

# Are the school prevention programmes - aimed at de-normalizing smoking among youths - beneficial in the long term? An example from the Smoke Free Class Competition in Italy

V. Zagà<sup>1</sup>, F. Giordano<sup>2</sup>, P. Gremigni<sup>3</sup>, D.L. Amram<sup>4</sup>, A. De Blasi<sup>5</sup>,  
M. Amendola<sup>2</sup>, J.F. Osborn<sup>2</sup>, M.S. Cattaruzza<sup>2</sup>

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*Parole Chiave: Fumo di Tabacco, Prevenzione, Giovani, Scuole, De-normalizzazione*

## Abstract

*Tobacco smoking by young people is of great concern because it usually leads to regular smoking, nicotine addiction and quitting difficulties. Young people “hooked” by tobacco maintain the profits of the tobacco industry by replacing smokers who quit or die. If new generations could be tobacco-free, as supported by tobacco endgame strategies, the tobacco epidemic could end within decades. Smoking prevention programmes for teens are offered by schools with the aim to prevent or delay smoking onset. Among these, the Smoke Free Class Competition (SFC) was widely implemented in Europe. Its effectiveness yielded conflicting results, but it was only evaluated at short/medium term (6 – 18 months). The aim of this study is to evaluate its effectiveness after a longer follow-up (3 to 5 years) in order to allow enough time for the maturing of the students and the internalization of the experience and its contents. Fifteen classes were randomly sampled from two Italian high schools of Bologna province that regularly offered the SFC to first year students; 382 students (174 participating in the SFC and 208 controls) were retrospectively followed-up and provided their “smoking histories”. At the end of their last year of school (after 5 years from the SFC), the percentage of students who stated that they were regular smokers was lower among the SFC students than in controls: 13.5% vs 32.9% ( $p=0.03$ ). From the students’ “smoking histories”, statistically significant protective ORs were observed for SFC students at the end of 1st and 5th year: 0.42 (95% CI 0.19-0.93) and 0.32 (95% CI 0.11-0.91) respectively. Absence of smokers in the family was also a strongly statistically significant factor associated with being a non-smoker student. These results suggest that SFC may have a positive impact on lowering the prevalence of smoking in the long term (5 years).*

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<sup>1</sup> SITAB Italian Society of Tobaccology, Bologna, Italy

<sup>2</sup> Department of Public Health and Infectious Diseases, Sapienza University of Rome, Rome, Italy

<sup>3</sup> Department of Psychology, University of Bologna, Bologna, Italy

<sup>4</sup> ASL Northwest Tuscany Region, Pontedera (Pisa), Italy

<sup>5</sup> Department of Mental Health, Youth Sector, AUSL Bologna, Bologna, Italy

## Introduction

Tobacco smoke is the main avoidable single cause of morbidity and mortality in the world (1). It causes premature deaths and many chronic and invalidating illnesses with high costs for treatment (2).

Smoking initiation starts very early in life and the smoking habit very soon becomes dependence: 70% of smokers start before age 18 and 95% before age 25 (3).

The tobacco industry is well aware of this and tries to enhance youth experimentation with many different tobacco products. The aim is to “hook” young people and make them addicted to tobacco in order to replace smokers who quit or die and therefore to maintain sales and profits. Advertising, especially through labelling and packaging (with brand imagery carefully devised), tobacco additives (menthol, vanilla, exotic fruits etc.), use of misleading terms on cigarette packs (such as ‘light/mild’), have been used to make the product look safe and attractive and have been demonstrated to be very successful (4-8). With the approval of the new Tobacco Product Directive (TPD) by the European Parliament (9) and the implementation of national laws, many European Countries tried to better protect health, especially for new generations, by banning additives and adding large pictorial health warnings on packaging (10-14). Indeed, while tobacco smoking prevalence is declining in several industrialized countries, it still remains high among the young.

