RESEARCH ARTICLE

Prevalence of smoking in the Kuwaiti adult population in 2014: a cross-sectional study

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Abstract

The study objective was to assess tobacco smoking prevalence in Kuwaiti adults in relation to sociodemographic characteristics. A cross-sectional study survey was conducted in 2014 on 3917 Kuwaiti citizens (18–69 years) following the World Health Organization (WHO) STEPwise Approach to Surveillance (STEPS) methodology. The study assessed prevalence of self-reported ever-smoking or currently smoking tobacco products and exposure to secondhand smoke in relation to demographic and smoking-related characteristics. The prevalence of "ever smoker" in men and women was 49.9% and 4.4%, respectively, whereas the prevalence of "current smoker" was 39.2% and 3.3%, respectively. Sex (adjusted OR [AOR], 19.2 [95% confidence interval (CI) 13.0–28.3], male versus female) was significantly associated with current smoking. Among daily smokers, 87.1% used manufactured cigarettes. The average daily number of manufactured cigarettes for men and women was 21.8 and 13.0, respectively. Mean age at smoking initiation was 17.5 years (95% CI 17.2–17.9). The prevalence of secondhand smoke at home and work was 38.6% and 29.9%, respectively. Half of Kuwaiti men have smoked at some point in their life with most of these being current smokers. Secondhand smoke is a common exposure at home and work, posing serious health risks to the population.

Keywords Tobacco use prevalence · Tobacco · Shisha · Public health · Kuwait · Secondhand smoke

Introduction

Tobacco use is considered one of the leading risk factors for early morbidity and mortality worldwide, particularly in low-income countries (GBD 2015 Tobacco Collaborators 2017). Since 1990, tobacco use has been linked to more than 5 million deaths annually (GBD 2015 Risk Factors Collaborators 2016). In addition, the annual loss in productivity and health-care cost are estimated in billions of dollars due to the morbidity and mortality associated with tobacco use (Ekpu and Brown 2015).

Research studies have shown that several sociodemographic factors (e.g., sex, age, education, employment status, marital status, and income) can be associated with smoking prevalence (Casetta et al. 2017; Centers for Disease Control and Prevention 2011; Laaksonen et al. 2005; Lemstra et al. 2009; Li et al. 2016; Ng et al. 2014; Radovanovic et al. 1999). Generally, smoking prevalence was mostly higher in men than that in women (Stafylis et al. 2018; Wang et al. 2018). According to the Global Burden of Disease (GBD) Study in 2015, the global prevalence of smoking for men and women was 25% and 5.4%, respectively (Reitsma et al. 2017). The relationship between smoking prevalence and age has not been unidirectional (Stafylis et al. 2018; Wang et al. 2018). Lower socioeconomic status was associated with higher prevalence in developed countries (Bosdriesz et al. 2014; Cavelaars et al. 2000; Cho et al. 2004; Hanibuchi et al. 2016; Laaksonen et al. 2005; Lemstra et al. 2009; Schaap and Kunst 2009; Song and

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Byeon 2000), whereas, in developing countries (e.g., India, Thailand, and Malaysia), a positive association was reported (Barik et al. 2016; Siahpush et al. 2008). Given the variations in the relationships between smoking prevalence and sociodemographic factors across countries, there is a need to report the prevalence and associated sociodemographic factors at the local country-level.

Kuwait has been going through a rapid economic development over the past 50 years. These developments have impacted both the population demographics and the health indicators in the country. Hence, the profile of communicable and non-communicable diseases (NCDs) has changed significantly, with a shift towards NCDs (Boutayeb et al. 2013; Forouzanfar et al. 2016; Mokdad et al. 2014; Ng et al. 2011; Rahim et al. 2014). Tobacco use is a major NCD risk factor and one of the main public health challenges in Kuwait. Several studies have reported smoking prevalence in relation to sociodemographic factors in Kuwait (Al-Shammari et al. 2006; Alanbaei et al. 2012; Alansari 2005; Behbehani et al. 2004; Memon et al. 2000; Moh'd Al-Mulla et al. 2008; Mohammed et al. 2010a; Moody et al. 1998; Sugathan et al. 1998). According to these studies, the prevalence of smoking in Kuwait ranged between 17 and 65% with a median of 30% (Al-Shammari et al. 2006; Alanbaei et al. 2012; Alansari 2005; Behbehani et al. 2004; Memon et al. 2000; Moh'd Al-Mulla et al. 2008; Mohammed et al. 2010a; Moody et al. 1998; Sugathan et al. 1998). It was reported that smoking prevalence was significantly higher in men than that in women, and it was associated with lower levels of education, family income, as well as smoking among siblings and/or parents (Alansari 2005; Behbehani et al. 2004; Memon et al. 2000; Sugathan et al. 1998). Furthermore, smoking manufactured cigarettes alone or both waterpipe (shisha) and manufactured cigarettes was common among Kuwaiti citizens (Behbehani et al. 2004; Memon et al. 2000; Mohammed et al. 2010a). These prevalence estimates varied greatly among studies due to differences in study design, target population, sample size, and assessed risk factors.

In 2006, the Kuwait Ministry of Health conducted a comprehensive survey of Kuwaiti adult citizens ($n = 2280$) based on the World Health Organization (WHO) STEPwise Approach to Surveillance (STEPS) methodology (Ministry of Health 2006). Accordingly, the overall smoking prevalence was 23.6%, with 42.3% among men and 4.4% among women (Ministry of Health 2006). In 2014, a second STEPS survey of Kuwaiti citizens was conducted to describe the most recent estimates of NCD risk factors. The objective of the current study was to estimate the prevalence of active tobacco smoking and secondhand tobacco smoking in Kuwaiti adult citizens in relation to sociodemographic characteristics and related NCD risk factors, using the 2014 STEPwise data for Kuwait.

Materials and methods

This manuscript is reported according to the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) protocol (von Elm et al. 2014).

Study design and sampling plan

A cross-sectional study survey was conducted between February 2013 and September 2014 following the World Health Organization (WHO) Eastern Mediterranean Approach for Control of Non-Communicable Diseases and using the standard STEPwise approach to surveillance (STEPS) methodology (WHO 2014), with some added questions of local interest. Data collection utilized the STEPS methodology, including three standardized steps: (1) structured demographic and medical history questionnaire, (2) physical measurements, and (3) biochemical measurements. The target population was adult non-institutionalized Kuwaiti citizens (age 18–69 years) able to undergo the data collection procedures, without exclusion criteria. The study was supported by the Kuwait Ministry of Health. The sampling frame was provided by the Public Authority for Civil Information (PACI) where a randomly selected sample was selected. The overall sample was composed of registered Kuwaiti of both sexes, aged 18–69 years, and residents of all governorates. Based on age and sex, the sample was stratified in eight subgroups (i.e., strata) as follows: 18–29 years; 30–44 years; 45–59 years, and 60–69 years for both males and females.

