School-based smoking prevention programs for adolescents in South Korea: a systematic review

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Abstract

The number of research papers evaluating programs designed to prevent adolescent smoking have increased in the last 13 years in Korea. The purpose of this study was to evaluate these programs, to review the features of the studies and to systematically assess the results on the knowledge about, and attitude to, smoking and smoking behavior. Database searched were national digital library (NDL) and the Research Information Service System, which are major literature search systems for all academic fields in South Korea, and the Research Information Center for Health, which is a database for health field. A total of 11 papers were included. Program contents are described under five categories and the mode of delivery is described. Methodological features were investigated and effect of the size of the study on variables investigated was computed. Knowledge was the main content of the program in most of the studies. Most studies delivered classroom-based instructions that were mainly didactic presentations. School-based smoking programs have not influenced adolescent smoking behavior as much as anticipated. Methodological problems were discussed. Several recommendations are made to improve effectiveness of smoking prevention programs and reduce methodological flaws in future studies.

Introduction

Cigarette smoking has generated much concern in Korea. It has been reported that the lung cancer mortality rate has increased from 5.8 per 100 000 in 1983 to 26.4 per 100 000 in 2003 [1]. In Korea, based on relative risk of current smokers adjusting for age, alcohol and drinking, the estimated costs of medical care for diseases attributed to smoking such as cancer, respiratory disease, digestive disease and cardiovascular disease were reported as W233.1 billion (~$2300 million) and the indirect costs attributed to smoking, such as productivity loss and premature death, was estimated to be W372.6 billion (~$3700 million) [2].

It has been reported that the high school students’ smoking rate had been increasing rapidly until 1997, when it was 35.3% for boys and 8.1% for girls, but the trend of smoking rates among adolescents started to decrease in 1997, and was 15.9% for boys and 7.5% for girls in 2004 [3] (Fig. 1). The prevalence of current smoking among male middle school students increased from 1.8% in 1988 to 7.4% in 2000 and decreased to 2.4% in 2004 and smoking rate among female middle school students declined from 3.9% in 1997 to 1.7% in 2004 [3].

The decline in the smoking rate among adolescents is in part due to national policies on smoking that proclaim public buildings including schools as tobacco-free places, ban selling cigarette to people <19 years of age, restrict direct tobacco advertisement and require an inscription of a warning on the outside of cigarette packages based on the National Health Promotion Act enacted by Korean government in 1995. In addition, 2001 was designated as the year of ‘adolescent smoking prevention’ and
smoking prevention demonstration programs were carried out in schools. Smoking cessation camps for adolescent during vacation, antismoking education for teachers, school-based smoking prevention education and advertising antismoking messages through Internet and mass media have been activated along with national antismoking policies [2].

Adolescent smoking prevention has received considerable attention from the health promotion field, due to the difficulty in the treatment of the addiction and the relatively high relapse rate for adult smokers who try to quit. Most adults begin smoking as teenagers, therefore, prevention strategies for adolescents are critical and smoking prevention programs could possibly be more effective than smoking cessation programs [4]. Thus, school-based programs for smoking prevention have been widely developed and evaluated over the past decade [5–15].

Meta-analysis is a ways to summarize, integrate and interpret selected sets of scholarly works in the various disciplines. Meta-analysis provides scientific methods for comparing diverse program evaluations [16]. Several studies have performed systemic reviews through meta-analysis for smoking prevention program in foreign countries [16–26]. These reviewed papers were written in English only, so smoking prevention programs that were performed in South Korea and written in Korean have not been known to other countries.

The purpose of this study was to systemically review smoking prevention programs aimed at adolescents in South Korea. For this, the specific objectives were to investigate program features of school-based smoking prevention programs according to content and delivery method, to review methodological features and to compare the results regarding information on the knowledge about, and attitude to, smoking and smoking behavior.

**Methods**

**Locating studies and selection criteria for inclusion**

All databases were searched up to the most recent update available in April 2004. Databases searched were as follows: the National Digital Library of Korea, where an integrated and comprehensive search of Korean representative libraries including the National Library of Korea, the National Assembly Library of Korea, KAIST Digital Library Science is possible; the Research Information Service System which provides access to source information and full texts of distinguished journal articles and dissertations both in Korea and abroad; the Research Information Center for Health, which is a database of journal articles and conferences related to health. Search terms were combined with
smoking, prevention, education, program, anti-smoking, adolescents, youth, students, schools, evaluation and effect.

Research lists funded from the Korea Research Foundation, the Korea Science and Engineering Foundation and the Korea Institute of Health and Social Affairs were also examined and two research reports were found. One article was searched from bibliographies from other articles.

