

Prevention of smoking in adolescents with lower education: a school based intervention study

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J Epidemiol Community Health 2003;**57**:675–680

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Accepted for publication
26 January 2003

Objective: To assess the effect of an antismoking intervention focusing on adolescents in lower education. Students with lower education smoke more often and perceive more positive norms, and social pressure to smoke, than higher educated students. An intervention based on peer group pressure and social influence may therefore be useful to prevent smoking among these students.

Design: Group randomised controlled trial.

Setting: 26 Dutch schools that provided junior secondary education.

Subjects: 1444 students in the intervention and 1118 students in the control group, all in the first grade, average age 13 years.

Intervention: Three lessons on knowledge, attitudes, and social influence, followed by a class agreement not to start or to stop smoking for five months and a class based competition.

Main outcome measures: Comparison of smoking status before and immediately after and one year after the intervention, using multilevel analysis.

Results: In the intervention group, 9.6% of non-smokers started to smoke, in the control group 14.2%. This leads to an odds ratio of 0.61 (95% CI= 0.41 to 0.90) to uptake smoking in the intervention group compared with the control group. One year after the intervention, the effect was no longer significant.

Conclusions: In the short-term, an intervention based on peer pressure decreases the proportion of adolescents with lower education who start smoking. Influencing social norms and peer pressure would therefore be a promising strategy in terms of preventing smoking among adolescents. The results also suggest that additional interventions in later years are needed to maintain the effect.

Smoking is one of the most important public health problems. In 1990, it was estimated that in developed countries as a whole tobacco was responsible for 24% of all male deaths and 7% of all female deaths.¹ Since the 1970s, smoking has decreased among adults in the developed countries, but 30% of the Dutch population still smoke.² Particularly in north west Europe, smoking is more prevalent among adults with a lower education. This also applies to the Netherlands.³ In view of this higher prevalence of smoking among adults with a lower education, it is not surprising that the percentage of smokers among adolescents with a lower education (43%) is higher than among adolescents with a higher education (25%).⁴

Most smokers start to smoke in their early teens. It is estimated that 50% of adolescents who start to smoke go on smoking for at least 16 to 20 years.⁵ A study among twins showed that starting smoking is mostly influenced by environmental factors.⁶ The influence of peers seems to be an important environmental factor in starting to smoke, especially among adolescents with lower education. These adolescents perceive smoking as a way of meeting people. They see more positive norms and perceive more social pressure to smoke than other adolescents.^{7,8} Despite this socioeconomic gradient, existing interventions are mainly directed at all adolescents, with no discrimination for education. Furthermore, the prevalence of smoking at school is an important determinant of smoking.⁹ Reviews to date show there are several strong evidence based characteristics for effective drug prevention programmes. The characteristics are: interactive delivery methods; methods based on the "social influence model"; methods focused on norms, commitment not to use, and intention not to use; methods adding community

interventions to school based interventions; methods using peer leaders; and methods adding life skills training to social influence programmes.¹⁰⁻¹² We, therefore, developed a school based intervention, which targeted at social influence. The peer pressure component was directed both at resisting the pressure to smoke and at promoting peer pressure not to start smoking. The aim of this study is to discover if this intervention reduces the percentage of adolescents in lower education who start to smoke.

METHODS

This study consisted of a group randomised controlled trial on the effects of a peer pressure based intervention. The local medical ethical committee approved the design of the study.

Participants

Twenty six schools throughout the Netherlands that provided lower secondary education participated in the study. Only the first grades participated (average age was 13 years). The recruitment of schools and students took place step by step. Firstly, all community health services in the Netherlands (n=54), except three services that participated in another study, were asked to participate in the study and to provide the names of the schools that were probably prepared to participate. Fourteen community health services provided the names of 48 schools, in total. Secondly, the researchers approached these schools directly. All schools received a brief explanation about the intervention to motivate them to participate in the study. This was just a general explanation of the intervention and of the time investment needed. Eighteen

schools were willing to participate. Four other community health services approached the school themselves. They recruited eight schools.

Sample size

A power calculation indicated that 1400 students were needed in both the intervention and the control group to find a difference of 5% in smoking increase: a power of 80%, α of 0.05, and an intraclass correlation of smoking behaviour by class of 0.075. We assumed that group pressure on the class level would influence individual outcomes.