The sample size was calculated based on parameter estimate of 50%, 95% confidence interval (CI), and 5% acceptable margin of error within each stratum, and equal representation of the eight strata. This resulted into an estimated sample size of 3842 individuals required to achieve the specified margin of error. The sample was then inflated by 12.5% to account for non-response and incomplete data collection resulting into a total sample list of 4391 individuals selected by PACI.

Data collection

Study individuals received phone calls from a study team member asking them to visit a selected local Ministry of Health primary health clinic in their governorates to inform them about the study and invite them to participate. Data collectors met consenting participants at the clinic between March and September 2014. After obtaining written informed consent, data collection was conducted in a private designed clinic room with a face-to-face interview designed to collect information via a questionnaire on demographics and socio-economic status, tobacco use, diet, physical activities, and self-reported medical history (WHO 2014). The tobacco use questions were focused on current and previous smoking

status, initiation and duration of smoking, quantity of tobacco use, exposure to secondhand smoke, and information related to quitting smoking. In the second step, the team members obtained physical measurements of the participating individuals, including blood pressure, height, weight, and waist circumference measurements, whereas, in the third step, biochemical analyses including fasting plasma glucose (FPG) and hemoglobin A1c (HbA1c) from venous blood samples were conducted.

Definitions of smoking and related variables

In this study, the variable ever smoker was defined as a binary variable indicating whether the survey participant ever smoked any tobacco products in their past (WHO 2014). The variable current smoker was defined as a binary variable indicating whether the participant self-identifies as a current smoker of any tobacco product such as manufactured cigarettes, shisha, hand-rolled cigarettes, and/or pipe, at the time of the survey (WHO 2014). The current smoker variable included both daily and occasional smokers. The number of tobacco products currently used was also included as a variable. That is, whether the participant used one tobacco product (i.e., user of one tobacco product: manufactured cigarettes, hand-rolled cigarettes, pipes, or shisha) or used two, three, or four products.

The exposure to secondhand smoke was defined in this study as the participant's self-reported exposure to smoke from burning tobacco products at home or at work in a closed area. The variable "smokers who tried to stop smoking" was defined as whether the respondent reported an attempt to stop smoking in the past 12 months, regardless of the type of tobacco smoking. Because of the interest in examining the relationship between smoking variables and other NCD risk factors, we included obesity, diabetes, and hypertension (HTN) in this study. Diabetes (as a binary variable) was defined as self-reported diabetes history or FPG $\geq$ 7.0 mmol/L or HbA1c $\geq$ 6.5% as described elsewhere (Alkandari et al. 2018). Obesity (as a binary variable) was defined as body mass index (BMI) $\geq$ 30 kg/m^2. Hypertension (as a binary variable) was defined as systolic blood pressure $\geq$ 140 mmHg, or diastolic blood pressure $\geq$ 90 mmHg, or normal blood pressure (BP) on BP-lowering medication as described previously (Alkandari et al. 2018).

Statistical analyses

Sample weights to represent the Kuwaiti adult populations by sex and age groups (eight strata) were calculated as: 1/(stratum n/population n). To generate estimates generalizable to the adult Kuwaiti population, the prevalence estimates, the cross-tabulations, and the logistic regression models were all run under the STATA "survey" commands to take the sample weights into consideration. The main binary outcomes of interest in this study were ever smoker, current smoker, and "exposure to secondhand smoke." Each weighted outcome was cross tabulated with the sociodemographic risk factors (i.e., sex, age group, sex–age group, marital status, level of education, and employment status) as well as with obesity, diabetes, and hypertension. The weighted prevalence of each outcome was compared across the levels of each risk factor, using 2×2 chi-square or $2 \times n$ likelihood ratio chi-square test, as appropriate, in STATA software version 14.1 (StataCorp., College Station, TX). A multivariable analysis was conducted to assess the association between each outcome and the potential risk factors using a logistic regression model in STATA software. Sex and sex–age groups were included in all the multivariable models to adjust for potential confounding. All other variables (marital status, level of education, employment status, obesity, diabetes, and hypertension) were assessed in the models using the backward elimination selection process. When using exposure to secondhand smoke outcome in the analysis, participants who were classified as current smokers (i.e., active smokers) were excluded from the analysis. The proportion of daily smokers was cross-tabulated by the number of tobacco products used (up to 4) and by sex. Furthermore, the distribution of smoking quantities for daily smokers by sex and type of tobacco product was assessed.

Results

A total of 3917 participants were enrolled and answered the questions regarding tobacco smoking in the questionnaire. The response rates in steps 1 and 2 were 89.2% (n = 3917; 95.8% for females, and 80.0% for males).

The overall weighted prevalence of ever smoker and current smoker (n = 3917) was 26.2% and 20.5%, respectively. The weighted prevalence of ever smoker according to sex, sex–age group, marital status, education, employment status, BMI category, hypertension, and diabetes is shown in Table 1.

The prevalence of ever smoker in men (49.9%) was significantly ($p < 0.001$) higher than that in women (4.4%). Moreover, the prevalence of ever smoker by age–sex groups was significantly higher in the male age groups compared with female age groups ($p < 0.001$; Table 1). Marital status, highest education level, employment status, BMI factor, and hypertension status were also significantly associated with ever-smoker prevalence (Table 1). Widowed participants had the lowest prevalence (11.4%) compared with other marital statuses. The percentage of participants who ever smoke and achieved up to an intermediate school level had the highest prevalence (38%), whereas the lowest prevalence was in those with less than primary education (5.7%). Furthermore, self-employed participants had the highest ever-smoker prevalence (44.8%), while the lowest value was among those identified

