



Smoking Cessation and Mental Health According to Use of E-cigarettes and Heated Tobacco Products by Korean Adults

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Abstract

The health burden due to smoking, including mental health, is well documented. Previous studies reported the beneficial effect of smoking cessation on mental health. This study investigates depression and the effect of smoking cessation according to use of e-cigarettes or heated tobacco products among Korean adults. Data were obtained from the Korea Community Health Study (2019). Use of cigarettes, e-cigarettes, and heated tobacco products was assessed, and former cigarette smokers were categorized according to use of e-cigarettes and heated tobacco products. Depression, as defined by depressed mood or depressive symptoms, was assessed with the Patients Health Questionnaire-9 (PHQ-9). Study participants consisted of lifetime smokers of cigarettes (36.9%), e-cigarettes (6.0%), and heated tobacco products (7.6%). Among former smokers, complete smoking cessation was associated with decreased prevalence of depression. However, former cigarette smokers who had ever used e-cigarettes were more likely to experience a depressed mood (aOR = 1.36, 95% CI = 1.10–1.68) and depressive symptoms (aOR = 1.90, 95% CI = 1.47–2.46), compared to former smokers who had not used them. Former cigarette smokers who had ever used heated tobacco products were more likely to experience depressed mood, compared to former smokers who had not used them. Similarly, current use of e-cigarettes and current use of heated tobacco products by former smokers were both associated with higher prevalence of depressed mood and depressive symptoms. Smoking cessation altogether was associated with decreased depression in Korean adults. However, the use of e-cigarettes or heated tobacco products at any time may reduce the beneficial effect of smoking cessation.

Keywords Cigarette smoking · Electronic nicotine delivery systems · Health surveys · Smoking · Smoking cessation

The burden of smoking on health is well recognized and includes life expectancy reduction, cardiovascular disease, and mental health problems (Allender et al., 2009; Nguyen

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et al., 2019; Oh et al., 2012). Therefore, smoking cessation has been an important goal. Previous studies reported that smoking cessation is associated with decreased risks of cancer (Bosetti et al., 2006a, b) and death (Critchley & Capewell, 2003) and with improved mental health (Mino et al., 2000; Taylor et al., 2014).

In a systematic review, the prevalence of depression among those who had stopped smoking was 18% (95% CI=14–22%), and the odds ratio was significantly lower than in current smokers (Amiri, 2020). A systematic review of longitudinal studies indicates that smoking cessation is associated with reduced depression, anxiety, and stress and with improved positive moods and quality of life compared to current smokers (Taylor et al., 2014).

However, if other types of tobacco products were used instead of cigarettes, the benefit of smoking cessation might be altered. A study using the Canadian Community Health Survey data that addressed smoking cessation and mental health reported that the risk of depressive symptoms was significantly higher in former smokers who used e-cigarettes, compared to former smokers who did not (Dahal et al., 2020). Dual use of cigarettes and e-cigarettes is known to have higher health risks compared to the use of cigarettes only (Kim et al., 2020a; Wang et al., 2018). Dual use of cigarettes and e-cigarettes was associated with increased risk of poor mental health (Leventhal et al., 2016), depression (Okunna, 2020), and suicidality (Lee & Lee, 2019). These findings might imply that the negative effects of using dual or multiple types of tobacco products might continue after cigarette smoking ceased or smoking changed to other types of tobacco products.

The use of e-cigarettes has significantly increased in many countries. Among US adults, 12.8% and 3.7% reported ever using or currently using e-cigarettes, respectively, according to data from the 2014 National Health Interview Survey (Wilson & Wang, 2017). Overall, 8.5% of Canadians aged 15 and older reported having ever tried an e-cigarette, and 1.8% had used one in the past 30 days, according to data from the nationally representative 2013 Canadian Tobacco, Alcohol and Drugs Survey (Reid et al., 2015).

In Korea, current cigarette smoking rates have decreased continuously, from 30.2 in 2001 to 22.4% in 2018. However, newly introduced types of tobacco products, such as e-cigarettes and heated tobacco products, have been adopted rapidly in Korea. The respective prevalences of e-cigarette use at any time or currently were 7.0% and 1.1% in 2013 and 11.2% and 4.3% in 2018, according to data from the Korean National Health and Nutrition Examination Survey of 2018 (Ministry of Health & Welfare, 2019).

