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Predictors of long-term abstinence rate by income level in the Korean smoking cessation programme

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ABSTRACT

Background and Aims To assess whether predictors of success in stopping smoking vary as a function of income level in Korean smoking cessation services. **Design** Prospective study of predictors of smoking cessation up to 6 months' follow up. **Participants** A sample of 954 people (mean age 49.13 ± 10.69 years; 863 [90.5%] men) enrolled in the Korean National Health Insurance Service smoking cessation programme in 2015. **Measures** The outcome measure was self-reported continuous abstinence up to 6-month follow up. Predictors were income and other sociodemographic variables as well as smoking-related variables measured at baseline. **Results** The continuous 6-month abstinence rate was 30.5%. The adjusted odds of 6-month continuous abstinence were lower among low-income versus the middle- or high-income smokers (OR, 0.54; 95% CI, 0.35–0.84), those with severe versus light/moderate cigarette dependence (OR, 0.72; 95% CI, 0.52–0.98), and use of bupropion versus varenicline (OR, 0.60; 95% CI, 0.39–0.91). The association between cigarette dependence and outcome was only present among low-income smokers. **Conclusions** Lower income, higher cigarette dependence, and choice of bupropion versus varenicline are associated with lower chances of stopping smoking in Korean smoking cessation services, but the association with cigarette dependence is only found in low-income smokers.

Keywords Abstinence, cigarette dependence, income, policy, smoking cessation, taxation, tobacco.

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INTRODUCTION

Globally, smoking is a leading cause of morbidity and premature death [1–4], killing an estimated 7 million people each year [5]. Approximately 18.5% of adults smoke on a daily basis, but prevalence differs substantially across countries [6]. In Korea, smoking prevalence is estimated at around 17%, but there is a marked gender disparity, with prevalence much higher in men (31%) than women (3%) [6]. In 2012, smoking was estimated to result in 58 155 deaths in Korea, and among Korean adult males (aged ≥30 years), smoking-attributable mortality represented 34.7% of all deaths [7]. With people from more disadvantaged socioeconomic backgrounds more likely to smoke (worldwide, and in Korea specifically [8]), smoking is also an important contributor to health inequalities.

Smoking cessation can substantially reduce the risks of morbidity and premature mortality [9], but while many smokers want to quit, far fewer achieve long-term abstinence. For example, a report by the US Centers for Disease Control and Prevention indicated that while more than two-thirds (69%) of adult daily smokers were interested in quitting smoking and over half (52%) of daily smokers had attempted to quit smoking in the past year, just 6% remained abstinent a year later [10]. Disadvantaged smokers tend to be just as likely as more affluent smokers to want to quit but have lower rates of success [11–14]. Affordability of cessation support may be an important barrier to cessation.

In 2015, the Korean government implemented two strategies to reduce population smoking prevalence and promote quitting. First, in line with regulations recommended by the WHO Framework Convention on Tobacco Control [15], they raised the tobacco prices by 80% on January 1, 2015. In parallel, they initiated the National Health Insurance Service (NHIS) smoking

cessation programme (February 25, 2015), which subsidises doctor consultation fees and the purchase of smoking cessation medication. There is strong evidence that using behavioural support and pharmacotherapies such as varenicline, bupropion, and nicotine replacement therapy (NRT) to support a quit attempt increases the chances of success [16,17]. Subsidising smoking cessation services offers the potential to level the playing field for smokers of all socioeconomic backgrounds to access support to quit, but the extent to which the odds of successful cessation among users of the NHIS smoking cessation programme varies by sociodemographic and smoking-related characteristics has not been established. Several systematic reviews have identified motivational factors, cigarette dependence, and socioeconomic factors as predictors of quit success in adult general population samples in other countries [18–21]. The present study aimed to (1) evaluate predictors of 6-month continuous abstinence among participants of the Korean NHIS smoking cessation programme and (2) examine the extent to which predictors of successful cessation vary according to income level.

METHODS

Participants

A total of 230 800 people were enrolled in the Korean National Health Insurance Service (NHIS) smoking cessation programme in 2015. All smokers were eligible for the smoking cessation programme. Of those who enrolled in the programme, we excluded people who did not have data on the stratification variables (i.e., age, sex, region, and programme completion status). Based on stepwise population statistics (number of cases and composition ratio), samples were extracted for the telephone survey by random sampling with programme completion status as the first, region as the second, and sex and age as the third stage stratification variables. Based on an expected survey response rate of 20%, a sample of 5000 programme users (5 times the target 1000) was extracted using the multistage stratified cluster sampling method, as described above.