Inclusion criteria were as follows: (i) implementation of an intervention designed to prevent smoking in middle school and/or high school; (ii) possession of a control or comparison group that did not receive an organized intervention designed to prevent smoking and (iii) inclusion of some quantitative outcome measures with respect to the knowledge about smoking, attitude to smoking or smoking behavior.

The scope of this systematic review was limited to adolescents. Studies of elementary school students were not included based on the following reasons; most prevention programs in South Korea have different foci depending on the age of the target group. For example, programs targeting elementary school students emphasize enhancing knowledge about smoking and changing attitude toward smoking [27–30], while those targeting adolescents emphasize preventing or delaying smoking as well as enhancing knowledge and changing attitude [6, 7, 9, 11–13]; prevention strategies for adolescents might be critical because most smokers begin smoking as teenager [8].

Comprehensive search procedures retrieved 22 studies. The author reviewed 22 full texts and eliminated more studies based on inclusion criteria. Four were excluded due to absence of control groups and two studies were excluded because they were designed to compare teaching methods. One was ruled out because it was not an evaluation study. And two theses and two research reports were found to be same as articles in journals. Finally, 11 studies were included in this evaluation.

Description of program features and methodological features

Program features are described for each study in terms of the duration of intervention, the number of intervention sessions, program contents and the delivery method. Program contents were divided into four components: knowledge, refusal skills, life skills and others.

Each study was reviewed in terms of 10 variables. These variables were chosen since they were suggested to be important in a previous systemic review or meta-analysis [17, 20, 31].

Computation of effect size

Effect size estimates are based on the equation of Hedges and Olkin [32], \( g = \frac{M_e - M_c}{S_p} \), where \( M_e \) is the mean of the experimental group, \( M_c \) is the mean of the control group and \( S_p \) is the pooled standard deviation (SD). Whenever direct computations based on means and SDs could not be calculated, the effect sizes were estimated from \( t \)-, \( F \)- or chi-value, based on Lipsey and Wilson’s equations for those values [33]. The estimates of effect sizes tend to be overestimated for small samples. Unbiased effect size estimates were obtained by multiplying a correction factor \( c \), for \( c = 1 - \frac{3}{4N - 9} \), where \( N \) is the total sample size [33].

In this paper, the overall effect size could not be calculated because the studies included were found to be heterogeneous (determined by the homogeneity test). The effect size of each study was presented in the results instead of overall effect size.

Results

A total of 11 research papers evaluating programs designed to prevent adolescent smoking have been included in this analysis [5–15] (Table I). Smoking prevention programs in Korea have ranged from those that teach factual knowledge about smoking to those that teach personal skills that help one resist smoking.

Program features

The duration of intervention was 4 days to 1 year, the median was 5 weeks and the mode was 4 weeks, only two programs lasted >10 weeks [11, 15]. Most
interventions contained four to six sessions and no intervention included ‘booster’ sessions (Table I).

All of the smoking prevention programs had knowledge aspects, mainly consisting of understanding the components of tobacco smoke, health consequences of smoking on the human body, levels of tobacco use among adolescents, the social influence on tobacco usage, passive smoking and nicotine addiction.

Nine programs delivered refusal skills with or without public commitment [6–9, 11, 13–15]. Six programs delivered communication skills [8, 12, 13, 15] and/or assertiveness skills [11, 14, 15] and three programs contained stress management [10, 13] and/or identifying alternatives [6, 13].

Three programs had affective contents aimed at enhancing self-esteem [8, 10, 12] and one program provided a smoking cessation strategy [15], one program gave critical thinking with regard to tobacco advertising [6], and one program gave an orientation of the program to the participants [11].

The main delivery methods were lectures, discussions and by video. Experiments were given in four studies [12–15]. For other delivery methods, one study applied brain storming and role play [6], one group chose questions and answers as a main delivery method [8] and another offered poster and material display [13]. Two studies introduced information communication technology, newspaper in education and games [14, 15].

### Methodological features

Seven of the smoking prevention programs took place in middle schools and four programs were in high schools. Seventh grade was the most common grade level targeted. Six of the studies selected participants from only one school and the rest of the studies were from two to three schools. The sample size was <300 in five studies, 301–500 in two studies and was >501 in three studies (Table II).

Random assignment was used in only two studies [9, 13]. Five studies had equivalent groups at ‘baseline’, with regard to outcome variables [5–7, 9, 10] and adjustments for the differences at baseline were made in three studies [2, 13, 14]. The attrition rate in the treatment and control groups, post-test, ranged from 0 to 19.4%. Five studies were <2% attrition [5–7, 10, 15], three were >10% [11, 13] and two were in the 5–10% range [8, 9].