Table 1 Prevalence of "ever smoker" and "current smoker" stratified by participant characteristics (weighted for the age and sex distribution of the Kuwaiti population, n = 3917)

| Characteristic | Subgroup | Weighted[a] prevalence "ever smoker" | | | Weighted[a] prevalence "current smoker" | | |
	n	%	[95% CI]	p value	%	[95% CI]	p value
Overall	3917	26.2	[24.8–27.8]		20.5	[19.1–21.9]	
Sex				< 0.001			< 0.001
Female	2459	4.4	[3.7–5.3]		3.3	[26.7–40.9]	
Male	1458	49.9	[47.4–52.5]		39.2	[36.6–41.7]	
Men				< 0.001			< 0.001
18–29	525	46.5	[42.2–50.8]		41.1	[37.0–45.4]	
30–44	507	54.4	[50.1–58.7]		44.4	[40.1–48.7]	
45–59	347	50.1	[44.9–55.4]		31.1	[26.5–36.2]	
60–69	79	48.1	[37.3–59.0]		20.3	[12.8–30.5]	
Women							
18–29	781	4.6	[3.3–6.3]		3.1	[2.1–4.5]	
30–44	1013	4.3	[3.1–5.7]		3.5	[2.5–4.9]	
45–59	531	5.5	[3.8–7.8]		4.3	[2.9–6.4]	
60–69	134	1.5	[0.4–5.8]		0.8	[0.1–5.1]	
Marital status				0.002			0.003
Single	892	25.1	[22.1–28.3]		21.6	[18.8–24.7]	
Married	2710	27.7	[25.9–29.5]		20.9	[19.2–22.6]	
Separated/divorced	191	21.7	[16.0–28.8]		17.1	[12.0–3.7]	
Widowed	123	11.4	[6.6–19.0]		7.5	[3.8–14.3]	
Highest education level				< 0.001			< 0.001
Less than primary	121	5.7	[2.5–12.3]		0.6	[0.08–4.1]	
Primary school	80	20.9	[12.8–32.1]		9.1	[4.1–18.7]	
Intermediate school	451	38.0	[33.4–42.9]		27.1	[22.9–31.8]	
High school	720	30.8	[27.4–34.6]		23.8	[20.6–27.3]	
Diploma/college	1333	22.9	[20.5–25.6]		19.6	[17.3–22.1]	
Post-graduate	1026	24.1	[21.3–27.0]		19	[16.5–21.8]	
Employment status				< 0.001			< 0.001
Government	2737	27.4	[25.6–29.3]		22.7	[21.0–24.5]	
Non-government	132	36.6	[28.5–45.6]		29.8	[22.2–38.8]	
Self-employed	28	44.8	[27.5–63.6]		24.3	[11.9–43.5]	
Student	284	22.4	[17.6–28.0]		17.5	[13.2–22.7]	
Homemaker	369	3.1	[1.8–5.4]		1.6	[0.7–3.4]	
Retired/unemployed	364	26.3	[24.8–27.8]		19.7	[15.7–4.3]	
Obesity				0.002			0.007
BMI < 30	2090	28.4	[26.4–30.6]		22.2	[20.3–24.2]	
BMI ≥ 30	1827	23.6	[21.5–25.8]		18.4	[16.5–20.4]	
HTN				0.003			0.803
Yes	763	31.9	[28.5–35.5]		20.4	[17.5–23.7]	
No	2428	26.0	[24.1–28.0]		20.9	[19.1–22.7]	
Diabetes				0.793			0.312
Yes	494	28.3	[24.2–32.7]		20.0	[16.5–24.1]	
No	2561	27.6	[25.6–29.8]		22.3	[20.3–24.3]	

[a] Sampling weights were considered in all analyses

themselves as homemakers (3.1%). Moreover, there was a significant inverse relationship between the prevalence of ever smoker and obesity, but a significant direct association with hypertension. However, after adjusting for potential

confounding factors in the multivariable model, the prevalence of ever smoker was significantly associated only with sex (adjusted OR (AOR) for men = 42.3 [95% CI 10.3–173.9] compared with women) (Fig. 1).

As for the current smoker data, the weighted prevalence in men (39.2%) was significantly ($p < 0.001$) higher than that in women (3.3%). The prevalence of current smokers was significantly and inversely associated with age groups above 45 years in men (Table 1). Marital status, education level, employment status, and BMI factor were also significantly associated with the current smoker prevalence. Widowed participants had the lowest current smoker prevalence compared with other marital statuses. Participants with less than primary (0.6%) or primary (9.1%) school education had the lowest prevalence compared with other education levels. Most of the employed participants regardless of their employment status had relatively high current smoker prevalence except for those who identified themselves as homemakers (Table 1). Moreover, non-obese participants had significantly higher smoking prevalence compared with obese participants. Nonetheless, hypertension and diabetes status were not significantly associated with current smoker prevalence (Table 1).

After adjusting for potential confounding factors in the multivariable model, current smoker prevalence was only significantly ($p < 0.001$) associated with sex (AOR for men = 43.1 [95% CI 5.8–319.3] compared with women), and age–sex group (men, 60–69 years old with AOR = 0.3 [95% CI 0.1–0.8], $p = 0.02$) compared with the referent group (men, 18–29) (Fig. 1).

Daily smokers accounted for 87.9% of current smokers ($n = 803$) in this study (data not shown in the tables). The average age of starting smoking was 17.5 years (95% CI 17.2–17.9) and by sex, 17.1 and 22.5 years for men and women, respectively. Most of the current smokers (i.e., 81.3%) started smoking at age 20 years or younger. Significantly ($p < 0.001$), more men (85.1%) than women (53.9%) participants began smoking at age 20 years or younger. About 3% of current smokers indicated that they started smoking between ages 8 and 10 years old.

. The highest quantity of manufactured cigarette use among men was 20 per day, but this was lower among women. Among daily smokers, 87.1% used manufactured cigarettes. The average number of manufactured cigarette use among daily smokers for men and women was 21.8 (95% CI 20.7–22.8) and 13.0 (95% CI 9.1–17.0) per day, respectively. The distribution of manufactured cigarettes among users ($n = 487$) by category (< 20 cigarettes, 20–40, and > 40) was 31.8%, 63.7%, and 4.5%, respectively. Interestingly, the average numbers of shisha smoking sessions in men and women were similar: 2.1 (95% CI 1.8–2.4) and 1.9 (95% CI 1.2–2.6), respectively. The distributions of shisha smoking among users ($n = 112$) by category (< 2 session, 2–4, and > 4) were 49.1%,

42.0%, and 8.9%, respectively. The quantities of both tobacco pipes and hand-rolled cigarettes per day were close to nil among men and women, and too small to indicate any differences by sex.

The frequency and percentage of the daily smokers stratified by combinations of tobacco products used (up to 4 products [i.e., manufactured cigarettes, shisha, tobacco pipes, and hand-rolled cigarettes]) and by sex are shown in Table 2. The most common form of smoking among men who smoked daily ($n = 506$) was manufactured cigarettes alone (79.1%), followed by shisha smoking alone (8.9%), and both manufactured cigarettes and shisha (7.5%). Less than 1% of male daily smokers used 4 tobacco products. Among women who smoked daily ($n = 46$), 52.2% smoked manufactured cigarettes, whereas 30.4% smoked shisha, 15.2% smoked both manufactured cigarettes and shisha, and none used more than 2 types of tobacco products.