A total of 985 participants responded to the follow-up telephone survey in which abstinence was assessed (described below). Of these, we excluded 31 participants who did not have data on our predictor variables of interest (income level, hospital type, nicotine dependence level, duration of smoking, and type of smoking cessation medication), leaving a final analytic sample of 954 participants (Fig. 1). In line with OECD Health Statistics, which report smoking prevalence among Korean men to be almost 10 times higher than that of Korean women (31.4% vs. 3.4% in 2015) [6], the analysed sample was predominantly male (n = 863, 90.5%).

This study was conducted in accordance with the Declaration of Helsinki. The study protocol was approved by the Institutional Review Board of Hallym University Sacred Heart Hospital (approval number: 2017-I011). The need for informed consent was waived on account of the retrospective nature of the National Health Information Database.

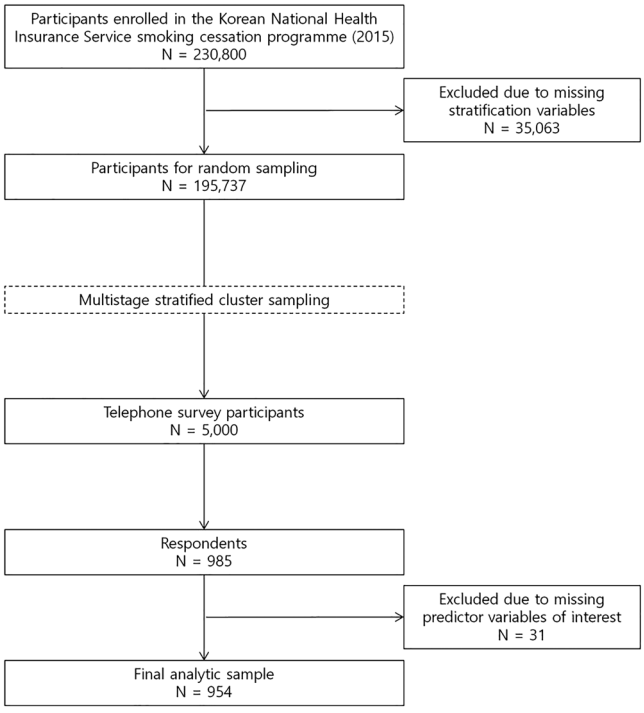

Figure 1 Participants and their selectionA total of 230 800 people were enrolled in the smoking cessation programme of the Korean National Health Insurance Service (2015). A total of 954 subjects (863 men, 90.5%) were selected for analysis using the multistage stratified cluster sampling method.

Intervention: National Health Insurance Service smoking cessation programme

The NHIS smoking cessation programme was introduced on February 25, 2015, immediately after the tobacco tax raise. The programme subsidises the doctor consultation fee for up to six appointments and supports the purchase of smoking cessation medications (varenicline, bupropion, NRT [nicotine patch, gum or lozenges]) for a period of up to 8–12 weeks once registered. A total of two registrations were possible per year. Programme completion was defined as either the completion of six consultations with the doctor or 8–12 weeks of medication.

Measures

Income level

Korea has a national health insurance system, which is run by a single insurer (NHIS) for all citizens. It is mandatory for all citizens to join the health insurance scheme and pay the insurance premium. The insured are divided into the employee insured and the self-employed insured. The employee insured consist of the workers and employers in all workplaces and the public officials and private school employees. The self-employed insured are the insured other than the employee insured and their dependants. Premiums vary according to income, with employees' premium payments computed based on their average monthly wage, and premium payments of self-employed insured people computed based on their level of income [22]. Those who fall in the lowest quintile of premium payments are classified as low-income and all medical expenses related to smoking cessation are fully supported. Those in the upper four quintiles of premium payments have smoking cessation expenses partially supported. For the purpose of the present analyses, we used premium payment as a surrogate marker for income level, defining the low-income (LI) group as participants with premium payments in the lowest 20% and the middle- or high-income (MHI) group as participants with premium payments in the upper 80%.

