

Effectiveness of the “Smoke-Free Class Competition” in Delaying the Onset of Smoking in Adolescence¹

Gudrun Wiborg, Ph.D.² and Reiner Hanewinkel, Ph.D.

Institute for Therapy and Health Research, 24105 Kiel, Germany

Background. This paper examines the effectiveness of the “Smoke-Free Class Competition” in delaying the onset of smoking in adolescence. Each participating class must decide if they want to be a “smoke-free class” for the 6-month period from fall to spring. Classes monitor their (non-)smoking behavior and report it to the teacher regularly. Classes in which pupils refrain from smoking for this period of time participate in a prize draw, in which they can win a number of attractive prizes.

Methods. To evaluate the effectiveness of the competition, a sample of 131 participating and nonparticipating classes (number of pupils 2,142; mean age 12.9 years, SD = 0.98) was compared with regard to their smoking behavior. Smoking status was determined by self-assessment on three occasions: (a) prior to the beginning of the competition, (b) 1 month after the competition, and (c) 1 year after the start of the competition.

Results. From pretest to posttest smoking increased by 7.5% in the comparison group, while it decreased by 0.2% in the intervention group (OR = 2.19; $P < 0.001$). In the follow-up measurement, a clear increase in smoking prevalence occurs in all groups; however, the pupils in the intervention condition still have a significant lower increase of smoking (OR = 1.45; $P < 0.01$). Moreover, with regard to the nonsmokers at baseline, pupils in the comparison group showed significantly higher prevalences in smoking than the intervention group in the postmeasurement, 7.8 versus 13.9% (OR = 1.98; $P < 0.001$), as well as in the in the follow-up-measurement, 17 versus 21.3% (OR = 1.36; $P < 0.05$).

¹ This study was funded by the European Commission within the program “Europe against Cancer.”

² To whom correspondence and reprint requests should be addressed at Institute for Therapy and Health Research, IFT-Nord, Düsternbrooker Weg 2, 24105 Kiel, Germany. Fax: +49 431 570 29 29. E-mail: wiborg@ift-nord.de.

Conclusions. The results suggest that the participation in the competition could delay the onset of smoking in adolescence. © 2002 American Health Foundation and Elsevier Science (USA)

Key Words: school-based prevention programs; onset of smoking; competition; adolescence.

INTRODUCTION

It is well known that smoking is the single most preventable cause of disease morbidity and mortality worldwide [1–4]. Young adolescence is the age at which young people begin to experiment with tobacco products [5]. Epidemiological studies indicate that smoking prevalences among youth underwent a sustained and substantial decline in the 1970s and 1980s, but during the 1990s, smoking prevalence increased among adolescents in Canada and the United States [6], in Europe [7], and also in Germany [8]. The results from the “Health Behaviour in School-Aged Children Study” reveal that there is a dramatic increase in the number of young people who reported having tried smoking between the ages of 11 and 15. At the age of 11, around 20–30% from a sample of 28 investigated countries have tried at least one cigarette in their lives. At the age of 15 however, the lifetime prevalence has increased to 60–70% [7].

There is a strong positive correlation between the age of starting to experiment with cigarette smoking and the probability of becoming a regular smoker [9]. The early onset of smoking is one of the most important predictors for later smoking [10,11], and it correlates with heavier smoking [12]. The probability of becoming a regular smoker after adolescence is relatively small [13]. Despite the greater negative health effects of regular smoking compared to occasional smoking [14], daily smokers have more difficulties in quitting [15], and a number of studies have shown a positive corre-

lation between daily smoking and the experimentation with other psychoactive substances [16–18].

Several conclusions can be drawn from these studies: (a) primary prevention measures of smoking should begin before the majority of young people start to experiment with smoking, (b) a first goal of prevention interventions should be the delay or prevention of smoking initiation, and (c) a second goal should be the prevention of the transition from experimental to regular smoking.

There is a great variety of smoking prevention programs which are based on information regarding the long-term harmful consequences of smoking on health. But it is well understood now that programs which concentrate solely on information and fear arousal strategies—albeit leading to a better knowledge of the harmful effects smoking has on health—show only limited effects on attitudinal or behavioral changes in pupils [17,19,20]. Among the antismoking education programs available today, the comprehensive social influence programs appear to be the most successful in reducing the onset of smoking [21–25]. These programs are based on the assumption that inoculation to resist social pressure to smoke would help to prevent pupils from experimenting with smoking. Recently, some serious questions have been made regarding the long-term impact of the social influence model. For example the Hutchinson Smoking Prevention Project, a huge longitudinal study ($N = 8,388$) conducted from September 1984 to August 1999, which was carried out in grade 3–12, could not show any significant difference between the intervention and the control group in the prevalence of daily smoking neither at grade 12 nor at 2 years after high school [26–28].

