

## ORIGINAL ARTICLE

## Second-hand smoke prevalence in 252 regions of South Korea in three exposure locations

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## Abstract

**Purpose:** The association between regional contextual factors and second-hand smoke (SHS) prevalence is important, but is unclear. This study investigated the changes of SHS prevalence from 2011 to 2013 and explored the correlations of SHS prevalence and regional contextual factors by exposure location.

**Methods:** The data were obtained from the 2011 and 2013 Korean Community Health Survey and the Development of Health Indicators for Community Health Ranking report. A *t*-test was used to examine and compare the SHS prevalence in 2011 and 2013 by exposure location (home, workplace, and public places). A correlation analysis and linear regression were used to investigate the impacts of the regional variables on SHS prevalence by location.

**Results:** The prevalence of SHS in all three locations had a decreased trend overall, but remained high in public locales. There were clear differences in the prevalence of SHS and its change by region between 2011 and 2013. The SHS prevalence in the workplace and public places had increased in the high social and economic characteristic regions, compared to the other regions in 2 years. The SHS had an increased trend in regions featuring a high level of socioeconomic development. It was observed that regional factors affecting SHS prevalence differed in the three locations.

**Conclusion:** The differences and changes of regional SHS prevalence by location were influenced by specific social contextual factors of the particular region. Local government initiatives regarding special SHS protective measures or tailored regulations, according to specific regional status and location, are recommended, with attention to high socioeconomic regions in particular.

**Key words:** prevalence, second-hand smoke, sociological factors, tobacco smoke pollution.

## INTRODUCTION

Smoking is a leading cause of preventable diseases and early death and is one of the most important public health problems. Exposure to second-hand smoke (SHS) causes serious illness and exacts considerable economic and social losses. Second-hand smoke is associated with cardiovascular disease, respiratory disease,

and cancer (WHO, 2012), with an estimated 603,000 deaths and 10.9 million disability-adjusted life years worldwide (Öberg, Jaakkola, Woodward, Peruga, & Prüss-Ustün, 2010).

Many countries are implementing smoking ban policies to lessen smoke and SHS exposure actively, but the prevalence of active smoking and exposure to SHS is still very high.

Despite governmental efforts in South Korea, it has been reported that 36.1% of non-smokers were exposed to SHS at work or at home in 2011 and 44.8% of non-smoking Korean adults were exposed to SHS in 2012 (Lee & Ha, 2011; Lee, Park, Kim, & Jung-Choi, 2014). In most cases, active smoking is a behavior that is

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driven by personal preference, while SHS exposure by non-smokers is involuntary. This SHS exposure is affected by many social contextual and regional environmental factors.

Moreover, the social contextual factors of SHS are also different in specific exposure locations. However, few previous studies have focused on it. In several studies, regional characteristics have been taken into account. One study looked at SHS exposure in a deprived locality of England (Alwan, Siddiqi, Thomson, & Cameron, 2010) and another assessed SHS exposure in six areas (Yao, Sung, Zhengzhong, Hu, & Max, 2012). Their results showed that different social contextual factors regarding exposure to SHS were difference: a study in Bangladesh documented the marked variation in SHS exposure levels in the workplace, home, and public locations across various socioeconomic factors (Palipudi *et al.*, 2011).

Regional factors affect the home, workplace, and public locations and which variables are strongly associated with the SHS prevalence at each location are unclear. Active smoking rates are affected by regional characteristics, including the regional socioeconomic levels, environment, and residential community (Jemal *et al.*, 2011; Park, Kim, Kawachi, Kim, & Cho, 2010). However, few previous studies have focused on identifying the SHS regional contextual factors, especially in Korea.

An ecological perspective could clarify whether and how the social context is related to health or health behavior and it is essential to gain a broader sense of environmental characteristics on health behaviors (Honjo, 2004).

In Korea, a previous ecological study assessed active smoking rates. It reported a difference in regional socioeconomic characteristics between communities with and without smoke ban implementation (Lee *et al.*, 2014). Unfortunately, no published study has examined the correlations of the SHS prevalence and regional variables by using an ecological study method.