In Italy, in 2016, the DOXA-ISS survey (3) showed that, between ages 15 and 24, the prevalence of smoking was 21.7%, an increase of 3.4% compared to 2015. In the same age-group, also the percentage of young people smoking 15-24 cigarettes a day increased from 15.0% in 2015 to 17.7% in 2016.

Smoking by young people is of great concern because:

- smoking at age 15 is a strong predictor

of becoming a regular / heavy smoker in adulthood (15-17);

- starting to smoke regularly in the early phases of adolescence strongly reduces the likelihood of quitting later on (18-20);

- starting to smoke before age 15 is associated with a higher rate of nicotine addiction (21);

- there is a correlation between early and regular tobacco smoking and experimenting with other drugs (22-24);

- smokers who start smoking at an early age, and continue to smoke, have a 50% probability of dying from a tobacco-related illness (1).

- it exposes young non-smokers to Second Hand Smoke (SHS) due to their socializing together (25).

If smoking could be completely avoided by young people, the tobacco epidemic would end within decades even without any other intervention. The “tobacco endgame” strategies, implemented by nations such as Ireland and Scotland, which support the concept of “tobacco-free new generations” (for example those born in the year 2000 and later) are aimed at de-normalising tobacco use and make it less attractive especially for young people, in order to prevent their being hooked (26-27). In countries where this has not been achieved, such as Italy, at least some specific prevention programmes for teens and pre-teens are offered by the school system, using its educational opportunities (15, 28, 29). The aim is to prevent or delay smoking onset in this crucial age phase (30).

It is possible to classify the school-based tobacco smoking preventive interventions according to their different targets: information, social skills, social influence and combinations of different strategies (31). Programmes of the first kind offer participants information on smoking, on its prevalence and its health hazards (32) which are intended to boost students’ knowledge but not to modify their smoking behaviour (33). Programmes of the second type are based

on the “learning theory by imitation” of Bandura (34) and are designed to achieve the acquisition of social skills, which reinforce auto-efficacy and decision making. The approaches centred on “social influence” are based on the theories of “persuasive communication” of Mc Guire (35) and on the “psychological inoculation” of Evans (36), and are designed to increase the coping capacities of adolescents towards the media and peers (37). Combined approaches integrate the different aspects of each of these models. Some programmes also introduced incentives given to individual participants to prevent the onset of smoking.

The Smoke Free Class Competition (SFC: [www.smokefreeclass.info](http://www.smokefreeclass.info)) is a school-based programme of prevention of tobacco use which integrates the “learning theory by imitation”, by means of positive reinforcement, with the theory of “social influence” and uses prizes as rewards.

It was born in Finland in 1989 (38) and it has been widely implemented throughout Europe (39). Indeed, from 1997 to 2009 it was co-funded by the European Commission and 22 European Countries used it. In Italy, in some regions (such as Veneto) it is still offered to 1<sup>st</sup> year students.

Participating classes commit themselves to stay smoke-free for a six month period (from autumn to spring) and self-monitor their smoking status. Classes that remain smoke-free, enter a competition to win prizes. These general rules are the same in each country, but the programme has some flexibility regarding the national rules so that details can be developed to suit the needs and circumstances of individual countries. In the European participating countries, the SFC was found to enjoy high acceptance and feasibility (30).

The aim of the SFC is to consolidate the no-smoking status of youngsters who have never smoked using the rewards as primary reinforcement. The social influence is involved when abstinence from

smoking turns into a popular and positive behaviour so that non-smoking becomes the “normality”.

The several studies evaluating the effectiveness of SFC have obtained conflicting results, with studies reporting some effect of preventing and/or delaying regular smoking, while others showing no differences between classes which took part in the programme and those which did not (40-43). However, in these studies, the effectiveness of SFC was only evaluated at short or medium term, that is, from 6 to 18 months.

The aim of the present study is to evaluate effectiveness after a longer follow-up: 3 to 5 years after the participation in the SFC of 2 Italian schools.

Tobacco smoking was assessed in students of the last three grades of high school, which participated in a SFC edition during their first year and was compared with the tobacco smoking habits of students of classes which did not participate in the SFC programme, in the same schools.