Among current smokers, the 12-month-period prevalence of quitting attempts was significantly associated with participants noticing warning labels on cigarette packages in the past 30 days (AOR = 3.7 [95% CI 2.5–5.3]). Other factors (i.e., advise from health-care workers to quit smoking, age at which started smoking, sex, age group, smoking quitting information [TV, newspaper, radio]) during the past 30 days and tobacco promotion advertisements or signs during the past 30 days were not significantly associated with the 12-month-period prevalence of quitting attempts.

The overall weighted prevalence of secondhand smoke at home was 38.6% ($n = 3268$; Table 3). The prevalence differed significantly ($p < 0.001$) by sex with higher exposure among women (42.9%) compared with men (31.3%). Similarly, women across the four age groups had higher exposure prevalence estimates compared with men of the same age groups. While the secondhand smoke prevalence by education levels and employment status was high for most categories (> 30%), participants who were self-employed had the lowest prevalence (8.4%). Obesity, diabetes, and hypertension status were not significantly ($p > 0.05$) associated with the prevalence of secondhand smoke at home. After adjusting for potential confounding factors in the multivariable models (Fig. 2), secondhand smoke prevalence was significantly ($p < 0.001$) associated with sex (AOR for men = 0.7 [95% CI 0.5–0.9] compared with women), and self-employed (AOR = 0.5 [95% CI 0.1–0.7) compared with the referent group (government-employed).

As for secondhand smoke at work in a closed area, the overall weighted prevalence was 29.9% ($n = 3019$; Table 3). The prevalence differed significantly ($p < 0.001$) by sex with higher exposure in men (51.2%) than women (17.3%). Older participants (age 60–69 group) had the lowest prevalence (18.8%) of secondhand smoke at work compared with other age groups. Prevalence of secondhand smoke at work was associated significantly with BMI < 30 and hypertension.
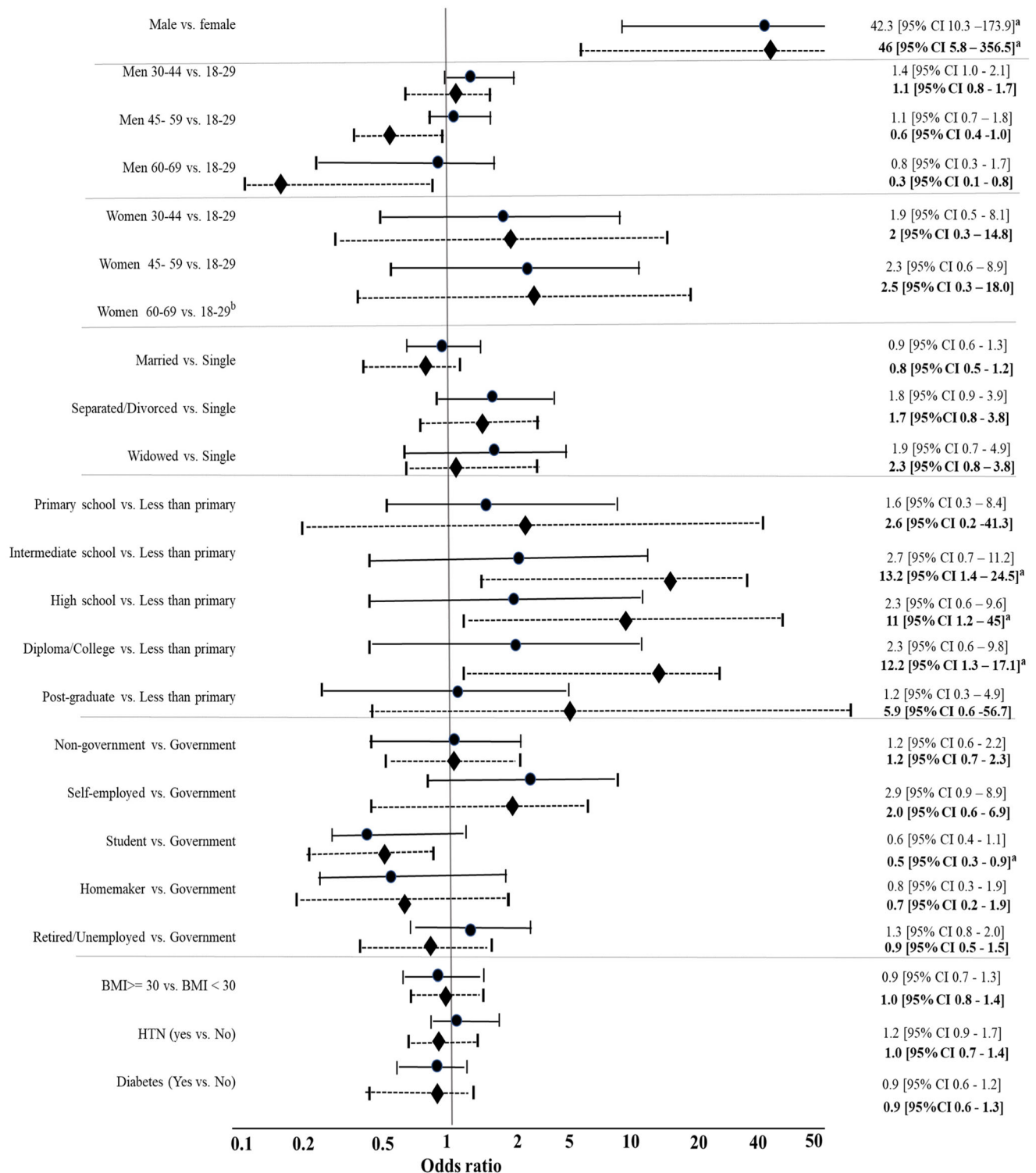
Fig. 1 Forrest plots illustrating the results of the multivariate logistic regression analysis stratified by participant characteristics (weighted for the age and sex distribution of the Kuwaiti population, $n = 3917$). Sex and sex–age groups were included as covariates in all the multivariate models to adjust for potential confounding. All other variables (marital status, level of education, employment status, obesity, diabetes, and hypertension) were assessed in the models using the backward elimination selection process. ⊢•→ represents adjusted OR of "ever smoker," and ⊢♦→ represents adjusted OR of "current smoker." [a]Significant difference between odds ratios was detected based on the adjusted multivariate models. [b]The subgroup variable was dropped due to the collinearity

