Tobacco Use Insights

ORIGINAL RESEARCH

Smoking Prevalence and the Association Between Smoking and Sociodemographic Factors Using the Korea National Health and Nutrition Examination Survey Data, 2008 to 2010

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Abstract: Using data from the Korea National Health and Nutrition Examination Survey collected from 2008 to 2010, smoking prevalence for Korean adults (n = 11,681) by gender and age group and the association between smoking and sociodemographic factors were evaluated.

Smoking prevalence was 42.3% for men and 5.6% for women. Young adult (YA) males, ie, 19 to 24 and 25 to 34 years old, were 2.45 (95% CI: 1.60, 3.73) and 5.05 (95% CI: 3.83, 6.66) times more likely to smoke compared to male adults aged 65 and above (31.6%) after controlling for sociodemographic factors. The association between smoking and marital status was different by gender.

In South Korea, the high smoking prevalence among young adults is a troubling pattern. The high smoking prevalence among widowed or divorced women is also concern.

Keywords: smoking prevalence, KNHANES, marital status, sociodemographic factor

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Introduction

Cigarette smoking is one of the most serious problems and preventable risk factors for adverse health outcomes and it is a major cause of morbidity and mortality.[1,2] According to the World Health Organization (WHO),[1] more than 30% of the adult male population smokes globally and the mortality rate for smokers will reach one in six people by 2030 if this trend continues. Among the WHO regions, the Western Pacific region, which covers East Asia and the Pacific, including Korea, Japan, and China, has the highest smoking rate, with smoking rates close to 50% or higher among men. A WHO[2] report indicated that the age-adjusted self-reported prevalence of cigarette smoking among adult women in Korea, once considered taboo, has risen in the last decade to nearly 5.6%.

In South Korea, the mortality rate for lung cancer due to smoking has been on the rise for both men and women.[3] According to Jee et al,[4] when male non-smokers were compared with male smokers, the risk of death from lung cancer among male smokers increased by 4.6 times (95% confidence interval (CI) = 4.0–5.3) after cancer of the larynx, which was increased by 6.5 times (RR = 6.5, 95% CI = 3.3–12.8). The mortality rate for lung cancer among female smokers increased by a factor of 2.5 (95% CI = 2.0–3.1), followed by cervical, pancreatic, liver, stomach, and breast cancer when compared to non-smokers.[4] Other studies based on the Korean population have reported that cigarette smoking is a major behavioral risk factor[5] and smoking frequency is associated with blood lead/cadmium levels.[6]

Furthermore, several recent population-based studies reported that smoking prevalence is higher among those who have low sociodemographic status (SDS).[7–9] A study that used data obtained from 22 European countries also reported that education level-related inequalities in smoking are larger among men.[10] In addition, it has been reported that marital status could affect the health of men and women differently,[11] however, little information is available regarding the associations between gender, marital status, and smoking in the Korean population.

The information of smoking prevalence is essential for documenting the extent of the tobacco epidemic and evaluating the progress of tobacco control programs aiming to protect people's health.[12–15] Using multiyear national population-based data from the Korea National Health and Nutrition Examination Survey (KNHANES), this study examined smoking prevalence among Korean adults and the association between smoking and SDS factors according to gender and age.

Methods

Data source

The data corresponding to the fourth and fifth KNHANES sessions were used for analysis. The KNHANES IV and V data (2008–2010) comprised of nationally representative samples and were extracted from standard survey households using a systematic sampling method that was adjusted to the number of households while accounting for region, the administration district, and the type of residence (apartment or individual house) in South Korea. Trained interviewers visited the subjects in their homes and administered a standardized health examination and questionnaire. Biomonitoring of urine cotinine was first conducted in 2008 in the fourth survey and continued in 2009. The fifth survey (KNHANES V) was started in 2010, of which the first-year data (2010) are available. More details on the sampling methodology and the data of KNHANES IV and V are available from the Guidelines for Use of KNHANES IV and V Raw Data[16] and Final Reports of KNHANES IV and V Sampling Frames.[17] This study was approved by the Institutional Review Board of Human Research of Soonchunhyang University.

