

# THREE-YEAR FOLLOW-UP ON THE EFFECTS OF A SMOKING PREVENTION PROGRAM FOR ELEMENTARY SCHOOL CHILDREN WITH A QUASI-EXPERIMENTAL DESIGN IN JAPAN

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**Objective** We performed the follow-up tests for three years for junior high school students by the quasi-experimental design to investigate the medium-term effect of smoking prevention education in the elementary school.

**Methods** The intervention group consisted of 106 school students of three elementary schools and received a smoking prevention program in the elementary school. Moreover, the follow-up tests were conducted at each grade of junior high school, and the booster program was mailed. The comparison group consisted of 193 school students of another three elementary schools without the program.

**Results** The intervention effects were recognized on knowledge up to the second grade of junior high school for boys and up to the third grade for girls, on awareness of the importance of not smoking at the second grade, and on the intention of smoking at the age of 20 for girls up to the first grade. On the other hand, the intervention effects were not recognized on smoking experience for boys and girls. However, increase of the rate of smoking experience was not significant in the intervention group, while it was significant in the comparison group.

**Conclusion** The effect of the program for three years was judged to be moderate.

**Key words** : smoking prevention education, quasi-experimental design, follow-up studies, three-years

## I. Introduction

As smoking poses one of the greatest health threats to young people in Japan, prevention is receiving emphasis in the national curriculum.

Thus, children in Japan are scheduled to receive smoking prevention education at all stages, including elementary school, junior high school, and senior high school. Moreover, the Ministry of Education, Culture, Sports, Science and Technology has developed brochures for children and teaching manuals for school teachers for smoking prevention education, and distributed them to schools across the country<sup>1)</sup>.

However, these measures have shown no marked effect. For example, the rates of current smokers at the ages of 14–15, and 17–18 were found in one study to be 10% and 27% for boys, and 4% and 11% for girls, although smoking under the age of 20 is prohibited by law. The rates of ever smokers of the same ages were 45% and 54% for boys, and 27% and 30% for girls, respectively<sup>2)</sup>. Thus, it is necessary to improve smoking prevention education and continually evaluate effectiveness<sup>3)</sup>, particularly with follow-ups of over one year, which have been lacking except in high school students<sup>4,5)</sup>. Recently, the importance of environmental measures for smok-

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ing prevention is emphasized but effective coordination with health education is necessary. Verifying a medium-term effect of smoking prevention education would contribute a great deal.

We earlier performed an intervention study of fifth and sixth graders of elementary schools with a quasi-experimental design to evaluate the short and medium term effects of a smoking prevention program in Japan. As a short-term effect of the intervention, acquired knowledge on the acute influence of smoking was remarkably increased and enhancement of the awareness of the importance of not smoking was significant. However, the intervention effect on smoking behavior was not clear due to the low rate of smoking in this age group<sup>6,7)</sup>.

As the next step, medium-term effects of the intervention were examined with the same subjects in junior high schools. That is, follow-up tests were performed by the mailing method three years after the intervention in the elementary school had been completed.

## II. Methods

### Subject

One intervention school and one comparison school were chosen from each of three cities in Niigata prefecture. The sampling of schools was not random. The intervention group, consisting of 106 school students (52 boys and 54 girls) at three elementary schools, received a smoking prevention program of three sessions in June and July of 1992 for the fifth graders and three sessions in June and October of 1993 for the sixth graders (Figure 1).

In developing the program, we referred to the conclusions of a National Cancer Institute-convened Expert Advisory Panel<sup>8)</sup> and the Know Your Body Program<sup>9)</sup> that showed the effects on smoking prevention. Thus, the program focused on short-term influences and psycho-social factors involved in starting smoking, and on training to resist advertisements and peer group pressure. The content of the program for fifth graders included: 1) lifestyles that influence health; 2) short-term physiological effects of smoking; 3) factors behind starting smoking and dependence on smoking. For sixth graders were included: 1) review of the lessons for fifth graders and short-term physiological effects of smoking; 2) analysis of tricks used in advertising of cigarettes; 3) training in assertive communication skills to resist peer pressure.

Moreover, pre-test, post-test and follow-up tests were executed, and the self-learning booklet as a booster program was mailed at the second grade of junior high school.

The comparison group consisted of 193 school students (102 boys and 91 girls) from another three elementary schools in the same three cities. The pre-, post- and follow-up tests were performed at the same time as the intervention group but without the preceding smoking prevention and booster programs.