After adjusting for potential confounding factors in the multivariable models (Fig. 2), the prevalence of secondhand smoker at work was significantly associated with sex (AOR for men = 4.0 [95% CI 1.5–10.3] compared with women);

Table 2 Distribution of daily smoker frequency (%) stratified by the number of tobacco products used and sex in the Kuwaiti population

Tobacco product[a]	Male		Female	
	Frequency	Percentage	Frequency	Percentage
Cigarettes only	400	79.1	24	52.2
Shisha only	45	8.9	14	30.4
Cigarettes and shisha	38	7.5	7	15.2
Cigarettes and roll	7	1.4	1	2.2
Roll only	5	1.0	0	0.0
Cigarettes and shisha and pipe	4	0.8	0	0.0
Cigarettes and shisha and pipe and roll	2	0.4	0	0.0
Cigarettes and pipe	2	0.4	0	0.0
Cigarettes and pipe and roll	1	0.2	0	0.0
Cigarettes and shisha and roll	1	0.2	0	0.0
Shisha and pipe	1	0.2	0	0.0
Total	506	100.0	46	100.0

[a] Cigarettes = manufactured cigarettes, roll = hand-rolled cigarettes, and pipe = tobacco pipe

men aged 30–44 years (AOR = 1.8 [95% CI 1.1–3.1]) compared with the referent group (men aged 18–29 years); homemaker and retired/unemployed with AOR = 0.4 [95% CI 0.2 – 0.8] and 0.3 [95% CI 0.1 – 0.4], respectively, compared with the referent group (government employee); and those with hypertension had AOR = 1.5 [95% CI 1.1–2] compared with those without hypertension (Fig. 2).

Discussion

This cross-sectional study provides population-based prevalence estimates of smoking and associated risk factors representative of the adult Kuwaiti population based on the 2014 WHO-STEPS survey.

Smoking prevalence and risk factors

The prevalence of ever smoker in men compared with women was 49.9% and 4.4%, respectively, whereas the prevalence of current smokers in men compared with women was 39.2% and 3.3%, respectively. These estimates in the adult male Kuwaiti population are higher than the global prevalence estimate (i.e., 25%) for smoking in men (Reitsma et al. 2017). In comparison, the prevalence of current smoking in men and women reported by the 2006 STEPS was 42.3% [95% C.I., 38.6–45.9%] and 4.4% [95% C.I., 3.2–5.6%], respectively (slightly higher than this study, but widely overlapping with this study's confidence intervals) (Ministry of Health 2006). Both STEPS surveys (2006 and 2014) included the adult Kuwaiti population, but the age distribution in 2006 differed slightly (ages 20 to 64 years). While it is possible that there was a slight decrease in the prevalence of current smoking between 2006 and 2014, this finding also could have also

arisen by chance, in light of the overlapping confidence intervals. In another study conducted to assess prevalence of overweight and obesity in Kuwaiti adults in relation to risk factors (including smoking) based on the 2014 WHO-STEPS survey, authors reported that prevalence of never smoker among men (n = 1381) and women (n=2208) was 49.4% and 96.5%, respectively (Weiderpass et al. 2019). Moreover, authors reported that 11.9% and 1.9% of men and women were former smokers (Weiderpass et al. 2019).

Other studies conducted in Kuwait, where assessing smoking prevalence was the main outcome that had limited representation to a specific target population(s). For instance, in a study conducted in 1996 and involved 3859 participants who worked at government ministries in Kuwait, authors reported an overall prevalence of current smokers at 17% (Memon et al. 2000). In another study in 2004, authors reported current smoker prevalence at 42.2% (n = 777) in undergraduate male students at Kuwait University (Alansari 2005). Moreover, a study conducted in 1997 on a similar male student population at Kuwait University reported 30% (n = 664) current smoker prevalence (Sugathan et al. 1998). Furthermore, in a study published in 2004, the prevalence of current smokers among Kuwaiti male physicians (n = 297) was 31% (Behbehani et al. 2004). Moreover, in a study published in 2020, authors reported that the ever-smoker prevalence of cigarettes in Kuwaiti adolescents (11th and 12th graders) was 42.5% (n = 1525) and 67.9% among males and 21.3% among females (Esmaeil et al. 2020). While our study focused on the adult population, Esmaeil et al. (2020) study showed the common use of tobacco among adolescents. In another study, Mohammed et al. (2010b) reported that, among Kuwaiti adults (n = 2972), the prevalence of cigarette smokers was 12.4% which is lower than our estimates. Furthermore, in another study by Husain et al. (2016), authors revealed that

Table 3 Prevalence of "secondhand smoker" at home (n = 3269) and work (n = 3019) stratified by participant characteristics (weighted for the age and sex distribution of the Kuwaiti population)