The purpose of the present study was to investigate the association between smoking cessation and depression in Korean adults. In addition, the status of using e-cigarettes and heated tobacco products, and their effects on depression after smoking cessation, was investigated.

Methods

Data Source and Study Participants

This study used data from the Korea Community Health Survey (KCHS), organized by the Korea Centers for Disease Prevention and Control (KCDC) since 2008. KCHS is an annual cross-sectional survey drawn from 255 communities in Korea. Sample areas were selected using stratified systematic sampling methods, and sample households were selected using a systematic sampling method. Trained interviewers visited each household surveyed, and

an average of 900 adults (age 19 years or above) were surveyed per community by computer-assisted personal interview. The protocol of KCHS was approved by the Institutional Review Board of KCDC (2016-10-01-P-A). The details of KCHS have been described elsewhere (Kang et al., 2015). In total, 229,099 adults participated in the 2019 KCHS. After exclusion of people for whom depression data were missing, 229,045 adults were analyzed.

Measures

Smoking Behavior

Cigarette smoking status was classified as never, former, or current use of cigarettes. Current smokers were defined as those who had smoked more than 100 cigarettes during their lifetime and currently smoked either every day or some days. Former smokers were defined as those who had smoked more than 100 cigarettes during their lifetime and currently did not smoke. Users of e-cigarettes were defined as adults who had used e-cigarettes containing nicotine, and were categorized as having used them ever (during their lifetime) or currently (during the past month). Users of heated tobacco products were defined as adults who had ever smoked heated tobacco products and were categorized as having used them ever (during their lifetime) or currently, which included their use every day or some days. The numbers and types of tobacco products used ever or currently were categorized as none of, all of, or each possible combination of cigarettes, e-cigarettes, and heated tobacco products.

Depression

Depression was assessed as a depressed mood or occurrence of depressive symptoms. Experience of a depressed mood was defined as a “yes” response to the question “Have you ever felt sadness or despair affecting your ordinary life, for 2 consecutive weeks or more during the past year?”. Depressive symptoms were assessed using Patient Health Questionnaire-9 (PHQ-9). PHQ-9 asked “Have you suffered from the following symptoms during the past 2 weeks?”, for which the 9 symptoms included “having little interest or pleasure in doing things”; “feeling down, depressed, or hopeless”; and “trouble falling or staying asleep or sleeping too much.” Each item response was scored as “not at all (=0),” “several days a week (=1),” “more than several days a week (=2),” and “almost every day (=3).” The total score could range from 0 to 27, with scores of 10 or more defined as having depressive symptoms.

General Characteristics

General characteristics of study participants included sex (men, women), age (19–44, 45–64, 65 or over), educational level (middle school or lower, high school, college or higher), frequency of alcohol consumption in the past year (≤ 1 or ≥ 2 drinks/week), chronic disease (history of hypertension or diabetes mellitus diagnosed by physician), and monthly household income, for which the categories were < 1 , 1 to < 3 , 3 to < 5 , and ≥ 5 million Korean won (approximately 5,000 US dollars).

Statistical Analysis

All analyses were performed using SAS version 9.4 (SAS Institute Inc., Cary, NC, USA). The SAS survey procedures used reflected complex survey design. Descriptive analyses were used for the general characteristics of the study population and the proportion of depression. Smoking status of the study population was presented as proportion with 95% confidence interval (CI). Sex- and age-adjusted proportions with 95% CI for experience of depressed mood and for depressive symptoms, based on smoking status, were calculated using the PROC SURVEYREG procedure. Multiple logistic regression analyses were performed to calculate adjusted odds ratios (aOR) and CIs for depression according to each smoking status using the PROC SURVEYLOGISTIC procedure. The Akaike Information Criterion (AIC), Schwarz Criterion (SC), and -2 Log likelihood (-2 log L) were used to check model fit.

Results

Among the total population surveyed, 6.2% had experienced depressed mood for 2 consecutive weeks or more during the past year, and 3.2% had depressive symptoms as assessed by PHQ-9. The proportion having a depressed mood was higher in women, older persons, those with low household income, those with lower education level, non-drinkers of alcohol, and those with chronic disease. The figures were similar for the proportions having depressive symptoms (Table 1).