Study population

In this study, data from KNHANES respondents aged 19 and above who participated in the study from 2008 to 2010 and who provided cotinine concentration data (n = 12,249) were included. Individuals who were using nicotine patches (n = 480), undergoing nicotine replacement therapy (n = 19), or both (n = 9), and those with renal diseases (serum creatinine ≥ 1.5 mg/dL, n = 52) were excluded from the study. No pregnant women (n = 60) were included. Then, those aged from 19 to 24 at the time of the interviews were placed in the same group, whereas the remaining participants were grouped by age into 10-year intervals, (ie, 19 to 24, 25 to 34, 34 to 45, 45 to 54, 55 to 64, and 65 and above). Those with ages from 19 to 24 were separated from people in their late twenties because the former

largely consisted of college or university students. A smoker was defined as a person who reported himself/herself as a smoker and who had smoked 100 or more cigarettes at the time of the interview. Everyone else was classified as a non-smoker.

Statistical analysis

This study was conducted with a cross-sectional study design. A pooled survey weight for the data sets from 2008, 2009, and 2010 was applied to increase statistical power and account for the complex sampling design. Data was analyzed using SAS survey procedures. Smoking prevalence was calculated for men and women in the various age groups, education level (elementary, middle, high, college or higher), household income (1st and 2nd quartiles versus 3rd and 4th quartiles) and marital status (married, unmarried, widowed, or divorced). Married people are comprised by those who were married and lived together at the time of interview.

The means and standard errors (SE) were calculated for continuous variables and the means for smokers and non-smokers were compared. Rao-Scott Chi square tests were used to compare smoking prevalence between the various categorical variables. Crude odds ratios (ORs) and 95% confidence intervals (CI) were used to estimate the association between smoking and sociodemographic factors. Adjusted ORs and 95% CIs for the associations were obtained for each sex and then broken down by the young adult (YA, 19 to 34 years), old adult (OA, 65 or older years) and middle aged adult (MA, 35 to 64 years) groups of the each sex.

Three different models were run. First, univariate models were used to estimate the association between being a smoker and each of the SDS factors mentioned above after stratifying the data by sex. These models provided crude ORs and 95% CI. The second model included the same SDS factors stated above but evaluated the association according to sex using multivariate models. Thus, adjusted ORs were obtained. The final model was conducted after stratifying the data by sex and age groups using multivariate models. For those three models, to make them more meaningful and relevant, this study used a centered version (median value adjusted) for age and BMI so that estimation of $\beta 0$, intercept, is based on independent variables that are at their median values rather than zero.

To evaluate model sensitivity, separated multivariate models according to sex and age for each individual year were conducted. Statistical analyses were conducted using SAS version 9.2.

Results

Analysis was conducted using data obtained from 11,629 adult participants (9,082 non-smokers and 2,547 smokers) aged 19 and above. The self-reported demographic characteristics of the 11,629 participants are summarized in Table 1. For each sex, the mean (SE) ages (41.2 (0.4) years for men, 41.9 (1.3) years for women) of smokers were approximately four to five years younger than that of non-smokers. The mean (SE) of body mass index (BMI) of non-smokers was 24.1 (0.07) for men and 23.3 (0.06) for women, and 23.9 (0.08) for male smokers and 22.7 (0.2) for female smokers. Among smokers, the mean (SE) number of cigarettes smoked daily was 16.1 (0.2) for the men and 9.0 (0.4) for the women. Among male smokers, 21.8% had unmarried, 4.4% were widowed, 1.8% were divorced, and 71.8% were married. Among female smokers, 23.1% had unmarried, 10.7% were widowed, and 19.8% were divorced. The proportions were different between smokers and non-smokers for both men and women ($P < 0.001$) (Table 1). The predominant education levels completed for female smokers were high school (45.5%) followed by elementary school (31.4%), whereas the education levels completed for male smokers were high school (40.3%) followed by college or university (30.7%). Education levels were different between male and female smokers and non-smokers ($P = 0.015$ for men, $P < 0.001$ for women). More than half (57.1%) of the female smokers' household income were in the 1st and 2nd quartiles whereas 55.9% of the male smokers had household incomes in the 3rd and 4th quartiles. Household income levels differed between smokers and non- smokers of each sex as well ($P = 0.011$ for men, $P < 0.001$ for women). The smoking prevalence obtained in the overall sample was 42.3% for men and 5.6% for women. (Table 1).

Table 2 shows smoking prevalence and crude and adjusted associations between smoking and sociodemographic factors after stratification of data by sex. The smoking prevalence of men aged 25 to 34 years (55.7%), men aged 35 to 44 years (49.8%), women aged 19 to 24 years (11.3%), and women

Table 1. Demographic characteristics of the KNHANES 2008–2010 study population according to the self-reported smoking status and classified as overall or by sex.

