was approved by the ethics committee of Nara Women's University.

## Results

### Baseline characteristics of the participants

Figure 1 shows the flowchart of the participants included in the present study. Out of 1534 enrollees, 1122 completed the baseline questionnaire without data missing. Excluding teachers who smoked at baseline, had definite/suspected diseases at baseline, did not answer the follow-up questionnaire, and had missing data in the follow-up survey, the remaining 689 were eligible for the analyses. Compared with the eligible participants (n = 689), teachers who did not answer the follow-up questionnaire or had missing data in the SF-8 at follow-up (n = 234) were somewhat more likely to be male (106 of 234 [45%] vs 257 of 689 [37%]; p = 0.030) and had a less positive attitude towards the smoke-free school policy (173 of 234 [74%] vs 555 of 689 [81%]; p = 0.032).

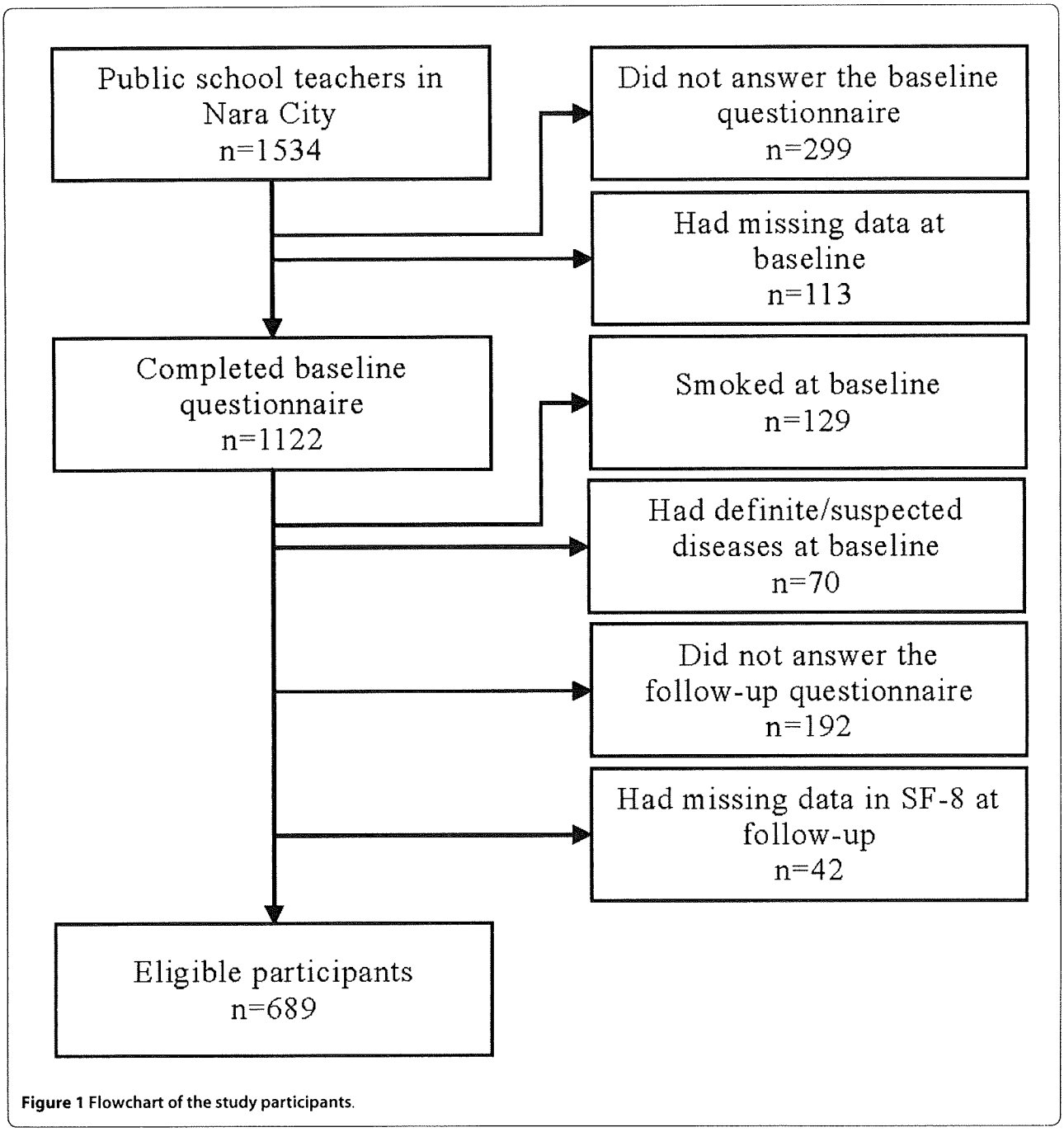


**Figure 1** Flowchart of the study participants.

After the enforcement of the smoke-free policy, 16 (14%) of the 111 smoking teachers completing the follow-up survey had quit smoking successfully.

Table 1 shows the baseline characteristics of the participants. The number of participants of non-smokers and passive smokers was 447 and 242, respectively. Passive smokers were somewhat younger (p = 0.036) and more likely to belong to junior and senior high schools (p = 0.001) compared with non-smokers. Only a few senior high school teachers (31 in number) were available because of the uniqueness of the municipal high school in Nara City.

### Change in HRQOL before and after the enforcement of the smoke-free school policy

Table 2 shows the SF-8 scores at baseline and at follow-up for each group. The category scores of passive smokers at baseline were lower than those of non-smokers for GH (1.4, p = 0.013), SF (2.3, p = 0.001), MH (1.4, p = 0.011), and RE (1.6, p = 0.004). Significant increases were observed after the enforcement of the smoke-free school policy in the scores for MH (0.9; 95% CI, 0.2-1.5) and RE (0.7; 95% CI, 0.0-1.3) in non-smokers, and GH (2.2; 95% CI, 1.2-3.1), VT (1.8; 95% CI, 0.9-2.7), SF (2.7; 95% CI, 1.6-3.8), MH (2.0; 95% CI, 1.0-2.9), and RE (2.0; 95% CI, 1.2-2.8) in passive smokers.

Table 3 shows the differences of the net changes in the category scores between non-smokers and passive smokers, and the regression coefficients generated by the linear regression analyses. The results of the univariable and multivariable analyses were quite similar. All of the category scores, but for RP among passive smokers, increased significantly more than those among non-smokers.

## Discussion

The smoke-free school policy was originally introduced to protect pupils from exposure to ETS [17]. It was also expected to encourage smoking teachers to quit or reduce their smoking [18] and to prevent pupils from starting smoking [19-21]. Our results implied that a smoke-free school policy would also contribute to improving the HRQOL of non-smoking teachers who are exposed to ETS at school. Although our follow-up study design allowed us to assess the causal relationship between the smoke-free school policy and the changes in HRQOL, this simple before-and-after comparison could not indicate when HRQOL had changed. Further time-series studies are needed to clarify this.

The baseline SF-8 scores of teachers who were regularly exposed to ETS in workplaces were lower than those of non-smokers and also lower than the Japanese National Norms [16], even though the study participants were limited to subjectively healthy persons. This finding is consistent with the previous study [2]. Referring to the studies using SF-8 reporting that patients with Japanese cedar pollinosis had a lower mental component score by 1.7 on the SF-8 than the Japanese National Norm [22], and that university students having any allergic disorders showed lower domain scores by 2.3 on the SF-8 than those having no allergy [23], the differences in the SF-8 scores between non-smokers and passive smokers at baseline were considered to be clinically relevant.

Our follow-up survey results suggest that the elimination of ETS by the enforcement of the smoke-free school policy would improve all categories of SF-8 except for RP among passive smokers, reaching identical levels to those of the non-smokers at follow-up. To our knowledge, the present study is the first follow-up survey to evaluate the effects of a social healthcare intervention using SF-8. Therefore, it is difficult to compare its efficacy with those of other social interventions.

