

A comparative study on changes in the use of heat-not-burn tobacco products based on whether apartment buildings have designated non-smoking areas

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ABSTRACT

INTRODUCTION Since 2016, multi-family housing developments in South Korea can designate public areas such as staircases, elevator, corridors, and underground parking lots as non-smoking areas if at least half of the households residing in the development agree. This study investigated whether there were changes in the use of heat-not-burn tobacco products (HnB) based on whether non-smoking areas were introduced in multi-family housing developments.

METHODS An online survey of 1200 apartment residents (599 men and 601 women) in seven metropolitan cities in South Korea was conducted from 10 to 18 October 2018.

RESULTS Among the 1200 people who completed the survey, 493 were smokers (351 men and 142 women), of whom 287 (195 men and 92 women) were currently using HnB. In total, 51.5% (n=148) of the HnB users reported that their smoking frequency inside (n=75) or outside (n=73) the apartment building increased after using HnB, whereas the smoking frequency of 27.5% (n=79) decreased and that of 20.9% (n=6) remained unchanged. Of the HnB users, 25.4% (n=73) were currently living in non-smoking apartments, of whom 39.7% reported that the smoking frequency outside the apartment building increased. On the other hand, of 214 people who did not currently reside in non-smoking apartments, 30.4% reported that the smoking frequency in the apartment increased.

CONCLUSIONS For smokers to quit smoking, the expansion of non-smoking areas should be accompanied by the facilitation of a smoke-free atmosphere and a smoking-cessation service for smokers.

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INTRODUCTION

In terms of regulating non-smoking areas, indoor public spaces take priority over personal spaces. The World Health Organization Framework Convention on Tobacco Control (FCTC) recommends that countries should designate public spaces such as indoor workplaces and public transportation facilities as non-smoking areas to protect non-smokers from exposure to cigarette smoke. However, although the FCTC encourages the allocation of personal spaces such as personal vehicles and offices as non-smoking areas, it does not make any recommendations on

multi-family housing.

Besides the apartment units themselves, indoor staircases, corridors, underground parking lots, and elevators in apartment buildings are shared among the residents. For this reason, smoking in shared areas not only deteriorates indoor air quality but also exposes the non-smoking population to secondhand smoke.

In South Korea, a large proportion of the population lives in apartment buildings, and smoking in common areas is one of the major causes of conflict among residents. To address this problem,

the South Korean government issued a revision to the National Health Promotion Act in 2016, stating that if at least half the residents of an apartment building agree, hallways, staircases, elevators and underground parking lots can be entirely or partially designated as non-smoking areas. Upon the designation of common areas in multi-family housing developments as non-smoking areas based on a residential vote, instances of smoking in these areas can lead to fines of 50000 won (about US\$ 4.5). This also applies to non-smoking areas designated in indoor public spaces such as hospitals, schools and public transportation.

Designating spaces as non-smoking areas affects the smoking behavior of smokers. The designation of large non-smoking areas in workplaces and public spaces can provide momentum for smokers to quit smoking, leading to a decline in smoking prevalence and tobacco product consumption¹. However, whether the designation of common residential spaces as non-smoking areas influences smoking behavior at residence remains unknown^{2,3}.

Recently, tobacco users have switched from using combusted cigarettes to heat-not-burn tobacco products (HnB) for various reasons. Users consider HnB less harmful compared to combusted cigarettes and think that their use can help with smoking cessation⁴. In contrast to combusted cigarettes, HnB are more frequently used in indoor spaces because they produce less odour⁵.

Although HnB sales are prohibited in some countries, global sales have continued to rise. As of 2018, the global market for HnB was expected to be worth US\$4.4 billion³. Euromonitor forecasted that, although the combusted cigarette market will lose US\$7.7 billion by 2021, the HnB market will expand by up to US\$13.2 billion during the same period⁶. Since June 2017, after Philip Morris International, British American Tobacco, and KT&G released the products IQOS, glo, and lil, respectively, in South Korea, competition among HnB producers has intensified nationally. HnB sales in Korea have been steadily increasing since this product was released, faster than in any other country in the world⁷.