The lifetime smoking rates were 36.9% for use of cigarettes, 6.0% for e-cigarettes, and 7.6% for heated tobacco products. The rates of current smoking were 18.6% for cigarettes, 2.3% for e-cigarettes, and 3.2% for heated tobacco products. A single type of tobacco product was used by 28% of the population in their lifetime, 5.3% used two types, and 3.9% had used all three in their lifetime. For current use, 16.4% used one type of tobacco product, 2.9% used two types, and 0.6% used all three. The most common type of tobacco product used was conventional cigarettes (27.8%), followed by use of both cigarettes and heated tobacco products (3.4%), or use of all three (3.9%). For current use, 15.2% used conventional cigarettes only, and 1.7% used both cigarettes and heated tobacco products (Table 2).

According to smoking status, the prevalence of depressed mood in former smokers (7.2%) was higher than in those who had never smoked (5.2%) but lower than in current smokers (9.0%). However, when former smokers were subdivided according to their e-cigarette use, the aOR for depressed mood was significantly higher in former smokers who had ever used e-cigarettes (aOR = 1.36, 95% CI = 1.10–1.68) or who currently used e-cigarettes (aOR = 1.38, 95% CI = 0.96–1.99). Also, the aOR for depressed mood was significantly higher in former smokers who had ever used heated tobacco products (aOR = 1.42, 95% CI = 1.17–1.71) or who currently used heated tobacco products (aOR = 1.42, 95% CI = 1.07–1.87) (Table 3).

Similar figures were found for depressive symptoms identified using the PHQ-9. The prevalence of depressive symptoms in former smokers (3.8%) was higher than in those who had never smoked (2.5%) but lower than in current smokers (5.3%). The aOR for depressive symptoms was significantly higher in former smokers who had ever used e-cigarettes (aOR = 1.90, 95% CI = 1.47–2.46) or who currently used e-cigarettes (aOR = 1.76, 95% CI = 1.12–2.75). Additionally, aOR for depressed mood was significantly higher in former

Table 1 General characteristics and depression in Korean adults

Characteristics	Total (<i>N</i> = 229,045) ^a	Experience of depressed mood ^b	Depressive symptoms (PHQ-9) ^b
Total		6.2 (6.1–6.4)	3.2 (3.1–3.3)
Sex			
Men	102,551 (49.6)	4.5 (4.4–4.7)	2.2 (2.1–2.4)
Women	126,494 (50.4)	7.9 (7.7–8.1)	4.2 (4.1–4.4)
Age (years)			
19–44	66,286 (42.5)	5.8 (5.6–6.0)	3.2 (3.1–3.4)
45–64	88,257 (38.4)	6.1 (5.9–6.3)	2.4 (2.3–2.5)
65 +	74,502 (19.1)	7.6 (7.3–7.9)	5.0 (4.7–5.2)
Household income (10,000 won/month)			
< 100	35,019 (8.0)	13.0 (12.4–13.6)	9.0 (8.5–9.4)
100–< 300	70,093 (24.6)	7.8 (7.6–8.1)	4.1 (3.9–4.3)
300–< 500	57,740 (28.8)	5.3 (5.1–5.6)	2.6 (2.5–2.8)
≥ 500	64,428 (38.5)	4.5 (4.3–4.7)	1.9 (1.8–2.1)
Education level			
≤ Middle school	83,359 (20.9)	9.0 (8.7–9.3)	5.4 (5.2–5.7)
High school	75,404 (37.1)	6.2 (6.0–6.5)	3.1 (3.0–3.3)
≥ College	70,058 (42.1)	4.9 (4.7–5.1)	2.3 (2.1–2.4)
Alcohol drinking frequency			
None	82,721 (27.3)	7.4 (7.2–7.7)	4.5 (4.3–4.7)
≤ 1/week	55,152 (26.7)	6.5 (6.2–6.8)	3.0 (2.8–3.2)
≥ 2/week	91,142 (46.0)	5.4 (5.2–5.6)	2.6 (2.5–2.8)
Chronic disease			
No	153,459 (75.7)	5.8 (5.6–5.9)	2.9 (2.7–3.0)
Yes	75,586 (24.3)	7.8 (7.5–8.1)	4.4 (4.2–4.6)

^aCrude number (weighted %); ^bWeighted % (95% confidence interval)

smokers who had ever used heated tobacco products (aOR = 1.67, 95% CI = 1.30–2.14) or who currently used heated tobacco products (aOR = 1.56, 95% CI = 1.04–2.32). For each model, the AIC, SC, -2 Log L of the intercept and covariate values were lower than the intercept only (Table 3).