We assessed the HRQOL of the participants using SF-8, the scores of which can be directly compared with the scores obtained from the Medical Outcomes Survey 36-item short form health survey (SF-36) [24,25], a widely-accepted scale for measuring comprehensive quality of life. A decline in the scores for SF-36 would increase the risk of death and of hospitalization [26], and the scores also predict total healthcare costs [27]. Since SF-8 is a shortened version of SF-36, its accuracy might be inferior to that of SF-36. However, the correlation coefficient of each 8-category scale score between SF-8 and SF-36 was substantially high (Spearman r = 0.56 - 0.87) [16], and it was deemed to be a suitable surrogate for evaluating HRQOL. The primary advantage of SF-8 is its simplicity, and as such, it is better suited for mass screening.

This study had some limitations in its design. First, self-reported secondhand smoke was not verified for the measure of ETS exposure in schools. Since the questionnaire survey for ETS exposure and active smoking were reported to be vulnerable to misclassification [28,29], biochemical measures, such as expiratory gas carbon monoxide and urine or blood cotinine, would be desirable. However, these methods are time-consuming and costly and cannot identify the source of secondhand smoke. The large number of the participants and the long time between the policy enforcement and the surveys should have minimized the temporary fluctuations in the answers. Second, we did not consider exposure to ETS at home or in other private places. Bridevaux et al. [2] reported that exposure to ETS at home strongly affects HRQOL. Additionally, several studies pointed out the significant relationship between one's physical activity level and HRQOL [30-34]. These factors might have confounded the results. Third, findings among teachers cannot be well generalized. The proportion of smokers at

**Table 1: Baseline characteristics of the participants**

| | Total | | Non-smokers* | | Passive smokers** | | P-value |
|---|---|---|---|---|---|---|---|
| | n | (%) | n | (%) | n | (%) | |
| Age | | | | | | | |
| <50 years old | 367 | (53%) | 225 | (50%) | 142 | (59%) | 0.036 |
| ≥50 years old | 322 | (47%) | 222 | (50%) | 100 | (41%) | |
| Sex | | | | | | | |
| Male | 257 | (37%) | 159 | (36%) | 98 | (40%) | 0.137 |
| Female | 432 | (63%) | 288 | (64%) | 144 | (60%) | |
| Managerial position | | | | | | | |
| General teacher | 572 | (83%) | 373 | (83%) | 199 | (82%) | 0.269 |
| Principal or vice-principal | 60 | (9%) | 42 | (9%) | 18 | (7%) | |
| School nurse or dietitian | 57 | (8%) | 32 | (7%) | 25 | (10%) | |
| School type | | | | | | | |
| Elementary school | 437 | (63%) | 300 | (67%) | 137 | (57%) | 0.001 |
| Junior high school | 221 | (32%) | 135 | (30%) | 86 | (36%) | |
| High school | 31 | (4%) | 12 | (3%) | 19 | (8%) | |
| Attitude towards smoke-free schools | | | | | | | |
| Positive | 555 | (81%) | 357 | (80%) | 198 | (82%) | 0.537 |
| Not positive | 134 | (19%) | 90 | (20%) | 44 | (18%) | |
| **Total** | **689** | | **447** | | **242** | | |

*Non-smokers: Participants who were not exposed to environmental tobacco smoke at baseline
**Passive smokers: Participants who were exposed to environmental tobacco smoke at baseline

baseline (male, 29%; female, 1%) was substantially lower than that of the general population in Japan (male, 40%; female, 10%) [35]. This is probably because schoolteachers are highly educated and are expected to behave as role models for pupils. Fourth, since the baseline survey was carried out in mid-winter and the follow-up survey in early autumn, the shift in seasons might have affected HRQOL. Actually, even among teachers who were not exposed to ETS, some domain scores of the SF-8 significantly improved, though they should not be influenced by the enforcement of the smoke-free school policy. The changes in the scores might partly be seasonal effects.

**Table 2: SF-8 scores before and after the enforcement of the smoke-free school policy**

| Group | Domain of SF-8* | Score | | P-value |
|---|---|---|---|---|
| | | Baseline | Follow-up | |
| | | Mean ± SD | Mean ± SD | |
| Non-smokers | GH | 48.3 ± 6.7 | 48.6 ± 6.7 | 0.304 |
| | RP | 46.8 ± 6.5 | 47.2 ± 6.9 | 0.214 |
| | VT | 47.7 ± 6.3 | 48.1 ± 5.9 | 0.256 |
| | SF | 45.8 ± 8.2 | 46.1 ± 7.8 | 0.501 |
| | MH | 46.9 ± 6.6 | 47.7 ± 6.5 | 0.013 |
| | RE | 47.1 ± 6.9 | 47.8 ± 6.1 | 0.040 |
| Passive smokers | GH | 46.9 ± 7.2 | 49.0 ± 7.0 | <0.001 |
| | RP | 46.7 ± 6.5 | 47.3 ± 7.3 | 0.201 |
| | VT | 47.2 ± 6.8 | 49.0 ± 6.9 | <0.001 |
| | SF | 43.6 ± 8.4 | 46.2 ± 8.4 | <0.001 |
| | MH | 45.5 ± 7.2 | 47.4 ± 7.2 | <0.001 |
| | RE | 45.5 ± 7.3 | 47.5 ± 6.9 | <0.001 |

*GH: General health, RP: Role-physical, VT: Vitality SF: Social functioning, MH: Mental health, RE: Role-emotional

**Table 3: Differences of the net changes in SF-8 scores between non-smokers and passive smokers**

| Domain of SF-8* | Net changes in SF-8 scores before and after enforcement of the smoke-free school policy | | Differences of the net changes in the SF-8 scores between non-smokers and passive smokers | |
|---|---|---|---|---|
| | | | Univariable analysis | Multivariable analysis** |
| | Non-smokers | Passive smokers | Regression coefficient (95% CI) | Regression coefficient (95% CI) |
| GH | 0.3 | 2.2 | 1.8 (0.7 - 3.0) | 1.8 (0.7 - 2.9) |
| RP | 0.4 | 0.6 | 0.2 (-0.9 - 1.3) | 0.2 (-1.0 - 1.3) |
| VT | 0.3 | 1.8 | 1.5 (0.4 - 2.5) | 1.4 (0.3 - 2.5) |
| SF | 0.3 | 2.7 | 2.4 (1.0 - 3.8) | 2.5 (1.1 - 3.9) |
| MH | 0.9 | 2.0 | 1.1 (0.0 - 2.2) | 1.2 (0.1 - 2.4) |
| RE | 0.7 | 2.0 | 1.3 (0.2 - 2.4) | 1.6 (0.5 - 2.7) |

*GH: General health, RP: Role-physical, VT: Vitality SF: Social functioning, MH: Mental health, RE: Role-emotional
** Adjusted for sex, age, school type, managerial position, and attitude towards smoke-free school policy

However, we primarily focused on the comparison between non-smokers and passive smokers, and their inter-group comparability was preserved. Fifth, we excluded two domains of the SF-8, PF and BP, from the questionnaire form. According to the SF-8 manual for Japanese, people suffering any physical disorder showed significantly lower category scores particularly in the physical-related domain, such as BP, RP, and PF, than did healthy people [16]. Since the study participants were subjectively healthy teachers, physical-related domains would have little relation to the short-term effects of smoke-free school policy. Therefore, we excluded PF and BP from the questionnaire and included only RP to check its independency. As expected, no significant changes in RP score were seen in either non-smokers or passive smokers. However, our arbitrary alternation of the standardized instrument is a methodological violation, and it would preclude a thorough interpretation of the results. As the previous study suggested a relationship between those physical-related domains and exposure to ETS among nonsmoking women [2], these domains should have been examined as well.