Characteristic	Weighted prevalence secondhand smoker at home[a]				Weighted prevalence secondhand smoker at work[b]			
	n	%	95% CI	p	n	%	95% CI	p
Overall	3268	38.6	[36.9–40.4]		3019	29.9%	28.1–31.6	
Sex				< 0.001				< 0.001
Female	2376	42.9	[40.8–44.9]		2188	17.3	[15.8–19.0]	
Male	892	31.3	[28.3–34.5]		831	51.2	[47.8–54.6]	
Men				< 0.001				< 0.001
18–29	309	34.6	[29.5–40.1]		290	53.5	[47.7–59.1]	
30–44	282	29.1	[24.1–34.6]		271	57.2	[51.2–63.0]	
45–59	238	28.2	[22.8–34.2]		218	44.0	[37.6–50.7]	
60–69	63	31.8	[21.6–44.2]		52	30.8	[19.8–44.5]	
Women								
18–29	757	43.6	[40.1–47.2]		721	18.7	[16–21.7]	
30–44	978	41.5	[38.5–44.6]		941	17.4	[15.1–20.0]	
45–59	508	43.1	[38.9–47.5]		434	16.1	[13–20.0]	
60–69	133	44.4	[36.2–52.9]		92	10.9	[5.9–19.0]	
Marital status				0.593				0.023
Single	736	39.7	[36.2–43.4]		683	31.7	[28.1–35.5]	
Married	2254	38.1	[36.1–40.2]		2101	29.6	[27.5–31.7]	
Separated/divorced	162	36.3	[29.1–44.2]		150	29.9	[25.8–41.6]	
Widowed	115	43.2	[34.3–52.5]		84	15.3	[9.0–24.9]	
Highest education level				< 0.001				< 0.001
Less than primary	120	47.1	[38.2–56.2]		71	7.0	[2.9–15.9]	
Primary school	74	58.1	[46.3–69.0]		59	31.9	[21.1–45.1]	
Intermediate school	352	44.2	[38.9 -49.6]		296	30.6	[25.2–36.5]	
High school	574	43.6	[39.5–47.9]		520	37.3	[33.1–41.8]	
Diploma/college	1131	39.6	[36.7–42.6]		1089	25.3	[22.6–28.1]	
Post-graduate	867	32.1	[28.9–35.3]		835	32.6	[29.3–36.1]	
Employment status				0.001				< 0.001
Government	2243	37.3	[35.2–39.3]		2210	31.3	[29.3–33.4]	
Non-government	98	34	[25.1–44.1]		94	52.8	[42.5–62.9]	
Self-employed	21	8.4	[2.1–28.6]		19	23.7	[9.2–48.8]	
Student	241	39.7	[33.6–46.2]		211	37.7	[31.2–44.7]	
Homemaker	363	47.7	[42.6–53.0]		248	11.4	[8.0–16.0]	
Retired/unemployed	299	40.9	[35.4–46.7]		235	16.5	[12.2–22.0]	
Obesity				0.955				0.003
BMI < 30	1708	38.6	[36.2–41.0]		1604	32.3	[29.9–34.8]	
BMI≥ 30	1560	38.7	[36.2–41.2]		1415	27	[24.6–29.5	
HTN				0.899				
Yes	627	39.5	[35.7–43.5]		549	35.8	[31.7–40.1]	0.029
No	2025	39.2	[37.4–41.2]		1927	30.6	[28.5–32.9]	
Diabetes				0.272				
Yes	410	40.8	[36.0–45.7]		336	32.8	[27.8–38.3]	0.797
No	1699	37.7	[35.4–40.2]		1583	32.1	[29.7–34.6]	

[a] Active smokers were excluded from the analyses

[b] Active smokers and those did not work in a closed area were excluded from the analyses

high prevalence (i.e., 46%) of 525 university students in Kuwait were current smokers.

Additionally, several other studies have evaluated smoking as a risk factor for other public health determinants in Kuwait. For instance, the prevalence of coronary artery disease in Kuwaiti adults (3621 women and 3988 men) in relation to

risk factors was assessed using a household survey (Olusi et al. 2003). The prevalence of current smokers was significantly higher among men (31.7%) than among women (1.4%), slightly lower than that in our study. In another study based on the 2006 WHO-STEPS survey, authors evaluated the relationship between prevalence of coronary artery disease
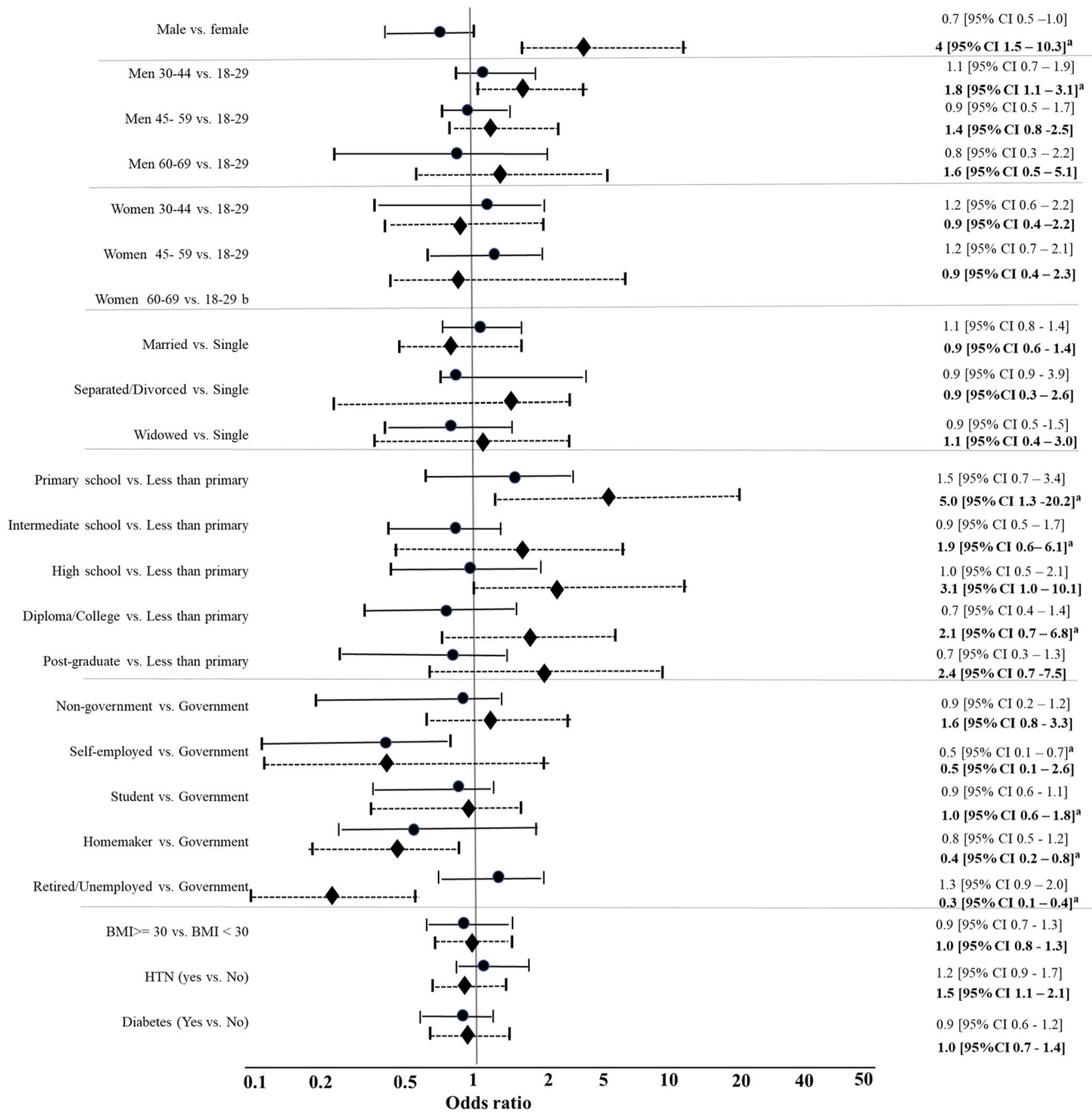
Fig. 2 Forrest plots illustrating the results of the multivariate logistic regression analysis for "secondhand smoker" at home (*n* = 3269) and work (*n* = 3019) stratified by participant characteristics (weighted for the age and sex distribution of the Kuwaiti population). Sex and sex–age group were included as covariates in all the multivariable models to adjust for potential confounding. All other variables (marital status, level of education, employment status, obesity, diabetes, and hypertension) were assessed in the models using the backward elimination selection process. ⊢•⊣ represents adjusted OR of secondhand smoke at home, and ⊢◆⊣ represents adjusted OR secondhand smoke at work. [a]Significant difference between odds ratios was detected based on the adjusted multivariate models. [b]The subgroup variable was dropped due to the collinearity

and its associated risk factors in adult Kuwaiti population (n = 1970) (Alarouj et al. 2013). The overall smoking prevalence was 17.8%; however, authors did not report the smoker prevalence by sex or type (current, former, ever, never).