Randomisation

We ranked the schools by size and stratified them in use or not use of a frequently used national drug education programme¹³: both the intervention and the control schools continued to use this drug prevention programme during the time of the intervention. The schools were randomly assigned to either the intervention or the control group. This was done by asking an independent person to toss a coin.

Intervention

The National Institute against Smoking (Stivoro) and the National Institute on Mental Health and Addiction (Trimbos Institute) developed and conducted the intervention. The intervention consisted of three lessons on knowledge, attitudes and social influence, followed by a class agreement not to start smoking or to stop smoking for the next five months. The reason that the period of five months was chosen, was because the intervention had to fit in one school year and we wanted to measure smoking behaviour directly before and after the intervention. Two extra video lessons on smoking and social influence were available as an optional extra during these five months. Admission to the final competition was restricted to classes that filled out three registration forms on smoking status at the beginning of, halfway through, and at the end of, the agreement period. The registration forms were sent to Stivoro. Admission was also dependent on the class having fewer than 10% smokers after five months. The criterion to establish <10% of class smokers as a cut off point was that the goal should be feasible. Ten per cent is 5% less than the mean percentage of smokers among Dutch students in the first grade of secondary education.⁴ The final activity of the class was to make a photo expressing the idea of a non-smoking class. There were competition prizes (ranging from €220 to €450) for six classes with less than 10% smokers and a photo best expressing a non-smoking class.

Stivoro and the researchers trained the intervention schools in the use of the intervention and in the procedure of the study activities. After the initial training Stivoro and the Trimbos Institute supported the schools in all activities concerning the intervention. Stivoro and the Trimbos Institute looked at the adherence to the protocol of the intervention. They collected the registration forms and the pictures. The researchers supported the intervention schools regarding all parts of the evaluation.

Control

During the study, the control group used the drug prevention programme they normally gave to their students: seven schools gave the national drug education programme. The schools in the control condition were given the option of using the intervention one year later. They were not informed of the final contents of the intervention at the start of the study. The researchers trained the control schools and supported them regarding all parts of the evaluation.

Outcomes

Data were obtained by a questionnaire administered immediately before (October 1998) and after the intervention in June

1999, and in June 2000. The data related to smoking status—that is, smoking behaviour and attitudes towards smoking, perceived social influences, self efficacy, and intention to remain a non-smoker.¹⁴ In the analyses, “smoking” was defined as all students who experiment with smoking or who smoke weekly or daily. Furthermore, data were obtained about background characteristics: ethnicity of the adolescents and of their mothers and fathers, work and educational of mother and father, religion, age, and gender of the adolescent. All questionnaires were anonymous: only the school, date of birth, and the first two letters of the student’s name were asked in order to be able to link the three questionnaires to single students.

Statistical methods

In the analyses, we used multilevel techniques to account for the clustering effect among students in classes and schools.¹⁵ We compared the intervention and control groups in terms of the change in the proportion of smokers before and immediately after the intervention and in terms of the proportion of students who took up smoking. The analyses were adjusted for the background characteristics on which the intervention and control group significantly differed. Next, we examined changes in attitudes, social influence, personal efficacy, and intention. Finally, to assess the potential effect of selective drop out, we conducted an “intention to treat” analysis on the basis of three assumptions regarding drop outs:

- All drop outs stopped smoking (or stayed non-smokers).
- All drop outs started smoking (or continued to smoke).
- No drop outs changed their smoking behaviour.

RESULTS

Participant flow

Altogether 2562 adolescents completed the baseline questionnaire: 1444 in the intervention group and 1118 in the control group. The study included 154 first classes. In the subsequent measurements, a number of students did not fill in their date of birth and the first two letters of their name. This made it impossible to link the baseline measurement to the follow up measurements. Furthermore, in the last measurement, three schools dropped out of the study because of difficulties in finding the students again, lack of motivation, and illness of the coordinator (fig 1).