Discussion

This study investigated the use of cigarettes, e-cigarettes, and heated tobacco products and the association between smoking cessation and depression according to the use of e-cigarettes or heated tobacco products. Respectively, 6.0% and 7.6% of adults had ever used e-cigarettes or heated tobacco products. Depressed moods or depressive symptoms were reported in 6.2% and 3.2% of the population, respectively. Former smokers showed decreased prevalence of depression compared to current smokers. However, former smokers who used e-cigarettes and heated tobacco products had higher prevalence of depression

Table 2 Smoking behavior among Korean adults

	N = 229,045	% (95% CI) ^a
Lifetime smoking experience		
Cigarettes	80,550	36.9 (36.7–37.1)
E-cigarettes	8,793	6.0 (5.8–6.1)
Heated tobacco products	11,540	7.6 (7.5–7.8)
Current smoking		
Cigarettes	37,257	18.6 (18.4–18.8)
E-cigarettes	3,231	2.3 (2.2–2.4)
Heated tobacco products	4,591	3.2 (3.1–3.3)
Number of ever tobacco products use		
None	147,775	62.7 (62.4–62.9)
One	66,877	28.1 (27.9–28.3)
Two	8,628	5.3 (5.2–5.5)
All of them	5,568	3.9 (3.8–4.0)
Number of current tobacco products use		
None	189,713	80.1 (79.8–80.3)
One	34,045	16.4 (16.2–16.6)
Two	4,232	2.9 (2.8–3.0)
All of them	848	0.6 (0.6–0.7)
Types of ever tobacco products use		
Never	147,775	62.7 (62.4–62.9)
Cigarettes only	66,514	27.8 (27.6–28)
E-cigarettes only	133	0.1 (0.1–0.1)
Heated tobacco products only	230	0.2 (0.1–0.2)
Cigarettes and e-cigarettes	2,895	1.8 (1.7–1.9)
Cigarettes and heated tobacco products	5,538	3.4 (3.3–3.5)
E-cigarettes and heated tobacco products	195	0.2 (0.1–0.2)
All of them	5,568	3.9 (3.8–4.0)
Types of current tobacco products use		
Never	189,713	80.1 (79.8–80.3)
Cigarettes only	32,435	15.2 (15–15.4)
E-cigarettes only	575	0.4 (0.4–0.5)
Heated tobacco products only	1,035	0.7 (0.7–0.7)
Cigarettes and e-cigarettes	1,528	1.1 (1.0–1.1)
Cigarettes and heated tobacco products	2,427	1.7 (1.6–1.8)
E-cigarettes and heated tobacco products	277	0.2 (0.2–0.2)
All of them	848	0.6 (0.6–0.7)

Data were expressed as weighted % (95% confidence interval)

than former smokers who did not use them and similar to the prevalence observed in current smokers.

Previous studies have focused on beneficial effects of smoking cessation on mental health, as well as on physical health (Amiri, 2020; Taylor et al., 2014). Consistent with previous studies, the present study found positive effects of smoking cessation wherein