Other predictor variables

Baseline data from the National Health Information Database of NHIS in 2015 included: income level, region (Seoul metropolitan area or non-metropolitan areas), hospital type (community clinics or others), programme completion status, nicotine dependence level (Fagerstrom Test for Nicotine Dependence [FTND] score: 0–3, light; 4–6, moderate; 7–10, severe), duration of smoking, and type of smoking cessation medication (varenicline, bupropion, or nicotine replacement therapy [NRT]).

Outcome variable: Smoking cessation

A telephone survey of smoking cessation was conducted by the NHIS call centre on December 5, 2016, at least 6 months after the first consultation with the doctor. Abstinence was assessed with the question: "How long did you maintain smoking cessation status after registering for the NHIS smoking cessation programme in 2015?" with response options of <1 month, ≥ 1 month, ≥ 3 months, or ≥ 6 months. We dichotomised responses to distinguish between those who reported continuous abstinence for more versus less than 6 months.

Statistical analysis

We used χ^2 tests (for categorical variables) and *t*-tests (for continuous variables) to analyse differences in predictor variables by income level (LI versus MHI). Logistic regression was used to examine associations between the predictor variables of interest (income level, age, sex, region, hospital type, programme completion status, nicotine dependence level, duration of smoking, and smoking cessation medication) and 6-month continuous abstinence. We constructed three models for each predictor of interest. Model 1 was a bivariate (unadjusted) model. Model 2 was adjusted for age and sex. Model 3 was adjusted for income level and all other predictor variables of interest. These analyses were done on the whole sample and stratified by income level.

We calculated Bayes factors for non-significant findings to help interpret the non-significant results [23]. Bayes factors were calculated using an online calculator [24]. We specified a normal (two-tailed) distribution with a mean of 0 and standard deviation equivalent to the expected effect size taken from a recent systematic review [25]. This review found a risk ratio of 1.55 (equivalent to OR of 1.55 assuming 0.1 baseline probability for long-term abstinence) for the efficacy of NRT for smoking cessation relative to placebo/no treatment. This was chosen as we were interested in whether other factors have such a clinically significant effect. ORs were entered on the log odds scale via the simple transformation LN (OR). A smaller effect size (OR = 1.05) was specified for duration of smoking as it was modelled as a continuous variable.

For interaction analysis, we used an F distribution with denominator degrees of freedom and calculated Bayes factors for interaction effects. We specified a uniform distribution with a lower limit as 0 and an upper limit as the OR of each variable in the logistic regression analysis for MHI group.

All statistical analyses were performed using Stata/MP version 14.0 (StataCorp, College Station, TX, USA). All statistical tests were two-sided, and statistical significance was determined at p value <0.05.

RESULTS

Descriptive characteristics of the sample, overall and by income level, are presented in Table 1. The mean age of participants was 49.13 ± 10.69 years, and the majority (90.5%) were male. The LI group was on average significantly older than the MHI group. A greater proportion of LI than MHI participants were women, and fewer were treated in community clinics.

The 6-month continuous abstinence rate was 30.5%; 23.45% in the LI group and 31.77% in the MHI group. Results of the whole-sample logistic regression analyses are shown in Table 2. In the fully adjusted model (Model 3), the odds of 6-month continuous abstinence were significantly lower in the LI group compared with the MHI group, those with severe compared with light/moderate nicotine dependence, and those who used bupropion compared with varenicline, and significantly higher in those who completed the programme. Bayes factors supported the null hypothesis for the association between duration of smoking and 6-month continuous abstinence, but indicated data for other non-significant findings were insensitive to detect associations (Table S1).

Income-stratified logistic regression results are shown in Table 3 (MHI) and Table 4 (LI). Among MHI participants, programme completion was associated with significantly higher odds of 6-month continuous abstinence in the fully adjusted model, and use of bupropion versus varenicline was associated with significantly lower odds (Table 3, Model 3). Among LI participants, female sex and programme completion were associated with significantly higher odds of 6-month continuous abstinence, and severe compared with light/moderate nicotine dependence was associated with significantly lower odds (Table 4, Model 3). The Bayes factors for the non-significant findings suggested that the data were insensitive (Tables S2-S3).

We tested for an interaction between income levels and nicotine dependence levels and found a significant

Table 1 Characteristics of participants categorized according to their income level.