All studies collected data through self-report questionnaires without any other measurements. Eight studies used instruments showing Cronbach α > 0.70. Outcome variables were measured after intervals of varying length from soon after intervention to 4 months after intervention.

### Table I. Features of smoking prevention programs

<table>
<thead>
<tr>
<th>Reference</th>
<th>Duration</th>
<th>Total sessions</th>
<th>No. of session by contents</th>
<th>Delivery method</th>
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<tbody>
<tr>
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<td>Kn</td>
<td>Refu</td>
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<tr>
<td>[6]</td>
<td>2 weeks</td>
<td>6a</td>
<td>1.5</td>
<td>4</td>
</tr>
<tr>
<td>[7]</td>
<td>4 days</td>
<td>4b</td>
<td>3</td>
<td>1</td>
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<tr>
<td>[8]</td>
<td>5 weeks</td>
<td>5b</td>
<td>2</td>
<td>1.5</td>
</tr>
<tr>
<td>[9]</td>
<td>2 weeks</td>
<td>2b</td>
<td>1.8</td>
<td>0.2</td>
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<tr>
<td>[10]</td>
<td>4 weeks</td>
<td>4b</td>
<td>U</td>
<td>U</td>
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<tr>
<td>[11]</td>
<td>1 year</td>
<td>4b</td>
<td>1</td>
<td>2</td>
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<tr>
<td>[12]</td>
<td>3 weeks</td>
<td>6b</td>
<td>4</td>
<td>0.5</td>
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<tr>
<td>[13]</td>
<td>5 weeks</td>
<td>5a</td>
<td>2</td>
<td>0</td>
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<tr>
<td>[14]</td>
<td>8 weeks</td>
<td>8a</td>
<td>6.5</td>
<td>1</td>
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<tr>
<td>[15]</td>
<td>10 weeks</td>
<td>10b</td>
<td>6</td>
<td>0.5</td>
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*Fifty min per session. †Forty-five min per session.
<table>
<thead>
<tr>
<th>Reference</th>
<th>Grade</th>
<th>No. of schools</th>
<th>No. of subjects</th>
<th>Random assignment</th>
<th>Research design</th>
<th>Pre-equivalence</th>
<th>Attrition</th>
<th>Reliability</th>
<th>Measures</th>
<th>Time to post-test</th>
<th>Effect size of outcomes</th>
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<td>[5]</td>
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<td>491</td>
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<td>Quasi-exp</td>
<td>Eq</td>
<td>Exp. 2.0%;</td>
<td>−</td>
<td>Q</td>
<td>16 weeks</td>
<td>−0.0698</td>
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<tr>
<td>[6]</td>
<td>10</td>
<td>1</td>
<td>209</td>
<td>No</td>
<td>Quasi-exp</td>
<td>Eq</td>
<td>0%</td>
<td>+</td>
<td>Q</td>
<td>0 weeks; 4 weeks</td>
<td>−0.1839</td>
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<tr>
<td>[7]</td>
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<td>1</td>
<td>150</td>
<td>No</td>
<td>Quasi-exp</td>
<td>Eq</td>
<td>Exp 1.3%</td>
<td>+</td>
<td>Q</td>
<td>5 weeks</td>
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<td>[8]</td>
<td>7</td>
<td>2</td>
<td>625</td>
<td>No</td>
<td>Quasi-exp</td>
<td>D/ad</td>
<td>Exp 9%;</td>
<td>−</td>
<td>Q</td>
<td>0 weeks</td>
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<td>[9]</td>
<td>9</td>
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<td>Yes</td>
<td>Exp</td>
<td>Eq</td>
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<td>Q</td>
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<td>2</td>
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<td>Quasi-exp</td>
<td>Eq</td>
<td>Exp. 1.3%;</td>
<td>+</td>
<td>Q</td>
<td>4 weeks</td>
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<td>Con 0%</td>
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<tr>
<td>[11]</td>
<td>7</td>
<td>2</td>
<td>705</td>
<td>No</td>
<td>Quasi-exp</td>
<td>Unknown</td>
<td>Exp 11.1%;</td>
<td>+(K); −(A)</td>
<td>Q</td>
<td>Unknown</td>
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<tr>
<td>[12]</td>
<td>7–9</td>
<td>3</td>
<td>846</td>
<td>No</td>
<td>Quasi-exp</td>
<td>D/No ad</td>
<td>Unknown</td>
<td>+</td>
<td>Q</td>
<td>1 week</td>
<td>1.1600</td>
</tr>
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<td>[13]</td>
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<td>1</td>
<td>280</td>
<td>Yes</td>
<td>Exp</td>
<td>D/ad</td>
<td>19.4%</td>
<td>−</td>
<td>Q</td>
<td>1 week; 2 months</td>
<td>0.3666;</td>
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<td>Con 0%</td>
<td></td>
<td></td>
<td></td>
<td>−0.0700</td>
</tr>
<tr>
<td>[14]</td>
<td>10</td>
<td>2</td>
<td>417</td>
<td>No</td>
<td>Quasi-exp</td>
<td>D/ad</td>
<td>Exp 6.7%;</td>
<td>+</td>
<td>Q</td>
<td>4 weeks</td>
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<td>[15]</td>
<td>8</td>
<td>1</td>
<td>144</td>
<td>Unknown</td>
<td>Exp</td>
<td>Unknown</td>
<td>0%</td>
<td>+</td>
<td>Q</td>
<td>1 week; 8 weeks</td>
<td>1.7756</td>
</tr>
</tbody>
</table>