## Conclusions

Exposure to ETS in schools lowers HRQOL among nonsmoking teachers, and the enforcement of a smoke-free school policy would improve their HRQOL. Our findings should encourage policy makers to push ahead with restricting smoking in schools.

## List of abbreviations

ETS: environmental tobacco smoke; HRQOL: health-related quality of life; COPD: chronic obstructive pulmonary disease; SF-8: Medical Outcomes Survey Short Form-8 questionnaire; GH: general health perception; PF: physical functioning; RP: role functioning physical; BP: bodily pain; VT: vitality; SF: social functioning; MH: mental health; RE: role functioning emotional; CI: confidence interval; SF-36: Medical Outcomes Survey 36-item short form health survey.

### Competing interests

The authors declare that they have no competing interests.

### Authors' contributions

KK designed the questionnaire, analyzed the data, and drafted the manuscript. YI designed the questionnaire, performed the survey, and collected and input the data. TK designed the statistical analyses and drafted the manuscript. YM designed the questionnaire and performed the survey. YT supervised the whole survey. All authors read and approved the final manuscript.

### Acknowledgements

This study was supported by a Grant-in-Aid for Scientific Research from the Ministry of Health, Labor, and Welfare of Japan. We gratefully acknowledge the Board of Education of Nara City for its approbation of our survey. We also would like to thank Dr. Paul Matychuk for language support.

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Received: 7 September 2009 Accepted: 28 April 2010
Published: 28 April 2010

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doi: 10.1186/1477-7525-8-44
**Cite this article as:** Kiyohara *et al.*, Changes in the SF-8 scores among healthy non-smoking school teachers after the enforcement of a smoke-free school policy: a comparison by passive smoke status *Health and Quality of Life Outcomes* 2010, **8**:44

Nicotine & Tobacco Research, Volume 12, Number 10 (October 2010) 1043–1049

Brief Report

# The start of smoking and prior lifestyles among Japanese college students: a retrospective cohort study

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Received February 14, 2010; accepted July 27, 2010

## Abstract

**Introduction:** Using annual health checkup questionnaire data, the present study aimed to explore the relationship between lifestyles and subsequent new smoking of college students.

**Methods:** Among the all undergraduate students who entered Kyoto University from 2000 through 2004, those who had never smoked until the beginning of their 2nd year were enrolled in the study. A Cox proportional-hazards regression analysis was performed to reveal the association between lifestyle characteristics at the beginning of the 2nd year and the start of smoking during the 2nd and 3rd years.

**Results:** A total of 12,872 participants were enrolled in the analyses, 865 of whom started smoking during the subsequent 2 years. Among the lifestyle characteristics we examined, skipping breakfast 2–4 times a week (hazard ratio [HR] = 1.6; 95% *CI* = 1.4–1.9) or ≥5 times a week (HR = 2.0; 95% *CI* = 1.6–2.5), eating out for supper 2–4 times a week (HR = 1.4; 95% *CI* = 1.2–1.7) or ≥5 times a week (HR = 1.4; 95% *CI* = 1.2–1.8), drinking occasionally (HR = 1.7; 95% *CI* = 1.5–2.0) or almost everyday (HR = 4.1; 95% *CI* = 3.1–5.7), and sleeping <6 hr a day (HR = 1.3; 95% *CI* = 1.1–1.6) were significant risk factors for the start of smoking. However, exercising ≥5 times a week (HR = 0.5; 95% *CI* = 0.4–0.7) was a protective factor.

**Discussion:** Our results suggested that even never-smoking undergraduates with poor life habits are likely to start smoking and would make good candidates for preventive intervention.

## Introduction

Smoking tobacco poses one of the world's major public health risks. In order to reduce tobacco-related diseases, further efforts to reduce the number of new smokers as well as to encourage smoking cessation are needed. To effectively carry out preventive programs, populations at high risk of taking up smoking should be identified.

Many habitual smokers started the habit before the age of 18 (Giovino, Henningfield, Tomar, Escobedo, & Slade, 1995; Lee, Gilpin, & Pierce, 1993; Olds & Thombs, 2001) or while college students (Everett et al., 1999; Gray, 1993; Wechsler, Rigotti, Gledhill-Hoyt, & Lee, 1998; Wetter et al., 2004), and their smoking became habitual during their college years (Rigotti, Lee, & Wechsler, 2000). College-age smokers are less likely to smoke daily or smoke many cigarettes, but more likely to be interested in quitting or have actually attempted to quit, compared with older smokers. However, their attempts were seldom successful (Soiberg, Boyle, McCarty, Asche, & Thoele, 2007). Therefore, identifying the characteristics of college student smokers would be very helpful in designing antismoking interventions. Nevertheless, since the designs of most studies examining the predictors of smoking of college students have been cross-sectional, simply descriptive, or both, then longitudinal studies would be needed to identify their risk factors, as one review article suggested (Patterson, Lerman, Kaufmann, Neuner, & Audrain-McGovern, 2004). The existing follow-up studies were limited in terms of the small sample size (Wetter et al.) and not targeting on college-age–specific lifestyles (Choi, Harris, Okuyemi, & Ahluwalia, 2003).

There was little difference in dietary habits and physical activities between Japanese and American college students (Kobayashi, 2007). Nevertheless, smoking is more common among Japanese youth compared with U.S. college students, while other illicit drug use is considerably less common (McCabe et al., 2005; O'Malley & Johnston, 2002; Shimane, Wada, Mishima, & Fujiwara, 2009; The Ministry of Health, Labor and Welfare, Japan, 2006; Wada, Ozaki, & Kondo, 2008). Thus, smoking is the main problem to be resolved with regard to substance use among Japanese college students.

The aim of the present study was to explore the possible lifestyle factors that might subsequently increase the number of those who started smoking during their 2nd or 3rd college years

doi: 10.1093/ntr/ntq141
Advance Access published on August 28, 2010

among never-smokers, using the annual health checkup questionnaire data.

# Methods

## Data source

The students of Kyoto University were required to undergo an annual health checkup offered by the University Health Service in April and to fill out the self-administered lifestyle questionnaire during the period of 2000–2007.

## Study participants

Among all undergraduate students who entered Kyoto University from 2000 through 2004 ($n$ = 14,660), those who had never smoked until the beginning of their 2nd year were enrolled in the study. Excluded were the students who had skipped either 1st- or 2nd-year health checkups, did not have Japanese citizenship, or showed no missing data in the required questions.

## Measurement

The baseline data of the participants were obtained from the health checkup questionnaire at the beginning of their 2nd year. Those data included four sociodemographic items (sex, age at admission, major subject, and admission year) as well as seven lifestyle items (regular exercise, skipping breakfast, eating out for supper, alcohol consumption, sleeping, residential status, and food preferences) and two medical items (depressive mood and any diseases under medical treatment). The outcome measure (smoking status) was obtained from the questionnaires in both the 3rd- and the 4th-year checkups. Any student who smoked in either of those years was defined as a new smoker.

## Statistical methods

Cox proportional-hazards regression analysis was conducted to estimate adjusted hazard ratios (HRs) with their 95% *CI*s for new smoking during 2nd or 3rd college year. Baseline characteristics that showed statistical significance ($p < .05$) in the log-rank tests were included in the analysis, and the valid independent variables for the model were selected using the backward selection method. All analyses were conducted with SPSS software v.15.0J for Windows (SPSS Inc., Chicago, IL).

## Ethics

Such annual health checkups are mandated by the School Health Law of Japan to promote students' health, and school physicians are allowed by law to carry out analyses of intra-school health survey. Since the Japanese national ethical guidelines for epidemiological studies do not require an ethical review for studies based on the legislation, our study protocol was not submitted to the ethics committee for peer review.