	Total (N = 954)	*MHI group (N = 809)*	*LI group (N = 145)*	*p-value*[a]
Sex				
Male	863 (90.46)	746 (92.21)	117 (80.69)	< 0.001
Female	91 (9.54)	63 (7.79)	28 (19.31)	
Age (year)				
Mean ± SD	49.13 ± 10.69	48.68 ± 10.52	51.59 ± 11.34	0.003
< 50 years	506 (53.04)	447 (55.25)	59 (40.69)	0.001
≥ 50 years	448 (46.96)	362 (44.75)	86 (59.31)	
Region				
Seoul metropolitan area	414 (43.40)	351 (43.39)	63 (43.45)	0.989
Non-metropolitan areas	540 (56.60)	458 (56.61)	82 (56.55)	
Hospital type				
Community clinics	757 (79.35)	654 (80.84)	103 (71.03)	0.007
Others	197 (20.65)	155 (19.16)	42 (28.97)	
Programme completion status				
Incomplete	680 (71.28)	584 (72.19)	96 (66.21)	0.143
Complete	274 (28.72)	225 (27.81)	49 (33.79)	
Nicotine dependence level[b]				
Light/moderate	629 (65.93)	534 (66.01)	95 (65.52)	0.909
Severe	325 (34.07)	275 (33.99)	50 (34.48)	
Duration of smoking (year)	26.66 ± 10.60	26.68 ± 10.40	26.50 ± 11.69	0.852
Smoking cessation medication				
Varenicline	701 (73.48)	590 (72.93)	111 (76.55)	0.743
Bupropion	169 (17.71)	148 (18.29)	21 (14.48)	
NRT	25 (2.62)	21 (2.60)	4 (2.76)	
Others[c]	59 (6.18)	50 (6.18)	9 (6.21)	
Duration of smoking cessation				
< 6 months	663 (69.50)	552 (68.23)	111 (76.55)	0.045
≥ 6 months	291 (30.50)	257 (31.77)	34 (23.45)	

MHI, middle- or high-income; LI, low-income; SD, standard deviation; NRT, nicotine replacement therapy Data are presented as mean ± SD or number (%) [a]p value from a χ^2 test for binary outcomes or *t*-test for continuous outcomes, comparing the differences between any two groups. [b]Nicotine dependence level defined by the Fagerstrom Test for Nicotine Dependence (FTND) score: 0–3, light; 4–6, moderate; 7–10, severe. [c]Combination use of smoking cessation medications.

Table 2 Logistic regression analysis of continuous abstinence over 6 months.

	Model 1	*p-value*	*Model 2*	*p-value*	*Model 3*	*p-value*
Sex						
Male	1 (reference)				1 (reference)	
Female	1.20 (0.76 to 1.89)	0.438			1.25 (0.75 to 2.08)	0.392
Age (year)						
< 50 years	1 (reference)				1 (reference)	
≥ 50 years	1.13 (0.86 to 1.49)	0.371			1.29 (0.86 to 1.91)	0.215
Income level						
MHI group	1 (reference)		1 (reference)		1 (reference)	
LI group	0.66 (0.44 to 0.99)	0.046	0.62 (0.41 to 0.95)	0.027	0.54 (0.35 to 0.84)	0.006
Region						
Seoul metropolitan area	1 (reference)		1 (reference)		1 (reference)	
Non-metropolitan areas	0.67 (0.51 to 0.89)	0.005	0.68 (0.51 to 0.89)	0.006	0.82 (0.61 to 1.10)	0.180
Hospital type						
Community clinics	1 (reference)		1 (reference)		1 (reference)	
Others	1.38 (0.99 to 1.91)	0.059	1.37 (0.99 to 1.91)	0.060	1.24 (0.87 to 1.76)	0.226
Programme completion status						
Incomplete	1 (reference)		1 (reference)		1 (reference)	
Complete	2.84 (2.12 to 3.82)	< 0.001	2.86 (2.12 to 3.84)	< 0.001	2.64 (1.93 to 3.61)	< 0.001
Nicotine dependence level[a]						
Light/moderate	1 (reference)		1 (reference)		1 (reference)	
Severe	0.69 (0.51 to 0.94)	0.017	0.70 (0.52 to 0.94)	0.019	0.72 (0.52 to 0.98)	0.039
Duration of smoking (year)	1.00 (0.99 to 1.01)	0.794	1.00 (0.98 to 1.02)	0.860	0.99 (0.97 to 1.01)	0.335
Smoking cessation medication						
Varenicline	1 (reference)		1 (reference)		1 (reference)	
Bupropion	0.56 (0.37 to 0.84)	0.005	0.56 (0.37 to 0.84)	0.005	0.60 (0.39 to 0.91)	0.016
NRT	1.98 (0.89 to 4.41)	0.095	1.94 (0.87 to 4.34)	0.105	2.03 (0.89 to 4.66)	0.095
Others[b]	1.18 (0.68 to 2.07)	0.551	1.18 (0.68 to 2.06)	0.555	1.02 (0.57 to 1.83)	0.940

