Original article

Living with a nonsmoking partner and smoking cessation of middle-aged Japanese male smokers: a prospective cohort study

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**Background:** Smokers’ nonsmoking partners may be expected to encourage the smokers to quit smoking. However, there is little evidence regarding whether this expectation is applicable to the cases of middle-aged Japanese male smokers.

**Objective:** We examined the relationship between living with a nonsmoking partner and smoking cessation of middle-aged Japanese male smokers.

**Methods:** A prospective cohort study was performed. Five hundred seventy nine male smokers were observed for two years during which no intensive smoking cessation interventions were offered to either the subjects or their partners. The smoking status of the subjects and their partners was assessed based on the subjects’ self-reporting. Age, the number of cigarettes smoked per day, educational background, illness being treated, frequent alcohol use, and occupational class of the subjects at the baseline were considered as the covariates related to their smoking behaviors. Using a multiple logistic regression analysis, we calculated the odds ratio of living with a nonsmoking partner at the baseline on smoking cessation of the subjects at the follow-up adjusted for the covariates.

**Results:** At the follow-up, smoking cessation rates were 5.7% (24/419) among the subjects who were living with a nonsmoking partner at the baseline and 4.4% (7/160) among those who were not. The difference in cessation rates between these two groups was not statistically significant. The adjusted odds ratio of living with a nonsmoking partner at the baseline on smoking cessation was 0.79 (95% confidence interval: 0.31, 2.01, \(p = 0.625\)).

**Conclusion:** This study did not show that living with a nonsmoking partner significantly facilitated smoking cessation of middle-aged Japanese male smokers. It may be an excessive, unreal expectation that nonsmoking women in Japan automatically encourage their middle-aged male smoking partners to quit smoking when no intensive support for smoking cessation is offered.

**Keywords:** Japan, middle-aged smokers, partners of smokers, prospective cohort study, smoking cessation

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Smoking prevalence remains high, at 43% to 66%, among men in East Asian countries, such as Japan, South Korea, and China [1]. Identifying factors that facilitate smoking cessation may help the smokers achieve smoking cessation more easily. Smokers at all age levels benefit by quitting smoking. Even middle-aged smokers can extend their lifetimes by smoking cessation [2]. Although a variety of effective therapeutic options is available, behavioral factors remain important for successfully quitting smoking [3]. From this point of view, the smoking status of smokers’ partners has attracted interest of practitioners and researchers in the field of tobacco control.

Smokers’ nonsmoking partners may be expected to encourage the smokers to quit smoking. However, there is little evidence regarding whether this expectation is applicable to the cases of middle-aged Japanese male smokers. Although nonsmoking partners are more helpful than smoking partners in motivating smokers to quit smoking [4], change in the
motivation does not always bring about achievement of smoking cessation. Few longitudinal studies have so far been performed for middle-aged male smokers in order to examine the effects of smokers’ nonsmoking partners on smoking cessation of the smokers. Only a Danish study observed smokers aged 30 to 60 years for 10 years and indicated that smokers with nonsmoking partners quit smoking more frequently than those with smoking partners and those without partners [5]. The majority of relevant studies have exclusively focused on recently married young couples [6-8]. In addition, most relevant studies have been conducted in the U.S. and Europe but few in the Asian region.

Hence, the authors conducted a prospective cohort study to examine whether living with a nonsmoking partner facilitated smoking cessation of middle-aged Japanese male smokers.

Materials and methods
The procedure and purpose of this prospective cohort study were explained to all who were eligible for the study before the subjects provided written consent. No intensive interventions for smoking cessation were offered to either the subjects or their partners during the two-year observation period. The Ethics Committees of Kochi Medical School approved the study protocol. The details of this prospective cohort study were also reported elsewhere [9, 10].

Subjects
The participants were recruited from an electrical products corporate group in Osaka, Japan, in July 2003. The eligibility criteria included age (39 years or older) and absence of health-related work limitations. Of the eligible 1,423 male employees, 579 (41%) were identified as smokers at the baseline (see definition below) and were enrolled as the subjects. A follow-up examination was conducted after two years, in July 2005. Of the subjects, 347 (60%) underwent the follow-up examination (the remaining subjects), whereas 232 (40%) dropped out before the follow-up (the dropouts). We were unable to investigate the reasons for their nonparticipation. However, periodic personnel reshuffling and mandatory age-bound retirement could be the main reasons. The dropouts were older (48.6 (6.5) vs. 46.3 (5.3), \(p < 0.001\)) and had been smoking for more years (28.4 (6.7) vs. 26.2 (5.8), \(p < 0.001\)) than the remaining subjects. There were no significant differences in any other baseline variables between the remaining subjects and the dropouts. The dropouts were included in the analysis as existing smokers.