# Results

A total of 14,660 persons entered the university as undergraduates from 2000 through 2004, and those who skipped the 1st- or 2nd-year health checkups ($n$ = 422), had foreign citizenship ($n$ = 122), or showed missing data ($n$ = 275) were excluded. Furthermore, smokers either at admission or at the beginning of their 2nd year were excluded ($n$ = 969), and the remaining 12,872 participants were eligible for the following analyses.

Table 1 shows the baseline characteristics and starting smoking during 2nd or 3rd year of the study participants. During the 2-year follow-up, a total of 1,464 participants dropped out because of skipping the 3rd- or 4th-year checkup or showing missing data. Compared with the participants who completed the follow-up, students who dropped out ($n$ = 1,464) were somewhat more likely to be male (76.0% vs. 78.8%; $p$ = .015) and majoring in medicine (8.1% vs. 10.5%; $p$ = .001). Total follow-up size was 23,495 person-years with the mean follow-ups period of 1.83 years. During the follow-up period, a total of 865 new smokers were found (during 2nd year, $n$ = 593; during 3rd year, $n$ = 272). The incident rate (IR) of starting smoking per 100 person-years was 3.7. The log-rank test revealed that almost all the baseline factors showed significant relationship with subsequent starting smoking ($p < .05$), with the exception of dieting habit ($p$ = .217). The IR was considerably high in the students with skipping breakfast five times or more a week (IR = 7.4), consuming alcohol almost everyday (IR = 9.9), and feeling depressed (IR = 6.8), while it was considerably low in the students with female gender (IR = 1.3) and majoring in medicine (IR = 1.8).

Table 2 shows the HRs of new smoking during 2nd or 3rd year by Cox proportional-hazards regression analysis. Among the baseline characteristics, which were analyzed, admission year and residential status were excluded from the model. Among the selected factors, those significantly more likely to start smoking compared with their respective reference groups were males (HR = 2.7; 95% *CI* = 2.1–3.5), admission at the age of 18 (HR = 1.8; 95% *CI* = 1.3–2.4), skipping breakfast two to four times a week (HR = 1.6; 95% *CI* = 1.4–1.9) or five times or more a week (HR = 2.0; 95% *CI* = 1.6–2.5), eating out for supper two to four times a week (HR = 1.4; 95% *CI* = 1.2–1.7) or five times a week or more (HR = 1.4; 95% *CI* = 1.2–1.8), drinking occasionally (HR = 1.7; 95% *CI* = 1.5–2.0) or almost everyday (HR = 4.1; 95% *CI* = 3.1–5.7), sleeping less than 6 hr a day (HR = 1.3; 95% *CI* = 1.1–1.7), or subject to depression (HR = 1.7; 95% *CI* = 1.2–2.5). Inversely, majoring in medicine (HR = 0.5; 95% *CI* = 0.4–0.8), exercising five times a week or more (HR = 0.5; 95% *CI* = 0.4–0.7), and having any diseases under treatment (HR = 0.7; 95% *CI* = 0.5–0.9) served as protective factors against newly started smoking.

# Discussion

Our study demonstrates that undergraduates who never smoked but who had unhealthy lifestyles, such as frequently skipping breakfast, often eating out, consuming alcohol, or depriving themselves of sleep, are likely to subsequently take up smoking. These findings are consistent with a number of studies, indicating that smoking often accompanied other unhealthy habits (Oleckno & Blacconiere, 1990; Rosal et al., 2001; Serdula et al., 1996). Among the habits, daily alcohol consumption was the strongest predictor of subsequent smoking. Many previous studies (Emmons, Wechsler, Dowdall, & Abraham, 1998; Hines, Fretz, & Nollen, 1998; Jones, Oeltmann, Wilson, Brener, & Hill, 2001; McKee, Hinson, Rounsaville, & Petrelli, 2004; Rigotti et al., 2000; Saules et al., 2004; Schorling, Gutgesell, Klas, Smith, & Keller, 1994) with the exception of one (Wetter et al., 2004) also pointed out a significant relationship between drinking alcohol

## Table 1. Baseline characteristics and starting smoking during 2nd and 3rd year of participants

| Baseline characteristics | | Total follow-up | Number of participants starting smoking during 2nd and 3rd year | | Incident rate | Log-rank test |
|---|---|---|---|---|---|---|
| | | | 2nd year | 3rd year | | |
| | *n* | Person-years | *n* | *n* | Per 100 person-years | *p* value |
| Sex | | | | | | **<.001** |
| Male | 9,778 | 17,866 | 546 | 244 | 4.4 | |
| Female | 3,094 | 5,629 | 47 | 28 | 1.3 | |
| Age at admission | | | | | | **<.001** |
| 18 | 7,315 | 13,463 | 402 | 167 | 4.2 | |
| 19 | 4,467 | 8,313 | 162 | 90 | 3.0 | |
| ≥20 | 1,090 | 1,719 | 29 | 15 | 2.6 | |
| Major | | | | | | **<.001** |
| Humanities | 3,947 | 7,219 | 194 | 82 | 3.8 | |
| Sciences | 7,325 | 13,609 | 361 | 173 | 3.9 | |
| Medicine | 1,050 | 1,643 | 23 | 7 | 1.8 | |
| Miscellaneous | 550 | 1,024 | 15 | 10 | 2.4 | |
| Admission year | | | | | | **.001** |
| 2000 | 2,552 | 4,629 | 142 | 70 | 4.6 | |
| 2001 | 2,567 | 4,662 | 127 | 58 | 4.0 | |
| 2002 | 2,618 | 4,785 | 106 | 61 | 3.5 | |
| 2003 | 2,604 | 4,768 | 101 | 40 | 3.0 | |
| 2004 | 2,531 | 4,651 | 117 | 43 | 3.4 | |
| Regular exercise | | | | | | **<.001** |
| ≤once a week | 7,925 | 14,381 | 358 | 156 | 3.6 | |
| 2–4 times a week | 3,537 | 6,451 | 204 | 94 | 4.6 | |
| ≥5 times a week | 1,410 | 2,663 | 31 | 22 | 2.0 | |
| Skipping breakfast | | | | | | **<.001** |
| ≤once a week | 7,620 | 14,140 | 223 | 113 | 2.4 | |
| 2–4 times a week | 4,102 | 7,354 | 265 | 116 | 5.2 | |
| ≥5 times a week | 1,150 | 2,001 | 105 | 43 | 7.4 | |
| Eating out for supper | | | | | | **<.001** |
| ≤once a week | 4,877 | 9,013 | 125 | 69 | 2.2 | |
| 2–4 times a week | 6,267 | 11,403 | 342 | 154 | 4.3 | |
| ≥5 times a week | 1,728 | 3,079 | 126 | 49 | 5.7 | |
| Consuming alcohol | | | | | | **<.001** |
| Never or seldom | 5,252 | 9,715 | 157 | 66 | 2.3 | |
| Occasionally | 7,451 | 13,517 | 418 | 198 | 4.6 | |
| Almost everyday | 169 | 263 | 18 | 8 | 9.9 | |
| Sleeping time | | | | | | **.001** |
| <6 hr a day | 2,230 | 4,017 | 120 | 48 | 4.2 | |
| 6–8 hr a day | 9,816 | 17,997 | 420 | 199 | 3.4 | |
| ≥8 hr a day | 826 | 1,481 | 53 | 25 | 5.3 | |
| Residential status | | | | | | **<.001** |
| Apart from parents | 9,075 | 16,482 | 474 | 216 | 4.2 | |
| With parents | 3,797 | 7,013 | 119 | 56 | 2.5 | |
| Dieting | | | | | | .217 |
| Yes | 236 | 420 | 9 | 2 | 2.6 | |
| No | 12,636 | 23,075 | 584 | 270 | 3.7 | |
| Feel depressed | | | | | | **.002** |
| Yes | 244 | 414 | 16 | 12 | 6.8 | |
| No | 12,628 | 23,081 | 577 | 260 | 3.6 | |
| Diseases under treatment | | | | | | **.004** |
| Yes | 1,074 | 1,950 | 32 | 17 | 2.5 | |
| No | 11,798 | 21,545 | 561 | 255 | 3.8 | |
| Total | 12,872 | 23,495 | 593 | 272 | 3.7 | |

*Note.* The bold *p*-values denote statistical significance ($p < 0.05$).