	All			Male			Female		
	Nonsmokers	**Smokers**		**Nonsmokers**	**Smokers**		**Nonsmokers**	**Smokers**	
Number of subjects (%)									
2008–2010	9082 (78.1)	2547 (21.9)		2984 (57.7)	2184 (42.3)		6098 (94.4)	363 (5.6)	
2008	4206 (78.6)	1144 (21.4)		1301 (57.6)	959 (42.4)		2905 (94.1)	185 (5.1)	
2009	3534 (78.3)	980 (21.7)		1203 (58.7)	844 (41.2)		2331 (94.5)	136 (5.5)	
2010	1342 (76.0)	423 (24.0)		480 (55.8)	381 (44.2)		862 (95.4)	42 (4.6)	
Age (years)									
Mean (SE)	45.9 (0.3)	41.3 (0.4)	<0.001‡	44.8 (0.4)	41.2 (0.4)	<0.001‡	46.5 (0.3)	41.9 (1.3)	<0.001
BMI (kg/m^2)									
Mean (SE)	23.6 (0.05)	23.7 (0.08)	0.0526	24.1 (0.07)	23.9 (0.08)	0.123	23.3 (0.06)	22.7 (0.2)	0.004‡
No. of cigarettes/day									
Mean (SE)	–	15.2 (0.2)		–	16.1 (0.2)		–	9.0 (0.4)	
0~5 (%)		14.7			10.8			37.7	
6~15		42.1			40.9			49.3	
16~25		34.5			38.6			10.5	
26~35		5.3			6.0			1.1	
36~45		2.9			3.2			1.4	
46 or more		0.5			0.5			0.0	
Marital status (%) #									
Married	71.5	68.1	<0.001*	78.1	71.8	<0.001*	68.2	45.7	<0.001*
Single	13.1	22.0		16.8	21.8		11.3	23.1	
Widowed	4.1	5.3		2.6	4.4		4.8	10.7	
Divorced	11.0	4.4		2.0	1.8		15.4	19.8	
Education level (%)									
Elementary	29.9	18.7	<0.001*	19.2	16.6	0.015*	35.2	31.4	<0.001*
Middle school	11.1	11.9		12.2	12.4		10.5	8.8	
High school	33.2	41.1		35.8	40.3		32.0	45.5	
College or higher	25.8	28.3		32.8	30.7		22.3	14.3	
Household income (%)			0.359			0.011*			<0.001*
1st and 2nd quartile (low)	45.7	46.0		41.9	44.1		47.6	57.1	
3rd and 4th quartile (high)	54.3	54.0		58.1	55.9		52.4	42.9	

Notes: Weighted data was used for the variables of age, BMI, the number of cigarette/day, marital status, education level, household income; ‡mean was different between smokers and nonsmokers; *distribution was statistically different between smokers and nonsmokers from Rao-Scott chi-square test. # Percents may not sum to 100% due to missing data.
Abbreviations: BMI, body mass index; SE, standard error.

Table 2. Smoking prevalence and crude and adjusted odds ratio (95% confidence interval) of current smoking among male and female adults by selected characteristics in South Korea, 2008–2010.