### Data collection and measures

The study was conducted with a quasi-experimental design where the intervention and comparison groups recruited from different schools. The data for each child over the test period of five years was assigned to an ID number although all the tests

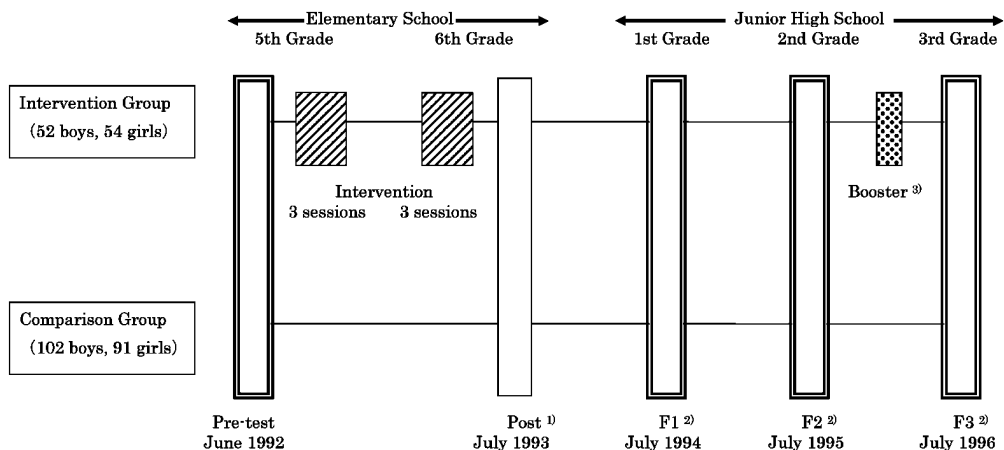


Figure 1. Study Design

- 1) Post-test on July 1993 was excluded from the analysis.
- 2) F1, F2 and F3 show the first, the second and third follow-up tests, respectively.
- 3) A self-learning booklet was mailed to each student of the intervention group as a booster.

were conducted anonymously.

The following measures concerning research ethics were undertaken in addition to ensuring the anonymity of tests. The students were not compelled to answer, and the planning for test execution was reported to students' parents with a postcard before each test and to students' junior high school by telephone. However, approval of an ethical committee was not obtained because such committees had not been set up.

The follow-up tests were performed by the mailing method once for each grade in junior high school, in July and August of 1994 to 1996. Two weeks later, postcards thanking the respondent for answering or requesting non-responders to provide answers were mailed to the children.

The test questionnaire covered the following items: the smoking status of the student, his/her family members and friends, knowledge, attitude and behavior regarding smoking, and the implementation status for education of smoking prevention in the junior high schools. A free description system for knowledge and a single answer system for other variables were adopted for the test format.

Moreover, in the booster program a self-learning booklet whose content was similar to that of the program itself at elementary school was mailed to each student in the intervention group in December 1995.

*Analysis*

We defined the respondents as students who responded to all the follow-up tests, and longitudinal

study is always facing problems of attrition<sup>10)</sup>. At first, differences in their features between the respondents and the non-respondents were examined by comparing pre-test status. Differences in pre-test knowledge, attitude and behavior on smoking, as well as on the smoking status of the surrounding people, were assessed between the intervention and comparison groups by Chi-squared test.

Then, we conducted the MacNemar Test for the results of the pre-test and each follow-up test to confirm changes in the results. Multiple logistic regression analysis was finally executed to clarify factors affecting the attitude and behavior regarding smoking in each follow-up test. The selection of predictor variables was on the basis of correlation coefficients and plausible explanation (Table 1). The step-wise method with forward selection was used for the analysis, with SPSS 12.0 J for Windows (SPSS Japan Inc), and the significance cut-off was set at 5%.

**III. Results**

*Response rate in the Follow-up tests*

With the boys, the response rate was about 80% up to the second follow-up test (F2) but fell to 59.6% at the third follow-up test (F3) in the intervention group, while the response rate of about 80% persisted to F3 in the comparison group. Significant differences between the groups were found at pre-test and at F3, with lower values in the intervention group (Table 2). Similar findings were evident for