The largest sociodemographic difference in smoking prevalence in this study was observed between men and women with significantly higher estimates in men. These large differences by sex are similar to the 2006 STEPS study as well as in other studies conducted in Kuwait and other countries regionally and globally (Al-Mulla and Bener 2003; Al-Zalabani and Kasim 2015; Behbehani et al. 2004; GBD 2015 Tobacco Collaborators 2017; Hosseinpoor et al. 2011; Kasza et al. 2017; Memon et al. 2000). In a survey study conducted to assess tobacco use habits in people ≥ 40 years old in the Middle East and North Africa, authors reported higher overall ever-smoker prevalence in men (48.0%) compared with women (13.8%) (Khattab et al. 2012). The prevalence by sex at the country-level varied greatly. For instance, the prevalence in men ranged between 29.7% in Morocco to 61.0% in Turkey, whereas, in women, the prevalence ranged from 1.4% in Morocco to 47.3% in Lebanon (Khattab et al. 2012). In other countries, the prevalence of adult ever smoker and current smokers in China was 62.4% and 54.0% in men and 3.4% and 0.8% in women, respectively (Liu et al. 2017). Moreover, in the USA, the 2016 prevalence of current adult cigarette smokers in men was 17.5% compared with women (13.5%) (Jamal et al. 2018). In light of the much higher smoking prevalence among men in Kuwait, health promotion campaigns should take these results into account, targeting the Kuwaiti male population in particular.

Smoking prevalence also differed by age–sex group. The highest prevalence was in men age-groups 18–29 and 30–44 years, but the lowest in the 60–69 years. These age-related differences are similar to the 2006 WHO STEPS study. Moreover, the findings are in agreement with what was reported in Saudi Arabia (Moradi-Lakeh et al. 2015), as well as in the USA (Centers for Disease Control and Prevention 2011) and the UK (Office for National Statistics 2011). However, our findings were in contrast with Memon et al. (2000) study in Kuwait which reported smoking prevalence among government employees increased with older age.

The average age of smoking initiation was 17.9 years (17.2 years for men and 22.8 years for women) in this study. In comparison to the 2006 STEPS study, the average age of starting smoking for men and women was 18.1 and 23.1 years, respectively. In Memon et al. (2000), men and women reported smoking initiation (on average) at 18 and 21 years, respectively. In another study in Kuwait, 5% of 525 university students have begun smoking between the age of 7–12 years (Husain et al. 2016). In the GCC countries, the overall average age of smoking initiation was 19.1 years in Saudi Arabia (Moradi-Lakeh et al. 2015) and 21.3 years in Bahrain (Hamadeh et al. 1992) which are higher than that in Kuwait.

In China, the average age of smoking initiation in men and women was 20.3 and 26.9 years, respectively (Liu et al. 2017), whereas, in the European countries, the recent estimates of smoking initiation age for both men and women ranged between 15 and 18 years (Marcon et al. 2018). As a signatory to the Framework Convention on Tobacco Control (FCTC), Kuwait has implemented procedures to restrict access of cigarettes to minors. However, given that approximately half of the smokers reported initiation before age 18, more focus on tobacco use prevention in the teenage population, particularly male teens, is required. The Ministry of Health and Ministry of Education should prioritize tobacco use prevention programs in the schools.

Most participants smoked manufactured cigarettes with a daily average of 21.8 cigarettes for men and 13 for women, whereas the figures among men and men are quite similar for smoking shisha (2.1 to 1.9, respectively). These findings are similar to the 2006 STEPS study (men reported smoking on average 20 cigarettes and 3.3 shisha sessions per day and women reported 12.4 cigarettes and 1.9 shisha sessions per day). The gender gap in the quantity of cigarettes smoked daily has been observed in other studies in the GCC countries, other middle eastern countries, and worldwide (Baddoura and Wehbeh-Chidiac 2001; Jha et al. 2002; Khattab et al. 2012; Moradi-Lakeh et al. 2015; Van Minh et al. 2017). However, this gender gap is small when it comes to smoking shisha (a popular form of tobacco smoking in the Middle East including Kuwait) as shown in other studies (Maziak et al. 2004; Memon et al. 2000; Moradi-Lakeh et al. 2015). Furthermore, Mohammed et al. (2010b) revealed that 44.6% of adult Kuwaitis (n = 2972) smoked only water pipe, which is much higher than that in our estimates (i.e., 9.8% among smokers). Smoking multiple tobacco products was not common among current smokers in this study (i.e., < 8%), except for female current smokers where 15.2% smoked both manufactured cigarettes and shisha. Multiple tobacco use with different forms has been reported in several studies from the region and internationally with varying percentages (Lee et al. 2014; Mostafa et al. 2018; Soneji et al. 2016).

Other socioeconomic factors have been also recognized as predictors for smoking prevalence in many studies. However, the relationships between such factors and smoking prevalence differ based on the targeted study population, sample size, and data collection methodology. In this study, there was an inverse relationship between education and smoking prevalence based on the univariate analysis. Furthermore, there was no clear trend in the relationship between employment and smoking prevalence. A national-level study from Saudi Arabia reported no significant differences in smoking prevalence by education level (Moradi-Lakeh et al. 2015). Employment relationship with smoking prevalence was not significant according to Memon et al. (2000) study in Kuwait as well in other studies (Al-Badri et al. 2017; Bang

and Kim 2001; Sheridan et al. 2018). Single and married participants had the highest smoking prevalence compared with other marital status in this study. This finding is in agreement with those from the UAE, Saudi Arabia, Iraq, and Thailand (Al-Badri et al. 2017; Al-Houqani et al. 2018; Jitnarin et al. 2008; Moradi-Lakeh et al. 2015).