The *National Health Promotion Act 1995* that was implemented in Korea established smoke-free regulations. It is important to monitor and investigate the changes of SHS prevalence in recent years by region. The exploration and comparison of the different characteristics of increased and decreased SHS prevalence in the regions in the three exposure locations separately are also important.

Accordingly, the aims of this study were to: (i) estimate the prevalence of SHS in 252 regions in South Korea; (ii) explore whether and how regional contextual factors affect SHS prevalence; (iii) compare

the difference of SHS regional affecting factors, depending on the exposure location (home, workplace, public places); and (iv) compare the effect of regional factors on decreased and increased trends of SHS prevalence (comparison of 2011 and 2013 prevalence data).

## METHODS

### Study design

An ecological study design, with “region” as the unit of analysis, was used.

### Setting and sample

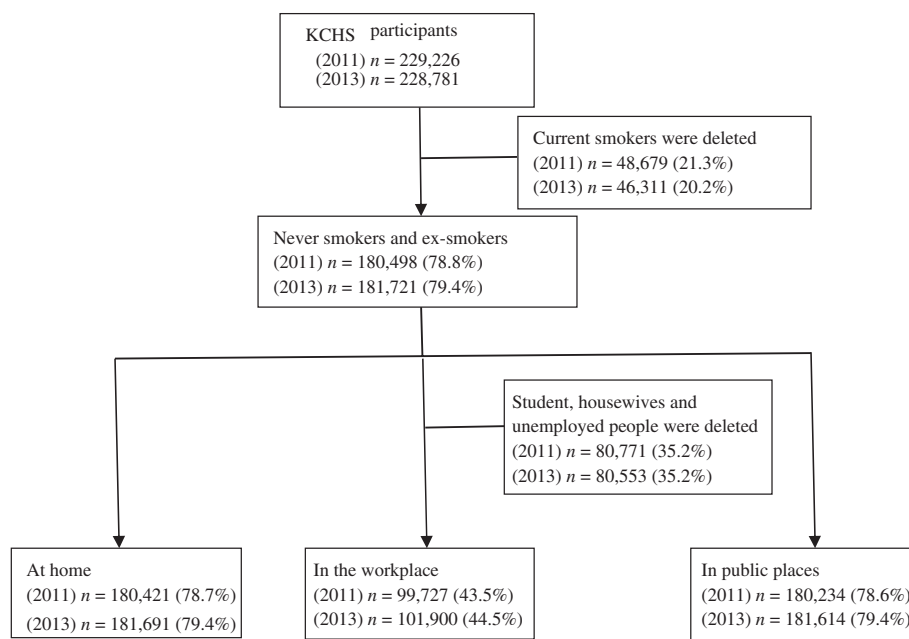
Data came from the 2011 and 2013 Korean Community Health Survey (KCHS) (KCHS, 2013) and the Development of Health Indicators for Community Health Ranking (DICR) report (Korea CDC, 2013). The KCHS was a nationwide survey. It collected data from 253 local communities and first was conducted in 2008. The surveys used similar multistage, stratified cluster sample designs to produce nationally representative data. The 2011 survey was completed by 229,226 adults who were aged  $\geq 19$  years and the corresponding 2013 number was 227,859. The DICR used a theoretically and empirically supported community health model and collected data from 253 local communities. The health factors were measured in five domains: social and economic factors, clinical care, health behaviors, physical environment, and health policies. There were two regions that were not included in the present study because Yeongi county was exempted in the 2013 KCHS and because Sejong City was exempted in the DICR.

### Ethical considerations

The data sources are publicly available. This study was approved by the Institutional Review Board of Sungkyunkwan university (IRB No: 2014-06-008).

### Measurements

The dependent variables were the prevalence of SHS exposure in the home, in the workplace, and in public places. The survey queried the daily exposure (h) to SHS in the home and workplace and exposure to SHS in public places in the prior year. The responses were recorded as 1 for “No exposure/0 h” and 2 for “Yes/exposure.” The SHS exposure in the three regions was analyzed separately.