**Table 2. Hazard ratios of new smoking during 2nd or 3rd year by Cox proportional-hazards regression analysis**

| Factors of starting smoking during 2nd or 3rd year | Hazard ratio | 95% *CI* |
|---|---|---|
| Sex | | |
| Male | **2.7** | **2.1–3.5** |
| Female | Reference | |
| Age at admission | | |
| 18 | **1.8** | **1.3–2.4** |
| 19 | 1.1 | 0.8–1.6 |
| ≥20 | Reference | |
| Major | | |
| Humanities | Reference | |
| Sciences | 0.8 | 0.7–1.0 |
| Medicine | **0.5** | **0.4–0.8** |
| Miscellaneous | 0.7 | 0.4–1.1 |
| Regular exercise | | |
| ≤once a week | Reference | |
| 2–4 times a week | 1.1 | 0.9–1.2 |
| ≥5 times a week | **0.5** | **0.4–0.7** |
| Skipping breakfast | | |
| ≤once a week | Reference | |
| 2–4 times a week | **1.6** | **1.4–1.9** |
| ≥5 times a week | **2.0** | **1.6–2.5** |
| Eating out for supper | | |
| ≤once a week | Reference | |
| 2–4 times a week | **1.4** | **1.2–1.7** |
| ≥5 times a week | **1.4** | **1.2–1.8** |
| Consuming alcohol | | |
| Never or seldom | Reference | |
| Occasionally | **1.7** | **1.5–2.0** |
| Almost everyday | **4.1** | **3.1–5.7** |
| Sleeping time | | |
| <6 hr a day | **1.3** | **1.1–1.6** |
| 6–8 hr a day | Reference | |
| ≥8 hr a day | 1.1 | 0.9–1.5 |
| Feel depressed | | |
| Yes | **1.7** | **1.2–2.5** |
| No | Reference | |
| Diseases under treatment | | |
| Yes | **0.7** | **0.5–0.9** |
| No | Reference | |

*Note.* Admission year and residential status were excluded from the model by the backward selection method. The bold *p*-values denote statistical significance ($p < 0.05$).

and smoking among college students. Therefore, a health education program that included modest alcohol consumption might act to restrain future smoking.

Among the lifestyle factors we considered, exercising five times a week or more was the sole protective factor against subsequent smoking. One plausible explanation is those who many frequently exercise or participate in sports competitions as college club members tend to avoid tobacco as hampering their athletic performance.

Although dieting and a desire to lose weight are well-known factors for smoking among female adolescents (Camp, Klesges, & Relyea, 1993; French, Perry, Leon, & Fulkerson, 1994; Honjo & Siegel, 2003; Klesges, Elliott, & Robinson, 1997), no significant relationships between them were found in our study. However, the small number of our participants on the diet (1.8%) would not be sufficient to prove this relationship.

Among other background factors, male gender, admission at the age of 18, and depressive moods were indicated as risk factors of subsequent smoking. The gender difference in smoking might be based on the traditional conviction that Japanese women should never take up smoking unlike those in western countries (Rigotti et al., 2000; Wechsler et al., 1998). Even though the gender difference in smoking behavior has been recently attenuated (The Ministry of Health, Labor and Welfare, Japan, 2006), female smokers are still rare in our highly intelligent world. As for the age at admission, it is plausible that the students entering university at age 18 years become 20 years old during their 2nd year, the age when legally permitted to smoke in Japan. As for the depressive moods noted in our results, several studies have also implied that student smoking might be the result of a predisposition to depression, feelings of unhappiness, or increased levels of stress (Emmons et al., 1998; Lenz, 2004; Naquin & Gilbert, 1996; Patterson et al., 2004; Rigotti et al.). Conversely, majoring in medicine and having any diseases under treatment were indicated as preventive factors. The medical knowledge about smoking-inducing risks and health concerns of sick students would understandably dissuade them from smoking.

Although Kyoto University did not establish any particular tobacco control policies during the study period, the Japanese national government raised the tobacco tax by about 30 yen per pack in 2004 and again in 2006. Several studies showed that higher cigarette prices tended to discourage cigarette smoking and reduce tobacco consumption (Gallus, Schiaffino, La Vecchia, Townsend, & Fernandez, 2006; Liang & Chaloupka, 2002; Liang, Chaloupka, Nichter, & Clayton, 2003; Ross & Chaloupka, 2003). We, therefore, took students' admission year into consideration. However, the Cox regression analysis did not show that the admission year affected student smoking behavior. This finding would suggest that the countermeasure by the Japanese government is insufficient to reduce new smokers.

The main advantages of our study are its large sample size (more than 10,000 participants) and its high response rate, so our findings may be expected to be highly reliable and less biased. Although the eligible participants had some different characteristics (gender and major) compared with the nonresponders, their differences were rather small. Therefore, the influences of nonrespondents on the entire results should be minimal. Another advantage is its follow-up study design, which enabled us to establish the contextual relationship between the baseline factors and the outcome measures.

In summary, the present study suggested that undergraduates given to unhealthy lifestyles are likely to start smoking and would be prime candidates for antismoking interventions. We are now preparing an person-level comprehensive (not limited to smoking cessation) lifestyle modification program as well as promising institution-level interventions, such as smoke-free policy and antitobacco campaign (Murphy-Hoefer et al., 2005), in order to effectively reduce the number of new smokers.

## Limitations

The fact that our data were originally collected for nonresearch purposes posed several study limitations as noted below.

First, we measured smoking status using self-administered questionnaires rather than biological markers such as expiratory gas carbon monoxide and urine or blood cotinine. However, several studies have indicated that self-reported smoking measurements are indeed comparable with biochemical methods (Etter, Vu Duc, & Perneger, 2000; Patrick et al., 1994; Prokhorov et al., 2000). In addition, biochemical verification is suggested to be neither feasible nor necessary in large population studies (SRNT Subcommitee on Biochemical Verification, 2002). Thus, our measurements of smoking status should be accepted in terms of their feasibility.

Second, although this study was large in size, our data were collected only at Kyoto University, and therefore, the results could not be immediately generalized. Further studies should be needed using other college students' data. The students of Kyoto University are, however, regarded as the nation's future leaders whose behavior presumably reflects that of the general population for good or ill. Indeed, the proportion of student smokers at admission and/or at the beginning of the 2nd year was 7.0%, which was substantially lower than that of other national university students in Japan. On the other hand, alcohol consumption and physical exercise did not much differ (The Japanese National University Council of Health Administration Facilities, 1997, 2008). Their high intelligence would suppress the curiosity to smoke.

Third, we included only a small number of possible risk factors for beginning to smoke. Our study did not examine academic achievement (Saatci, Inan, Bozdemir, Akpinar, & Ergun, 2004; Schorling et al., 1994), attitudes toward tobacco (Hines, 1996), parents'/friends' smoking status and attitudes (DeBernardo et al., 1999; Hines et al., 1998; Ridner, 2005; Wechsler et al., 1998), parents' academic background (Emmons et al., 1998; Patterson et al., 2004; Saatci et al.; Wechsler et al.; Wetter et al., 2004), or drug abuse (Emmons et al.; Jones et al., 2001; Ridner; Rigotti et al., 2000; Schorling et al.). In addition, participation in extracurricular activities and part-time jobs would substantially affect Japanese college life, but unfortunately, they were not inquired in the health checkup. Thus, further studies focusing on sociopsychological factors and involving more students in various settings should be required to identify smoking-prone characteristics among college students.