	Male					Female				
	No. of smokers (%)	Crude		Adjusted‡		No. of smokers (%)	Crude		Adjusted‡	
		OR	95% CI	OR	95% CI		OR	95% CI	OR	95% CI
Age										
19–24 years	646,549 (41.8)	1.55	1.15–2.12	2.45	1.60–3.73	139,488 (11.3)*	2.00	1.17–3.42	4.20	1.67–10.6
25–34	1,693,973 (55.7)*	2.73	2.20–3.38	5.05	3.83–6.66	239,687 (9.7)*	1.68	1.07–2.64	6.85	3.55–13.2
35–44	1,594,181 (49.8)*	2.15	1.74–2.64	3.61	2.84–4.59	149,736 (5.4)	0.89	0.56–1.43	3.24	1.77–5.91
45–54	1,274,381 (43.6)	1.67	1.34–2.08	2.35	1.85–2.97	138,296 (4.7)	0.78	0.48–1.26	1.75	1.02–3.00
55–64	608,150 (35.8)	1.21	0.98–1.50	1.39	1.11–1.74	53,783 (2.9)	0.46	0.27–0.79	0.79	0.47–1.34
65 or older (ref)	468,612 (31.6)	1.00				129,667 (6.0)	1.00			
Marital status										
Married (ref)	4,181,104 (43.6)	1.00				361,562 (4.1)	1.00			
Single	1,779,293 (48.7)	1.24	1.06–1.45	0.90	0.71–1.14	242,426 (11.2)	2.91	2.10–4.02	1.99	1.21–3.29
Widowed	248,352 (57.8)	1.79	1.24–2.58	1.55	1.07–2.25	87,347 (12.7)	3.36	2.18–5.18	3.12	2.06–5.02
Divorced	63,308 (36.5)	0.72	0.43–1.21	0.97	0.59–1.59	150,091 (8.9)	2.23	1.51–3.31	3.31	2.17–5.04
BMI (unit increase) (BMI-21)		0.98	0.96–1.00	0.98	0.96–0.99		0.95	0.91–0.98	0.97	0.93–1.01
Education level										
Elementary (ref)	771,837 (43.3)	1.00				224,397 (5.9)	1.00			
Middle school	696,842 (48.1)	1.21	0.95–1.54	0.99	0.77–1.28	78,024 (5.6)	0.95	0.57–1.58	0.84	0.51–1.40
High school	2,781,806 (47.4)	1.19	0.99–1.43	0.68	0.54–0.85	415,817 (8.4)	1.48	1.07–2.04	0.67	0.41–1.10
College or higher	2,023,548 (42.4)	0.97	0.80–1.17	0.48	0.38–0.61	132,421 (4.1)	0.68	0.46–1.02	0.23	0.13–0.41
Household income										
1st and 2nd quartile (low, ref)	2,676,795 (47.6)	1.00				478,844 (7.7)	1.00			
3rd and 4th quartile (high)	3,609,052 (43.6)	0.86	0.75–0.97	0.82	0.71–0.93	371,814 (5.2)	0.66	0.52–0.83	0.74	0.58–0.96

Notes: Weighted data was used with a pooled weight for a combined dataset for 2008, 2009, 2010 KNHANES data. *Smoking prevalence (%) differed significantly from the hypothesized values (42.3% for men, 5.6% for women) obtained from over all samples by sex and age group according to chi-square test at the significance level of 0.05; ‡adjusted for age group, marital status, BMI, education level, household income.
Abbreviations: OR, odds ratio; CI, confidence interval.

aged 25 to 34 years (9.7%) differ significantly from the smoking prevalence obtained in the overall sample. According to the results of crude analysis, men aged 25 to 34 (55.7%) and men aged 35 to 44 (49.8%) were 2.73 (95% CI: 2.20, 3.38) and 2.15 (95% CI: 1.74, 2.64) times more likely to smoke respectively than men aged 65 and above (31.6%; the reference age group). Men aged 19 to 24 and men aged 45 to 54 also showed significantly higher (1.55 for men aged 19 to 24, and 1.67 for men aged 45 to 54) smoking prevalence compared to that of men aged 65 and above. On the other hand, women aged 19 to 24 (11.3%) and women aged 25 to 34 (9.7%) were 2.00 (95% CI: 1.17, 3.42) and 1.68 times (95% CI: 1.07, 2.64) more likely to smoke respectively compared to women aged 65 and above. Women aged 55 to 64 had lower smoking prevalence compared to the reference group ($P < 0.05$). According to univariate analysis, smoking prevalence differed according to sociodemographic factors such as marital status, education level, and household income level.

Adjusted smoking prevalence was calculated from multivariate models while controlling for age group, marital status, BMI, education level, and household income level (Table 2). Men aged 25 to 34 and men aged 35 to 44 were 5.05 (95% CI: 3.83, 6.66) and 3.61 (95% CI: 2.84, 4.59) times more likely to be smokers respectively compared to men aged 65 and above, after controlling for other explanatory variables. Similarly, smoking prevalence for women aged 25 to 34 (9.7%) was 6.85 (95% CI: 3.55–13.2) times higher compared with smoking prevalence of women aged 65 and above (Table 2).