The idea of the smoke-free class competition is different from those traditional approaches, because instead of using fear arousal strategies to hinder pupils from smoking, the desired nonsmoking behavior is reinforced: Nonsmokers are rewarded if they stay smoke-free. It is well known from learning theory that positive reinforcement enhances the probability of producing a desired behavior. In this way nonsmoking becomes a popular and worthwhile behavior, and social norms within the peer groups are influenced in a way that nonsmoking becomes more common in classes than smoking. The idea of this competition was first established in Finland, where it has been carried out annually since 1989 [29].

In the school year 1997/1998 the smoke-free class competition was carried out on a European level for the first time and seven countries participated in the program with a total 3,819 classes with approximately 100,000 pupils [30]. Since then the number of participating countries has increased each year and in the school year 2001/2002 15 European countries have im-

plemented the program in their country with a total of more than 18,000 classes with approximately 500,000 pupils. Although the competition has some flexibility regarding the national rules so that details can be developed to suit the needs and circumstances of individual countries, the general rules are the same in each country: The class decides to be a nonsmoking class for a period of 6 months. Classes monitor their (non)smoking behavior and give a regular feedback to the organizers of the competition. Classes that refrain from smoking can win a number of attractive prizes, the main prize being a trip to one of the other participating countries.

An evaluation study carried out in Finland in the school year 1992/1993 reveals that the smoke-free class competition can delay the onset of smoking in adolescence. In this study from Vartiainen and colleagues [29], the daily smoking prevalence increased from pretest to 1 month posttest by 2.3% among those pupils who participated in the competition, 3.9% in the group which dropped out of the competition, and 5.1% in the comparison group which did not participate in the competition. However, one important methodological weakness of this study was that the comparison group was recruited from classes that did not want to participate in the competition. Therefore, systematic differences between the intervention compared to the comparison group regarding smoking behavior cannot be ruled out.

The objective of this study is the evaluation of the smoke-free class competition in Germany. To our present knowledge this is the second evaluation of the smoke-free class competition. In contrast to the Vartiainen *et al.* study [29], in the present study a comparison group was recruited from classes that were not invited to participate in the program. This was an attempt to reduce the problem of a self-selection bias that occurred in the study by Vartiainen *et al.* [29]. Nevertheless, in the present study, too, it was not possible to apply a fully randomized design, due to the fact that the intervention group consisted of classes that had registered for the competition and that these classes could not be randomly assigned to either the comparison or intervention group. However, a major advantage to the Finnish study is the fact that the comparison group classes were randomly drawn.

Prior to the conduction of the present outcome evaluation, a process evaluation was carried out showing that the idea of the program and the rules for the competition met both teachers' and pupils' approval [31,32]. Moreover, the competition is easy to implement in class and is not very time-consuming, which is of great advantage, when bearing in mind the limited time teachers have at their disposal to carry out activities that go beyond their normal lessons.

TABLE 1

Demographic Variables and Smoking Status at Baseline Measurement for the Intervention and the Comparison Groups

	Intervention group				Comparison group				<i>P</i> value
	Mean	SD	<i>N</i>	(%)	Mean	SD	<i>N</i>	(%)	
Age (years)	12.94	1.03			12.89	0.87			<i>ns</i>
Sex									
Female			798	53.4			321	49.6	<i>ns</i>
Male			697	46.6			326	50.4	
Smoking status									
4-week prevalence			227	15.2			118	18.4	<0.1
Daily smoking			43	2.9			28	4.4	<0.1

Note. The *P* values refer to comparisons across intervention and comparison group. The *P* value for age was derived from a *t* test; all other *P* values were derived from χ^2 .

In the present study, we examined the effectiveness of the smoke-free class competition on all participants, regardless of their smoking status at the beginning of the program. Additionally, we examined the effect of the intervention on nonsmokers in particular. It was hypothesized that the participation in the competition would delay the onset of smoking in pupils who did not smoke at the beginning of the intervention.

METHODS

Intervention

The smoke-free class competition was carried out under the slogan "Be Smart—Don't Start" in Hamburg and Berlin, two cities in Northern Germany, from the beginning of November 1998 until the end of April 1999. Classes were invited to participate via flyers that were sent to all secondary schools at the beginning of the school year in September 1998. If at least 90% of the class decided to carry out the program, classes could register and were provided with a folder containing a class contract for the pupils to sign committing themselves to remain smoke-free for the following 6 months. On this contract classes placed a sticker for each week that they had stayed smoke-free, to monitor their progress in the program. A class was considered to be "smoke-free" if no more than 10% of the pupils had smoked during the previous week. This 10% threshold was introduced to reduce possible lying in pupils who already smoked and also possible negative peer pressure (bullying) carried out by nonsmokers on smokers. This way pupils which already smoked did not have to fear that the whole class would have to drop out of the competition because of them. For each month that the classes succeeded, they sent a postcard to the organizers of the competition confirming further participation in the program. The teachers received a brochure containing information on the theoretical background of the program as well as the rules of the competition and advice on how to deal with possibly occurring problems during the program, such as smok-

ing in pupils. During the competition two newsletters with general information about the competition were sent to all participating classes.