**Table 1.** Outcome and predictor variables in the logistic regression analysis

Outcome variables (F1, F2, F3) <sup>1)</sup>	Specific predictor variables at pre-test for each outcome variable	Common predictor variables at pre-test for each outcome variable
○ Awareness of the importance of not smoking • very important <sup>2)</sup>	○ Awareness of the importance of not smoking ○ Knowledge on effects of smoking • have one or more pieces of knowledge	○ Experience of smoking ○ Intention of smoking at the age of 20 ○ Smoking of parents • neither father nor mother smoke ○ Smoking of friends • no friends smoke ○ Intervention
○ Intention of smoking at the age of 20 • absolutely or probably not smoke	○ Awareness of the importance of not smoking ○ Self-efficacy of refusing to smoke ○ Knowledge on effects of smoking	
○ Self-efficacy of refusing to smoke against pressure from friends • definitely refuse	○ Self-efficacy of refusing to smoke ○ Knowledge on effects of smoking	
○ Experience of smoking • never smoke	○ Knowledge on effects of smoking	

<sup>1)</sup> F1, F2 and F3 are the first, second and third follow-up tests, respectively.

<sup>2)</sup> The reference category of the variable is shown after the black spot.

**Table 2.** Response rates (%)

	Intervention	N	Pre-test	F1	F2	F3
Boys	I	52	100	86.5	78.8	59.6
	C	102	92.7	82.7	85.5	78.2
	Between Groups		*			*
Girls	I	54	91.5	84.7	83.1	69.5
	C	91	96.8	89.4	85.1	87.2
	Between Groups					*

\* significantly different between intervention and comparison groups:  $P < 0.05$

<sup>1)</sup> I: Intervention group, C: Comparison group

<sup>2)</sup> F1, F2 and F3 are the first, second and third follow-up tests, respectively.

the girls at F3.

#### *Comparison between respondents and non-respondents*

In the case of boys of the intervention group, the respondents had significantly more knowledge than non-respondents at pre-test. However, there was no other significant variation in either sex.

#### *Comparison between groups*

There were no significant differences in knowledge, attitudes, behavior regarding smoking, and the smoking rates of surrounding people between the intervention and comparison groups for boys or girls at pre-test. (see Table 3)

#### *Effect of intervention*

The rates of students who had knowledge regarding the acute influence of smoking in the intervention group fell by grade (Table 3). Nevertheless, the rates at the first follow-up test (F1) and F2 for boys and at F1, F2 and F3 for girls were significantly higher than the rates at pre-test. This was also the general case for the comparison group but the increase was greater in the intervention group. Significant differences between the intervention and comparison groups were recognized at F1 and F2 for boys and at F1, F2 and F3 for girls.

On attitudes, the rates for awareness of the importance of not smoking in both intervention and comparison groups demonstrated no significant differences to the pre-test values for boys or girls. Awareness was significantly more frequent in the intervention than comparison girls only at F2.

The intervention group rates for intention to smoking at the age of 20 demonstrated no significant difference with the pre-test rate as well as the comparison group for boys and the girls. A significant difference for females between the groups was found

at F1, a non-smoking intention was more likely in the intervention group. Similarly, self-efficacy in refusing to smoke at follow-up tests in the intervention group demonstrated no significant differences from the pre-test rate, in clear contrast to the comparison group.

Regarding smoking behavior, the increase in the rate of smoking experience between the pre-test and F3 in the intervention group was non-significant at 3.7% for boys and 14.7% for girls. In the comparison group, the respective rates were 13.5% for boys and 13.4% for girls, and partly significant.

However, we found inconsistencies in the answers for smoking experience among students. Namely, some answered "not yet experienced" although they answered "experienced" in the previous test. For reference, we treated all cases that had once answered "experienced" as "experienced" for all successive answers. Comparing both groups, the rate for boys of the intervention group was lower by 8% to 13% although not significant (Table 4). Furthermore, the difference grew as the grade rose. For girls, there was little difference, but increase was smaller in the intervention group.

Regarding normal smoking prevention education in junior high schools, the implementation rates were about 10% in the intervention group, while they were over 40% in the comparison group.

#### *Factors affecting follow-up test results*

The factors affecting the results of follow-up tests identified by multiple logistic regression analysis are listed in Table 5.

Intervention effects were found on intention to smoke at the age of 20 at F1 and awareness of the importance of not smoking at F2 for girls, but regarding attitude for boys. No influence on actual smoking behavior was apparent.

The status of attitude and behavior at pre-test had a strong influence at F1, F2 and F3. In particular, this was significant at each follow-up test regarding intention to smoke at the age of 20 for boys and girls, and on the self-efficacy in refusing to smoke for boys. Moreover, the intention of smoking at the age of 20 at pre-test also influenced the awareness of the importance of not smoking for boys and girls.

