

# School Factors and Smoking Prevalence among High School Students in Japan

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## Abstract

The purpose of this study was to analyze the relationship between student smoking prevalence by school and school factors. Junior and senior high schools were selected from throughout Japan using a simple random sampling.

One hundred junior high schools and 50 senior high schools were randomly selected. Of these 70 junior high schools (70%) and 33 senior high schools (66%) responded to this survey. Self-administered anonymous questionnaires were completed by all enrolled students in each school. The principal of each school completed a school questionnaire about school factors.

The smoking rate of male teachers was significantly related to the student smoking rate in junior high schools. This factor was still associated with the student smoking rate after adjusting for family smoking status. Surprisingly, the smoking rates for junior high school boys in schools with a school policy against teachers smoking were higher than those of schools without one. The dropout rate and the proportion of students who went on to college were significantly related to the smoking rates among senior high school students of both sexes. The regular-smoker rate of boys in schools with health education on smoking was more likely to be low.

It is important to take account of school factors in designing smoking control programs for junior and senior high schools.

**Key words:** Smoking behavior, Adolescent behavior, School factor

## Introduction

Recent efforts aimed at preventing smoking among students have focused on social skills training to resist peer pressure to smoke. Many studies have reported individual factors associated with student smoking behavior, such as peer smoking, family smoking, student knowledge and attitudes. However, it is essential to determine correlates associated with student smoking behavior to develop anti-smoking education for this age group. Students spend much time in their schools and anti-smoking education is usually received there from teachers. Discerning school factors relating to student smoking is important, as are individual correlates of their smoking. These school characteristics will be helpful for focusing on schools that require smoking prevention programs, and may also provide possible cues for school improvement including a change of teacher smoking

behavior or smoking policy against teachers smoking. However, the association between school factors, such as teachers' smoking habits, anti-smoking education and school policy against smoking, and student smoking is analyzed by only a few surveys.<sup>1-4)</sup> There is no study from this point of view in Japan as yet.

We conducted a nationwide survey on smoking prevalence among junior and senior high school students in Japan.<sup>5)</sup> Since we surveyed some school characteristics simultaneously, we analyzed the association between student smoking prevalence and school factors.

## Methods

In 1990, there were 11,182 junior high schools and 3,995 full-time senior high schools in Japan. We randomly selected 100 junior high schools and 50 full-time senior high schools using the National School Directory. We sent each school an explanatory letter, a school questionnaire for completion by the principal, and questionnaires for completion by all students. Hence, the sampling method was single-stage cluster sampling with clusters of unequal sizes. This survey was carried out in December 1990 and January 1991.

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Seventy junior high schools and thirty-three senior high schools responded. The proportion of students returning questionnaires to total enrollment in responding schools was 96.5% in junior high schools and 90.7% in senior high schools. A total of 57,189 student questionnaires were subjected to analysis. The self-administered anonymous questionnaire for students contained questions about: 1) smoking status, 2) the number of cigarettes smoked per day, 3) the source of tobacco, 4) the smoking status of family, friends, and so on. Further details have been published elsewhere.<sup>5)</sup>

The school questionnaire asked for background information concerning: 1) the number of enrolled students, 2) the number of students who had dropped out in 1989, 3) the number of students who had gone on to college in 1989 (senior high schools only), 4) the smoking rate among teachers by gender, 5) presence of a school nurse, and 6) anti-smoking education. Moreover, a second school questionnaire was sent to principals in November 1991. This questionnaire asked about the school policy against teachers smoking. Sixty-three of the 70 junior high schools and 25 out of the 33 senior high schools responded.

The terms, 'experimenter', 'current smoker', and 'regular smoker' as used in this paper are defined as follows:

Experimenters were students who had smoked at least once. Current smokers were students who had smoked at least once during the previous month. In Japan, 'monthly smoking' is recently used as the definition of 'current smoking' among adolescents, because the latter is basically consistent with the self-referential label of the former.<sup>6)</sup> Regular smokers were students who smoked almost every day (three or more times each week).