Participants

The survey's total sample at the baseline measurement consisted of 4,372 pupils from 131 classes in the intervention and 56 classes in the comparison group. Of the total sample that was pretested, 2,142 pupils (48.9%) from 131 classes participated in the study at pretest, posttest, and follow-up measurements and were included in the final sample. Eighty-nine of the classes (number of pupils 1,495) were in the intervention group and 42 classes (number of pupils 647) in the comparison group. There were no significant differences among the groups with regard to age, sex, and smoking status at baseline (Table 1).

Design

In the evaluation study, classes that participated in the competition were compared to classes that were not allowed to participate. In Hamburg and Berlin, the classes that had registered for the competition were invited to participate in the survey as the intervention group. For the comparison group, a random sample of classes from the city of Hanover was drawn and invited to participate in the study. Hanover was chosen because (a) the competition was not offered there and (b) it is comparable to Hamburg and Berlin in socioeconomical and cultural aspects. Prior to drawing the sample of classes in the comparison group, in the intervention group, the percentage of different grades as well as different school types were analyzed. The same proportion of classes from different grades and school types for the comparison group was drawn and invited to take part in the study. The participation in the study was voluntary for the classes and pupils. During the competition, up to 10% of the pupils in a class were allowed to smoke; if more than 10% of the pupils smoked, the class dropped out of the competition.

Therefore, during the competition, a subgroup developed from the original intervention group, consisting of the classes that dropped out of the competition and but did not end the intervention. In the following, the group of pupils from classes that successfully ended the competition, and the pupils from classes that dropped out, is referred to as "intervention group all" (IGa); the group consisting of the pupils from the classes that dropped out from the competition is referred to as "intervention group dropout" (IGd) and the group consisting of the pupils in the classes that successfully ended the competition is referred to as "intervention group successful" (IGs). The IGd consisted of 25 classes (number of pupils 419); the IGs of 64 classes (number of the pupils 1,076).

Measures

Self-reported smoking status was assessed by the following questions: (a) "Have you smoked during the last four weeks?" and (b) "Have you smoked daily during the last seven days?" with the response choices "Yes" or "No." Moreover, pupils were asked to indicate, which of the following statements would suit them best: "I have never smoked"; "I have smoked a few times;" "I am a smoker"; and "I have smoked regularly, but I quit."

Data Collection Procedure

Data collection was carried out in Germany in October/November 1998 (pretest), May 1999 (posttest), and November 1999 (follow-up).

Questionnaires for the pupils were distributed by their teachers. To increase the validity of self-reported smoking, data assessment was carried out anonymously, only assessing a code for the class and a personal code for the pupil. Moreover, the survey was separated from the competition. Pupils in the intervention group were not informed that the study was related to the competition and were informed when they asked that the study did not have any influence on their chances to win a prize. Teachers were provided with a detailed instruction leaflet informing them how to let the pupils fill in the questionnaire and to place them into an envelope in front of the pupils, to seal it, and to send it to the research team. This procedure is important in increasing the validity of self-reported smoking in pupils [33]. The whole procedure was examined and permitted under the data protection official. Moreover, prior to the pretest survey administration, pupils were asked to have their parents sign and return a letter providing written permission for participation in the study.

Statistical Analyses

Characteristics of the sample were analyzed with *t* tests and χ^2 tests. Examine the effects of the program

on smoking behavior logistic regression analyses were conducted. The analyses were adjusted for the factors age, sex, and smoking status at baseline. Posttest and follow-up smoking status (4-week prevalence and daily smoking) served as the dependent variables. Group condition (comparison group vs. intervention group all) served as an independent variable.

The analyses were carried out in two different ways: (a) as an overall analysis testing the general effect on the whole sample and (b) as subgroup analyses, to allow an examination of the differential effect of the intervention on nonsmokers at baseline. Nonsmokers at baseline were defined as those who reported having never tried smoking or having tried smoking a few times, but did not smoke during the past 4 weeks.

The data analyses were carried out by SPSS.