**Figure 1** Selection process of the study's population sample. KCHS, Korean Community Health Survey.

Previous studies analyzed the impact of regional environments, socioeconomic factors, and active smoking prevalence (Jemal *et al.*, 2011; Park *et al.*, 2010). These dimensions were used to develop the model for analysis in order to obtain the information on SHS exposure. A model of three dimensions (health behavior factors, socioeconomic status, and health policy), including nine independent regional variables, was made to evaluate their relationship with SHS prevalence.

The health behavior variables included the prevalence of active smoking, cancer screening rate, and drinking rate that would be considered excessive and dangerous. The socioeconomic variables that were analyzed included the unemployment rate, high school graduation rates, equalization of household income, and proportions of families with a single parent or grandparents only. The health policy variables were the proportion of the health budget and financial autonomy variables. The correlation of these regional variables with SHS prevalence was analyzed according to the exposure locations.

### Data collection

In Korea, the male adult ( $\geq 19$  years of age) population was ~17,974,000 and the female population was 18,791,000 in 2010 (KOSIS, 2010). There were 229,226 adults who were  $\geq 19$  years of age in the 2011

completed interviews and 228,781 adults in the 2013 completed interviews in the KCHS.

Among the participants (non-smokers, including “never smokers” and “ex-smokers” in 2013), 60,051 (26.2%) were men and 121,670 (53.2%) were women. Among the men, 25,044 (10.9%) were never smokers and 34,996 (15.3%) were ex-smokers. There were 118,647 (51.9%) women who were never smokers and 3017 (1.3%) who were ex-smokers. As Figure 1 shows, students, housewives, and unemployed persons were removed from the data of SHS exposure in the workplace. The same method was used to select the study population sample of 2011.

### Data analysis

The median, minimum, and maximum values of SHS prevalence in the three exposure locales in the 252 regions were determined. A chi-squared test was used to examine and compare the SHS prevalence in 2011 and 2013 at the regional level and a paired *t*-test was used to compare the SHS prevalence of 2011 and 2013 in 252 regions. The regions with a significant difference in SHS prevalence in 2013, compared to 2011, were divided into two groups according to decreased SHS prevalence (group 1) and increased prevalence (group 2). In order to estimate the difference in regional characteristics between the two groups, a *t*-test analysis was used. A correlation analysis and linear regression

were used to investigate the impacts of the regional variables on SHS prevalence. To account for differential probabilities of selection, the sampling weight was calculated for each respondent. These weights were used in the analysis to ensure regional representation. The Cronbach's alpha was used to test the consistency in SHS exposure at the home, workplace, and public locations. The analyses relied on an alpha level of 0.05 to confer statistical significance of the results. The analyses were run by using the IBM SPSS Statistics for Windows v. 20 system (IBM Corporation, Armonk, NY, USA).

## RESULTS

### Second-hand smoke prevalence patterns

The SHS prevalence median values and regions at the extremes of the ranges for the variables that were studied are summarized in Table 1. There was a wide variation in SHS prevalence across regions. The prevalence of SHS ranged from 1.8% to 20.6% in the home, 3.1% to 36.7% in the workplace, and 21.6% to 96.8% in public places. At the same time, a wide variation in regional variables also was observed.

Second-hand smoke has been decreasing in Korea. Its prevalence at home, in the workplace, and in public locales has decreased from 10.2% in 2011 to 8.9% in 2013, from 24.2% in 2011 to 18.7% in 2013, and from 87.4% in 2011 to 86.2% in 2013. The degree of differences in the regional SHS prevalence differed significantly in 2013, compared to 2011 (Table 2). The Cronbach's alpha coefficient for SHS exposure at the three different locations was 0.223 in 2013 and 0.231 in 2011, indicating inconsistency in SHS exposure in the three locales (data not shown).