MHI, middle- or high-income; LI, low-income Data are presented as odds ratio (95% confidence interval) Model 1: unadjusted Model 2: adjusted for age and sex Model 3: model 2 + income level, region, hospital type, programme completion status, nicotine dependence level, duration of smoking, and smoking cessation medication [a]Nicotine dependence level defined by the Fagerstrom Test for Nicotine Dependence (FTND) score: 0–3, light; 4–6, moderate; 7–10, severe. [b]Combination use of smoking cessation medications.

interaction effect ($F(1, 952) = 4.28$, $P = 0.039$, Bayes factor = 5.7). However, there was no income level × duration of smoking interaction ($F(1, 952) = 2.47$, $P = 0.116$, Bayes factor = 0.01). We also tested for income level × region interaction ($F(1, 952) = 0.56$, $P = 0.454$, Bayes factor = 0.78), income level × hospital type interaction ($F(1, 952) = 1.10$, $P = 0.294$, Bayes factor = 0.47), income level × programme completion status interaction ($F(1, 952) = 0.39$, $P = 0.534$, Bayes factor = 0.81), and income level × type of smoking cessation medication interaction ($F(3, 952) = 1.12$, $P = 0.339$, Bayes factor = 1.54 (bupropion); 1.43 (NRT); 0.82 (Others)). The Bayes factors for the non-significant interactions suggest that the data are insensitive.

DISCUSSION

In Korean smoking cessation services, lower income, higher cigarette dependence, and use of bupropion versus varenicline were found to be associated with lower chances of achieving 6-month continuous abstinence from smoking. In analyses stratified by income level, the association with cigarette dependence was only observed in low-income smokers and there was an additional association between female sex and higher odds of 6-month continuous abstinence.

After the implementation of the NHIS smoking cessation programme in early 2015, the 6-month continuous abstinence rate among its users was 30.5%. This is somewhat higher than has been reported in previous studies evaluating similar interventions. For example, in a national smoking cessation programme in Taiwan (2012–2015), the 6-month point-prevalence abstinence rates of varenicline users and bupropion or NRT users were 16% and 10–12%, respectively [26]. In a nationwide internet-based contingency management intervention programme aiming to promote smoking cessation in the United States, the 6-month point-prevalence abstinence rate of the intervention group ranged between 13% and 23% [27]. It should be noted that direct comparisons with other studies are difficult due to diverse study situations and definitions of abstinence.

Table 3 Logistic regression analysis of continuous abstinence over 6 months among participants with middle- or high-income status.