## Methods

This observational follow-up study refers to a previous quasi-experimental intervention based on the participation in the SFC of some classes of two Italian senior high schools (State Technological Institutes of the Bologna Province, Italy).

The SFC programme was regularly offered by the schools to first year students from 1997/98 to 2009/10.

In this study, fifteen classes of the two schools were randomly sampled providing 382 students to be retrospectively followed-up. In particular: Two third, 2 fourth and 2 fifth grade classes were randomly sampled from those who successfully participated in the SFC when the students were in first grade for a total of 174 students, and 3 third, 3 fourth, and 3 fifth grade classes were

randomly sampled from those who did not participate in the SFC, for a total of 208 students (controls).

The participation in SFC in the first grade was a free decision made by the class when the programme was offered. The students of the participating classes accepted the general rules of the programme and in particular: they committed themselves not to begin smoking if non-smokers and to quit smoking if smokers, for six months. The contract was signed by the students, their parents and a tutor-teacher. During the competition period, each week, students discussed tobacco related problems and the evolution of the commitment; an elected representative signed the monitoring module every month. The sampled classes maintained the commitment of not smoking for the six months and participated in the scheduled lottery.

All the 382 students of this observational follow-up study were asked to fill in an anonymous questionnaire aimed to assess their demographic characteristics (age and gender) and their smoking habit since the first grade class. Thus, each student provided his/her "smoking history" during the previous 3 to 5 years (according to the class attended by students at enrolment in this study). Data on the number of people smoking in the family were also collected.

Smoking status was self-declared and "regular smokers" were defined as those students who smoked at least one cigarette per day. No biomarkers were used to confirm the smoking status.

Descriptive statistical analysis was performed to calculate means ( $\pm$  standard deviations) and relative frequencies. This study presents data which refer both to a cross-sectional and a cohort analysis. Cross-sectional analysis refer to data of students who were enrolled in school year 2009-2010; cohort analysis refer to data collected through the smoking history of students. For each cohort of students,

smoking habits were recorded at baseline (prior to SFC programme) and at the end of each school year. Since students were followed-up for 3 to 5 years, data of each year were not independent of the previous one. Thus, absolute differences of smoking prevalence between SFC participating students and controls were calculated for each year and no comparisons were made among years. Similarly, for each year, ORs and 95% CI were calculated to estimate the risk of smoking in SFC participating students compared with controls.

Only for the 5<sup>th</sup> year students, multivariate logistic regression analysis was used to estimate the effect of SFC programme, controlling for number of smokers in the family.

SPSS version 23 was used to perform statistical analysis.

## Results

Figure 1 reports the details of classes that participated in the SFC programme and those which did not. It shows the cross-sectional and the cohort design reporting calendar year, cohorts of students and classes attended by students at enrolment in the study.

Cross-sectional data of students participating in the study in school year 2009-2010 are reported in Table 1.

For each of the three classes considered, the students who participated in the SFC were younger than those who did not participate: the differences were statistically significant, but very small (3-5 months younger on average).

The percentages of female students were very high in all classes, ranging from 66% to 84%, but differences were not statistically significant.

The percentages of students who stated to be regular smokers were higher among SFC participating students in the 3<sup>rd</sup> class (20.3% vs 17.8%;  $p=0.70$ ), but not in the 4<sup>th</sup> (19.0%