### Statistical methods

Multiple linear regression analysis was applied to examine associations between student smoking prevalence and school factors. One junior high school and one senior high school were excluded from the analyses because of a lack of completed questionnaires for one grade. The analyses were performed by gender and school level. Three different dependent variables were used for analyses, namely the experimenter rate, current-smoker rate, and regular-smoker rate. These smoking rates were adjusted using the total number of responding students by gender and school level as the reference population.

Seven variables were used as independent variables for analyses of junior high schools, i.e., the presence of a school nurse, anti-smoking education, the smoking rate of male teachers, the smoking rate of female teachers, the type of school (public or private), the population of the municipality in which the school was located, and a school policy against teachers smoking. Since most junior high schools do not have dropouts, the dropout rate was not included in this model. Seven variables were used as independent variables for the analyses of senior high schools, i.e., anti-smoking education, smoking rate of male teachers, smoking rate of female teachers, population of the municipality in which the school was located, the dropout rate, the proportion of students who went on to college, and the type of school (general or vocational).

Since only one senior high school had no school nurse and one other school was a private school, these two variables were not included in the model for senior high schools. Moreover, since the response rate for questionnaires about the school policy

concerning teachers smoking was relatively low among senior high schools, this variable was not included in the model either. Finally, 60 junior high schools, 28 senior high schools for boys, and 25 senior high schools for girls were used for multiple linear regression analyses, other schools being excluded because of lack of information.

After the analyses of associations between the student smoking rates and school factors, we again analyzed these associations while adjusting for family smoking status. The smoking rate for fathers, that for mothers, the proportion of students who reported that their brother smoked, the proportion of students who reported that their sister smoked, and the proportion of students with other family members who smoked were used as variables in this adjustment. All five variables were reported by students. A stepwise method was applied for multiple linear regression analyses weighted by the number of students of each gender. The probability of the entry of a variable was 0.10, and that of removal was 0.15. For statistical analyses, SPSS for Windows (SPSS Inc. IL, USA) was used.

### Results

Table I and Table II show characteristics of responding schools by school level. The smoking rate of teachers was higher among junior high schools than among senior high schools for both sexes. The smoking rate of female teachers among senior high schools was very low. Thirty-five percent of junior high schools and 39% of senior high schools provided no health education on smoking in the year preceding this survey. The majority of junior and senior high schools had a school policy against teachers smoking. Only one smoke-free school was found among the junior high schools. This school was a denominational school. Junior high schools were more likely to have active regulations limiting teacher smoking (Table II).

School factors, namely the smoking rate of male teachers and the presence of a school policy against teachers smoking, were significantly related to the current smoker rate of junior high school boys (Table III). This indicated that the current smoker rate of junior high school boys was more likely to be high in schools with a high smoking rate for male teachers or a strict school policy against teachers smoking. The presence of health education on smoking and a school policy against teachers smoking were significantly related to the regular smoker rate of junior high school boys (Table III). This indicated that the smoking rate of schools with health education on smoking was more likely to be low. The population of the municipality where the school was located was positively related to the current and regular smoker rates of junior high school girls (Table III), implying that smoking rates of schools in city areas were more likely to be high.

The dropout rate and proportion of students who went on to college (college rate) were significantly related to the experimenter, current-smoker, and regular-smoker rates of senior high school boys (Table IV). Student smoking rates of schools with high dropout rates were more likely to be high, whereas smoking rates of schools with a high college rate were more likely to be low. The regular-smoker rate for schools with health education on smoking was more likely to be low (Table IV).