## Declaration of Interests

*None declared.*

## Funding

This work was carried out on the researcher's own initiative using the free research fund allocated to the university teachers.

## Acknowledgments

*We gratefully acknowledge the contribution of the entire staff of the Kyoto University Health Service to the data collection in the health checkups. We also would like to thank Dr. Paul Matychuk for language support.*

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＜短報＞

# 初診時SDSスコアは禁煙達成成否の強い独立決定因子である

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**要　旨**

**背景**：うつ病は、糖尿病、高血圧、喫煙習慣とならんで、心血管イベントの独立した重要な危険因子である。最近、我々は禁煙外来初診で精神疾患の既往のない喫煙者において、潜在的うつ状態が高頻度に存在することを報告した。しかしながら、初診時のうつ状態が禁煙成功率に及ぼす影響については明らかではない。そこで今回、初診時のうつ状態の度合いを判定するSDS（self-rating depression scale）テストのスコアが12週後の禁煙達成成否に及ぼす影響について検討した。

**方法**：2007年7月から2008年4月の間に、国立病院機構京都医療センター禁煙外来を新規受診して同意した患者65例（連続症例）を対象にSDSテストを施行した。精神疾患の既往、精神科あるいは心療内科受診歴のある患者は除外した。SDSスコア39点以上47点以下を正常／神経症境界、48点以上を神経症／うつ病とした。

**結果**：禁煙成功率は正常群（n＝29）69%に対し、正常／神経症境界群（n＝17）35%（P＝0.030）、神経症／うつ病群（n＝19）21%（P＝0.002）と、うつ状態の程度に従い禁煙成功率は顕著に低下した。初診時の性別、年齢、喫煙開始年齢、喫煙年数、1日の喫煙本数、ブリンクマン指数（喫煙本数／日×年数）、ニコチン依存度の指標であるFTNDスコア及びTDSスコア、禁煙の自信度、ＳＤＳスコアを変数とした多重ロジスティック回帰分析の結果、12週後の禁煙成否を規定する唯一の独立因子がSDSスコアであった（P＝0.032, OR: 0.927, CI: 0.866-0.993）。

**結論**：初診時のうつ状態は短期的禁煙成功率に深く関連し、SDSスコアは短期禁煙達成成否を規定する最も強力な因子であった。潜在的うつ状態の存在が禁煙の最大の妨げであることが明らかとなった。

キーワード：喫煙、SDSテスト、うつ状態

## 緒　　言

うつ病は糖尿病 、高血圧などの生活習慣病において高頻度で存在し、生活習慣病の終末像である心血管疾患においても、予後とうつ病の発症との間に強い関連があることが報告されている[1-7]。すなわち、うつ病は、糖尿病、高血圧、喫煙習慣と並ぶ、心血管イベントの独立したリスクファクターである。

うつ病は喫煙とも深く関連している。喫煙により摂取されたタバコの活性成分ニコチンは、ノルアドレナリン、ドーパミンなどの脳内神経伝達物質の分泌を通して脳の覚醒や快感に関与している。さらにニコチンはセロトニンの分泌により気分の調整にも関与し、抗うつ、抗不安に作用するため、ニコチン摂取によりうつ状態が軽減する可能性が示唆されている[8,9]。海外の報告ではうつ状態の患者は喫煙率が高いと同時に、禁煙成功率が低いこと[10,11]、うつ病の患者を無理に禁煙するとうつ状態が悪化することなどの報告がある[12]。すなわち心理社会的

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論文受領　2008年7月17日

ストレスに端を発するうつ病は喫煙と密接な相互関係がある。

うつ病と喫煙はそれぞれ独立した心血管危険因子であると同時に、相互に悪循環を形成し、心血管リスクを増大させていると考えられる。わが国でも、昨今の社会情勢や高ストレス社会を反映して、うつ病や潜在的うつ状態を伴う患者は急増していると推測され、禁煙支援において重要な問題と考えられるが、これらについての国内での報告はまだ少ない。

最近、我々は精神疾患の既往のない禁煙外来初診患者において、4分の1以上が神経症以上のうつ状態であり、正常／神経症境界群を含めば半数以上に潜在的うつ状態を認めることを報告した[13]。しかしながら、このうつ状態が禁煙達成成否に及ぼす影響については不明である。そこで今回我々は、精神疾患の既往のない禁煙外来初診患者を対象にうつ状態のスクリーニング調査を実施し、潜在的うつ状態と初診から3ヶ月後の禁煙達成成否との関連を検討した。

## 方　法

### 対象

対象は2007年7月から2008年4月の期間に、国立病院機構京都医療センター禁煙外来を受診した新規患者のうち、本調査の趣旨に同意が得られた患者65例（連続症例）である。過去に精神疾患の既往のある患者、精神科あるいは心療内科受診歴のある患者は除外した。

### うつ状態の評価

うつ状態の自記式評価尺度であるSDS（self-rating depression scale）テストを用いて、うつ状態の程度を評価した。SDSテストは患者自身が記入し、記入漏れや記入ミスのあった症例については確認の上、再度記入した。SDSスコア38点以下を正常、39点以上47点以下を正常／神経症境界、48点以上を神経症／うつ病とした。

### 禁煙治療

禁煙治療は「禁煙治療のための標準手順書」（2006年3月に日本循環器学会、日本肺癌学会、日本癌学会が発表）に従い、初診ならびに初診から2，4，8，12週後に診察を行い、ニコチン代替療法を施行した。再診時には禁煙継続の成否を確認するとともに、禁煙継続に対する具体的なアドバイスを行った。禁煙治療終了時（12週後）に禁煙継続の成否を評価した。禁煙成功は呼気CO濃度7 ppm以下と自己申告の両方を満たした場合とした。途中で来院されなくなった方、最後まで受診されたが禁煙出来なかった方を合わせて禁煙不成功とした。

### 統計解析

Stat View 5.0（Windows用）を用いた。禁煙成功・不成功群の2群間比較はMann-Whitney U testで検定した。SDSスコアによる正常群、正常／神経症境界群、神経症／うつ病群の3群間比較はone-way ANOVAにより検定し、有意差があった場合、Fisher's PLSDで各群間の有意差を検定した。12週後の禁煙成否を規定する因子の解析は多重ロジスティック回帰分析により検定した。$P<0.05$をもって有意差ありとした。

## 結　果

### 1．禁煙外来初診時のSDSスコア分布

本調査で対象とした禁煙外来受診患者65例の内訳は、男性48例、女性17例、平均年齢59.7歳であった。SDSスコアは23－68点の範囲に分布しており、その内、正常（SDSスコア: 23-38）は29名（44.6%）、正常／神経症境界（SDSスコア: 39-47）は17名（26.2%）、神経症／うつ病（SDSスコア: 48-68）は19名（29.2%）であった。

### 2．初診時SDSスコアと短期禁煙成功率の関係

禁煙外来初診患者のうつ状態をSDSスコアにより、正常群（SDSスコア: 23-38）、正常／神経症境界群（SDSスコア: 39-47）、神経症／うつ病群（SDSスコア: 48-68）の3群に分類し、初診時データを比較した（表1）。年齢は正常群に比較して正常／神経症境界群で有意に低かった（$P=0.029$）。禁煙の自信度は正常群に比較して神経症／うつ病群で有意に低かった（$P=0.018$）。興味深いことに、禁煙成功率は正常群では69%であったのに比して、正常／神経症境界群では35%（$P=0.030$）、神経症／うつ病群（$P=0.002$）で21%と正常群に比し有意に低く、うつ状態の程度に従って禁煙成功率が顕著に低くなって行くことが判明した（図1）。