Further analysis revealed factors that are significantly associated with smoking for both male and female YA, MA, and OA (Table 3). An increase in age of male YA increases the likelihood of being a smoker by a factor of 1.11 (95% CI: 1.06, 1.15) whereas the likelihood was decreased in MA [0.96 (95% CI: 0.95, 0.97) for men; 0.94 (95% CI: 0.92, 0.97) for women] and OA [0.96 (95% CI: 0.92, 0.99) for men]. Age- and sex-adjusted models of this study showed that among male MA, widowed men were more (OR: 1.60, 95% CI: 1.10, 2.34) likely to smoke compared to married men. Similarly, among female MA, widowed [OR: 3.29 (95% CI: 2.02, 5.33)] and divorced women [OR: 2.78 (95% CI: 1.49, 5.10)] were more likely to be smokers compared to married women. Being a divorced woman in the OA group also increased one's chances of being a smoker [OR: 2.98 (95% CI: 1.44, 6.17)]. Among YA, smoking prevalence differed significantly between married and unmarried or widowed women, whereas no such difference was found for men. Age- and sex-adjusted models of this study demonstrated that unit increase of BMI values reduced the likelihood of being a current smoker by a factor of 0.96 (95% CI: 0.93, 0.98) for male MA and 0.86 (95% CI: 0.79, 0.94) for female OA. No statistically significant association between BMI level and smoking was found for YA. In male and female MA and male OA, a negative association was found between education level and smoking. Household income had an inverse association with smoking for both men and women in the MA group; compared to those with household income in the 1st and 2nd quartiles, those with incomes in the 3rd and 4th quartiles had 0.79 (95% CI: 0.66, 0.94) and 0.64 (95% CI: 0.44, 0.92) times lower smoking prevalence, respectively.

Discussion

This study examined smoking prevalence in a sample of KNHANES respondents for the years of 2008, 2009, and 2010 with a pooled weight for a combined dataset. This study found a substantial difference in smoking prevalence between Korean men (42.3%) and women (5.6%). Importantly, smoking prevalence was different depending on age group; high prevalence rates were observed in men aged 25 to 34 and 35 to 44 years and in women aged 19 to 24 and 25 to 34 years after adjustment for other variables, including marital status, BMI, education level, and household income.

According to Jee et al,[4] who sampled participants of the Korea national insurance program in 1992, 1993, 1994, and 1995, smoking prevalence for young Korean men was higher than smoking prevalence for old men. In this study, findings of smoking prevalence in Korean YA (aged 19 to 24 and 25 to 34 years), which are two to five times higher than that of OA (aged 65 years), are larger in terms of the difference between the groups but are consistent with the results of Jee et al's study. Since study design of this study differs from their study in terms of the population used and the variables included in the models, further comparison might not be appropriate. However, concern is warranted and smoking cessation programs should be promoted for

Table 3. Smoking prevalence and adjusted odds ratio (95% confidence interval) for male and female adults by age, 2008–2010.