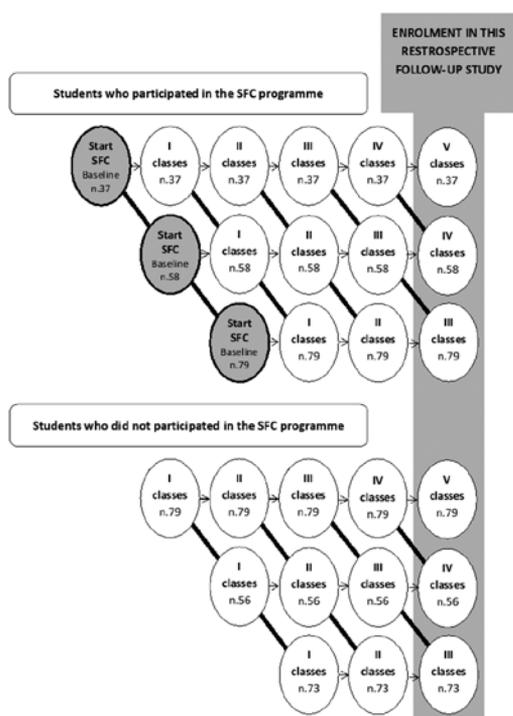


Figure 1 - Details of the fifteen classes that did and did not participate to the SFC programme; cross-sectional and cohort design

vs 33.9%;  $p=0.07$ ) and the 5<sup>th</sup> (13.5% vs 32.9%;  $p=0.03$ ) class.

About the presence of smokers in the family, the students who participated in the SFC reported smaller percentages in comparison to those who did not and the differences were statistically significant for the 4<sup>th</sup> and the 5<sup>th</sup> years students ( $p=0.01$  and 0.02 respectively).

Considering the cohorts of students and their smoking histories, in each year, the prevalence of smoking is equal (at baseline) or always lower in SFC participating students than in controls (Table 2). Even if statistical comparison among years is not valid due to the lack of independence of the data, it is however possible to observe that smoking prevalence generally increases with time for both SFC participating and control students.

For each year, the ORs show that the risk of smoking in SFC participating students is lower in comparison to controls; these risks are statistically significant at the end of the 1<sup>st</sup> and the 5<sup>th</sup> year: 0.42 (95% CI 0.19-0.93) and 0.32 (95% CI 0.11-0.91), respectively.

Table 1 - Cross-sectional design: characteristics of the students at enrolment

Variables	3 <sup>rd</sup> class		4 <sup>th</sup> class		5 <sup>th</sup> class	
	SFC participation		SFC participation		SFC participation	
	Yes N (%)	No N (%)	Yes N (%)	No N (%)	Yes N (%)	No N (%)
Age (Mean $\pm$ S.D.)	<b>16.2 <math>\pm</math>0.5</b>	<b>16.5 <math>\pm</math>0.7</b>	<b>17.2 <math>\pm</math>0.4</b>	<b>17.6 <math>\pm</math>0.6</b>	<b>18.1 <math>\pm</math>0.4</b>	<b>18.5 <math>\pm</math>0.6</b>
Sex= female	60 (75.9)	48 (65.8)	46 (79.3)	42 (75.0)	25 (67.6)	66 (83.5)
Smoking status						
- regular smoker	16 (20.3)	13 (17.8)	11 (19.0)	19 (33.9)	5 ( <b>13.5</b> )	26 ( <b>32.9</b> )
- non smoker	57 (72.2)	53 (72.6)	43 (74.1)	32 (57.1)	32 (86.5)	53 (70.9)
- ex-smoker	6 (7.6)	7 (9.6)	4 (6.9)	5 (8.9)	0 (0.0)	0 (0.0)
Presence of smokers in the family	38 (48.1)	39 (53.4)	25 ( <b>43.1</b> )	37 ( <b>66.1</b> )	15 ( <b>40.5</b> )	50 ( <b>63.3</b> )
Total	79 (100)	73 (100)	58 (100)	56 (100)	37 (100)	79 (100)

Differences between means and percentages (within classes) are in bold when statistically significant at  $p<0.05$  the 5% level

Table 2 - Smoking history of cohort of students. Data are reported at baseline, prior to SFC intervention and at each year after it, according to years of follow-up (from 3 to 5 year according to cohort). Differences are calculated for current smokers.