	Model 1	*p-value*	*Model 2*	*p-value*	*Model 3*	*p-value*
Sex						
Male	1 (reference)				1 (reference)	
Female	0.92 (0.53 to 1.61)	0.775			0.82 (0.45 to 1.50)	0.515
Age (year)						
< 50 years	1 (reference)				1 (reference)	
≥ 50 years	1.02 (0.76 to 1.38)	0.879			1.21 (0.79 to 1.85)	0.389
Region						
Seoul metropolitan area	1 (reference)		1 (reference)		1 (reference)	
Non-metropolitan areas	0.70 (0.52 to 0.94)	0.018	0.70 (0.52 to 0.94)	0.017	0.83 (0.60 to 1.14)	0.244
Hospital type						
Community clinics	1 (reference)		1 (reference)		1 (reference)	
Others	1.32 (0.92 to 1.90)	0.137	1.32 (0.91 to 1.90)	0.139	1.15 (0.78 to 1.68)	0.489
Programme completion status						
Incomplete	1 (reference)		1 (reference)		1 (reference)	
Complete	2.84 (2.06 to 3.92)	< 0.001	2.85 (2.07 to 3.94)	< 0.001	2.64 (1.88 to 3.71)	< 0.001
Nicotine dependence level[a]						
Light/moderate	1 (reference)		1 (reference)		1 (reference)	
Severe	0.79 (0.57 to 1.08)	0.136	0.78 (0.57 to 1.08)	0.132	0.83 (0.60 to 1.16)	0.280
Duration of smoking (year)	1.00 (0.98 to 1.01)	0.604	0.99 (0.97 to 1.01)	0.336	0.98 (0.96 to 1.01)	0.157
Smoking cessation medication						
Varenicline	1 (reference)		1 (reference)		1 (reference)	
Bupropion	0.57 (0.37 to 0.87)	0.010	0.60 (0.37 to 0.87)	0.009	0.63 (0.40 to 0.97)	0.035
NRT	1.81 (0.76 to 4.34)	0.182	1.81 (0.75 to 4.33)	0.186	2.07 (0.84 to 5.11)	0.116
Others[b]	1.03 (0.56 to 1.89)	0.930	1.02 (0.56 to 1.89)	0.937	0.82 (0.44 to 1.56)	0.548

Data are presented as odds ratio (95% confidence interval) Model 1: unadjusted Model 2: adjusted for age and sex Model 3: model 2 + region, hospital type, programme completion status, nicotine dependence level, duration of smoking, and smoking cessation medication [a]Nicotine dependence level defined by the Fagerstrom Test for Nicotine Dependence (FTND) score: 0–3, light; 4–6, moderate; 7–10, severe. [b]Combination use of smoking cessation medications.

In the present study, LI participants had significantly lower odds of achieving 6-month continuous abstinence from smoking than MHI participants. Previous studies have shown that low socioeconomic position is associated with lower rates of cessation [12–14]. Barriers to smoking cessation in this sociodemographic group may include: lack of knowledge or concern about the harmful effects of smoking, different attitudes and social norms related to smoking and cessation, high stress and dependence on smoking, low self-efficacy for quitting, lack of support from health and other service providers, and the high prevalence and acceptability of smoking in vulnerable communities [12–14,28,29]. However, studies have shown that disadvantaged smokers are typically no less likely than more affluent smokers to make a quit attempt; rather, it is the rate of success that is lower [12,13].

In addition to income level, other variables found to be significantly associated with 6-month continuous abstinence were programme completion, low nicotine dependence, and use of varenicline. These findings are consistent with previous studies. For example, a national prospective cohort study from Taiwan reported that 6-month point-prevalence abstinence was associated with the following variables: old age, hospital outpatient clinics, light or moderate nicotine dependence level, fewer smoking years, high frequency of clinic visits, and long duration of medication use [26]. Additionally, this Taiwanese study found that 6-month abstinence rates were higher in varenicline users than in NRT patch users. Another observational study from China reported that FTND score, stage of quitting smoking, perceived confidence or difficulty in quitting, and chronic disease types were independently correlated with 3-month continuous abstinence at 6-month follow-up [30].

While use of varenicline compared with bupropion was associated with increased odds of 6-month continuous abstinence overall and in the MHI group, type of smoking cessation medication was not significantly associated with 6-month continuous abstinence in the LI group. It is likely that this is a power issue, as the effect size was larger in the LI than MHI group (OR = 0.19 versus 0.63).

Medication types and proportions in our study differ from those in a Taiwanese study [26]. Varenicline prescription (73.5%) was predominant in the Korean NHIS smoking cessation programme (bupropion 17.7%, NRT 2.6%), whereas varenicline (42.2%) or NRT (50.9%) was evenly prescribed in the Taiwanese programme. Since 2005, the public health centre in Korea has provided NRT free of charge, so those who wanted oral medications for smoking cessation were considered to have participated

Table 4 Logistic regression analysis of continuous abstinence over 6 months among participants with low-income status.