Table 3 Smoking status and depression in Korean adults

Smoking status	Total ^a	Experience of depressed mood		Depressive symptoms (PHQ-9)	
		% (95% CI) ^b	aOR (95% CI) ^c	% (95% CI) ^b	aOR (95% CI) ^c
Cigarettes use					
Never	148,483 (63.1)	5.2 (5.0–5.4)	1.00	2.5 (2.3–2.6)	1.00
Former	43,293 (18.3)	7.2 (6.8–7.6)	1.52 (1.39–1.66)	3.8 (3.5–4.1)	1.65 (1.47–1.86)
Current	37,257 (18.6)	9.0 (8.6–9.4)	1.91 (1.75–2.08)	5.3 (5.0–5.6)	2.40 (2.15–2.67)
E-cigarettes use					
Never	220,083 (94.0)	6.0 (5.8–6.1)	1.00	3.0 (2.9–3.1)	1.00
Former	5561 (3.6)	10.4 (9.4–11.3)	2.02 (1.79–2.28)	5.8 (5.1–6.5)	2.24 (1.91–2.63)
Current	3231 (2.3)	11.0 (9.8–12.1)	2.20 (1.90–2.54)	7.5 (6.5–8.5)	3.14 (2.65–3.73)
Heated tobacco products					
Never	217,373 (92.4)	6.0 (5.8–6.1)	1.00	3.1 (2.9–3.2)	1.00
Former	6940 (4.4)	9.9 (9.1–10.8)	1.93 (1.72–2.17)	5.6 (5.0–6.3)	2.17 (1.87–2.52)
Current	4591 (3.2)	9.1 (8.2–10.1)	1.77 (1.54–2.04)	5.2 (4.5–6.0)	2.12 (1.77–2.54)
Cigarettes use					
Never	148,483 (63.1)	5.2 (5.0–5.4)	0.68 (0.62–0.74)	2.5 (2.3–2.6)	0.65 (0.58–0.73)
Former, ever e-cigarettes non-use	41,215 (16.9)	7.0 (6.6–7.4)	1.00	3.6 (3.3–3.9)	1.00
Former, ever e-cigarettes user	2060 (1.4)	9.0 (7.7–10.4)	1.36 (1.10–1.68)	5.8 (4.7–7.0)	1.90 (1.47–2.46)
Current	37,257 (18.6)	9.0 (8.6–9.4)	1.30 (1.19–1.41)	5.3 (5.0–5.6)	1.56 (1.39–1.74)
Cigarettes use					
Never	148,483 (63.1)	5.2 (5.0–5.4)	0.69 (0.63–0.75)	2.5 (2.3–2.6)	0.65 (0.57–0.73)
Former, ever heated tobacco products non-use	40,633 (16.5)	7.0 (6.6–7.4)	1.00	3.6 (3.4–3.9)	1.00
Former, ever heated tobacco products use	2647 (1.8)	9.1 (7.9–10.3)	1.42 (1.17–1.71)	5.1 (4.2–6.0)	1.67 (1.30–2.14)
Current	37,257 (18.6)	9.0 (8.6–9.4)	1.31 (1.21–1.42)	5.3 (5.0–5.6)	1.55 (1.38–1.73)
Cigarettes use					
Never	148,483 (63.1)	5.2 (5.0–5.4)	0.67 (0.61–0.73)	2.5 (2.3–2.6)	0.62 (0.55–0.70)
Former, current e-cigarettes non-use	42,555 (17.8)	7.1 (6.8–7.5)	1.00	3.7 (3.5–4.0)	1.00

Table 3 (continued)

Smoking status	Total ^a	Experience of depressed mood		Depressive symptoms (PHQ-9)	
		% (95% CI) ^b	aOR (95% CI) ^c	% (95% CI) ^b	aOR (95% CI) ^c
Former, current e-cigarettes use	720 (0.5)	8.9 (6.8–11)	1.38 (0.96–1.99)	5.4 (3.7–7.1)	1.76 (1.12–2.75)
Current	37,257 (18.6)	9.0 (8.6–9.4)	1.27 (1.17–1.38)	5.3 (5.0–5.6)	1.48 (1.33–1.66)
Cigarettes use					
Never	148,483 (63.1)	5.2 (5.0–5.4)	0.67 (0.61–0.73)	2.5 (2.3–2.6)	0.62 (0.55–0.70)
Former, current heated tobacco products non-use	42,151 (17.5)	7.1 (6.7–7.5)	1.00	3.7 (3.5–4.0)	1.00
Former, current heated tobacco products use	1127 (0.8)	9.2 (7.5–11.0)	1.42 (1.07–1.87)	4.8 (3.6–6.1)	1.56 (1.04–2.32)
Current	37,257 (18.6)	9.0 (8.6–9.4)	1.28 (1.18–1.39)	5.3 (5.0–5.6)	1.48 (1.33–1.66)

^aCrude number (weighted %)^bSex- and age-adjusted weighed value^cAdjusted for sex, age, household income, education level, alcohol drinking, and chronic disease

OR odds ratio, CI confidence interval

the prevalence of depression was significantly lower in former smokers than in current smokers. However, former cigarette smokers who used e-cigarettes or heated tobacco products might not benefit from smoking cessation.

Nicotine exposure by smoking has been regarded as a major attributor of the negative effects of smoking on mental health (Quattrochi et al., 2000; Taylor et al., 2014). E-cigarettes and heated tobacco products, although the delivery method and concentration of nicotine and other chemicals have changed, could be exposed nicotine (Goniewicz et al., 2013) and could negatively affect on mental health.