Therefore, this study examined whether the designation of non-smoking areas in multi-family housing developments leads to changes in smoking behavior; namely, where smoking occurs and

smoking frequency. Because HnB use is increasing in South Korea, the study focused on HnB users.

METHODS

Sampling protocol

In this study, we conducted an online survey, recruiting adults who had been living in an apartment for more than 6 months. Surveys were conducted using the quota sampling method while considering ages and regions. We aimed to recruit 1200 people in total, limiting the geographical scope to seven metropolitan cities (Seoul, Busan, Daegu, Incheon, Gwangju, Daejeon, and Ulsan). Surveys were conducted by a professional research institute as online self-administered questionnaires. To recruit participants, the company sent a survey participation notice to an online panel administered by the company. Applicants could participate in the survey after consenting to the study. Each participant received 5000 won (about US\$4.5) mobile gift card for completing the survey. Surveys were conducted from 10 to 18 October 2018.

Measures

The subjects were asked what kinds of cigarette/tobacco products they had used in their entire life, i.e. cigarettes, cigars, snus, hookah or waterpipe and/or HnB that produce aerosols containing nicotine and other chemicals using battery powered heating-systems such as IQOS, glo, and lil, and whether they were still using this product⁷. We also surveyed HnB users regarding changes in the amount of smoking inside and outside the apartment after using an HnB, whether smoking frequency increased inside or outside the apartment building, whether overall smoking frequency decreased, or whether no changes occurred. In addition, the subjects were asked whether the building they currently lived in designated common areas such as hallways, staircases, elevators and underground parking lots entirely or partially as non-smoking areas. Residents who provided 'designated' as an answer were classified as living in non-smoking multi-family housing; those who answered 'not designated' or 'not known' were classified as residents of multi-family housing without non-smoking areas.

Statistical analysis

A frequency analysis was conducted to assess the

number and percentage of subjects according to demographic characteristics and change after the usage of HnB depending on designation of non-smoking apartment buildings. In addition, crude logistic regression was applied to explore the relationship between smoking pattern and residential type among heat-not-burn tobacco products. The results are presented as odds ratios (ORs) and 95% confidence interval (CIs). Data were analyzed using

SPSS ver. 25 software (IBM Corporation, Armonk, NY, USA), and $p < 0.05$ was considered statistically significant.

RESULTS

Of all respondents, 49.9% ($n=599$) were male and 50.1% ($n=601$) were female (Table 1). Respondents in their 40s made up the largest age group, and the largest proportion of respondents lived in Seoul

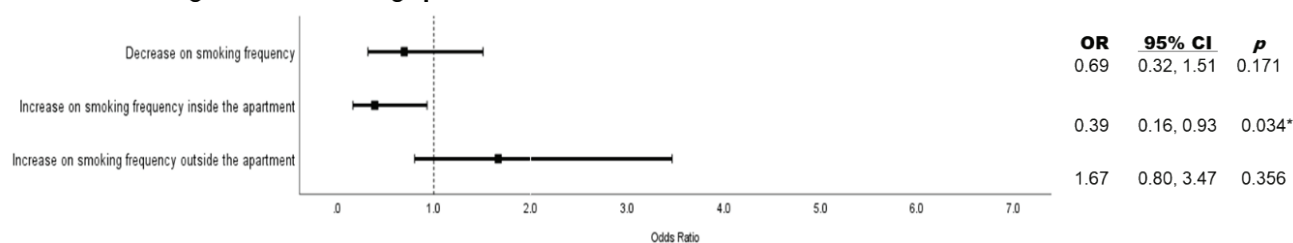
Table 1. Demographic characteristics and change after the usage of heat-not-burn tobacco products, depending on designation of non-smoking apartment buildings in South Korea 2018 (N=1200)