	Model 1	*p-value*	*Model 2*	*p-value*	*Model 3*	*p-value*
Sex						
Male	1 (reference)				1 (reference)	
Female	3.24 (1.34 to 7.81)	0.009			6.30 (1.79 to 22.20)	0.004
Age (year)						
< 50 years	1 (reference)				1 (reference)	
≥ 50 years	3.40 (1.37 to 8.45)	0.008			3.15 (0.85 to 11.67)	0.086
Region						
Seoul metropolitan area	1 (reference)		1 (reference)		1 (reference)	
Non-metropolitan areas	0.52 (0.24 to 1.13)	0.097	0.60 (0.26 to 1.35)	0.217	0.64 (0.24 to 1.66)	0.355
Hospital type						
Community clinics	1 (reference)		1 (reference)		1 (reference)	
Others	2.08 (0.93 to 4.65)	0.076	2.81 (1.15 to 6.87)	0.023	2.11 (0.72 to 6.19)	0.175
Programme completion status						
Incomplete	1 (reference)		1 (reference)		1 (reference)	
Complete	3.42 (1.54 to 7.58)	0.002	4.73 (1.93 to 11.63)	0.001	5.59 (1.91 to 16.37)	0.002
Nicotine dependence level[a]						
Light/moderate	1 (reference)		1 (reference)		1 (reference)	
Severe	0.25 (0.09 to 0.70)	0.008	0.34 (0.12 to 1.00)	0.049	0.28 (0.08 to 0.94)	0.040
Duration of smoking (year)	1.03 (1.00 to 1.07)	0.070	1.03 (0.99 to 1.08)	0.150	1.01 (0.96 to 1.06)	0.732
Smoking cessation medication						
Varenicline	1 (reference)		1 (reference)		1 (reference)	
Bupropion	0.34 (0.08 to 1.58)	0.169	0.24 (0.05 to 1.23)	0.087	0.19 (0.03 to 1.15)	0.071
NRT	3.27 (0.44 to 24.36)	0.248	4.01 (0.49 to 32.69)	0.195	1.11 (0.10 to 12.81)	0.931
Others[b]	2.62 (0.65 to 10.46)	0.174	2.23 (0.52 to 9.53)	0.279	3.33 (0.54 to 20.42)	0.194

NRT, nicotine replacement therapy Data are presented as odds ratio (95% confidence interval) Model 1: unadjusted Model 2: adjusted for age and sex Model 3: model 2 + region, hospital type, programme completion status, nicotine dependence level, duration of smoking, and smoking cessation medication [a]Nicotine dependence level defined by the Fagerstrom Test for Nicotine Dependence (FTND) score: 0–3, light; 4–6, moderate; 7–10, severe. [b]Combination use of smoking cessation medications.

in the NHIS programme. Additionally, pharmaceutical companies actively promoted their products to the physicians after the NHIS smoking cessation programme was launched. These factors may have affected the high prescription rates of varenicline.

Although this study has several strengths including representative data from NHIS, stratified sampling, adjustment for potential confounding, and analysis of predictors of successful cessation by income level, there are also a number of limitations. First, we evaluated smoking cessation by self-report using telephone surveys. Although a urine cotinine test can be used to confirm the quit status at the last visit of the programme, this test was not actively used by physicians in the clinic because the test was not mandatory. Therefore, we lacked biochemical validation, introducing potential for recall bias. Second, it is possible that the abstinence rates were lower for those who did not respond to telephone surveys. Third, since the income data could not be obtained directly, the premium payment was used as a surrogate marker for the income level. Fourth, there is a possibility of potential confounding not accounted for. Finally, because the LI group sample size was relatively small, we recommend interpret these results with caution. If the sample size was larger, it is likely that certain results (e.g. regarding the medication type) would have been significant.

CONCLUSIONS

Lower income, higher cigarette dependence, and use of bupropion versus varenicline are associated with lower chances of stopping smoking in Korean smoking cessation services, but the association with cigarette dependence is only found in low-income smokers.

Declarations of interests

None.

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Supporting Information

Additional supporting information may be found online in the Supporting Information section at the end of the article.

Table S1 The Bayes factors for the non-significant findings: logistic regression analysis of continuous abstinence over 6 months.

Table S2 The Bayes factors for the non-significant findings: logistic regression analysis of continuous abstinence over 6 months among participants with middle- or high-income status.

Table S3 The Bayes factors for the non-significant findings: logistic regression analysis of continuous abstinence over 6 months among participants with low-income status.