	SFC participation		Absolute difference (b)-(a) (c)	OR (95%CI) (d)
	Yes N (%) (a)	No N (%) (b)		
Baseline (prior to SFC)				
<b>Current smoker</b>	6 (3.4)	7 (3.4)		
<b>Ex/never smoker</b>	168 (96.6)	201 (96.6)		
<b>Total</b>	<i>174 (100)</i>	<i>208 (100)</i>		
After 1 y from SFC				
<b>Current smoker</b>	9 (5.2)	24 (11.5)	6.3	<b>0.42 (0.19-0.93)</b>
<b>Ex/never smoker</b>	165 (94.8)	184 (88.5)		
<b>Total</b>	<i>174 (100)</i>	<i>208 (100)</i>		
After 2 y from SFC				
<b>Current smoker</b>	22 (12.6)	33 (15.9)	3.3	0.77 (0.43-1.37)
<b>Ex/never smoker</b>	152 (87.4)	175 (84.1)		
<b>Total</b>	<i>174 (100)</i>	<i>208 (100)</i>		
After 3 y from SFC				
<b>Current smoker</b>	27 (15.5)	47 (22.6)	7.1	0.63 (0.37-1.06)
<b>Ex/never smoker</b>	147 (84.5)	161 (77.4)		
<b>Total</b>	<i>174 (100)</i>	<i>208 (100)</i>		
After 4 y from SFC				
<b>Current smoker</b>	15 (15.8)	36 (26.7)	10.9	0.52 (0.26-1.01)
<b>Ex/never smoker</b>	80 (84.2)	99 (73.3)		
<b>Total</b>	<i>95 (100)</i>	<i>135 (100)</i>		
After 5 y from SFC				
<b>Current smoker</b>	5 (13.5)	26 (32.9)	19.4	<b>0.32 (0.11-0.91)</b>
<b>Ex/never smoker</b>	32 (86.5)	53 (67.1)		
<b>Total</b>	<i>37 (100)</i>	<i>79 (100)</i>		

ORs are in bold when statistically significant at  $p < 0.05$  the 5% level

Figure 2 shows the trends of the smoking prevalence for the SFC participating students and the controls, from baseline to five years after it. At the end of the 5<sup>th</sup> year the prevalence of current smokers in the SFC participating students was 13.5% while in the students that did not participate in SFC was 32.9%; the difference, 19.4%, was statistically significant ( $p=0.03$ ).

In the multivariate logistic regression analysis performed for the 5<sup>th</sup> year students, the absence of smokers in the family is

a strongly statistically significant factor associated with being a non-smoker student: those students who live in a family with non-smokers have more than 5 times the probability of being non-smokers in comparison with students who live with smokers (OR 5.43, 95% CI 1.88-15.69). The protective role of participating in the SFC programme was of more than two times (OR 2.42; 95% CI 0.80-7.30) but was not statistically significant.

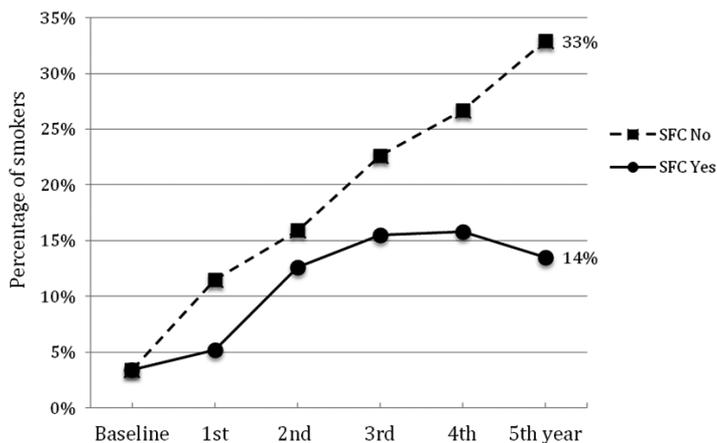


Figure 2 - Trend of smoking from baseline (prior to SFC programme) to five years after it, in SFC participating students and controls.