Eq: equivalent, D: different, Ad: adjusted, Rel: reliability, −: Cronbach alpha < 0.70, +: Cronbach alpha > 0.70, K: knowledge, A: attitude, Q: questionnaire, Exp: experimental group, Con: control group.
Review on the effect of smoking prevention programs

All studies measured knowledge about smoking as an outcome variable, 10 studies evaluated attitude to smoking, while only five studies measured the smoking rate. Magnitude of effect size was interpreted by using Cohen’s definition [34]. Cohen described small, medium and large effect sizes as 0.2, 0.5 and 0.8, respectively. Eight studies reported significant effects of knowledge about smoking, six studies showed medium effects and three studies reported a large effect. Four studies had a negative or small effect of attitude to smoking, three studies showed a medium and two had a large effect size. With respect to the smoking rate, no study reported a statistically significant effect on smoking behavior and the effect size was negative or close to zero (Table II).

Discussion

The duration of intervention of the smoking prevention programs varied from 4 days to 1 year, the median duration being 4 weeks. Most smoking prevention programs contained four to six sessions. The duration of smoking prevention programs and the number of sessions were relatively short. Previously a meta-analysis reported that smoking prevention programs should contain at least 10 sessions and over a period of 8–12 weeks [24]. The Center for Diseases [15] Control stated that failure of school-based smoking prevention programs is a direct result of the brevity of the programs [35]. One of reasons to shorten program sessions might be related to the burden of high school and university entrance examination. Researchers reported difficulty to ensure enough sessions for smoking prevention program during the regular curriculum [8]. In Korea, health education is not in the regular curriculum, so that smoking prevention programs cannot be continued and maintained for long period.

All the smoking prevention programs delivered knowledge on the harmful effects of smoking and this was a main part of the program in most of the studies. According to a previous meta-analysis of adolescent smoking prevention [20, 22], knowledge-based programs reported that effect size for behavior and attitude was smaller than for other programs, such as ‘social influential’ or ‘social norms’ programs. School-based tobacco prevention education programs, that focus on skills training approaches, have proven effective in reducing the onset of smoking [35].

All smoking prevention programs included in this meta-analysis were school-based, and mostly classroom-based, interventions. The delivery methods were mainly in the form of didactic presentations, videos and group discussions. These delivery methods can be termed ‘non-interactive methods’ since they entailed limited interactions with the participants [22]. The reason that non-interactive methods were more frequent might be related to class size with >35 students per class [36] and the non-interactive teaching styles in Korea [37]. Non-interactive programs [5, 8, 9] showed a smaller effect size than ‘interactive’ programs [6, 10, 12–15] same as previous study [22]. The delivery method that was most effective emphasized sharing, cooperativeness and contributing and the effective programs were highly interactive and participatory [23]. Programs that a peer played an important part were found to show a definite superiority, with respect to the magnitude of the effect size obtained, based on all outcome measures [18]. Interactive peer interventions for middle school students were statistically superior to non-interactive didactic lecture programs led by teachers or researchers [23]. Introduction of peer interventions could be considered as a way to improve the effect of smoking prevention programs in Korea.

In six studies, the participants were selected from only one school which could compromise the internal validity of the data. This is because participants were all selected from one school, thus there may be a ‘diffusion effect’ between treatment and control groups. In this situation, it is difficult to make an inference that the intervention is truly influencing the outcome variables [38], it is also possible for the effect of the intervention to be underestimated.
Common methodological problems prevalent in the smoking prevention literature in Korea are a lack of random assignment. Randomization in true experimental studies refers to assigning participants to experimental conditions so that each person has an equal chance of being selected for the treatment or control group [39, 40]. The purposes of randomization are to control extraneous variables of participant characteristics and to detect true difference between groups [41]. However, only two studies employed random assignment.