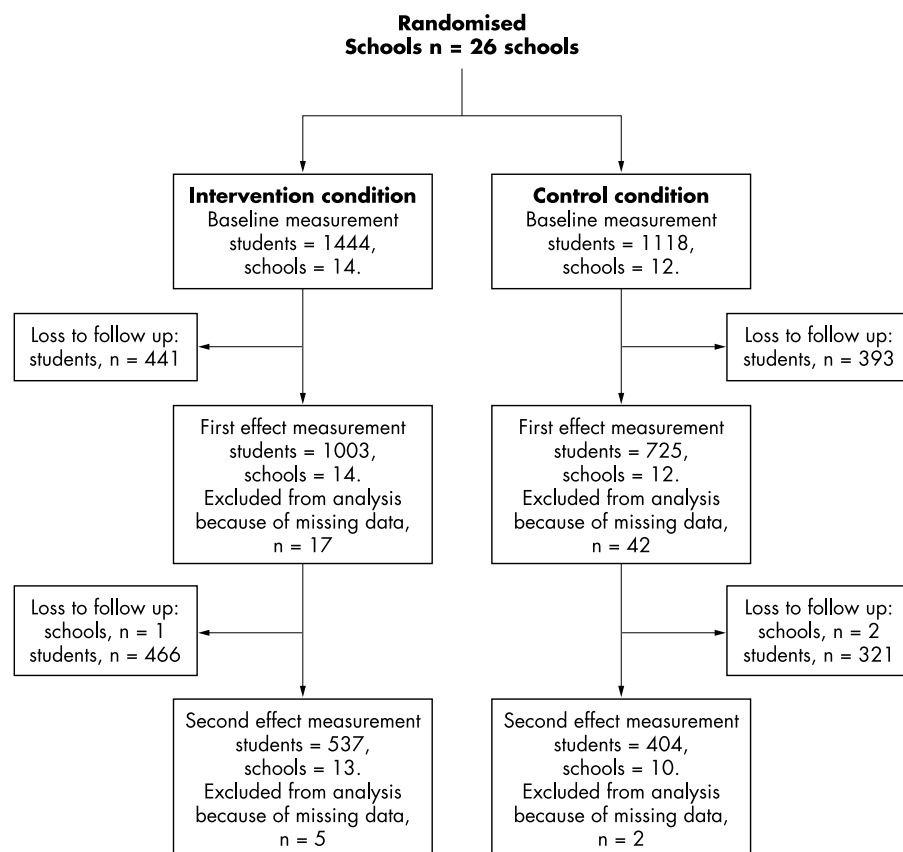
Baseline

Table 1 presents the baseline data for the intervention and control groups and the data for the non-response and response groups in the first follow up measurement. At baseline, there were significant differences between the intervention and control groups. In particular, the percentage of boys in the control group was higher than in the intervention group. The non-response group at the first follow up measurement differed statistically significantly from the response group regarding smoking. Non-response was higher among the smokers, especially in the control group.

Short-term effect on the percentage of smokers

The percentage of students who smoked at least one cigarette a week increased less in the intervention group than in the control group. In the intervention group also, more adolescents stopped smoking after having experimented (table 2).

After the intervention, the proportion of smokers had increased significantly less in the intervention group than in the control group (2.6% and 7.9%, respectively). The odds ratio (OR) for being a smoker in the first follow up measurement was 0.62 (95% confidence intervals (CI)= 0.43 to 0.90) for students in the intervention group compared with the

**Figure 1** Participant flow and follow up.

students in the control group (table 3). After adjustment for demographic variables, the OR hardly changes. However, this adjustment does explain some of the clustering at school level (indicated by a smaller random effect at this level) (table 3).

Short-term effect on the percentage of students taking up smoking

We examined separately the effect of the intervention among students who did not smoke at baseline. Among these non-smokers, the proportion of smokers increased less in the

Table 1 Characteristics of the intervention and control groups at baseline, and in the response and non-response groups at the first post-test