Study variables
Data was collected using a questionnaire that was distributed to the subjects when they underwent their annual health check-up. In Japan, following the Industrial Safety and Health Law, all employees must take an annual health check-up that their employers must set up.

The smoking status of the subjects was assessed at the baseline and follow-up. The subjects chose one of the following three options: “I have never smoked”, “I used to smoke”, and “I am currently smoking”. Those who chose the last one were defined as smokers. We referred to the WHO guideline for this definition [11]. We did not adopt biochemical verification because reviews indicate that the self-reported smoking status is reliable in observational studies [12-14]. The subjects who quit smoking were defined as those who were smoking at the baseline and were not smoking at the follow-up. Smoking duration and intensity were examined at the baseline: the subjects were asked to report the number of years they had been smoking and the average number of cigarettes they smoked per day.

The smoking status of the subjects’ partners was assessed at the baseline. The subjects chose one of the following three options: “My partner is not smoking”, “My partner is smoking”, and “I have no partner to live with”. The subjects who chose the first one were regarded as living with a nonsmoking partner. Referring to findings derived from Japanese smokers [15, 16], the authors considered the following baseline characteristics as the covariates that could be related to smoking behaviors: the subject’s age, educational background (junior high school, high school, and university graduate), illness being treated (hypertension, heart disease, cerebrovascular disease, respiratory disease, and/or other diseases), frequent alcohol use (consuming more than four nights per week), and occupational class. Regarding the occupational class, white-collar workers consisted of managers, office clerks, planners, sales, and engineers.

Data analysis
First, with the use of a chi-square test and a t-test, the baseline characteristics were compared between the subjects divided by living with a
nonsmoking partner at the baseline. Second, the relationship between each covariate and smoking cessation was examined using a chi-square test and a t-test. Finally, cessation rates were compared by living with a nonsmoking partner at the baseline. After a chi-square test was applied, a multiple logistic regression analysis was conducted to calculate the adjusted odds ratio of living with a nonsmoking partner at the baseline on smoking cessation. We set two models for this purpose. In Model 1, we adjusted for age and the number of cigarettes smoked per day of the subjects at the baseline. Next, in Model 2, educational background, illness being treated, frequent alcohol use, and occupational class of the subjects at the baseline were additionally adjusted. Smoking duration of the subjects at the baseline was not included because of possible multicollinearity. Spearman’s rank correlation coefficient between the subjects’ age and smoking duration at the baseline was 0.95 ($p < 0.001$).

Statistical calculations were executed by SPSS 17.0 for Windows (SPSS Japan Inc., Tokyo, Japan). The level of significance was set at 0.05 (two-tailed).

Results

Baseline characteristics of the subjects divided by living with a nonsmoking partner are indicated in Table 1. The subjects who were living with a nonsmoking partner included university graduates and white-collar workers at a higher rate than those who were not. There was no significant difference in any other baseline variables by living with a nonsmoking partner.

Thirty-one subjects (5.4%) quit smoking at the follow-up. Those who quit smoking were younger than those who did not [45.3 (4.6) vs. 47.3 (6.0), $p = 0.022$]. White-collar subjects showed a lower cessation rate than the others (4% vs. 8%, $p = 0.040$). No other covariates were related to smoking cessation.

The results of the relationship between living with a nonsmoking partner at the baseline and smoking cessation are shown in Table 2. The subjects who were living with a nonsmoking partner at the baseline presented a higher cessation rate than those who were not. However, the difference in cessation rates between these two groups was not significant.

<table>
<thead>
<tr>
<th>Table 1. Baseline characteristics of the subjects.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Living with a nonsmoking partner</td>
</tr>
<tr>
<td>---------------------------------</td>
</tr>
<tr>
<td>Age (years)</td>
</tr>
<tr>
<td>Smoking behaviors</td>
</tr>
<tr>
<td>Years of smoking experience</td>
</tr>
<tr>
<td>Number of cigarettes smoked/day</td>
</tr>
<tr>
<td>Educational background</td>
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<tr>
<td>Junior high school graduates</td>
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<tr>
<td>High school graduates</td>
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<tr>
<td>University graduates</td>
</tr>
<tr>
<td>Having illness being treated</td>
</tr>
<tr>
<td>Frequent alcohol use</td>
</tr>
<tr>
<td>≥4 nights per week</td>
</tr>
<tr>
<td>Occupational class</td>
</tr>
<tr>
<td>White-collar workers</td>
</tr>
</tbody>
</table>

Baseline characteristics are presented as mean (SD) or frequency (%). P values were calculated using a t-test for continuous variables and a chi-square test was used for discrete variables.
Discussion

