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Short Report

Neighborhood contextual factors for smoking among middle-aged Japanese: A multilevel analysis

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ABSTRACT

The purpose of this study is to explore neighborhood contextual factors in terms of smoking behaviors among middle-aged Japanese, by using a multilevel analysis. Subjects were Japanese men and women, between 40 and 59 years of age (40,961 for the cross-sectional analysis, and 9,177 for the longitudinal analysis), nested in 39 neighborhoods (*Kyuson*). The results showed that women in a less residentially stable neighborhood were more likely to be smokers. No associations were seen between current smoking and neighborhood deprivation; however, women in the most deprived neighborhood were more likely to quit smoking. This study is the first to demonstrate the associations between neighborhood environment and current smoking or smoking cessation, in a Japanese setting. The findings imply that policy makers should consider targeting neighborhood conditions in order to help reduce smoking prevalence, especially among women.

1. Introduction

"Neighborhood" has become a significant keyword in recent studies of social epidemiology and health geography. Researchers have explored whether or not neighborhood contextual factors affect the health of individuals, even after considering individual composition (Diez Roux and Mair, 2010; Kawachi and Berkman, 2003). This is also the case for health behaviors, including tobacco smoking. Neighborhood-level factors, as well as individual- and household-level factors, have been considered to relate to smoking (Lindström, 2008; Wilcox, 2003).

Although the possible neighborhood factors that affect smoking are considered to be multiple and diverse, it is obvious that area-level deprivation has attracted a lot of interest from researchers (Pearce et al., 2012). This is because the residents living in socio-economically deprived areas are assumed more likely to become smokers, through the mechanisms such as; availability of tobacco, exposure to tobacco advertising, or psychosocial stress related to living in a disadvantaged neighborhood (Diez Roux et al., 2003). To date, the direct and indirect effects of neighborhood deprivation or socioeconomic status (SES) on smoking have been well documented (Datta et al., 2006; Mathur et al., 2013; Matheson et al., 2011; Chuang et al., 2005; Kendzor et al., 2012; Cohen et al., 2011; Karvonen et al., 2008).

Social environment is another one of the important neighborhood factors related to smoking behavior, and it has been found to be associated with smoking prevalence. For example, the places or communities where many people smoke cigarettes may increase the probability of smoking, by creating social norms that accept smoking behavior (Ahern et al., 2009; Harbour, 2012; Karasek et al., 2012; Corsi et al., 2012). Social capital or social cohesion have also been considered to relate to health behaviors, such as smoking (Lindström, 2008; Brown et al., 2006; Poortinga, 2006). In addition, researchers have focused on residential stability in neighborhood community as a possible basis for building

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neighborhood social environments, like those mentioned above (Thorlindsson et al., 2012). To put it simply, residentially stable neighborhoods are assumed to have a strong social cohesion and shared social norms, resulting in an effect on smoking initiation, continuation, and cessation.

Despite this evidence, empirical studies examining how the above-mentioned neighborhood factors relate to smoking have been limited in Asian societies (Chuang et al., 2007), although some multilevel studies were performed recently. For example, in Taiwan, Chuang et al. (2007) found direct and indirect effects of neighborhood education level, neighborhood concentration of elderly people, and neighborhood social disorganization on smoking. Park et al. (2010) showed that manual jobs were associated with a higher likelihood of smoking, and the association was modified by area deprivation in South Korea. In China, Cai et al. (2013) reported that living in a high-income community was associated with a low rate of current smoking and exposure to second-hand smoke, in a tobacco-cultivating rural area.

In Japan, despite the fact that smoking was the main determinant of adult mortality from non-communicable diseases (Ikeda et al., 2011), research is lacking on the possible association between neighborhood environment and smoking behavior. Although some Japanese studies have analyzed contextual factors related to smoking, the analytical units used were not at the neighborhood-level; larger geographical units have been used, like prefecture (Fukuda et al., 2005) and municipality (Takeuchi et al., 2012), or non-geographical units, like workplace (Suzuki et al., 2010) and school (Takakura, 2011). By using small area units (*cho-cho-aza*), Murayama et al. (2012) analyzed the association between a co-occurrence of risk factors, including smoking, and four types of neighborhood social capital. Although the authors found no significant association, the outcome variable was not specific to smoking behaviors.