## IV. Discussion

#### *Influence of dropout*

The response rate achieved was relatively high although a mailing method was adopted. Moreover, the features of respondents and non-respondents were very similar, judging from the results of the pre-test although the rate of the intervention group at F3 was significantly lower than that of the compari-

Table 3. Results of the pre-test and follow-up tests

Item	Sex	Inter- vention <sup>1)</sup>	Pre-test		F1		F2		F3	
			%	between groups	%	to Pre to groups	%	to Pre to groups	%	to Pre to groups
Knowledge on acute influence of smoking	Boys	I	11.1	63.0	*	40.7	*	33.3		
		C	6.8	16.2	※	13.5	※	18.9		
	Girls	I	11.8	61.8	*	50.0	*	50.0		
		C	7.4	23.5	*	22.1	*	20.6		
Awareness of the importance of not smoking "very important"	Boys	I	74.1	66.7	66.7	77.8				
		C	68.5	67.1	64.9	70.3				
	Girls	I	65.6	88.2	88.2	70.6				
		C	71.0	76.5	61.2	63.2				
Intention of smoking at the age of 20 "not smoke absolutely" or "not smoke maybe"	Boys	I	63.0	70.4	59.3	59.3				
		C	60.8	59.5	51.4	60.8				
	Girls	I	82.4	94.1	82.4	82.4				
		C	73.5	73.5	※	79.4				
Self-efficacy of refusing to smoke against pressure "refuse definitely"	Boys	I	48.1	59.3	48.1	59.3				
		C	33.8	50.0	*	52.1	*			
	Girls	I	58.8	58.8	76.5	61.8				
		C	45.6	50.0	58.2	60.3				
Experience of smoking "have smoked"	Boys	I	11.1	11.1	14.8	14.8				
		C	16.2	12.2	17.6	29.7				
	Girls	I	5.9	9.1	14.7	20.6				
		C	3.0	11.8	*	14.9	*			

\* significantly different from the pre-test result  $P < 0.05$ ※ significantly different between the intervention and comparison groups:  $P < 0.05$ 

1) I: Intervention group, C: Comparison group

2) F1, F2 and F3 are the first, second and third follow-up tests, respectively.

**Table 4.** Rates and numbers for smoking experience after revision

	Pre-test	F1	F2	F3
Boys				
I (27)	11.1( 3)	14.8( 4)	18.5( 5)	25.9( 7)
C(74)	16.2(12)	23.0(17)	27.0(20)	39.2(29)
Girl				
I (34)	5.9( 2)	12.1( 4)	20.6( 7)	23.5( 8)
C(68)	3.0( 2)	14.7(10)	20.9(14)	23.5(16)

The figures in parentheses show the revised numbers for smoking experience.

<sup>1)</sup> I: Intervention group, C: Comparison group

<sup>2)</sup> F1, F2 and F3 are the first, second and third follow-up tests, respectively.

son group. Thus, we do not envisage that there would be any problem even if the subjects of analysis were restricted to the respondents answering all the tests.

#### *Quality of assignment*

There was no significant difference between the intervention group and the comparison group regarding knowledge, attitude and behavior for smoking and surrounding smoking behavior at the time of the pre-test. Therefore, we judged that the assignment was effectively random. Furthermore, the rates for smoking experience of the students, and his or her parents were essentially the same as that of the JKYB survey<sup>11)</sup>, which was conducted at almost the same time, and used the same methods and questions, giving a difference value under 4% for boys and girls in both groups.

#### *Effect of intervention*

While the knowledge level regarding acute influence of smoking decreased gradually by grade level for both boys and girls in the intervention group, it was significantly higher than in the comparison group. Therefore, learning effects appeared to be sustained for three years after the intervention. On attitude, intervention in girls increased the awareness of importance of not smoking at F2 and the intention of smoking at the age of 20 at F1, but no influence on self-efficacy against pressure to smoke from friends was found in either gender.

The same results were also clear from the multiple logistic regression analysis. Namely, an intervention effect was recognized in case of awareness of the importance of not smoking at F2 for girls and smoking intention at the age of 20 at F1 for girls. The effect was restricted to girls and was not so remarkable but was recognized up to the second grade. Furthermore, it has become clear that status of attitude

at pre-test such as smoking intention at the age of 20 and the self-efficacy on refusing to smoke influenced the attitude at follow-up, suggesting the necessity for early smoking prevention education.

The intervention effects on actual smoking behavior were not recognized. However, the increase in rates of smoking experience was not significant in the intervention group, while it was in the comparison group. Moreover, the difference of the rates of smoking experience between the intervention group and the comparison group had expanded for boys when the revised value was used, and the increase was smaller in the intervention group. Thus, we judged that the intervention moderately influenced the smoking behavior.