### Crude and adjusted linear regression results of the regional variables

The crude results showed that, at home, active smoking prevalence had a positive relationship with SHS prevalence at home. In the adjusted results, the high school

**Table 1** Table of prevalence of second-hand smoke (SHS) exposure and regional variable data

Variable	Minimum	Maximum
Independent variables		
2013 prevalence of SHS (%)		
At home	1.76	20.61
At the workplace	3.05	36.70
At public places	21.63	96.80
2011 prevalence of SHS (%)		
At home	3.33	25.02
At the workplace	3.35	44.76
At public places	27.67	96.64
Regional-level variables		
Health behavior		
Prevalence of active smoking (%)	33.29	60.35
Heavy drinking rate (%)	5.98	28.69
Cancer screening rate (%)	20.41	66.36
Socioeconomic status		
High school graduation rate (%)	36.30	95.66
Unemployment rate (%)	1.50	11.20
Equalization of household income (10,000 KRW/month)	81.48	335.71
Proportion of families with a single parent or grandparents only (%)	4.41	13.84
Health policy		
Proportion of health budget (%)	0.88	8.73
Financial autonomy	32.80	90.10

graduation rate was positively related with SHS exposure, while a high level equalization of household income had a negative relationship.

In the workplace, a heavy drinking rate, high school graduation rates, equalization of household income, the proportion of families with a single parent or grandparents only, and the proportion of the health budget had a positive relationship with the SHS prevalence in the workplace, while the cancer screening rate had a negative relationship. After being adjusted, only the high school graduation rates were positively related with the SHS prevalence in the workplace.

**Table 2** Paired sample *t*-test results of second-hand smoke (SHS) prevalence of 2011 and 2013

Location	Mean	SD	95% confidence interval		<i>t</i> -value	<i>P</i> -value
			Lower	Upper		
PSHS_H 2013–PSHS_H 2011	−0.48	3.80	−0.96	−0.014	−2.03	0.044
PSHS_W 2013–PSHS_W 2011	−4.24	6.62	−5.07	−3.420	−10.17	0.000
PSHS_P 2013–PSHS_P 2011	−1.14	8.97	−2.25	−0.027	−2.02	0.045

PSHS\_H, prevalence of SHS at home; PSHS\_P, prevalence of SHS in public places PSHS\_W, prevalence of SHS in the workplace; SD, standard deviation.

**Table 3** *t*-Test results of two regional groups (second-hand smoke [SHS] prevalence increased and decreased)

Variable	At home			In the workplace			In public places		
	Mean		<i>P</i> -value	Mean		<i>P</i> -value	Mean		<i>P</i> -value
	Decreased	Increased		Decreased	Increased		Decreased	Increased	
Prevalence of active smoking (%)	47.36	46.94	0.654	46.91	46.65	0.830	48.03	45.29	0.001**
Heavy drinking rate (%)	16.60	15.44	0.081	15.88	15.73	0.875	15.05	15.40	0.605
Cancer screening rate (%)	48.50	50.75	0.858	48.48	52.13	0.032*	50.54	49.90	0.581
High school graduation rate (%)	67.00	66.45	0.932	66.94	62.55	0.229	60.70	68.08	0.002**
Unemployment rate (%)	6.31	6.28	0.786	–	–	–	6.82	5.88	0.002**
Equalization of household income (10,000 KRW/month)	167.90	165.53	0.370	166.89	157.47	0.365	147.48	174.99	0.000**
Proportion of family with a single parent or grandparents only (%)	9.00	8.57	0.754	8.65	8.27	0.492	7.99	8.50	0.157
Proportion of health budget (%)	1.85	1.80	0.323	1.87	1.79	0.734	1.66	1.88	0.109
Financial autonomy (%)	63.51	61.37	0.170	63.98	60.17	0.107	63.65	62.96	0.668

\*\* *P* < 0.01 and\*\*\* *P* < 0.05.

In public places, a heavy drinking rate, high school graduation rates, equalization of household income, the proportion of families with a single parent or grandparents only, and the proportion of the health budget had a positive relationship with the SHS prevalence, which were mostly the same as with the workplace. In the adjusted results, a heavy drinking rate, high school graduation rates, the proportion of families with a single parent or grandparents only and the cancer screening rate had a positive relationship.