The dropout rate, college rate, and the population of the municipality in which the school was located were significantly related to the experimenter and current-smoker rates of senior

**Table I Student smoking rates and school factors by school level**

	Junior High School			Senior High School		
	N	Mean	SD	N	Mean	SD
<b>Dependent Variables</b>						
Experimenter rate						
boys	69	0.327	0.148	31*	0.456	0.132
girls	69	0.134	0.078	29*	0.181	0.110
Current-smoker rate						
boys	69	0.072	0.053	31	0.211	0.109
girls	69	0.019	0.023	29	0.055	0.051
Regular-smoker rate						
boys	69	0.024	0.025	31	0.157	0.094
girls	69	0.006	0.011	29	0.028	0.030
<b>Independent Variables</b>						
Continuous Variables						
Number of students	69	456.3	346.2	32	891.3	471.0
Population of school's municipality	69	94107	151058	32	120240	146853
Smoking rate of teachers						
male	68	0.471	0.197	31	0.378	0.157
female	68	0.045	0.177	31	0.005	0.030
Dropout rate				30	0.022	0.028
Proportion of students who went on to college				29	0.209	0.300

\*The responding senior high schools included three all-boys schools and one all-girls school.

**Table II Characteristics of categorical school factors by school level**

	Junior High School			Senior High School		
	N	Frequency	%	N	Frequency	%
<b>Independent Variables</b>						
Dummy Variables						
Presence of school nurse	68	64	97.0	31	30	96.8
Presence of health education on smoking	66	43	65.2	31	19	61.3
Private school	69	2	2.9	32	1	3.1
Vocational school				32	9	28.1
Presence of school policy on teacher smoking in school	63	46	73.0	25	17	68.0
<b>Details of school policies</b>						
Staff can not smoke in front of students	63	32	50.8	25	3	12.0
Staff is recommended not to smoke in school	63	27	42.9	25	10	40.0
Staff can smoke only in a smoking section	63	14	22.2	25	3	12.0
Staff can not smoke when students in room	63	14	22.2	25	1	4.0
Staff can not smoke while attending teachers' meeting	63	6	9.5	25	9	36.0

high school girls. The dropout rate was related to the regular-smoker rate (Table V).

When variables on the smoking status of family were included in the model, few school factors were significantly related to the student smoking rate. The smoking rate of male teachers was related to the current-smoker rate of boys and experimenter rate of girls in junior high schools (Table VI). The pro-

portion of students who went on to college was related to the experimenter rate of senior high school boys. When the regular-smoker rate was adjusted for the smoking status of the family, the rate of vocational schools was lower than that of general schools for girls (Table VI).

Table III Results of multiple linear regression analysis among junior high schools

Dependent Variables	Independent Variables	partial regression		R-square	p-value
		covariance	coefficient		
boys					
Experimenter rate (n=60)	No variables selected				
Current-smoker rate (n=60)	Health education on smoking*	-0.0183	-0.2355	0.1707	0.077
	Smoking rate of male teachers	0.0703	0.2968		0.019§
	School policy on teachers† smoking in school multiple regression coefficient	0.0297	0.3484		0.011§ 0.013§
Regular-smoker rate (n=60)	Health education on smoking	-0.0123	-0.3004	0.1706	0.025§
	Smoking rate of male teachers	0.2590	0.2063		0.098
	School policy on teachers smoking in school multiple regression coefficient	0.0175	0.3880		0.005§ 0.013§
girls					
Experimenter rate (n=60)	Smoking rate of male teachers	0.0827	0.2221	0.1072	0.079
	Smoking rate of female teachers	0.2304	0.2469		0.051
	multiple regression coefficient				0.037§
Current-smoker rate (n=60)	Population of school's municipality‡	0.0049	0.3623	0.1312	0.004§ 0.004§
	multiple regression coefficient				
Regular-smoker rate (n=60)	Health education on smoking	-0.0037	-0.2179	0.2203	0.067
	Population of school's municipality‡ multiple regression coefficient	0.0025	0.3903		0.002§ <0.001§

\* Presence of health education on smoking = 1, Absence of it = 0

† Presence of school policy on teachers smoking = 1, Absence of it = 0

‡ Log of population (log transformation)

§ p&lt;0.05

Table IV Results of multiple linear regression analysis for male student smoking rates among senior high school