Our findings did not show that living with a nonsmoking partner significantly facilitated smoking cessation of middle-aged Japanese male smokers when no intensive support for smoking cessation was offered. Contrastingly, a Danish longitudinal study showed that nonsmoking spouses facilitated smoking cessation of smokers aged 30 to 60 years [5]. We suppose that female nonsmokers in Japan do not tend to take positive action toward their spousal smoking behaviors. A recent Internet-based poll conducted by Johnson & Johnson Japan Co. Ltd. also showed that only 7.8% of those who had attempted smoking cessation were motivated to do so by their partners (http://www.jnj.co.jp/group/press/2009/1216/index.html; accessed on August 19, 2011; written in Japanese). Furthermore, even if the subjects had been motivated to attempt smoking cessation by their nonsmoking partners, the subjects may not have succeeded in the attempt without nicotine replacement therapy (NRT) or another effective pharmacotherapy. We did not examine how many subjects received NRT. However, because only a few subjects quit smoking, we could not classify them into three subgroups for comparison of smoking cessation rates, that is, those with a nonsmoking partner, with a smoking partner, and without a partner, as in the Danish study [5]. According to Peduzzi et al. [19, 20], 10 or more events per predictor variable (EPV) are required in a logistic regression analysis for the accuracy and precision of regression coefficients. Although there was little difference in the odds ratios of living with a nonsmoking partner on smoking cessation between our Models 1 and 2, we had fewer than 10 EPV in Model 2. Our findings should be replicated in other larger studies, which include more people who quit smoking.

It could be possible that the present study underestimated the effects of living with a nonsmoking partner on smoking cessation. One possible cause is selection biases peculiar to occupational epidemiological studies [21]. Since, the subjects were healthy enough to work, they might have been less motivated to quit smoking for health reasons. Another reason is that our study included the dropouts in the analysis as existing smokers. However, because only a few subjects quit smoking, we could not classify them into three subgroups for comparison of smoking cessation rates, that is, those with a nonsmoking partner, with a smoking partner, and without a partner, as in the Danish study [5]. According to Peduzzi et al. [19, 20], 10 or more events per predictor variable (EPV) are required in a logistic regression analysis for the accuracy and precision of regression coefficients. Although there was little difference in the odds ratios of living with a nonsmoking partner on smoking cessation between our Models 1 and 2, we had fewer than 10 EPV in Model 2. Our findings should be replicated in other larger studies, which include more people who quit smoking.

We set a two-year observation period for this study. In fact, the appropriate observation period for this kind of research is still controversial. One to two years may not be long enough [22, 23]. Nevertheless, five years or longer might be problematic because changes during the period could disturb specifying the factors related to successful smoking cessation [24].

Table 2. Relationship between living with a nonsmoking partner at the baseline and smoking cessation.

<table>
<thead>
<tr>
<th></th>
<th>n</th>
<th>N of those who quit smoking(%)</th>
<th>Adjusted odds ratio</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(95% confidence interval)</td>
</tr>
<tr>
<td>Living with a nonsmoking partner</td>
<td>419</td>
<td>24 (5.7)</td>
<td>Reference</td>
<td></td>
</tr>
<tr>
<td>Not living with a nonsmoking partner</td>
<td>160</td>
<td>7 (4.4)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Model 1**</td>
<td></td>
<td></td>
<td>0.80 (0.34, 1.91)</td>
<td>0.612</td>
</tr>
<tr>
<td>Model 2”</td>
<td></td>
<td></td>
<td>0.79 (0.31, 2.01)</td>
<td>0.625</td>
</tr>
</tbody>
</table>

*p value was calculated using a chi-square test. **Adjusted odds ratios and p values were calculated using a multiple logistic regression analysis. In Model 1, the odds ratio was adjusted for age and the number of cigarettes smoked per day of the subjects at the baseline. In Model 2, the odds ratio was adjusted for age, the number of cigarettes smoked per day, educational background, illness being treated, frequent alcohol use, and occupational class of the subjects at the baseline.
If we had set a different duration for the observation period, different findings may have been observed.

The following limitations could limit the interpretation of the present findings. We should have examined the subjects’ degree of nicotine dependence assessed using the Fagerström Test for Nicotine Dependence [25] and the attitude and motivation to quit smoking evaluated using the Transtheoretical Model [26]. These factors might have affected their attempts and achievement of smoking cessation. Evidence regarding the accuracy of the partners’ smoking status as assessed in our study is insufficient. We did not examine how many ex-smokers were included in the nonsmoking partners. There could have been some difference between the ex-smoking and never-smoking partners with regard to encouraging the subjects to quit smoking. The present findings may not be directly applicable to smokers who receive intensive support for smoking cessation.

Conclusions

Our prospective cohort study did not indicate that living with a nonsmoking partner had a significant effect on smoking cessation rate of middle-aged Japanese male smokers. It may be an unreal expectation that nonsmoking women in Japan automatically encourage their middle-aged male smoking partners to quit smoking, when support for smoking cessation is not offered.

Acknowledgements

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