### Characteristics of the regions with increased and decreased second-hand smoke prevalence

The *t*-test results (Table 3) of the regions featuring increased and decreased SHS prevalence showed no significant relationship to the home location. The cancer screening rate was significantly associated with SHS exposure in the workplace. Active smoking prevalence, the high school graduation rate, unemployment rate, and equalization of household income were significantly related with SHS exposure in public places. In the workplace locations, the mean cancer screening rate was higher in the regions with an increased prevalence of SHS exposure than in the regions with a decreased prevalence of SHS exposure. In public places, the high school graduation rate and equalization of household income were higher in the regions with an increased prevalence of SHS exposure than in the regions with a decreased prevalence of SHS exposure, while active smoking prevalence and the unemployment rate were lower.

### DISCUSSION

In this study, the effects of socioeconomic factors, regional health behavior, and health policy on the prevalence of SHS in 252 regions of South Korea were analyzed. Compared to 2011, the prevalence of SHS in all three locations had a decreased trend overall. In Korea, the smoke-free zones in public facilities were expanded in 1999, 2003, 2006, and 2012 (Lee *et al.*, 2014). The decreasing overall trend that is evident from 2011 to 2013 indicates the influence of this policy in declining SHS exposure in Korea. Still, the prevalence of SHS exposure remains high on the whole, especially in public places. Additionally, this study's results show that the prevalence of SHS exposure varied in different regions by exposure location. This substantiates the view that SHS prevalence is affected by the specific location and also by regional characteristics.

At home, in the health behavior dimension of the regional level, the crude linear regression results showed that an active smoking prevalence had a positive correlation with SHS prevalence at home. It could be said that, in these high active smoking prevalence areas, there is still a high proportion of smokers at home. It seems that a smoke-free policy should be implemented not only in the workplace and public places, but also in residential areas. Meanwhile, the adjusted results indicated that education had a positive association with SHS exposure. The indication is that persons living in the regions with a high educational level have more SHS exposure at home. These persons usually have a high education level. They might have more awareness and are sensitive to SHS exposure. They might have

perceived exposure to SHS as a health hazard, which had been a profound experience in relation to SHS.

In contrast, the adjusted results indicated that a high level of household income had a negative association with SHS exposure. Persons who live in high income areas, such as in the district of detached houses, might have less exposure to SHS at home. A previous study's result was consistent with the results of this study, which stated that a high regional income level was inversely associated with exposure to SHS at home (Cai *et al.*, 2013).

In the workplace, it was observed that the SHS prevalence had a positive relationship with the drinking rate. It reflected a social and cultural phenomenon that is unique to Korea. In Korea, colleagues often have dinner together and they think that it is a very important way of social interaction and communication. Non-smokers with colleagues who are current smokers could have a high exposure to SHS. In general, persons who smoke or drink usually become friends or peers easily. They often go out together for social activities and influence each other.

Regarding the socioeconomic factor dimension, the SHS prevalence in the workplace was high in the regions that had a high level of education and income. As these regions generally have a high socioeconomic development level, such as urban, they also have a high density of persons. As the population density is intensive, persons who are jammed into narrow workplaces seem to be more exposed to SHS. Moreover, persons with a high education and income level might have more awareness and are sensitive to SHS exposure. They might have perceived the exposure to SHS as a health hazard, which had been a profound experience in relation to SHS. In contrast, although the authors think that education can provide the cultural, intellectual, and psychosocial resources that are necessary to cope with adverse personal circumstances in a more healthy way (Yi *et al.*, 2012), in this study's findings, highly educated persons continue to be exposed to SHS. It indicates that the education level might have an inverse association with SHS exposure in the social contextual environment.