### 3．禁煙成功群と不成功群の初診時患者データ比較

禁煙成功群と不成功群の初診時患者データを表2に示す。年齢は成功群の方が有意に高かった（$P=0.028$）。喫煙年数、喫煙開始年齢、喫煙本数、ブリンクマン指数、TDSスコアに有意差はなかった。禁煙の自信度は禁煙成功群で有意に高かった（$P=0.027$）。FTNDスコア

（P＝0.036）、SDSスコア（P＝0.001）は不成功群で有意に高かった。

### 4．禁煙の成否を規定する因子の解析

初診時患者データにおいて禁煙達成成否に影響を及ぼす可能性のある因子として、性別、年齢、喫煙開始年齢、喫煙年数、1日の喫煙本数、ブリンクマン指数（喫煙本数／日×年数）、ニコチン依存度の指標であるFTNDスコア及びTDSスコア、禁煙の自信度、SDSスコアを変数として採用し、12週後の禁煙成否の規定因子を多重ロジスティック回帰分析により求めた（表3）。4名（正常2名、正常／神経症境界2名）は禁煙の自信度の記載がなかったため、全てのデータが揃っている61名のデータで解析した。その結果、SDSスコアが12週後の禁煙成否を規定する唯一の独立決定因子であった（P＝0.032, OR: 0.927, CI: 0.866-0.993）。

## 考　察

今回の調査により、精神疾患の既往のない禁煙外来初診患者において、うつ状態の存在が禁煙成功率を著しく低下させることが明らかとなった。最近、我々が報告したように禁煙外来初診患者には明らかなうつ病の既往がなくとも、潜在的うつ状態が比較的高頻度に存在することから[13]、そのスクリーニングを施行することは禁煙の成否に関わる問題点を明らかにすると言う意味で重要である。

うつ状態は意欲の減退を伴う。神経症/うつ病群では禁煙に対する自信度が低く、禁煙に対する意欲の低下が、禁煙成功率の低さにつながっていると考えられた。しかし正常／神経症境界群の禁煙に対する自信度は正常群とほぼ同等であり、正常／神経症境界患者は表面上、禁煙に対する意欲を持っているものと考えられた。これらの患者においても禁煙成功率が有意に低かったことは、潜在的なうつ状態の存在も禁煙の妨げになっていることを強く示唆する。

我々は最近、喫煙者と非喫煙者に喫煙の健康被害に関するアンケート調査を施行した。その結果、両者の間で知識レベルは同等であるが、関心度は喫煙者において総じて低いことが明らかとなった[14]。うつによる意欲の減退は関心の低下とも関連あるため、喫煙者における潜在的うつ状態の存在が喫煙健康被害の関心低下に関与している可能性があると考えられた。

急性心筋梗塞患者が発症後うつ病を併発すると、心筋梗塞後半年間の死亡率が5.7倍上昇する[7]。すなわち、心筋梗塞後のうつ病併発は予後に極めて重大な影響を及ぼすが、うつ病を伴う心筋梗塞患者に選択的セロトニン再取り込み阻害薬（selective serotonin reuptake inhibitor, SSRI）などの抗うつ薬を投与すると、死亡率や心筋梗塞再発率が抗うつ薬非投与群と比べて有意に低下すると報告されている[15]。うつ状態患者に対して抗うつ薬を投与することで禁煙成功率が向上するかどうかに関しては、今後前向き試験にて検討してゆく必要がある。

最後に、本研究により精神疾患の既往のない禁煙外来初診患者において、禁煙成功の最大の阻害因子が潜在的うつ状態の存在であることが明らかとなった。禁煙は不安、抑うつ気分などの症状を伴う事が報告されており、禁煙支援日常診療において、初診時におけるうつ状態の評価のみならず、その経時的変化を注意深く観察することも重要である。今後、禁煙支援において潜在的うつ状態の存在を早期に発見し、これに対する適切な対処法を確立することは極めて重要であると考えられる。

## 謝　辞

本研究にあたり、浦　修一さん、山田　明さん、和田明美さん、嶋田清香さん、堀内詩子さん（(独）国立病院機構京都医療センター）、的場友里恵さん（京都大学大学院医学研究科人間健康科学系）に大変ご協力頂きました。本研究の一部は厚生労働省科学研究費（循環器疾患等生活習慣病対策総合研究事業）「各種禁煙対策の経済影響に関する研究」により援助されています。

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表1．初診時うつ状態の重症度別データの比較

| | 正常 | 正常/神経症境界 | 神経症/うつ病 |
|---|---|---|---|
| 男女比 | 23:6 | 12:5 | 13:6 |
| 初診時年齢 | 63.0 ± 1.6 | 55.9 ± 2.7[§] | 58.0 ± 3.3 |
| 喫煙年数 | 39.4 ± 1.6 | 35.8 ± 3.3 | 37.8 ± 3.0 |
| 喫煙開始年齢 | 22.7 ± 1.6 | 20.1 ± 1.7 | 20.1 ± 1.3 |
| 喫煙本数(本/日) | 25.4 ± 2.2 | 27.6 ± 3.6 | 23.5 ± 2.2 |
| ブリンクマン指数 | 962 ± 95 | 934 ± 137 | 809 ± 89 |
| FTNDスコア | 6.79 ± 0.3 | 7.77 ± 0.5 | 7.26 ± 0.5 |
| TDSスコア | 6.86 ± 0.5 | 7.94 ± 0.4 | 7.53 ± 0.6 |
| 禁煙の自信度 | 58.7 ± 6.2 | 54.3 ± 8.3 | 34.7 ± 7.7[§] |

mean ± SE　　[§] $P < 0.05$ vs 正常 by ANOVA

表2．禁煙成功群・不成功群の患者背景比較

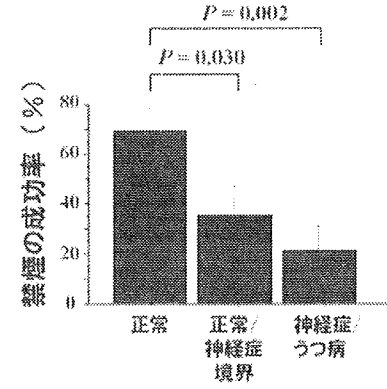
| | 不成功群 | 成功群 | P値 |
|---|---|---|---|
| 男女比 | 25：10 | 23：7 | |
| 初診時年齢 | 56.6 ± 2.1 | 63.2 ± 1.8 | 0.028 |
| 喫煙年数 | 36.3 ± 2.0 | 40.1 ± 2.0 | 0.283 |
| 喫煙開始年齢 | 20.0 ± 0.9 | 22.6 ± 1.6 | 0.150 |
| 喫煙本数(本/日) | 26.4 ± 2.1 | 24.3 ± 2.2 | 0.306 |
| ブリンクマン指数 | 897 ± 81 | 925 ± 93 | 0.990 |
| FTNDスコア | 7.69 ± 0.3 | 6.60 ± 0.4 | 0.036 |
| TDSスコア | 7.74 ± 0.3 | 6.87 ± 0.5 | 0.196 |
| 禁煙の自信度 | 41.9 ± 4.9 | 60.6 ± 7.2 | 0.027 |
| SDSスコア | 44.5 ± 1.6 | 36.2 ± 1.6 | 0.001 |

mean ± SE

表3．禁煙成功・不成功を規定する因子の解析

| | P | オッズ比 | 95%信頼区間 |
|---|---|---|---|
| 性別(男性) | 0.561 | 1.661 | 0.301 - 9.181 |
| 初診時年齢 | 0.938 | 0.986 | 0.693 - 1.403 |
| 喫煙年数 | 0.720 | 1.068 | 0.747 - 1.527 |
| 喫煙開始年齢 | 0.687 | 1.079 | 0.746 - 1.561 |
| 喫煙本数(本/日) | 0.522 | 1.046 | 0.911 - 1.202 |
| ブリンクマン指数 | 0.685 | 0.999 | 0.996 - 1.003 |
| FTNDスコア | 0.670 | 0.895 | 0.536 - 1.494 |
| TDSスコア | 0.999 | 1.000 | 0.683 - 1.465 |
| 禁煙の自信度 | 0.374 | 1.010 | 0.989 - 1.031 |
| SDSスコア | 0.032 | 0.927 | 0.866 - 0.993 |