	Adjusted (19–34 years)*			Adjusted (35–64 years)*			Adjusted (65 or older years)*		
	No. of smokers (%)	OR	(95% CI)	No. of smokers (%)	OR	(95% CI)	No. of smokers (%)	OR	(95% CI)
Male									
Age									
Unit increase (age-median)		1.11	1.06–1.15		0.96	0.95–0.97		0.96	0.92–0.99
Marital status									
Married (ref)	754,875 (58.8)	1.00		3,005,709 (43.2)	1.00		420,520 (31.3)	1.00	
Unmarried	1,553,789 (47.8)	1.02	0.73–1.42	225,505 (55.9)	1.18	0.80–1.77	NA	NA	NA
Widowed	23,924 (65.7)	1.15	0.30–4.47	209,815 (57.8)	1.60	1.10–2.34	14,712 (46.3)	1.69	0.39–7.39
Divorced	NA	NA	NA	31,705 (45.6)	1.16	0.55–2.45	31,603 (30.4)	0.99	0.51–1.92
BMI									
Unit increase (BMI-21)		1.01	0.97–1.04		0.96	0.93–0.98		0.96	0.89–1.03
Education									
Elementary (ref)	14,075 (100)	1.00		465,956 (46.7)	1.00		291,807 (38.0)	1.00	
Middle	63,469 (75.8)	1.18	0.09–15.3	556,349 (50.8)	1.14	0.83–1.56	77,024 (28.6)	0.62	0.36–1.07
High	1,361,418 (51.3)	0.48	0.05–4.71	1,349,541 (45.7)	0.76	0.57–1.01	70,848 (27.0)	0.58	0.35–0.96
College or higher	895243 (49.1)	0.29	0.03–2.84	1,101,093 (39.7)	0.58	0.43–0.77	27,212 (15.3)	0.28	0.15–0.54
House income									
1st and 2nd quartile (low, ref)	902,731 (53.5)	1.00		1,402,650 (50.0)	1.00		371,415 (33.0)	1.00	
3rd and 4th quartile (high)	1,437,791 (49.6)	0.86	0.65–1.10	2,074,063 (41.3)	0.79	0.66–0.94	97,198 (27.2)	1.03	0.64–1.64
Female									
Age									
Unit increase (age-median)		1.06	0.98–1.13		0.94	0.92–0.97		1.02	0.97–1.07
Marital status									
Married (ref)	120,979 (7.5)	1.00		220,449 (3.5)	1.00		20,133 (2.1)	1.00	
Unmarried	230,011 (11.4)	2.32	1.17–4.60	11,640 (8.4)	2.40	0.92–6.27	NA	NA	NA
Widowed	14,827 (25.0)	3.16	1.15–8.67	69,268 (12.1)	3.29	2.02–5.33	3,253 (6.2)	2.92	0.73–11.6
Divorced	NA	NA	NA	40,458 (7.8)	2.78	1.49–5.10	101,619 (8.7)	2.98	1.44–6.17
BMI									
Unit increase (BMI-21)		0.99	0.94–1.05		0.98	0.92–1.04		0.86	0.79–0.94
Education									
Elementary (ref)	7,155 (16.8)	1.00		95,361 (5.0)	1.00		121,881 (6.6)	1.00	
Middle	23,313 (45.3)	3.84	0.37–39.5	52,451 (4.3)	0.74	0.40–1.36	2,261 (1.7)	0.30	0.07–1.31
High	252,636 (13.9)	0.70	0.08–6.33	157,656 (5.2)	0.71	0.44–1.23	5,525 (4.4)	0.77	0.24–2.48
College or higher	96,073 (5.4)	0.24	0.03–1.68	36,348 (2.5)	0.33	0.16–0.70	NA	NA	NA

(*Continued*)

Table 3. (*Continued*)

	Adjusted (19–34 years)*			Adjusted (35–64 years)*			Adjusted (65 or older years)*		
	No. of smokers (%)	**OR**	**(95% CI)**	**No. of smokers (%)**	**OR**	**(95% CI)**	**No. of smokers (%)**	**OR**	**(95% CI)**
House income									
1st and 2nd quartile (low, ref)	184,844 (13.5)	1.00		197,467 (6.2)	1.00		96,534 (5.7)	1.00	
3rd and 4th quartile (high)	194,332 (8.3)	0.79	0.53–1.20	144,348 (3.3)	0.64	0.44–0.92	33,133 (7.0)	1.25	0.58–2.67

Notes: *Weighted data was used with a pooled weight for a combined dataset for 2008, 2009, 2010 KNHANES data. Adjusted for age group, marital status, BMI, education level, household income.
Abbreviations: OR, odds ratio; CI, confidence interval; NA, not applicable due to lack of information.

YA because of the larger prevalence of smokers in this group compared with older Koreans.

Present study also found that smoking prevalence differs according to marital status, especially for women. This finding is consistent with recent western study. Lindstrom reported that never-married subjects and divorced subjects showed a significantly higher prevalence of daily smoking than married and cohabitating respondents in her population-based study (n = 27,757) conducted in Sweden in 2010.[11] Social and cultural norms that have traditionally prevented women's smoking are changing in South Korea.[18] However, at the same time, being feminine is still very important in the relationship between husband and wife in Korean culture.[18] Therefore, the unmarried, widowed or divorced women may feel less stress from such restraints on smoking. Findings of present study underscore the significance of accounting for sex when investigating the relationship between marital status and smoking.

An association between smoking and body weight has been observed in previous studies. It has been reported that YA interested in trying to lose weight were 40% more likely to be a smoker.[19] However, according to Williamson et al[20] and Klesges et al,[21] among MA of U.S.A. weight gain was occurred among continuous quitters and point prevalent quitters. In this study, an inverse association was also observed between smoking and unit increase of BMI among male MA or female OA even after controlling for age and SDS factors. However, evaluating the impact of smoking cessation and weight change requires greater understanding of the behavioral and biological relationships between smoking and dietary habits. Therefore, further research on this topic among Koreans is necessary.