RESULTS

Attrition Analyses

In the comparison group, a random sample of 70 classes was invited for participation, of which 56 classes returned their questionnaires at pretest. It is known from five of the classes that they did not participate due to organizational and structural changes in their schools. In the intervention group, 10 classes did not return their questionnaires at pretest. At the second and third measurements, 14 classes in the comparison group and 42 classes in the intervention group dropped out. The retained sample size for the final analyses consisted of 2,142 pupils from 131 classes. There are different factors that caused the restriction of the final analyses sample from the full pretest measured sample ($N = 4,372$): (a) 12 classes in the 6th grade dropped out, because in these schools, pupils changed from primary to secondary school after the 6th grade (in most schools in Germany, pupils attend primary school to grade 4) and it was not possible to contact the pupils after changing to different schools. Moreover, 5 classes were excluded, because they returned their second questionnaires too late, and 3 classes had to be excluded, because obviously the wrong class filled in the questionnaires (100% of the individual coding was different); and (b) loss of subjects to 1-year follow-up (12 months after the pretest).

To examine the potential sample bias introduced by the loss or exclusion of pupils, a comparison of the retained sample and the sample that was not part of the retained sample was conducted (in the following we refer to the latter as "attrition sample," even though we know that not all the losses were due to attrition). For this purpose, a logistic regression analyses was carried out, in which the "selection variable" (retained sample vs. attrition sample) served as the dependant variable. In the first block, group condition (comparison group vs. intervention group), age, sex, and smoking status

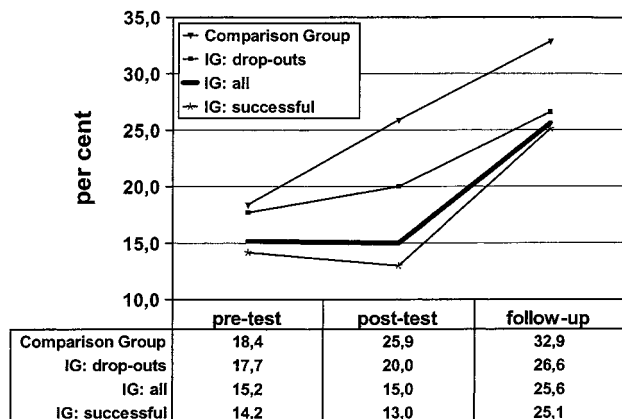


FIG. 1. Four-week smoking prevalence across time, for the intervention and the comparison group; whole sample. IG, intervention group.

(4-week prevalence) served as independent variables. In the second block, the interaction term Group condition \times Smoking status was included as covariable.

In the retention sample, 16.2% of the pupils reported to have had smoked during the previous 4 weeks, compared to 21.5% of the pupils in the attrition sample status (OR = 1.42 (1.21–1.67); $P < 0.001$). In the intervention group, 53.2% of the pupils dropped out from the study sample for some reason, compared to 45% in the comparison group (OR = 1.18 (1.10–1.26); $P < 0.001$). There were no significant differences between age (OR = 0.98 (0.92–1.03); *ns*) and sex (OR = 0.90 (0.80–1.10); *ns*) among the attrition sample compared to the retention sample. Moreover, no significant interaction could be found for smoking status and group condition (OR = 0.93 (0.78–1.10); *ns*) among the attrition and the retention sample.

Overall Analyses

Figure 1 shows the main results of this study with regard to 4-week prevalence of smoking in pupils across time. In the comparison group, smoking increased from pretest to posttest by 7.5% and in the IGd by 2.3%. In the IGs smoking even decreased by 1.2%. Taken together the IGd and the IGs prevalence of smoking decreased by 0.2%. The difference between the comparison group and the IGa is statistically significant (OR = 2.19 (1.69–2.85); $P < 0.001$). From pretest to follow-up measurement, a clear increase in smoking prevalence occurs in all groups; however, the pupils in the intervention condition still have a significant lower increase of smoking (OR = 1.45 (1.15–1.82); $P < 0.01$). A posttest to follow-up measurement showed no significant differences among the groups (OR = 1.19 (0.94–1.51); *ns*).

After the intervention, in the IGa 4.4% smoked daily, while in the comparison group daily smoking increased

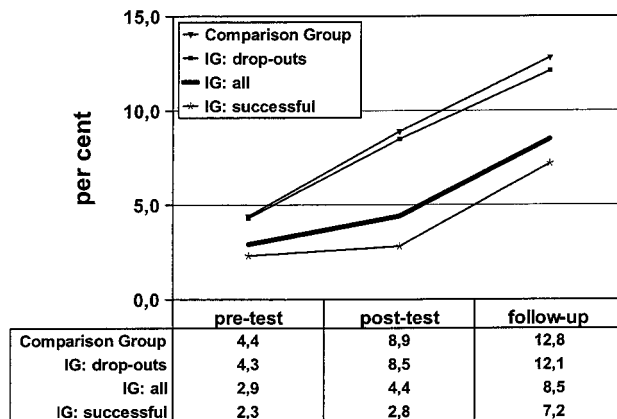


FIG. 2. Daily smoking prevalence across time, for the intervention and the comparison group; whole sample. IG, intervention group.

to 8.9%. The difference is significant at postmeasurement (OR = 2.23 (1.47–3.40); $P < 0.001$) as well as at follow-up measurement (OR = 1.52 (1.10–2.11); $P < 0.05$). However, the difference in daily smoking between the IGa and the comparison group can only be explained by the pupils in the IGs. There is barely any difference between the comparison group and the group of pupils who dropped out of the competition (IGd), neither at posttest, nor at follow-up test (Fig. 2). A posttest to follow-up measurement showed no significant differences among the groups (OR = 1.31 (0.92–1.87); *ns*).