All studies in this analysis assessed outcome only by use of a self-reporting questionnaire. Self-reporting questionnaires alone pose potential validity problems, a combination of a bogus pipeline (bogus objective measure) or biochemical measurement in addition to self-reporting of smoking behavior, were used to increase validity in 74% of previous psychosocial smoking prevention programs [24]. Using only self-report questionnaires for measuring the outcome of programs in Korea should be regarded as a methodological flaw and there should be efforts to enhance validity in the future by dealing with this issue.

Attrition or dropout of participants could seriously contribute to validity of the research. Although most of the studies reported an attrition rate, none analyzed the participants who dropped out. Again attrition can threaten internal validity. In a previous study, it was reported that participants who were missing from post-test assessments were more likely to be cigarette smokers [24]. A decrease in attrition rates would allow improvement of validation of smoking prevention programs.

Eight of 11 studies measured outcomes within 2 months after intervention. The time to the post-test is known as one of the factors contributing to effect size. Long-term results on smoking behavior diminish over time [20, 21, 24]. In this analysis, the studies on smoking prevention programs did not show meaningful effectiveness even for short-term results. It is clear that there is a need to find a more effective smoking prevention program in Korea.

All the smoking prevention studies measured ‘smoking knowledge’ (100%) as a major program outcome rather than ‘attitude’ (91%) or ‘behavior’ (45%). Although knowledge and attitude outcomes are mediating variables that lead to the final behavior outcome, theoretically, behavioral outcomes need to be assessed for the effects of the program because behavioral change is the ultimate goal of smoking prevention programs.

According to this analysis, school-based smoking programs in Korea have not influenced adolescent smoking behavior as much as expected. Over the past decade, the public health community has developed a new approach to preventing adolescents smoking: increase in tobacco price, regulation to prevent cigarette sales to adolescents, prohibition of smoking and cigarette advertisements in public buildings. While raising price on cigarette is considered to be one of the most effective components of a comprehensive tobacco policy in Western countries [42], the effectiveness of such a policy in Korea is still unknown. Nonetheless, empirical evidence suggests that without intensive public education, tobacco control policies often lose their effectiveness [43]. Therefore, smoking prevention programs targeting adolescents should continue. Several methodological issues identified by this analysis should help researchers to design more rigorous smoking prevention programs for adolescents.

Several recommendations can be made for program improvement based on these results and previous literature. Reduction in the onset of cigarette smoking among adolescents will be accomplished by social environmental, personal and behavioral approach [44] and program developers need to understand the factors that influence adolescent smoking.

In South Korea, male students in middle and high school reported curiosity, peer pressure and self-image in order as the motives to smoke. Girl students in middle schools represented self-image, curiosity and peer pressure, and female students in high schools chose peer pressure, curiosity and self-image [3]. Smoking prevalence among adults was 61.8% for male and 5.4% for female in 2001, showing a higher smoking rate in male adults compared with the Organisation for economic co-operation and development (OECD) countries [45]. Smoking prevention programs along with smoking cessation for
parents and teachers will result in improvement of outcomes since parents and teachers are important as role models. The emphasis on behavioral skills to resist influences to smoke will strengthen smoking prevention programs, and the effort to change the functional meaning of smoking should be combined with other strategies especially for middle school female students. Age-specific and gender-specific smoking prevention programs will enhance the effect.

The focus should be changed from a knowledge to a skill training approach and interactive delivery method need to be implemented to have better effects on smoking prevention [18, 22, 23, 46].

To increase the number of sessions and to extend durations, enough time for smoking prevention program should be guaranteed in advance. Regulation of sequential health education curriculum in the regular school curriculum could be one way to solve this difficulty. Parent training and parent involvement can be an effective strategy, which is also consistent with the traditional Korean philosophy of familism [47]. Also other program components might be helpful such as an antitobacco school policy, a tobacco-free environment, teacher training and community involvement.

In conclusion, most of smoking prevention programs in South Korea made a positive change in smoking knowledge, and some programs with more delivery methods and more various contents showed larger effects on attitude toward smoking. Common methodological problems were the selection of participants from only one school, the lack of random assignment, the validity of measuring outcomes, the omission of smoking behavior in the outcome study and the lack of study of long-term effects. Researchers need to consider these methodological aspects in the future. Only 11 evaluations were analyzed; however, this study provides some important information that should help to improve smoking prevention programs and evaluation methodology in Korea.

Conflict of interest statement

None declared.

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A systematic review: smoking prevention programs


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