A strong inverse relationship was found between education level and smoking among MA and OA. Additionally, MA group with household incomes in the 3rd and 4th quartiles was less likely to be smokers compared to those with household incomes in the 1st and 2nd quartiles. These results are consistent with those of previous studies conducted in Thailand,[22] Estonia,[23] and Argentina.[24] Fleisher et al analyzed data from the 2005 National Survey of Risk Factors for Non-communicable Diseases in Argentina and reported that higher socioeconomic position (SEP) was associated with a lower smoking prevalence for men in all age groups.[24] Jitnarin et al surveyed a

nationally representative sample of 7,858 Thai adults from 2004 to 2005 and found that smokers had lower education levels and household incomes.[22]

However, in this study, for both male and female YA and OA, no significant association between smoking prevalence and household income were found. This implies that socioeconomic status (SES) may not affect smoking behavior as strongly for YA and OA compared to MA. In general, smoking prevalence is believed to be higher among disadvantaged groups.[25,26] As a result, the pricing of tobacco products is designed to discourage smoking for smokers of low SES because of the high cost of the habit. However, from studies conducted in certain developed countries,[27,28] it has also been reported that smoking prevalence is higher among individuals with higher SES. Thus, results of present study suggest that smoking cessation or intervention programs in South Korea should not be discriminated by smoker's SES.

Limitations of this study should be addressed. First, even though present study used multiyear data from KNHANES with a pooled weight, sample sizes for some categories were relatively small after stratification by sex and age. This is especially true for women due to their relatively lower prevalence of smoking compared to men. However, dataset of this study consisted of nationally representative samples extracted from a standard survey of households through a systematic sampling method that was adjusted for region, administration district, and type of residence (apartment or regular house). Therefore, the difference in sample size within a category or between categories is probably random. Second, 42 individuals had less than 100 cigarettes in their lifetime but were classified as smokers because they reported currently smoking at least one cigarette daily. Results from biomonitoring of urine cotinine verified their claims as smokers; the median (IQR) value of their cotinine levels was 655 ng/mL (241 to 1122 ng/mL), which was much higher than the median urine cotinine value (5.0 ng/mL) of nonsmokers. Most of the 42 individuals were YA or MA (n = 8 and 10 for men and women respectively in YA; n = 13 and 7 for men and women respectively in MA; n = 2 and 2 for men and women respectively in OA). Since this study had a large number of subjects in each age group, the effect of adding these 42 additional smokers into the various age groups would be minimal. Present study investigated the interaction between sex and sociodemographic factors after controlling for age in the model but no interaction was found. As reported in previous studies, exposure to multiple SES factors may reduce the chances of successful smoking cessation.[29,30] Therefore, future studies should examine the effects of exposure to multiple SES factors or behavior-related factors on smoking.

Despite these limitations, this study contributes to existing literature in several ways. First, this study provided sex and age adjusted smoking prevalence for Korean adults and demonstrated high smoking prevalence in young adults. Second, results of this study suggest smoking cessation or intervention programs should not be discriminated by smoker's SES. Third, this study found that widowed or divorced female smokers might be underserved with regard to cessation-related advice and education and may lack adequate access to smoking cessation products and services. Thus, intervention strategies for smoking cessation among widowed or divorced female smokers on the part of policy makers may be needed to protect their health; such programs would benefit from the inclusion of a motivational enhancement component.

Conclusion

In South Korea, high smoking prevalence among young adults is a troubling pattern. The high smoking prevalence among widowed or divorced women is also of concern. This study provided information on smoking prevalence in terms of gender and age that is important for the planning of smoking cessation and prevention programs in South Korea.

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Author Contributions

Conceived and designed the experiments: SK. Analysed the data: SK. Wrote the first draft of the manuscript: SK. Contributed to the writing of the manuscript: SK. Agree with manuscript results and conclusions: SK. Jointly developed the structure and arguments for the paper: SK. Made critical revisions and approved final version: SK. All authors reviewed and approved of the final manuscript.

Competing Interests

Author(s) disclose no potential conflicts of interest.

Disclosure and Ethics

As a requirement of publication author(s) have provided to the publisher signed confirmation of compliance with legal and ethical obligations including but not limited to the following: authorship and contributorship, conflicts of interest, privacy and confidentiality and (where applicable) protection of human and animal research subjects. The authors have read and confirmed their agreement with the ICMJE authorship and conflict of interest criteria. The authors have also confirmed that this article is unique and not under consideration or published in any other publication, and that they have permission from rights holders to reproduce any copyrighted material. Any disclosures are made in this section. The external blind peer reviewers report no conflicts of interest.

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