Many people choose or switch to types of tobacco products other than conventional cigarettes for a variety of reasons, including as aids to stop smoking, cost, flavor, or especially health and safety concerns believing that e-cigarettes are less harmful and less addictive than cigarettes (Maglia et al., 2018; Pepper & Brewer, 2014). However, evidence supporting a benefit of e-cigarettes in smoking cessation was inconclusive (Malas et al., 2016), and use of heated tobacco products was not associated with smoking cessation (Luk et al., 2020) but was associated instead with relapse/initiation of conventional cigarettes (Matsuyama & Tabuchi, 2021). Regarding health effects, cardiopulmonary physiology studies in both humans and animals have consistently found similar negative health effects of e-cigarettes to those of cigarette smoking (Tsai et al., 2020). Evidence has come to light that e-cigarettes negatively affect cardiovascular health (Skotsimara et al., 2019). There is limited longitudinal or causal evidence for health effects upon switching from cigarette smoking to e-cigarettes (Goniewicz et al., 2020).

Of the total population, 9.2% have ever used or 3.5% currently use two or more types of tobacco products. Data from US national probability samples suggest that dual use of e-cigarettes and cigarettes was common among adult smokers, with a prevalence of 4.5% in 2017 and 3.7% in 2018 (Owusu et al., 2019). In 2018, among the 4.4% of Korean adults who used heated tobacco products, 90% used cigarettes and e-cigarettes simultaneously (Kim & Cho, 2020). In contrast with early impressions about new types of tobacco products being useful for smoking cessation or being less harmful than cigarettes, subsequent studies have reported that these products have harmful or inconclusive effects on health. In addition, use of dual or multiple types of tobacco products has been observed to produce more severe harmful effects on many aspects of health, including mortality (Choi et al., 2019) and mental health (Chido-Amajuoyi et al., 2021). Therefore, the health burden of tobacco should include new types of tobacco products, such as heated tobacco products, and must take into consideration those smokers who use two or more types of tobacco products.

Other than the sole use of conventional cigarettes, the most common type of tobacco product used was the dual use of cigarettes and heated tobacco products (7.6% had ever used and 3.2% used currently). Heated tobacco products were introduced recently in Korea, but their use was rapidly adopted and has increased faster than e-cigarettes. This rapid expansion is also observed in other countries (Zhu et al., 2021). According to the Japan Society and New Tobacco Internet Survey, use of heated tobacco products in Japan increased from 0.2% in 2015 to 11.3% in 2019 among participants aged 15–69 years (Hori et al., 2020). People chose heated tobacco products because they believed them to be less smelly (Kim et al., 2020b) and less dangerous than cigarettes (Maria Lotrean et al., 2020). However, heated tobacco product users are more likely to simultaneously use other types of tobacco, and risk assessment studies for chemicals found in heated tobacco products (Dusautoir et al., 2021) and studies on short-term health effects (Franzen et al., 2020) suggest that heated tobacco products have negative health effects similar to cigarettes. Since evidence on important long-term health

outcomes is limited, public health education should include potential health effects of new types of tobacco products.

This study has limitations due to the nature of the KCHS. The data collected were self-reported, and social desirability bias could have influenced responses about smoking behavior. KCHS was a cross-sectional survey, and therefore this study could not reveal temporal relationships. Additionally, smokers who suffer from depression might seek cigarette substitutes to relieve their symptoms, even when this is not medically proven. The dose–response relationship between smoking and its health effects and the improvement of beneficial effects of smoking cessation over time are well documented. However, KCHS did not collect information about the duration of use of e-cigarettes or heated tobacco products, and therefore, this study could not investigate the dose–response relationships between use of e-cigarettes and heated tobacco products or the duration of their use and the risk of depression in smokers.

Because harmful effects of smoking are well known, authorities have recommended smoking cessation, and individuals have tried to stop. Smoking cessation brings many positive effects, including economic benefits in addition to physical and mental health improvement. This study found that former smokers have a significantly reduced prevalence of depression. However, former smokers who used e-cigarettes or heated tobacco products did not show this favorable result. Therefore, for its health benefits to be fully realized, smoking cessation has to include not only cigarettes but also e-cigarettes and heated tobacco products. Further studies are recommended to reveal longitudinal associations, including the duration of use of dual or multiple types of tobacco products.

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Declarations

Ethics Approval The Korea Community Health Survey was approved by the institutional review board of the Korea Centers for Disease Control and Prevention (2016-10-01-P-A).

Conflict of Interest The author declares no competing interests.

Informed Consent Informed consent was obtained from all participants.

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