The purpose of this study is to explore the neighborhood contextual factors for smoking behaviors among middle-aged Japanese men and women, by using a multilevel model. Two neighborhood factors (deprivation and residential instability) were analyzed to determine their possible association with current smoking and smoking cessation, while controlling for individual demographic and socioeconomic variables. We also focus on the gender difference, because the presence of gender differences in the association between smoking and residential areas, including situations in Asian settings, have been previously reported (Chuang and Chuang, 2008; Fukuda et al., 2005). In this regard, the middle-aged population is distinctive, because greater gender difference (e.g., gendered division of labor and its relation to neighborhood) may be apparent in this age group.

2. Methods

2.1. Data

Data was obtained from the Japan Public Health Center-based Prospective Study (JPHC study), which began in 1990 (Cohort I) with a baseline survey that used a self-administered questionnaire. Subjects were aged between 40 and 59 years, living in four public health center (PHC) districts in four prefectures across Japan: Iwate prefecture, Akita prefecture, Nagano prefecture, and Okinawa prefecture. The four PHC districts were situated in relatively rural settings within middle-sized cities outside of the metropolitan areas.

The number of respondents living in the four PHC districts was 43,149 (20,665 men and 22,484 women), and the response rate was 79% (men 76%, women 82%). Of these, 9 respondents were excluded because they were deemed ineligible (7 were of non-Japanese nationality and 2 had moved before the start of the study). We further excluded people with a history of cancer, stroke, or cardiovascular diseases ($n=1,549$) to avoid biasing our results (i.e., the presence of such high-risk diseases may have influenced the individual's smoking status, socio-economic status, and living area). The number of remaining respondents was 41,591. We further excluded those with addresses that could not be geocoded ($n=4$), those who did not provide information on their smoking status at the baseline ($n=157$), or those who did not provide information on their years of residence ($n=488$). The final sample of the cross-sectional baseline data was comprised of 40,961 respondents (19,687 men and 21,274 women).

For the purpose of analyzing smoking cessation, in addition to the current smoking status at the baseline, data from a follow-up survey was used. A self-administered follow-up survey was conducted for all baseline participants in 2000 (10 years after the baseline survey), with a response rate of 84% (Honjo et al., 2010). By combining the data from the follow-up survey with the baseline survey, we made a longitudinal dataset on smoking, which consisted of respondents who smoked at the baseline and provided information on their smoking status in the follow-up survey ($n=9,177$; 8,307 men and 870 women).

More details of the JPHC study design are described elsewhere (Tsugane and Sobue, 2001). The study was approved by the human ethics review committee of the National Cancer Center, Japan.

2.2. Dependent variables

Two outcome variables of smoking behavior were used. "Current smoking" was defined as "1" if the respondent smoked at the baseline, and as "0" elsewhere. "Smoking cessation" was defined as "1" if the respondent smoked at the baseline but did not smoke at the time of the follow-up survey, and as "0" if they smoked at the time of both surveys.

2.3. Independent variables

Kyuson, which means "old village" and represents the municipal boundaries as of 1950, was used as the geographical unit for analysis. In our study area, the number of *Kyuson* was 39, and the average number of respondents was 1,050 (range: 120–8,660) for the baseline data. *Kyuson* is no longer an administrative unit due to their mergers with other municipalities over time; however, this unit is still used as a basis for social and cultural organization of the community (e.g., school districts). Although no clear definition of "neighborhood" has been established, the *Kyuson* is reasonably small and meaningful enough to be considered as a neighborhood-level geographical unit. Previous studies in Japan have also used this unit for contextual analyses (Ichida et al., 2009).

Possible contextual neighborhood factors for predicting smoking behaviors included deprivation and residential instability. For deprivation, we used the *Kyuson*-level deprivation index, devised by Nakaya (2011), which is a composite indicator consisting of weighted sums of several poverty-related census-based variables, such as proportion of old couple households, proportion of old single households, proportion of single-mother households, proportion of rented houses, proportion of sales and service workers, proportion of agricultural workers, proportion of blue collar workers, and the unemployment rate, from the 1995 population census. Details of the deprivation index are described elsewhere (Nakaya, 2011; Nakaya et al., 2014). Residential instability in each neighborhood was defined as the proportion of individuals who had lived in the same municipality for five years or less. The calculation was done using JPHC individual data, because this information has only been available since the population census of 2000. These neighborhood variables were grouped into quartiles. They were linked to the individual data at the baseline, and were used for both cross-sectional and longitudinal analyses.