Analyses of the Nonsmokers at Baseline

At baseline 1,721 of the pupils (80.3% of the whole sample) were assessed as being nonsmokers. The nonsmokers at baseline are named “nonsmokers” in the following.

Figures 3 and 4 give an overview of the main results

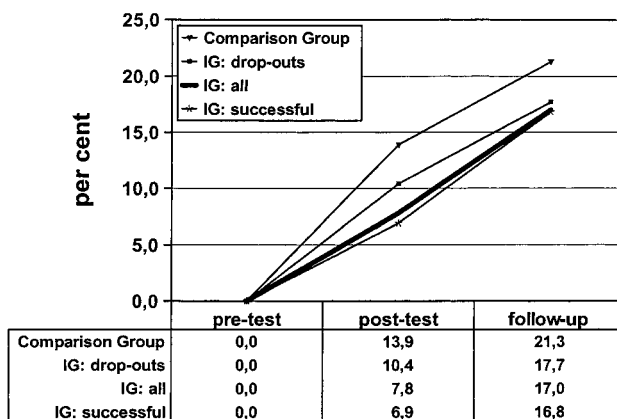


FIG. 3. Four-week smoking prevalence across time, for the intervention and the comparison group; nonsmokers at baseline. IG, intervention group.

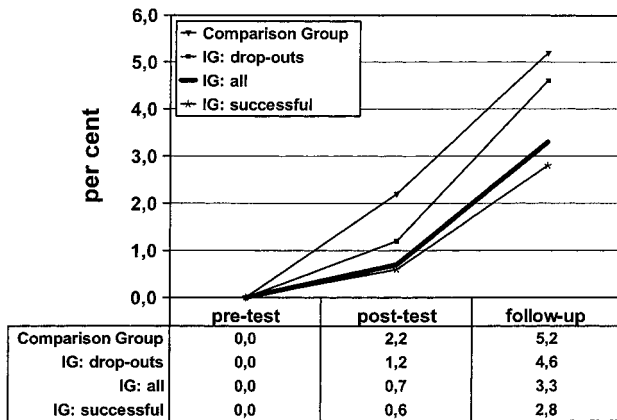


FIG. 4. Daily smoking prevalence across time, for the intervention and the comparison group; nonsmokers at baseline. IG, intervention group.

for the group of the nonsmokers. At the posttest, there were significant differences in smoking prevalence rates among the intervention and the comparison group. Of the IGa students, 7.8% reported having smoked during the past 4 weeks compared to 13.9% of the comparisons. The differences showed high statistical significance ($OR = 1.98 (1.42-2.76)$; $P < 0.001$). Smoking increased in the intervention group to 17% at the follow-up measurement and to 21.3% in the comparison group. The results showed statistical significance ($OR = 1.36 (1.04-1.76)$; $P < 0.05$). A posttest to follow-up measurement showed no significant differences among the groups ($OR = 1.23 (0.93-1.62)$; ns).

With regard to the onset of daily smoking, the increase of nonsmoking pupils that started to smoke daily was significantly lower in the intervention group ($OR = 3.58 (1.42-9.04)$; $P < 0.01$). In the comparison group 2.2% had started to smoke daily in the posttest compared to 0.7% in the intervention group. However, there was only a marginal effect in the follow-up measurement ($OR = 1.65 (0.99-2.75)$; $P < 0.1$) with 3.3% of daily smokers in the intervention group and 5.2% in the comparison group. A posttest to follow-up measurement showed a marginal difference among the groups ($OR = 1.61 (0.94-2.74)$; $P < 0.1$).

DISCUSSION

The present study examined the effectiveness of a nonsmoking competition in schools with regard to the delay of smoking initiation in pupils. Competitions have been applied in smoking cessation programs targeting adults and showed promising results [34-37]. In this study, a competition was carried out for adolescents. Target group were pupils aged 11-14 years. The rules of the competition are easy: Classes commit themselves to be nonsmoking classes for a period of 6

months. Classes monitor their smoking behavior and report it to the teachers once a week. Classes that refrain from smoking for that period of time can win a number of attractive prizes.

The results suggest that participating in the competition could delay the onset of smoking. With regard to the whole sample, smoking increased from pretest to posttest in the comparison group, while it decreased in the intervention group. In the follow-up measurement, a clear increase in smoking prevalence occurs in all groups; however, the pupils in the intervention condition still have a significant lower increase of smoking in the comparisons done to pretesting. From postmeasurement to follow-up there were no significant differences among the groups, indicating that after the intervention was finished, smoking increased to the same extent in the comparison as well as the intervention group.