図1．初診時うつ状態と禁煙成功率




## Self-rating depression scale score is a strong independent predictor of smoking cessation outcomes

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### Abstract

Depression is an independent risk factor of cardiovascular diseases. However, impact of latent depressive state on the achievement of smoking cessation is unknown. We performed a self-rating depression scale (SDS) test involving 65 consecutive patients who visited a smoking cessation clinic for the first time. Patients with previously diagnosed psychiatric disorders were excluded. The depressive state was evaluated according to the SDS score as normal (SDS score: 38 or lower, n=29), normal/neurosis borderline (SDS score: 39-47, n=17), and neurosis/depression (SDS: 48 or higher, n=19). The smoking cessation rate was markedly low in the normal/neurosis borderline group (35.3%, P=0.030 vs. normal) as well as the neurosis/depression group (21.1 %, P=0.002 vs. normal), compared with the normal group (69.0%). Multivariate logistic regression analysis revealed that among various variables on the initial consultation, the SDS score was the only independent determinant of smoking cessation failure (P=0.032, OR: 0.927, CI: 0.866-0.993). These findings suggest that even a latent depressive state greatly affects the achievement of smoking cession in Japanese patients.

Keyword: smoking, SDS test, depressive state

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# 喫煙による歯周疾患の超過医療費の試算

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# Estimation of periodontal care cost savings of quitting smoking based on the national data in Japan

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キーワード：喫煙、歯周疾患、医療費、医療経済、試算

## 要　約

国の既出統計データを用い、一定の条件下での喫煙による歯周疾患の超過医療費を推計した。その結果、平成17年度における喫煙がもたらす歯周疾患超過医療費は男女合計で1,720億円、男性で1,080億円、女性で640億円であった。超過医療費の歯周疾患医療費に対する割合は、それぞれ男女合計で20.5％、男性で31.5％、女性で12.9％であった。歯周疾患の超過医療費の歯科総医療費に占める割合は約6.7%と推計された。これらの結果から、喫煙による歯周疾患の超過医療費は、国民医療費においても重要な問題であり、早急な対応が必要であることが明らかになった。

## 緒　言

中原ら[1, 2)]は、わが国の国家統計をもとに喫煙によりもたらされる社会的損失を試算し、その総額は約4兆9千億円と推計した。社会的損失には喫煙関連疾患の罹患（悪性新生物、高血圧性疾患、虚血性心疾患、脳血管疾患、呼吸器疾患、胃・十二指腸潰瘍、肝疾患）による医療費の増加、入院や死亡による損失に加えて、たばこの火によって起こった火災による財産の喪失、火災による死亡や負傷も含まれている。なお、喫煙による医療費の損失は1兆3千億円と推計された。このように喫煙は医療経済の観点からも早急に解決すべき課題となっている。

喫煙は歯科領域においても重要な問題となっている。喫煙の及ぼす健康影響の知識と禁煙支援の普及は、「健康日本21」の「歯の健康」の中にある「成人期の歯周病予防」のリスク低減目標のひとつである[3)]。喫煙による歯科的な影響では、歯周疾患[4)]、口腔がん[5)]、歯の喪失[6)]などをはじめとして治療経過への悪影響[7)]に関する報告があり、中でも歯の喪失の主要因となっている歯周疾患への影響については多くの報告がなされている[8)]。しかし、喫煙が歯科医療費に及ぼす影響については、職域におけるコホート研究9)があるものの、ほとんど知られていない。そこで本研究は、わが国の国家データと喫煙による歯周疾患の疾病リスクのデータをもとに、歯周疾患による超過医療費の推計を行うことを目的とした。

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## 方　法

### 1．統計資料

1）国民医療費（平成17年度）[10]
2）社会医療診療行為別調査（平成17年度）[11]
3）平成17年度患者調査12)の推計患者数（外来・歯科）
4）平成16年国民生活基礎調査（大規模調査）[13]の喫煙率

### 2．超過医療費の算出方法

1）平成17年度の国民医療費の年齢階級別歯科医療費と同年度の社会医療診療行為別調査から、年齢階級別に歯周疾患（歯肉炎＋歯周炎）の費用を総額に対して計算することで歯周疾患の年齢階級別医療費として算出した。
2）平成17年度患者調査の推計歯周疾患患者数（外来・歯科）を用いて男女別の歯周疾患医療費と患者数を算出した。
3）その結果を、Shizukuishiら[4]が示した喫煙による歯周疾患への影響オッズ比（OR）2.1（男女とも、全年齢階級で）と平成16年度国民生活基礎調査で示された年齢階級別の喫煙率（喫煙経験＝毎日＋時々）から以下の計算式（①、②）を試作し、男女別歯周疾患患者数を喫煙者ならびに非喫煙者別に配分した。なお、喫煙率については、喫煙による歯周疾患への影響時期を配慮して、直近の平成16年度の喫煙率を採用した。
4）最後に喫煙者が非喫煙者である場合の医療費を算出し、その差をもって超過医療費として推定した（③）。

〔計算式〕

①喫煙者の歯周疾患患者数：

$$\frac{SR \times OR \times \text{患者数}}{(1-SR)+SR \times OR}$$

②非喫煙者の歯周疾患患者数：

$$\frac{(1-SR) \times \text{患者数}}{(1-SR)+SR \times OR}$$

③超過医療費：

$$\frac{\text{喫煙者の歯周疾患医療費} \times (OR-1)}{OR}$$

（SR：喫煙率，OR：オッズ比）

なお、喫煙者の歯周疾患医療費は下記の式で算出した。

$$\text{喫煙者の歯周疾患医療費：} \frac{\text{喫煙者の歯周疾患患者数}}{\text{歯周疾患患者数}} \times \left\{ \begin{array}{l} \text{患者調査配分} \\ \text{による歯周} \\ \text{疾患医療費} \end{array} \right\}$$

5）推定値算出に際しては、以下の問題を主な前提とした。
i）喫煙者・非喫煙者による受療率に差はない。
ii）喫煙者の過去の喫煙習慣・喫煙量（喫煙本数、喫煙年数）にかかわらず歯周疾患になる可能性をオッズ比2.1で算出した。
iii）歯単位の検討をせず、人単位で検討して医療費を配分した。
iv）歯周疾患に関わる他のリスク要因の影響を除外した。
v）喫煙者の歯の喪失リスクを考慮から除外した。

## 結　果

表1には歯周疾患医療費を男女別および年齢階級別に示した。歯周疾患医療費は女性が男性よりも高く、女性では30～34歳と60～64歳にピークがあったが、男性では35～39歳と55～59歳にピークがみられた。

表2には喫煙者と非喫煙者の歯周疾患医療費を男女別および年齢階級別に示した。総数では男性の場合、喫煙者の歯周疾患医療費は非喫煙者よりも多かったが、女性では非喫煙者の方が喫煙者よりも多かった。男性の歯周疾患医療費は喫煙者では35～39歳と55～59歳にピークがあったが、非喫煙者では65～69歳にピークがみられた。女性の喫煙者では30～34歳に歯周疾患医療費のピークがみられたが、非喫煙者では60～64歳にピークがみられた。

表3には、歯周疾患の超過医療費を男女別および年齢階級ごとに示した。喫煙がもたらす歯周疾患超過医療費と歯周疾患医療費に対する超過割合は、男女合計で1,723億円（20.5％）、男性で1,083億円（31.5％）、女性で639億円（12.9％）と推計