our study. However, most of the previous studies in Arab countries, including Libya[13], Saudi Arabia[14], and Lebanon[15] found that high SES groups were more likely to use WP daily. The relationship between SES and the prevalence of WP use in Iran may vary by geographic region, as substantial differences in the prevalence of water pipe have been observed in Iran by province[16]. Future studies should be conducted in high prevalence regions to understand better the interrelationship SES and geographic area on the prevalence of water pipe and to help target populations for prevention.

Some limitations of our study should be considered. The exact prevalence of tobacco use may have been underestimated, particularly for cigarette smoking among women, which may have been due to respondents' concerns about cultural perceptions. We do not have a concrete idea of how such a bias varies across socioeconomic levels. We also had limited information on SES. For example, economic status was assessed by households' assets, which might differ across provinces and rural/urban areas of residence. However, our study had several strengths. The sample size is large and is representative of the Iranian adult population. We also used an appropriate and robust survey and statistical methods for the analysis.

In conclusion, tobacco use (cigarettes and WP smoking) is more common in Iran among lower socioeconomic groups. The health outcomes dues to tobacco consumption are stronger among low SES groups due to co-morbidities, less access to the health care system, and impose a much more substantial financial burden on them. Therefore, tobacco use provides an essential and potentially ameliorable contribution to reducing health disparities. Education was the main factor that

explained the difference in the prevalence of tobacco use. The tobacco control program should consider the results of this study and design suitable interventions for illiterate and low SES groups.

ACKNOWLEDGMENT

This study was a part of the M.Sc. thesis of the first author supported by Tehran University of Medical Sciences. The authors would like to thank all administrative staff at Iran's center for NCDs and prevention for their invaluable support, and for providing us with the data. We also would like to thank all staff and interviewers at medical schools across the country, who have been involved in the entire process of conducting the survey.

FUNDING

This research did not receive any specific grant from any funding agencies in the public, commercial, or not-for-profit sectors.

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