Dependent Variables	Independent Variables	partial regression		R-square	p-value
		covariance	coefficient		
Experimenter rate (n=28)	Dropout rate	1.3347	0.2796	0.7504	0.021*
	Proportion of students who went on to college	-0.3236	-0.7820		<0.001*
	Vocational school† multiple regression coefficient	-0.0570	-0.2019		0.095 <0.001*
Current-smoker rate (n=28)	Dropout rate	1.4774	0.3729	0.6387	0.012*
	Health education on smoking	-0.0530	-0.2311		0.070
	Proportion of students who went on to college multiple regression coefficient	-0.1911	-0.5564		<0.001* <0.001*
Regular-smoker rate (n=28)	Dropout rate	1.1700	0.3469	0.6299	0.019*
	Health education on smoking	-0.0506	-0.2588		0.047*
	Proportion of students who went on to college multiple regression coefficient	-0.1662	-0.5685		<0.001* <0.001*

† Vocational school = 1, General school = 0

\* p&lt;0.05

Table V Results of multiple linear regression analysis for female student smoking rates among senior high schools

Dependent Variables	Independent Variables	partial regression		R-square	p-value
		covariance	coefficient		
Experimenter rate (n=25)	Dropout rate	1.4422	0.3670	0.6295	0.017†
	Population of school's municipality*	0.0215	0.3504		0.015†
	Proportion of students who went on to college multiple regression coefficient	-0.1406	-0.5249		0.002† <0.001†
Current-smoker rate (n=25)	Dropout rate	0.8712	0.4530	0.5721	0.007†
	Population of school's municipality*	0.0092	0.3067		0.042†
	Proportion of students who went on to college multiple regression coefficient	-0.0530	-0.4047		0.016† <0.001†
Regular-smoker rate (n=25)	Dropout rate multiple regression coefficient	0.7419	0.5957	0.3549	0.001† 0.001†

\* Log of population (log transformation)

† p &lt; 0.05

Table VI School factors selected by multiple linear regression analysis adjusting for family smoking status

Dependent Variables	Independent Variables	partial regression		R-square	p-value
		covariance	coefficient		
junior high school boys					
Experimenter rate (n=60)	Smoking rate of male teachers multiple regression coefficient	0.1410	0.2023	0.4017	0.078 <0.001†
	Current-smoker rate (n=60)	Smoking rate of male teachers multiple regression coefficient	0.0545		0.2300
girls					
Experimenter rate (n=60)	Smoking rate of male teachers multiple regression coefficient	0.0984	0.2643	0.2933	0.037† 0.004†
senior high school boys					
Experimenter rate (n=28)	Vocational school*	-0.0496	-0.1754	0.8850	0.083
	Proportion of students who went on to college multiple regression coefficient	-0.1847	-0.4463		0.004† <0.001†
girls					
Experimenter rate (n=24)	Smoking rate of female teachers multiple regression coefficient	0.8141	0.2180	0.7912	0.096 <0.001†
	Current-smoker rate (n=24)	Dropout rate multiple regression coefficient	0.3865		0.2023
Regular-smoker rate (n=24)	Vocational school multiple regression coefficient	-0.0171	-0.2771	0.8397	0.017† <0.001†

\* Vocational school = 1, General school = 0

† p &lt; 0.05

## Discussion

This study investigated some school factors associated with smoking prevalence among students. A possible methodological problem of this study is the reliability of reported smoking rates of both students and teachers. It is considered that the smoking

prevalence of students may be somewhat underestimated. We must take into account the limitations of a school-based study and social desirability bias even though students fill out questionnaires anonymously. In addition, 6 % of the enrolled students were absent on the survey day, which might also have contributed to underestimation of smoking prevalence. However, since it is

considered that these factors were uniform in terms of the school smoking prevalence, this underestimation probably did not cause a serious problem in the correlation between the student smoking rate and school factors. Indeed, the absentee rate for each school and school factors which were related to the student smoking rate were statistically independent of each other. On the other hand, the reported smoking rate of teachers was somewhat questionable, because the principal of each school reported the rate for his/her school. The reliability of the smoking status of respondents might have been affected by this.