In addition, it was found that persons who were living in a single parent family had more exposure to SHS in the workplace. The single parent seems to have more of an effect on his or her child's behavior and attitude regarding a healthy lifestyle. Previous evidence demonstrated that children who were living with a father who smoked were more than threefold as likely to initiate smoking (Gilman *et al.*, 2009). Thus, persons who grow

up in a single parent family are likely to have unhealthy behavior. Similarly, they would have a negligent attitude towards SHS exposure.

Additionally, the result showed that a high proportion of the health budget was positively associated with SHS prevalence in the workplace. Even though the regional income level is not the only determinant factor of the health budget, it plays an important role in defining how much can be spent on health by governments (Xu, Sak-sena, & Holly, 2011). Usually, the proportion of the health budget is higher in the high-socioeconomic areas than in the low-socioeconomic areas. As mentioned previously, in these areas, due to crowded space in the workplace, this creates more opportunity for SHS exposure.

In public places, the results showed that the drinking rate, education and income level, employment rate, single-parent family, and health budget were positively related with SHS prevalence. As mentioned previously, smoking and drinking behavior usually exist simultaneously. Persons who drink are likely to be more exposed to SHS in public places. The positive relationship between alcohol consumption and SHS exposure already has been confirmed in a previous study (Twose, Schiaffino, García, Borrás, & Fernández, 2007).

In contrast, persons who live in developed regions that have a high education and income level and high employment rate seem to easily be exposed to SHS in public places than in other regions. It might be that the high density of the population and the crowded space in public places create more opportunities for SHS exposure among non-smokers.

Moreover, the adjusted results indicated that the cancer screening rate had a significantly positive relationship with SHS prevalence. Persons who are living in these regions generally have a high socioeconomic status. Cancer screening adherence is positively associated with the socioeconomic status of the participants and an urban area of residence, which had been demonstrated in previous studies (Hay *et al.*, 2003; James, Greiner, Ellerbeck, Feng, & Ahluwalia, 2006).

In contrast, the authors speculated that SHS exposure and the cancer screening rate might have an inverse causal relationship. Persons who are more sensitive to the situation of SHS exposure and who are more concerned about their health seem to seek more cancer screening.

The comparison results between the two groups of increased SHS prevalence and decreased SHS prevalence regions indicated that, in the workplace, the cancer screening rate was high in the increased SHS prevalence regions. As mentioned previously, persons who live in a

**Table 4** Crude and adjusted linear regression results of the regional variables

Variable	At home		In the workplace		In public places	
	Crude	Adjusted <sup>†</sup>	Crude	Adjusted <sup>†</sup>	Crude	Adjusted <sup>†</sup>
Health behavior factors						
Prevalence of active smoking (%)	0.089*	0.10	−0.110	0.03	−0.173*	0.04
Heavy drinking rate (%)	0.132	0.05	0.171**	0.16	0.223**	0.39**
Cancer screening rate (%)	−0.090	−0.02	−0.189**	−0.08	0.029	0.25**
Socioeconomic status						
High school graduation rate (%)	0.190	0.07	0.561**	0.38**	0.678**	0.38**
Unemployment rate (%)	−0.090	−0.07	−0.049	0.37	−0.230**	−0.31
Equalization of household income (10,000 KRW/month)	0.045	−0.02	0.375**	−0.05	0.578**	0.01
Proportion of families with a single parent or grandparents only (%)	0.179	−0.01	0.522**	0.15	0.596**	1.24**
Health policy						
Proportion of health budget (%)	0.047	0.31	0.186**	0.53	0.604**	1.03
Financial autonomy (%)	0.031	0.03	−0.060	−0.01	−0.017	−0.02

<sup>†</sup>Adjusted for other regional variables.

\*\*  $P < 0.01$  and

\*\*\*  $P < 0.05$ .

high socioeconomic status region generally have good cancer screening adherence and persons with high SHS exposure are more sensitive to their health condition and have a high rate of cancer screening adherence.

In the public places, the high school graduation rates and equalization of household income in the regions with increased exposure to SHS was higher than in the regions with decreased exposure to SHS, while the active smoking prevalence and unemployment rate were lower. The prevalence of SHS in public places has an increased trend in the regions that have a high employment rate, high education and income level, and low active smoking prevalence.