Daily smoking showed a statistically higher increase in the comparison group compared to the intervention group from pretest to postmeasurement as well as from pretest to follow-up and a marginal effect from posttest to follow-up. However, it is important to note that the intervention did not have an effect on the prevention of daily smoking in pupils from classes that had to drop out from the competition. These results are comparable to the results of the Finnish study [29]; however, the Finnish sample showed a greater increase in daily smoking in the follow-up measurement. This might be explained by the longer follow-up, which was carried out 1 year after the end of the competition. Moreover, in the Finnish sample the baseline prevalence rates of daily smoking (8.0% in the intervention group and 11.3% in the control group) were nearly three times as high as in the German sample. This could be due to the higher age of the pupils in the Finnish sample, who were approximately 1 year older than the pupils in the German sample. This provides evidence that the competition should start at an early age, before pupils have initiated smoking.

With regard to the nonsmokers at baseline, the onset of smoking was significantly higher in the comparison group compared to the intervention group. Even though the effects tend to diminish after the intervention has finished and pupils in the intervention group "catch up" with smoking, they are still visible and statistically significant 1 year after the start of the intervention compared to pretest.

There are a number of limitations in the present study, which shall be discussed briefly. With regard to the internal validity of the program, it must be pointed out that, apart from the main rules, classes have great flexibility in carrying out the competition. Therefore, the implementation of the competition in the classes varies. In this study, we did not assess, in which sub-

jects the competition was carried out, whether further nonsmoking activities were initiated or how much time classes spent on the competition. Therefore, it is not entirely clear to which elements or which combination of elements the success of the competition can be put down to.

The design for this study was a quasi-experimental one. A randomized assignment of the pupils to the groups was not possible due to the fact that the intervention group consisted of the classes that decided to participate in the competition. Hence it cannot be ruled out that students self-selection occurred among the classes that registered for the competition. It is possible that in these classes the prevalence of smoking was lower to begin with, compared to the classes that did not participate in the competition. Therefore, the comparison group and the intervention group were analyzed on differences regarding their smoking behavior in the baseline measurement. In the comparison group, there was a 3.2% lower prevalence of smoking compared to the intervention group. The difference did not reach statistical significance ($P < 0.1$). Moreover, the nonindependence of students nested in classrooms caused by the assignment of classes to either comparison or intervention group also limits the internal validity of this study.

In any study measuring pre- and postintervention variables, missing participants present problems, particularly when the follow-up time extends over several years [38,39]. Johnson and colleagues [40] noted an attrition of 65% at the end of the intervention and Luepker *et al.* [41] around 50%; Ellickson and Bell [42] analyzed only 60% of their baseline sample. Nevertheless, in the present study the follow-up period was relatively short (12 months) and a high percentage of pupils dropped out or had to be excluded from the sample. Therefore, an attrition analyses was carried to find out whether the retention sample differs from the attrition sample.

The results showed that (a) in the attrition sample, more smokers dropped out compared to the retention sample and that (b) a higher percentage of pupils in the intervention group dropped out or were excluded from the study compared to the comparison group. However, the interaction between group condition (intervention vs. comparison group) and smoking status did not reach significance, which means that the number of smokers in the intervention group that dropped out from the study is not higher than the number of smokers that dropped out from the study in the comparison group.

From this findings, we draw the conclusion that in the retention group the percentage of smokers is underrepresented. With regard to sex and age the groups are comparable. However, it must be taken into ac-

count that the overall percentage of smokers is small in the attrition group, too.

In the study, most of the classes grade 6 dropped out of the study. To assure that the inclusion of the grade 6 pupils does not bias the results, the analyses were made without these pupils, showing no different effect of the intervention.

It cannot be ruled out that pupils in the intervention group did not tell the truth when smoking behavior was assessed and that the real smoking prevalences are underestimated. Moreover, self-reported smoking status was not validated by biochemical measurement. This possibility must be taken into account when bearing in mind that pupils in the intervention knew that they could win prizes in the competition and might not have believed that the study would not have any influence on their chances to win a prize. However, this should not have had an influence on their answers in the follow-up measurement, since the competition had been finished by then. Effects of the intervention are still evident at follow-up, too. Moreover, pupils in the intervention group that dropped out of the competition should not have had any motivation to lie, since they knew that they did not have the chance to win a prize anyway. In this case, the comparison group and the pupils that dropped out from the competition should show no differences in their smoking prevalence rates; at least the "dropouts" should not show smaller prevalences than the comparisons. A comparison of the comparison group and the pupils in the intervention group that dropped out of the competition showed a significant higher prevalence of smokers (4-week prevalence) in the comparison group in the postmeasurement (OR = 1.52 (1.07–2.15); $P < 0.05$), as well as in the follow-up (OR = 1.43 (1.05–1.95); $P < 0.05$). These results suggest that the pupils have told the truth; however, there are other variables that might have had an effect on self-reported smoking. Therefore, a firm conclusion can not be drawn.