#### *Factors influencing the effects*

One reason why the effects were moderate rather than significant could be the small number of subjects. Secondly, we point out the inequality of the smoking prevention education in the junior high school between the groups. That is, the implementation rate in the intervention group was 30% or more lower than in the comparison group. Although implementation of smoking prevention education in the junior high school had little relation to smoking related results, lower implementation of smoking prevention education in the intervention group could have made the intervention effect smaller. Third, the intervention applied in the elementary schools might have been insufficient to cause remarkable change. While the National Cancer Institute-convened Expert Advisory Panel proposed more than 10 class hours, the program was only 6 class hours<sup>8)</sup>. Since there is a "dose-response relation" between class hours and effects, a program of fewer hours might result in a more moderate effect<sup>12)</sup>. In particular, the sessions to build resistance skills against peer pressure to smoke with role playing were only 1 class hour.

Since a relation between self-esteem and smoking behavior has been confirmed in Japan<sup>13)</sup>, the future programs should also have contents to foster life skills such as enhancing self-esteem, decision making, or managing stress.

## V. Conclusion

Intervention effects were recognized on knowledge up to the second grade of junior high school for boys and up to the third grade for girls. Influence was also found up to the second grade on awareness of the importance of not smoking, and up to the first grade on the intention of smoking at age of 20 for girls. On the other hand, no intervention effects were recognized regarding actual smoking behavior for

**Table 5.** Factors affecting the results of follow-up tests on logistic regression analysis

Boys						
Outcome variable		Predictor variable	$\beta$	sig	Exp ( $\beta$ )	Confidence limits
Awareness of the importance of not smoking	F1	• Awareness of importance	1.210	0.014	3.354	1.281–8.780
		• Smoking friend	1.107	0.023	3.024	1.164–7.854
	F2	• Intention of smoking	1.067	0.016	2.905	1.219–6.922
	F3	• Smoking friend	3.209	0.008	24.763	2.289–267.9
• Knowledge on smoking		1.417	0.011	4.124	1.384–12.29	
Experience of smoking	F1	• Experience of smoking	3.929	0.000	50.871	8.284–312.4
		• Smoking friend	3.832	0.011	46.167	2.450–869.9
	F2	• Experience of smoking	3.181	0.000	24.064	5.383–107.6
		• Knowledge on smoking	–1.667	0.028	0.189	0.043–0.832
F3	• Experience of smoking	2.049	0.001	7.762	2.289–26.32	
	Intention of smoking at the age of 20	F1	• Intention of smoking	1.393	0.002	4.025
F2		• Intention of smoking	1.141	0.008	3.129	1.339–7.311
F3		• Intention of smoking	1.306	0.003	3.691	1.555–8.761
Self-efficacy of refusing to smoke against pressure from friends	F1	• Self-efficacy of refusing	1.195	0.007	3.304	1.389–7.858
	F2	• Self-efficacy of refusing	1.178	0.007	3.249	1.378–7.652
	F3	• Self-efficacy of refusing	1.041	0.017	2.833	1.205–6.658
Girls						
Outcome variable		Predictor variable	$\beta$	sig	Exp ( $\beta$ )	Confidence limits
Awareness of the importance of not smoking	F1	—				
	F2	• Intention of smoking	1.096	0.044	2.993	1.031–8.693
		• Intervention	1.407	0.021	4.083	1.235–13.50
F3	• Intention of smoking	1.386	0.004	4.000	1.564–10.23	
Experience of smoking	F1	• Experience of smoking	2.257	0.033	9.555	1.200–76.30
	F2	—				
	F3	—				
Intention of smoking at the age of 20	F1	• Intention of smoking	2.401	0.000	11.032	3.200–38.07
		• Intervention	1.840	0.031	6.293	1.182–33.49
	F2	• Intention of smoking	1.626	0.004	5.083	1.673–15.45
		• Intention of smoking	1.925	0.001	6.857	2.141–21.97
Self-efficacy of refusing to smoke against pressure from friend	F1	• Self-efficacy of refusing	0.809	0.048	2.246	1.007–5.006
	F2	—				
	F3	—				

<sup>1)</sup> I: Intervention group, C: Comparison group

<sup>2)</sup> F1, F2 and F3 are the first, second and third follow-up tests, respectively.

boys or girls, although increase in the rate of smoking experience was not significant in the intervention group, while significant in the comparison group. Hence, the effect of the program was judged to be moderate.

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