Characteristics	Total	Residents in designated non-smoking apartments (n=243)	Residents in unspecified non-smoking apartments (n=957)
	n (%)	n (%)	n (%)
Gender			
Male	599 (49.9)	129 (53.1)	470 (49.1)
Female	601 (50.1)	114 (46.9)	487 (50.9)
Age (years)			
20–29	231 (19.3)	55 (22.6)	176 (18.4)
30–39	242 (20.2)	45 (18.5)	197 (20.6)
40–49	271 (22.5)	63 (25.9)	208 (21.7)
50–59	270 (22.5)	49 (20.2)	221 (23.1)
≥60	186 (15.5)	31 (12.8)	155 (16.2)
Region			
Seoul	527 (43.9)	127 (52.3)	400 (41.8)
Busan	180 (15.0)	32 (13.2)	148 (15.5)
Daegu	129 (10.8)	19 (7.8)	110 (11.5)
Incheon	154 (12.8)	30 (12.3)	124 (13.0)
Gwangju	73 (6.1)	10 (4.1)	63 (6.6)
Daejeon	77 (6.4)	16 (6.6)	61 (6.4)
Ulsan	60 (5.0)	9 (3.7)	51 (5.2)
Cigarette use experience on entire life¹			
Cigarettes	633 (52.8)	125 (51.4)	508 (53.1)
E-cigarettes	348 (29.0)	82 (33.7)	266 (27.8)
Heat-not-burn tobacco products	287 (23.9)	73 (30.0)	214 (22.4)
Cigars	239 (19.9)	48 (19.8)	191 (20.0)
Snus	122 (10.2)	28 (11.5)	94 (9.8)
Hookah or waterpipe	74 (6.2)	20 (8.2)	54 (5.6)
Smoking pattern change²			
Increase in smoking frequency outside the apartment building	73 (25.5)	29 (39.7)	44 (20.6)
Increase in smoking frequency inside the apartment	75 (26.1)	10 (13.7)	65 (30.4)
Decrease in smoking frequency	79 (27.5)	17 (23.3)	62 (29.0)
No change	60 (20.9)	17 (23.3)	43 (20.0)

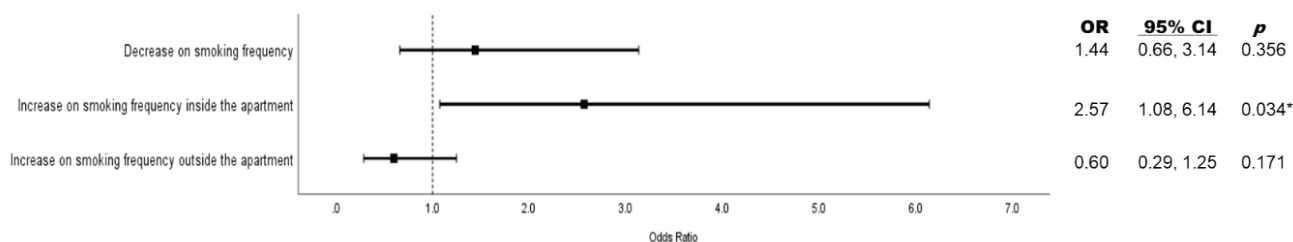
1 Multiple answers. 2 For heat-not-burn tobacco products users.

Figure 1. The relationship between smoking pattern and residential type among heat-not-burn tobacco products users (N=287)

A. Residents in designated non-smoking apartments



B. Residents in unspecified non-smoking apartments



*OR: odds ratio. CI: confidence interval. Crude logistic regression was applied to explore the relationship between smoking pattern (Reference: no change) for residents depending on designation of non-smoking apartment buildings among heat-not-burn tobacco products users.

(43.9%). In terms of non-smoking designations, 20.3% (n=243) of the respondents were living in apartment buildings with non-smoking common areas, whereas 69.7% (n=957) lived in buildings without such designated areas. More than half the respondents (52.8%) had used cigarettes or other tobacco products at least once in their life, and 29.0% had used e-cigarettes.

Of the 1200 respondents, 287 (23.9%) had used HnB. Of these 287 people, 73 people were currently living in buildings with designated non-smoking areas, and 214 were not. In terms of changes in the frequency of smoking by HnB users, respondents (n=79; 27.5%) who reported a decrease in smoking amount inside or outside the apartment comprised the largest proportion, followed by those who reported an increase in smoking inside (n=75; 26.1%) the apartment and outside (n=73; 25.5%) the apartment building, whereas 20.9% (n=60) did not report any changes.