Even though the present study contains a number of methodological difficulties that have to be taken into account when interpreting the results, the results suggest that the smoke-free class competition might be a suitable tool in the field of primary prevention of smoking. This is particularly encouraging, because a process evaluation, which is described elsewhere [31,32], shows that the intervention is not very time-consuming, an argument which is of great importance for secondary school teachers who only have limited time at their disposal to carry out additional activities. The "Smoke-Free Class Competition" is currently been implemented in 15 European countries. Two of them—Finland and Germany—have carried out an outcome evaluation. It is obvious that more evaluations are

necessary to establish the effectiveness of the competition.

In the future, classes should be motivated to participate more than once in the competition to extend the durability of the effects. Some classes in Germany reported that they had carried out their own competition after the official end and then started again officially in November. Moreover, it is of interest to examine whether cognitive variables, such as attitudes toward smoking, intention to smoke in future, and group norms, can be influenced by this approach. In addition, it would be worthwhile to apply this approach in intervention programs for the prevention of other substance use and misuse than nicotine such as alcohol and determine its effectiveness.

REFERENCES

- Satcher D. Why we need an international agreement on tobacco control. *Am J Pub Health* 2001;91:191-3.
- WHO. Tobacco or health: a global status report. Geneva: WHO, 1997.
- Peto R, Lopez AD, Boreham J, Thun M, Heath, C. Mortality from smoking in developed countries 1950-2000. Oxford: Oxford University Press, 1994.
- Ad Hoc Working Group on Treatment of Tobacco Dependence. Realignment of the nation's tobacco agenda: the need to treat tobacco dependence. *Prev Med* 2001;32:95-100.
- O'Loughlin J, Paradis G, Renaud L, Gomez LS. One-year predictors of smoking initiation and of continued smoking among elementary schoolchildren in multiethnic, low-income, inner-city neighbourhoods. *Tob Control* 1998;7:268-75.
- Ferrence R, Lothian S, Cape, D. Contemporary patterns of nicotine use in Canada and the United States. In: Roberta R, Slade J, Room R, Poe M, editors. *Nicotine and public health*. Washington, DC: American Public Health Association, 2000:287-300.
- WHO. Health and health behaviour among young people. Copenhagen: WHO, 2000.
- Bundeszentrale für gesundheitliche Aufklärung (BZgA). Die Drogenaffinität Jugendlicher in der Bundesrepublik Deutschland 2001. Eine Wiederholungsbefragung der Bundeszentrale für gesundheitliche Aufklärung. [Substance use among 12 to 25-year-old adolescents and young adults: trends and tendencies]. Köln: BZgA, 2001.
- Conrad KM, Flay BR, Hill D. Why children start smoking cigarettes: predictors of onset. *Br J Addiction* 1992;87:1711-24.
- Chassin L, Presson CC, Rose JS, Sherman SJ. The natural history of cigarette smoking from adolescence to adulthood: demographic predictors of continuity and change. *Health Psychol* 1996;15:478-84.
- Lando HA, Thai DT, Murray DM, Robinson LA, Jeffery RW, Sherwood NW, Hennrikus DJ. Age of initiation, smoking patterns, and risk in a population of working adults. *Prev Med* 1999;29:590-8.
- Breslau N, Peterson EL. Smoking cessation in young adults: age at initiation of cigarette smoking and other suspected influences. *Am J Pub Health* 1996;86:214-220.
- Paavola M, Vartiainen E, Puska P. Predicting adult smoking: the influence of smoking during adolescence and smoking among friends and family. *Health Educ Res* 1996;11:309-15.
- Wyser C, Bolliger CT. Smoking-related disorders. In: Bolliger CT, Fagerstöm KO, editors. *The tobacco epidemic. Progress in respiratory research*. Vol. 28. Basel: Karger, 1997:78-106.
- Paavola M, Vartiainen E, Puska P. Smoking cessation between teenage years and adulthood. *Health Educ Res* 2001;16:49-57.
- Lewinsohn PM, Rohde P, Brown RA. Level of current and past adolescent cigarette smoking as predictors of future substance use disorders in young adulthood. *Addiction* 1999;94:913-21.
- U.S. Department of Health and Human Services. Preventing tobacco use among young people: a report of the Surgeon General. Washington: U.S. Department of Health and Human Services, Public Health Service, Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion, Office on Smoking and Health, 1994.
- Bailey SL. Adolescents' multisubstance use patterns: the role of heavy alcohol and cigarette use. *Am J Pub Health* 1992;82:1220-4.
- Bruvold WH. A meta-analysis of adolescent smoking prevention programs. *Am J Pub Health* 1993;83:872-80.
- U.S. Department of Health and Human Services. Reducing tobacco use: a report of the Surgeon General. Washington: U.S. Department of Health and Human Services, Public Health Service, Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion, Office on Smoking and Health, 2000.
- Dijkstra M, Mesters I, de Vries H, v. Breukelen G, Parcel GS. Effectiveness of a social influence approach and boosters to smoking prevention. *Health Educ Res* 1999;14:791-802.
- Sussman S, Dent CW, Burton D, Stacy AW, Flay BR. Developing school-based tobacco use prevention and cessation programs. Thousand Oaks, CA: Sage, 1995.
- Botvin GJ, Baker E, Dusenbury L, Botvin EM, Diaz T. Long-term follow-up results of a randomized drug abuse prevention trial in a white middle-class population. *JAMA* 1995;273: 1106-12.
- Vartiainen E, Paavola M, McAlister A, Puska P. Fifteen-year follow-up of smoking prevention effects in the North Karelia Youth Project. *Am J Pub Health* 1998;88:81-5.
- Hansen WB. School-based substance abuse prevention: a review of the state of the art in curriculum, 1980-1990. *Health Educ Res* 1992;7:403-30.
- Mann SL, Peterson, Marek PM, Kealey KA. The Hutchinson Smoking Prevention Project trial: design and baseline characteristics. *Prev Med* 2000;30:485-95.
- Peterson AV, Kealey KA, Mann SL, Marek PM, Sarason IG. Hutchinson Smoking Prevention Project—long-term randomized trial in school-based tobacco use prevention: results on smoking. *J Natl Cancer Inst* 2000;92:1979-91.
- Clayton RR, Scutchfield FD, Wyatt SW. Hutchinson Smoking Prevention Project: A new gold standard in prevention science requires new transdisciplinary thinking. *J Natl Cancer Inst* 2000;92:1964-5.
- Vartiainen E, Saukko A, Paavola M, Vertio, H. 'No Smoking Class' competitions in Finland: their value in delaying the onset of smoking in adolescence. *Health Promotion Int* 1996;11:189-92.
- Hanewinkel R, Wiborg G, Paavola M, Vartiainen E. European smoke-free class competition. *Tob Control* 1998;7:326.
- Wiborg G, Hanewinkel R. "Be Smart. Don't Start" in Germany. In: Savolainen S, editor. *The Smokefree Class competition: a European school-based anti-smoking campaign. An overview of the 1997/98 round in seven countries*. Helsinki: National Public Health Institute, 1998:24-28.
- Wiborg G, Hanewinkel R. Konzeption und Prozessevaluation