As is known, high socioeconomic development regions generally have a very dense population and the space is very crowded. In these regions, there are many catering places where persons often visit. In crowded places, such as restaurants, coffee shops, and bistros, non-smokers are exposed to smoke as much as smokers (WHO, 2010). In addition, in high education and income regions, the employment rate is also higher than in the regions with low socioeconomic characteristics and usually they have more high-income and educated persons. As mentioned previously, these persons are more sensitive to the situation of SHS exposure.

In conclusion, since 2010, the Korean local government has established smoke-free regulations for controlling the active smoking prevalence in public places. Although the active smoking prevalence is decreasing, non-smokers living in the high income and educational level regions still have a higher rate of being exposed to SHS because of

crowded places and the high density of the population. Thus, according to this phenomenon, the authors would like to suggest that the local government should pay more attention to high-socioeconomic-characteristic regions and specific SHS control policy should be implemented in these regions.

There are several limitations to this study, whose conclusions could not explain the causal effects. Meanwhile, the result that was drawn from the ecological study could not be applicable to individuals, which is called “ecological fallacy.” Second, as the survey was not conducted annually, regional differences in the time point of survey implementation would affect SHS prevalence calculations. Nevertheless, the study emphasized societal, rather than individual, strategies and the ecological method includes a large number of persons that can be included in the study and a large number of risk factors that can be examined. It is an appropriate approach to assess region-level patterns and dynamics.

To the authors’ knowledge, this study was the first to examine the regional contextual factors that are related to SHS prevalence and how these factors differ by different exposure locations in Korea. In order to strengthen and improve the effect of SHS policies, the role of regional-level contextual factors should be recognized by policy-makers when addressing SHS exposure among persons. This study provides evidence to clarify the understanding of SHS exposure by considering the regional context.

It is suggested that local governments should make special protective measures or tailored regulations, according to the specific regional status and location, to protect non-

smokers from SHS. Persons who live in the regions that have a high socioeconomic level generally have more exposure to SHS. In this sense, more attention should be paid to high-socioeconomic-characteristic regions also. Moreover, as SHS exposure was most strongly associated with drinking behavior, a strict smoking ban should be implemented at catering places, such as bars and restaurants.

## CONFLICT OF INTEREST

The authors declare no conflict of interest.

## AUTHOR CONTRIBUTIONS

L-Y. S. conducted the whole study; J-H. P. supervised the study process.