	Baseline		p*	Response group*		Non-response group		†‡
	Intervention n=1444	Control n=1118		Intervention n=1003	Control n=725	Intervention n=441	Control n=393	
‡ (%) boys	713 (49.5)	677 (60.9)	<0.001	471 (47.0)	423 (58.3)	242 (55.3)	254 (65.6)	NS
Full time job			NS					0.006
‡ (%) yes	1152 (79.8)	866 (77.5)		833 (83.1)	586 (80.8)	319 (72.3)	280 (71.2)	
‡ (%) no	248 (17.2)	199 (17.8)		165 (16.5)	119 (16.4)	83 (18.8)	82 (20.9)	
‡ (%) unknown	44 (3.0)	53 (4.7)		5 (0.5)	20 (2.8)	39 (8.8)	33 (8.4)	
Ethnicity			<0.001					0.000
‡ (%) non-Dutch	150 (10.4)	154 (13.8)		104 (10.4)	76 (10.5)	46 (10.4)	78 (19.8)	
‡ (%) Dutch ‡ (%)	1252 (86.7)	907 (81.1)		882 (87.9)	608 (83.9)	370 (83.9)	299 (76.2)	
‡ (%) unknown	42 (2.9)	57 (5.1)		17 (1.7)	41 (5.7)	25 (5.7)	16 (4.1)	
Religion			<0.001					0.000
‡ (%) Christian	414 (28.7)	241 (21.6)		269 (26.8)	183 (25.2)	145 (32.9)	58 (14.8)	
‡ (%) non-Christian	117 (8.1)	121 (10.8)		80 (8.1)	61 (8.4)	37 (8.4)	60 (15.3)	
‡ (%) none	856 (59.3)	682 (61.0)		631 (62.9)	432 (59.6)	225 (51.0)	250 (63.6)	
‡ (%) unknown	57 (3.9)	74 (6.6)		23 (2.3)	49 (6.8)	34 (7.7)	25 (6.4)	
Age (y)			<0.001					0.043
‡ (%) 10 to 13	641 (44.4)	397 (35.5)		463 (46.3)	326 (45.0)	178 (40.4)	71 (18.1)	
‡ (%) 13	597 (46.1)	576 (51.5)		440 (43.9)	339 (46.8)	225 (51.0)	237 (60.3)	
‡ (%) 14	125 (9.6)	145 (13.0)		90 (10.0)	60 (8.3)	38 (8.6)	85 (21.6)	
Smoking at baseline			NS					0.007
‡ (%) yes	254 (17.6)	223 (19.9)		172 (17.1)	115 (15.9)	82 (18.6)	108 (27.5)	
‡ (%) no	1157 (80.1)	852 (76.2)		821 (81.9)	586 (80.8)	336 (76.2)	266 (67.7)	
‡ (%) unknown (excluded analyses)	33 (2.3)	43 (3.8)		10 (1.0)	24 (3.3)	23 (5.2)	19 (4.8)	

* χ^2 Statistics; NS= $p > 0.05$. †‡ Value for differences between the intervention and the control group regarding the distribution of the characteristics in the response group and the non-response group (χ^2 test). ‡Differences in baseline characteristics between the intervention and the control group (χ^2 test).

Table 2 Percentages of smokers, former smokers, and students with no smoking history at baseline and at the first follow up measurement (only students with data regarding baseline and first follow up measurement)*

	Intervention n=986		Control n=683	
	Baseline	Follow up measurement 1†	Baseline	Follow up measurement 1†
Smokes at least once a week	9.3	12.4	9.7	15.4
Smokes less than once a week	1.8	1.0	1.0	2.2
Experiments with smoking	6.1	6.4	5.6	6.6
Has smoked but quit	2.8	2.0	3.4	3.4
Has experiment with smoking, but does not smoke anymore	27.4	34.6	32.5	34.4
Has never smoked	52.5	43.6	47.9	38.1

*The smokers consist of the categories: smokes at least once a week, less than once a week, and experiments with smoking. The non-smokers consist of the categories: has quit, has experimented but does not anymore, and has never smoked. †As the person to person relation between baseline and follow up measurement is not presented in this table, it is not possible to calculate the students that took up smoking or stop smoking at the first follow up measurement.

Table 3 Odds ratio of smoking* in the intervention group compared with the control group at the first follow up measurement, adjusted for smoking at baseline; obtained by multilevel logistic regression (n=1669)

	Unadjusted OR	95% CI	Adjusted OR†	95% CI
Smoking				
Control group	1.00		1.00	
Intervention group	0.60	0.40 to 0.91	0.62	0.43 to 0.90
Random variance‡	Variance	95% CI	Variance	95% CI
School level	0.109	-0.06 to 0.28	0.028	-0.09 to 0.14
Class level	0.131	-0.08 to 0.34	0.140	-0.07 to 0.35
Individual level	0.959	0.89 to 1.03	0.975	0.91 to 1.04

*Smoking is defined as all students who experiment with smoking or who smoke daily or weekly. †Adjusted for the following factors: ethnicity, age, religion, and gender (all three at the class and individual levels). At school level, the size of the school was included. OR, odds ratio; CI, confidence intervals. ‡In multilevel logistic regression, random variance on the school and class levels represents the relation of the explained variance between the two levels. These variances cannot be compared with the random variance at the individual level due to the error estimate included in the latter variance.

intervention group (9.6%) than in the control group (14.2%); adjusted OR=0.61 (95% CI= 0.41 to 0.90) (table 4). Here again, demographic differences between the groups of students explained some of the clustering at the school level, but not at the class level (table 4).