Although asking each teacher about smoking status might be better, a study conducted in Great Britain reported a low response rate to a questionnaire on teacher smoking status.<sup>2)</sup> Teachers who did not respond might be more likely to be smokers.

Several factors support the validity of the present method. Teachers usually share a large teachers' room in Japan. Moreover, the relationship between principals and teachers is close. These conditions allow a principal to accurately estimate the number of teachers who smoke.

In addition, the average smoking rates of teachers are similar to the rate of smoking prevalence, according to an individual questionnaire survey conducted in Hokkaido Prefecture in Japan.<sup>7)</sup> Therefore, this methodological problem is unlikely to have caused a serious problem in data analysis.

The most important result of this survey was the discovery of a significant association of the male-teacher smoking rate with some student smoking rates. This correlation was observed only among junior high school boys. However, this factor was associated with student smoking rates both sexes after adjusting for family smoking status. In Western countries, only a few studies have reported a direct relationship between the teacher smoking rate and the student smoking rate,<sup>1,8)</sup> whereas other studies did not observe this relationship.<sup>2,3)</sup> Since the results of only one study were adjusted for the smoking status of the family,<sup>1)</sup> the results of the present study are worthy of note. One reason for this may be that Japanese students are easily exposed to teacher smoking because most schools in Japan allow teachers to smoke on school grounds, whereas many Western countries ban teachers from smoking at school. When the analyses for senior high schools were performed using the same variables as those for junior high schools, teacher smoking rates were not significantly related to student smoking rates. Younger students may be more likely to be influenced by a teacher's smoking habits. The significant relationship of the male-teacher smoking rate may be due to the extremely low smoking rate among female teachers. Therefore, this result indicates that it is important to take account of teachers' smoking habits in designing smoking control programs in schools.

The smoking rates among boys from junior high schools with a school policy against teachers smoking were higher than those of schools without one. Schools with a high student smoking rate may want to consider the influence of teacher smoking

on students. No significant correlation was observed among individual items of school policy against the teachers smoking, the teacher smoking rate, and the student smoking rate using simple linear regression analyses. A study conducted in Great Britain observed only a weak relationship between the student smoking rate and school policy against smoking.<sup>4)</sup> Schools with high smoking rates among students, however, may actually have strict policies against teachers smoking in order to reduce possible negative influences on their students. For this reason, a follow-up study is required to assess the variety and effectiveness of school policies on teachers smoking.

Among senior high schools, the proportion of students who went on to college (college rate) and the dropout rate were independently related to the student smoking rate by school. Academic performance and education are very important predictors of adolescent smoking.<sup>9-14)</sup> The college rate of this study was considered to be a factor reflecting the average academic performance by school. The dropout rate probably reflected not only the smoking habits of students but also other problematic behaviors. The high values of R-squared, the coefficient of determination, in models for senior high schools, implied that a high proportion of the variation in student smoking rates can be explained by the models with only school factors. We can predict student smoking rates for each senior high school if we know the pertinent school factors.

The absence of significant relationships between these factors and the student smoking rate after adjusting for smoking status of the family might be due to a close relationship among the educational level of the family, smoking behavior of the family, and the academic performance of the student. A study reporting the relationship between family social class and smoking rate by type of school also supports this hypothesis.<sup>15)</sup>

The smoking rate for girls was higher in schools in city areas than in rural areas. The presence of health education on smoking was only related to the smoking rate of boys, whereas a study conducted in Great Britain observed a relationship between the student smoking rate and anti-smoking education in both sexes.<sup>1)</sup> Although this association does not necessarily imply that health education can reduce the student smoking rate, it at least means that there is a lack of health education on smoking among high schools with a high prevalence of student smoking. To determine the effectiveness of the health education on smoking, a survey which takes into account not only the presence or absence of education but also the quantity and quality of education is important. Clearly, there are some gender differences here. This implies that different strategies for smoking control are required for each gender as mentioned in another study.<sup>1)</sup>

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