## REFERENCES

- Alwan, N., Siddiqi, K., Thomson, H. & Cameron, I. (2010). Children's exposure to second-hand smoke in the home: A household survey in the north of England. *Health & Social Care in the Community*, 18, 257–263.
- Cai, L., Wu, X., Goyal, A., Han, Y. T., Cui, W. L., He, J. H. *et al.* (2013). Multilevel analysis of the determinants of smoking and second-hand smoke exposure in a tobacco-cultivating rural area of southwest China. *Tobacco Control*, 22, ii16–ii20.
- Gilman, S. E., Rende, R., Boergers, J., Abrams, D. B., Buka, S. L., Clark, M. A. *et al.* (2009). Parental smoking and adolescent smoking initiation: An intergenerational perspective on tobacco control. *Pediatrics*, 123, e274–e281.
- Hay, J. L., Ford, J. S., Klein, D., Primavera, L. H., Buckley, T. R., Stein, T. R. *et al.* (2003). Adherence to colorectal cancer screening in mammography-adherent older women. *Journal of Behavioral Medicine*, 26, 553–576.
- Honjo, K. (2004). Social epidemiology: Definition, history, and research examples. *Environmental Health and Preventive Medicine*, 9, 193–199.
- James, T. M., Greiner, K. A., Ellerbeck, E. F., Feng, C. & Ahluwalia, J. S. (2006). Disparities in colorectal cancer screening: A guideline-based analysis of adherence. *Ethnicity & Disease*, 16, 228–233.
- Jemal, A., Thun, M., Yu, X. Q., Hartman, A. M., Cokkinides, V., Center, M. M. *et al.* (2011). Changes in smoking prevalence among U.S. adults by state and region: Estimates from the tobacco use supplement to the current population survey, 1992–2007. *BMC Public Health*, 11, 512.
- Korea Centers for Disease Control and Prevention. (2013). Disease prevention. [Cited 16 Dec 2015.] Available from URL: [http://www.cdc.go.kr/CDC/notice/CdcKrInfo0201.jsp?menuIds=HOME001-MNU0004-MNU0007-MNU0025&fid=28&q\\_type=&q\\_value=&cid=20625&pageNum equals;1](http://www.cdc.go.kr/CDC/notice/CdcKrInfo0201.jsp?menuIds=HOME001-MNU0004-MNU0007-MNU0025&fid=28&q_type=&q_value=&cid=20625&pageNum equals;1) (in Korean).
- Korea Community Health Survey. (2013). Database. [Cited 16 Dec 2015.] Available from URL: <https://chs.cdc.go.kr/chs/index> (in Korean).
- Korean Statistical Information Service. (2010). Statistical database. Population/household. [Cited 28 Jan 2015.] Available from URL: <http://kosis.kr/eng/>
- Lee, B. E. & Ha, E.-H. (2011). Exposure to environmental tobacco smoke among south Korean adults: A cross-sectional study of the 2005 Korea National Health and nutrition examination survey. *Environmental Health*, 10, 29.
- Lee, H. A., Park, H., Kim, H. & Jung-Choi, K. (2014). The effect of community-level smoke-free ordinances on smoking rates in men based on community health surveys. *Epidemiology and Health*, 36, e2014037.
- Öberg, M., Jaakkola, M. S., Woodward, A., Peruga, A. & Prüss-Ustün, A. (2010). Worldwide burden of disease from exposure to second-hand smoke: A retrospective analysis of data from 192 countries. *The Lancet*, 377, 139–146.
- Palipudi, K. M., Sinha, D. N., Choudhury, S., Mustafa, Z., Andes, L. & Asma, S. (2011). Exposure to tobacco smoke among adults in Bangladesh. *Indian Journal of Public Health*, 55, 210–219.
- Park, E. J., Kim, H., Kawachi, I., Kim, I. H. & Cho, S. I. (2010). Area deprivation, individual socioeconomic position and smoking among women in South Korea. *Tobacco Control*, 19, 383–390.
- Twose, J., Schiaffino, A., García, M., Borrás, J. M. & Fernández, E. (2007). Correlates of exposure to second-hand smoke in an urban Mediterranean population. *BMC Public Health*, 7, 194.
- World Health Organization. (2010). Global adult tobacco survey Poland 2009–2010. [Cited 28 Jan 2015.] Available from URL: [http://www.who.int/tobacco/surveillance/en/tf\\_gats\\_poland\\_report\\_2010.pdf](http://www.who.int/tobacco/surveillance/en/tf_gats_poland_report_2010.pdf)
- World Health Organization. (2012). WHO global report: mortality attributable to tobacco. [Cited 28 Jan 2015.] Available from URL: [http://www.who.int/tobacco/publications/surveillance/rep\\_mortality\\_attributable/en/](http://www.who.int/tobacco/publications/surveillance/rep_mortality_attributable/en/)
- Xu, K. Saksena, P., & Holly, A. (2011). The determinants of health expenditure: A country-level panel data analysis. Available from URL: [www.resultsfordevelopment.org](http://www.resultsfordevelopment.org)
- Yao, T., Sung, H.-Y., Zhengzhong, M., Hu, T.-W. & Max, W. (2012). Secondhand smoke exposure at home in rural China. *Cancer Causes & Control*, 23, 109–115.
- Yi, O., Kwon, H. J., Kim, D., Kim, H., Ha, M., Hong, S. J. *et al.* (2012). Association between environmental tobacco smoke exposure of children and parental socioeconomic status: A cross-sectional study in Korea. *Nicotine & Tobacco Research*, 14, 607–615.