Additional effect of the video

We compared the adolescents in the intervention group who had seen the video with the ones who had not. Thirty one per cent of the students said that they had seen the video. There was no difference in the percentage smokers between the

intervention group with and without the video. In both groups the percentage smokers increased with 3%, while in the control group it increased with 8%.

Short-term effect on the determinants of smoking

We found a significant difference between the intervention and the control group regarding the change in social pressure of classmates ($\beta=0.42$; 95% CI=0.05 to 0.79). The perceived social pressure from classmates to smoke decreased in the intervention group while it increased in the control group, meaning that in the control group the classmates were

Table 4 Odds ratio of students taking up smoking* in the intervention group compared with the control group at the first follow up measurement, adjusted for smoking at baseline; obtained by multilevel logistic regression (n=1388)†

	Unadjusted OR	95% CI	Adjusted OR‡	95% CI
Started to smoke				
Control group	1.00		1.00	
Intervention group	0.60	0.39 to 0.90	0.61	0.41 to 0.90
Random variance§	Variance	95% CI	Variance	95% CI
School level	0.063	-0.10 to 0.23	0.016	-0.11 to 0.15
Class level	0.205	-0.06 to 0.47	0.204	-0.05 to 0.46
Individual level	0.944	0.87 to 1.01	0.955	0.88 to 1.03

*Smoking is defined as all students who experiment with smoking or who smoke daily or weekly. †The "n" is lower than in the total study population as it only concerned the students that did not smoke at the first measurement. ‡Adjusted for the following factors: ethnicity, age, religion, and gender (all three at the class and individual levels). At school level, the size of the school was included. OR, odds ratio; CI, confidence intervals. In multilevel logistic regression, random variance on the school and class levels represents the relation of the explained variance between the two levels. These variances cannot be compared with the random variance at the individual level due to the error estimate included in the latter variance.

Table 5 Percentage of smokers and effects of the intervention according to the different assumptions about smoking behaviour of the drop outs

	% smokers, assuming that all drop outs smoke		% smokers, assuming that all drop outs do not smoke		% smokers, assuming that all drop outs did not change smoking behaviour	
	Intervention n=1411	Control n=1075	OR (95% CI)	Intervention n=1411	Control n=1075	OR (95% CI)
Baseline	18.0	20.7		18.0	20.7	
Follow up measurement 1	44.8	52.2	0.74 (0.62 to 0.87)	13.7	15.3	0.63 (0.48 to 0.83)
Follow up measurement 2	66.3	67.1	1.01 (0.85 to 1.20)	12.5	12.9	0.91 (0.70 to 1.18)

OR, odds ratio; CI, confidence intervals.

Key points

- Smoking is an important cause of poor health among people with lower education.
- Peer group pressure is an important reason for starting to smoke, especially in adolescents with lower education.
- We tried to use peer group pressure to prevent smoking by establishing a class level competition.
- This intervention is effective in preventing adolescents with lower education from starting to smoke.
- Booster interventions are needed to maintain this preventive effect.

perceived as becoming more positive towards smoking. This suggests that the variable social pressure of classmates has a mediating effect on smoking. To confirm this mediating effect, we also analysed the relation between the change in this variable and the change in smoking behaviour. For this aim, we divided the change in social pressure between baseline and first follow up measurement into three categories: more social pressure, equal social pressure, and less pressure from classmates to smoke at the follow up measurement. There was a significant association between the change in smoking behaviour and the change in the mediating factor. The students that perceived an increase in social pressure from classmates to smoke were more likely to be smokers at the first follow up measurement, than students perceiving equal social pressure or less social pressure: OR =2.21; 95% CI=1.53 to 3.18.

There were no changes in attitudes or in self efficacy of the students.