This study also assessed the association of smoking prevalence with NCD risk factors (BMI, hypertension, and diabetes). Non-obese participants had significantly higher smoking prevalence compared with the obese participants. This is in agreement with a study conducted in Saudi Arabia (Moradi-Lakeh et al. 2015) where participants with BMI < 25 had a smoking prevalence of 20.7% compared with 9.9% among those with BMI > 30. Furthermore, Plurphanswat and Rodu (2014) reported in a study conducted in the USA that current smokers tend to have lower BMI than those who never smoked. One potential explanation for this negative association is that tobacco use itself might be linked to weight loss, which is reversed with smoking cessation (Audrain-McGovern and Benowitz 2011). However, it is likely that other behavioral or cultural factors are present in this cross-sectional study, in which reverse causality also can be present.

In this study, diabetes and hypertension status were not associated with current smoking prevalence. These findings agree with a study from Saudi Arabia (Moradi-Lakeh et al. 2015). Similar observations were shown in a US-based national study where smoking prevalence was 25.7% among people with diabetes compared 24.1% among those without diabetes (Clair et al. 2013). However, in a study from Germany, current smoker prevalence was higher among people with diabetes compared with those without diabetes (38.0% compared with 17.3%, respectively) (Schipf et al. 2009). Hypertension was not recognized as a significant variable for smoking prevalence as reported in a study from the Czech Republic (Pankova et al. 2015). However, in an elderly population (> 60 years) in Malaysia, participants with known hypertension were less likely to smoke (Lim et al. 2016). In our study, there was no significant relationship between diabetes or hypertension and advice to stop smoking during the past 12 months. These findings are important, since it would be expected that people with hypertension or diabetes would receive intensive counseling to quit smoking, owing to the increased risk of cardiovascular disease (CVD). The Ministry of Health in Kuwait can use these data to inform CVD prevention programs among those at elevated risk for CVD, such as patients with diabetes or hypertension.

The prevalence of those smokers who tried to stop smoking was significantly and strongly associated (AOR = 3.7) with noticing warning labels on cigarette packages in the past 30 days, but not with other variables such as advice from health workers to quit smoking, tobacco advertisements, or signs. Other studies in different populations have shown that warning labels on cigarette packages had a positive impact on smoking cessation (Al-Lawati et al. 2017; Jradi and Saddik 2018; Shang et al. 2014). While these data suggest that the warning labels on cigarette packages may have influenced smokers to attempt cessation, it is also possible that those wanting to quit smoking would notice the warning labels more. The direction of causality cannot be determined in this cross-sectional study.

Approximately one-third of participants reported exposure to secondhand smoke at home and at work in closed areas. Exposure to secondhand smoke at home was higher in women compared with men, likely because most of the active smokers were men who likely smoke at home in the presence of other family members. Participants who were classified as self-employed had the lowest secondhand smoke at home. That is likely due to the fact that self-employed participants were among the highest percentages of smokers (i.e., active smokers and were excluded from the analysis). The exposure to secondhand smoke at work in a closed area was significantly higher in men than that in women. This probably due to the greater number of working men compared with women in Kuwait. According to a global study, the secondhand exposure to smoke in a closed environment was high in children (40%), women (35%), and men (33%) with variation between regions ranged from ≤ 13% in Africa to ≥ 50% in western Pacific region or eastern Europe region (Öberg et al. 2011). In Kuwait, a study conducted on high-school students ($n = 746$) revealed that the prevalence of environmental tobacco smoke at home was 54%, which is higher than that in our estimate (38.6%) (Abdualrasool et al. 2018). Moreover, another study from Kuwait reported that 45.8% ($n = 3836$) of middle-school students and 51.6% ($n = 1936$) of high-school students were exposed to secondhand smoke at home (Ziyab et al. 2020). Authors stated that low socioeconomic status or low parental education were associated with high household secondhand smoke prevalence (Ziyab et al. 2014). Another study conducted on high-school students in Kuwait revealed that 41.9% ($n = 1479$ students) were exposed to household secondhand smoke (Esmaeil et al. 2020). In contrast to our study, authors reported that men were significantly more exposed than women; however, age as well as maternal and paternal education were not associated with household secondhand smoke (Esmaeil et al. 2020). Since signing the FCTC treaty, Kuwait has made progress in restricting secondhand tobacco smoke exposure by banning tobacco use in public places. There are currently no taxes on tobacco products in Kuwait. Yet, Kuwait has agreed with the Gulf Cooperation Council (GCC) to implement an excise tax to include tobacco products. The process of imposing taxes in the country needs legislations to be issued which is currently ongoing. Nonetheless, Kuwait imposes custom fees on imported tobacco products. Furthermore, according to Kuwait Environmental Protection Law No. 42/2014 and its amendments, articles 56 and 138, there are strict penalties on tobacco

use in public in Kuwait. Moreover, more strict penalties on tobacco use in public have been developed in article 17 of Kuwait Law No. 8/1969 due to the current COVID-19 pandemic. However, the implementation of all penalties should be improved in Kuwait. It is worth mentioning that the Ministry of Interior in Kuwait has established an Environmental Protection Police Unit to enforce penalties associated with tobacco use violations. Health education programs targeting families and communities could be developed to reduce passive smoking at home. Ultimately, the key to reducing secondhand smoke will be to reduce the prevalence of smoking overall, particularly among Kuwaiti men.

Study limitations

This study has three main limitations. Firstly, only Kuwait adult citizens were part of this study; therefore, the findings reflected only the tobacco use characteristics in Kuwait citizens who represent around 30% of the overall population in Kuwait. Secondly, the number of participants in the age group (60–69) was low (about 5% of the total) which might have misrepresented tobacco use characteristics in that age group. People of that age group were probably more reluctant to participate. Moreover, Kuwait population is considered "young" with the majority of citizens under 40 years old. Thirdly, questions on smokeless tobacco use were not part of this survey questionnaire; hence, this might have underestimated the overall tobacco smoking prevalence among the participants.

Conclusions

Nearly 50% of adult Kuwaiti males have smoked at some point in their life including nearly 40% who were current smokers at the time of this survey's data collection in 2014. There has not been a major change in the current smoking prevalence estimates in this study compared with the 2006 STEPS study conducted on the same population. Kuwait has a young population in which a high percentage of its young male individuals smoke. Secondhand smoke is prevalent, posing a serious health problem, particularly in young children, women, and the elderly. Aggressive sustainable public health actions are needed to reduce active and secondhand tobacco use prevalence in Kuwait.

Compliance with ethical standards

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