- eines schulischen Nichtraucherwettbewerbs. [Concetion and process evaluation of school-based smoking prevention project]. *Sucht* 2001;47:25–32.
33. Velicer WF, Prochaska JO, Rossi JS, Snow MG. Assessing outcome in smoking cessation studies. *Psychol Bull* 1992;111:23–41.
34. Korhonen T, McAlister A, Laaksonen M, Laatikainen T, Puska P. International quit and win 1996: standardized evaluation in selected campaign countries. *Prev Med* 2000;31:742–51.
35. Sun S, Korhonen T, Uutela A, Korhonen HJ, Puska P, Jun Y, Chonghua Y, Zeyu G, Yonghao W, Wenqing X. International Quit and Win 1996: comparative evaluation study in China and Finland. *Tob Control* 2000;9:303–9.
36. Lando HA, Pechacek TF, Fruetel J. The Minnesota Heart Health Program community Quit and Win contests. *Am J Health Promot* 1994;9:85–7
37. Chapman S, Smith W, Mowbray G, Hugo C, Egger G. Quit and win smoking cessation contests: how should effectiveness be evaluated? *Prev Med* 1993;22:423–32.
38. Hansen WB, Collins LM, Malotte CK, Johnson CA, Fielding JE. Attrition in prevention research. *J Behav Med* 1985;8:261–75.
39. Siddiqui O, Flay BR, Hu FB. Factors affecting attrition in a longitudinal smoking prevention study. *Prev Med* 1996;25:554–60.
40. Johnson CA, Hansen WB, Collins LM, Graham JW. High-school smoking prevention: results of a three year longitudinal study. *J Behav Med* 1986;9:439–452.
41. Luepker RV, Johnson CA, Murray DM, Pechacek TF. Prevention of cigarette smoking: three-year follow-up of an education program for youth. *J Behav Med* 1983;6:53–62.
42. Ellickson PL, Bell RM. Drug prevention in junior high: a multi-site longitudinal test. *Science* 1990;247:1299–1305.