Long term effect on the percentage of smokers

Among the students, who completed all three questionnaires, 15% of both the intervention and the control groups smoked at baseline. Immediately, and one year after, the intervention, these figures were 17% and 25% respectively for the intervention group, and 23% and 29% respectively for the control group. After one year, the difference between the intervention and control group was no longer significant.

Intention to treat analysis

Loss to follow up was comparatively high. We examined its impact in an intention to treat analysis, using three scenarios; all drop outs started smoking, stopped smoking, or did not change their smoking behaviour (table 5). The results mostly indicate that the effects were stable, meaning a short-term effect but not a long term effect. This was not the case when it was assumed that all of the drop outs stopped smoking. Here, the short-term differences lost statistical significance.

DISCUSSION

This study examined the effect of an intervention based on peer group pressure to prevent smoking uptake among students with lower education. Results show a favourable effect in the short-term. Attitudes and self efficacy did not change, but the perceived subjective norm of classmates did. Classmates disapproved of smoking more often. This strongly suggests that the intervention worked by increasing peer pressure not to smoke. However, at one year follow up, the effect became smaller and was no longer significant.

Until now, there was no evidence on the effect of direct group pressure as a factor in preventing smoking among adolescents with lower education. Previous Dutch and Finnish studies among adolescents with higher education showed similar positive effects.^{13 16} However, these studies focused on dealing with social influence rather than on using peer pressure to prevent smoking.

We could not measure the “incentive effect” of the competition prize. In the planning of the study we have explicitly chosen not to control for it while a previous study showed that offering a prize to only a part of the intervention group would cause many practical problems. This previous study comprised a control group, an intervention group with incentive, and an intervention group without incentive. However, the intervention group without incentive found out that the other group received a prize and they started a lawsuit to also obtain this prize.¹⁷ We therefore decided not to control for the incentive effect.

Methodological considerations

The schools were randomly assigned to the intervention and control group to reduce the chance of selection bias. Despite the randomisation procedure, there were differences between the two groups at baseline, especially regarding gender. Chance confounding because of randomisation at school level may explain these differences, and we adjusted for them in our analysis.

Loss to follow up was somewhat selective but seemed to have a limited effect on the results. Especially in the control group, non-response was higher among the smokers. It is, however, highly unlikely that in this group a higher percentage of students stopped smoking than in the intervention group. The effect of the intervention in the short-term has therefore most probably been underestimated. Because of the large number of non-responders in the second follow up, it was not possible to calculate the exact effect of the intervention at the second follow up. This means that uncertainty remains regarding the long term effect.

All measurements were self reports, meaning that information bias could have occurred, especially in the intervention group. To prevent this bias, registration for the competition was conducted independently of the evaluation. Moreover, the jury of the competition was not informed about the results of the evaluation, and all students were explicitly informed of this. Another way of avoiding information bias would be to use biological objective measures like cotinine assays. We chose not to do so because most children of this age do not smoke daily. This makes cotinine measurements very unstable. Cotinine can only be detected if smoking or passive smoking occurs in the preceding two days.^{18, 19} Another reason was that we wanted to study peer pressure and we did not want to generate interference by introducing biological measures as an additional pressure.

Implications

Our class level intervention has been shown to have a significant and substantial effect on smoking uptake in the short-term, justifying its further implementation in schools in lower education levels. The intervention should, however, be extended to the following school years. This confirms the results of a previous Dutch study,²⁰ showing that booster interventions can reinforce the effects of smoking prevention activities. Besides boosters, strong evidence based characteristics for effective school based drug prevention, like adding community interventions to school based interventions, using peer leaders, and adding life skills training to social influence programmes could be used to maintain the effect of the intervention in the long term. But, as the students get older, it is also important to focus on students already experimenting with smoking and on smoking cessation. Another possibility

could be to focus more on a comprehensive approach, meaning that health promotion interventions at school focus on cognitive and social outcomes, rather than only on the achievement of specific behavioural outcomes.²¹

Finally, school programmes that specifically aim at increasing peer group pressure not to smoke can reduce smoking uptake by adolescents in lower education. This can be done by getting students to enter into a collective agreement not to smoke and by encouraging competition between classes or schools to keep off cigarettes for some defined time period.

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Funding: none.

Conflicts of interest: none.

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