In terms of changes in where smoking took place and the smoking frequency, residents of non-smoking apartment buildings who reported an increase in smoking outside the apartment building comprised the largest group of respondents (39.7%). Residents of buildings without designated non-

smoking areas who reported an increase in smoking at the apartment comprised the next largest group of respondents (30.4%). This difference in proportions was statistically significant (Pearson χ^2 test; $p=0.002$).

Figure 1 shows the results of a crude logistic regression analysis of the relationship between smoking pattern change and residential type among HnB users. A residential type was significantly associated with smoking frequency inside the apartment building. Among HnB users in designated non-smoking apartments, the probability of increase in smoking frequency inside was lower than for users whose usage patterns have not changed (increase in smoking frequency inside the apartment: OR=0.39; 95% CI: 0.16–0.93, $p=0.034$). The HnB users living in unspecified non-smoking apartments were more likely to increase smoking frequency inside compared to those who did not change pattern (increase in smoking frequency inside the apartment: OR=2.57; 95% CI: 1.08–6.14).

DISCUSSION

Since HnB started being sold in South Korea, the number of HnB users has increased steadily. A month after IQOS was released in South Korea (September

2017), only 5.7% of users had experience with this product. However, in October 2018 when this survey was conducted and when IQOS, lil, and glo were all available in the market, 23.9% people reported that they had used HnB, indicating that the consumption of these products had increased. Although e-cigarettes have been available in South Korea since 2007⁸, it is noteworthy that similar proportions of people reported experience with using e-cigarettes and HnB. This implies that HnB products, although a novel product, are rapidly dominating the Korean tobacco market.

HnB companies advertise their wares as state-of-the-art products representing new technological innovations to a target audience that includes youth^{9,10}. Mainly, these companies claim that, unlike existing tobacco products, HnB products are harmless to the human body, and this marketing strategy is rather successful. As the results of the survey showed, after they started using these products, HnB users increased rather than decreased the amount of smoking inside the apartment and outside the building. It was assumed that HnB produced less odor than existing tobacco products⁵, thus facilitating their use inside and outside the apartment. However, the safety of smoking HnB has been not sufficiently clarified. Because the smoke from HnB may contain carcinogenic chemicals, it can adversely affect indoor air quality and the health of people exposed to secondhand smoke^{11,12}. Therefore, accurate and readily available public health information as well as appropriate regulations are needed to prevent the indoor use of HnB and discourage the initial use of these products.

A new finding in this study was that HnB users changed their smoking behavior according to the characteristics of their residence. The designation of non-smoking common areas does not forbid the act of smoking at the apartment, only in common areas in apartment buildings. Smokers who lived in non-smoking apartment buildings tended to smoke outside instead of inside their residences. These results suggest that smokers could change their smoking location due to the creation of smoke-free environments, such as by designation as non-smoking areas.

CONCLUSIONS

Although HnB use and the availability of non-smoking

areas can influence the amount of smoking and smoking location of residents of multi-family housing, these changes do not necessarily lead to smoking cessation. In particular, a significant proportion of respondents reported an increase in smoking amount despite the expansion of non-smoking areas in the apartment buildings. Thus, the designation of such areas without a plan for smoking cessation might cause the impacts from secondhand smoke to be moved to another location. In addition to designating smoke-free areas, comprehensive approaches to encourage smokers to quit smoking, such as providing appropriate anti-smoking support services and developing effective messaging for smoking cessation, are needed.

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CONFLICTS OF INTEREST

The authors have completed and submitted the ICMJE Form for Disclosure of Potential Conflicts of Interest and none was reported.

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ETHICAL APPROVAL AND INFORMED CONSENT

This study was approved by the Institutional Review Board of the Seoul National University (No. 1809/003-007). Applicants could participate in the survey after consenting to the study.

DATA AVAILABILITY

The data supporting this research cannot be made available for privacy reasons.

AUTHORS' CONTRIBUTIONS

JH designed the study, analyzed and interpreted the data, and wrote the manuscript. SC contributed to the study design and interpretation of the results.

PROVENANCE AND PEER REVIEW

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