## Discussion and Conclusions

Students who did and did not participate in the SFC are similar, nevertheless there are some differences. They could not be randomised to the SFC intervention and to the control group due to the rules of SFC, which set that classes are enrolled according to their voluntary adhesion. However, classes were randomly selected (cluster sampling). Thus, the differences observed at enrolment may reflect the study design. Indeed, students who participated in the SFC are slightly younger (about 3 to 5 months) than those who did not. This small difference is statistically significant, because the standard deviation is very small, due to the fact that the students belong to the same class and so have about the same age. Classes were predominantly feminine, with no statistically significant difference between the two groups.

Smoking habits were self-reported by the students. The use of biomarkers or the measurements of carbon monoxide (CO) in their breath could not be used due to costs and the unwillingness of the schools. The SFC programme was welcomed by students

and teachers and no unfavourable events were registered. The criticisms expressed by Etter (44) about the SFC conducted in Switzerland, that is to facilitate bullish behaviour by non smokers towards the smokers, was not observed and - on the contrary - smokers were not excluded or isolated but positively encouraged to quit (as in 45, 46).

From the cross-sectional analysis, it is possible to observe that the prevalence of smokers was higher ( $p=0.70$ ) for the 3<sup>rd</sup> year students who participated in the SFC, but not for 4<sup>th</sup> and 5<sup>th</sup> years' students, where the prevalences of smoking were higher for controls ( $p=0.07$  and  $p=0.03$ , respectively). In the 5<sup>th</sup> year, the percentages of smoking among students who did not participate in the SFC was 2.5 times that of the participants; the difference between the prevalences of smoking between students who did (13.5%) and did not (32.9%) participate in the SFC was 19.4% and was statistically significant. Thus, participating in the SFC seems to produce a beneficial reduction in the prevalence of smoking in the long term, that is, 5 years from the participation (Table 1).

Considering the cohorts of students and their smoking histories, for each year, the ORs show that the risk of smoking in SFC participating students is lower in comparison to controls and risks are statistically significant at the end of the 1<sup>st</sup> and the 5<sup>th</sup> year, thus showing a protective role of SFC programme in reducing smoking prevalence among students immediately after its fulfilment and in the long term (Table 2).

This result is important because, in the literature, the effectiveness of SFC has been evaluated only after 18-24 months at maximum, with conflicting results: a protective effect was reported for example by Wiborg and Crone (30, 47) but not by the Hutchinson Smoking Prevention Project (48).

A more complete picture is shown in Figure 2, which traces what happened to the students during their high school years. Being aware that we could not make significance tests to evaluate the trends (due to lack of data independence), we could, however, observe that there is a 20% difference in the smoking prevalence observed between the two groups of students at the end of high school. The smoking prevalence of the SFC students is always lower than that of controls and in particular: at baseline (prior to SFC intervention) it is equal to that of the control group, at the end of 1<sup>st</sup> year (immediately after the SFC) it is half of it, at the end of 2<sup>nd</sup> year, rises approaching that of control group (12.6% vs 15.9%), and then remains lower, especially at the end of the 5<sup>th</sup> year. Thus, having participated in SFC at the beginning of the first year of high school seems to help in reducing and/or delaying smoking. The scientific and educational information and the motivational inputs received in the first grade by SFC students might be analysed successively and might result effective with the maturing of the students. Our results suggest that SFC may have a positive impact on lowering the prevalence of smoking in the long term.

Results which support our hypothesis, that beneficial effects may appear in the long term, have been recently published by Jit (49), who estimated that school-based smoking prevention programmes have potential for a beneficial effect over the lifetime of the participants, even if they have no apparent effect at school-leaving age.

In the literature, the effectiveness of SFC has had conflicting results, but it has only been evaluated in the short-medium term (24 months at most). Indeed, Schulze et al. (43), in a controlled study on German pupils, reported that, after 18 months, the proportion of pupils remaining “a never-smoker” was 62.1% in the intervention group and 61.5% in the control group (OR 1.02; 95%CI 0.83-1.24). This evaluation of effectiveness was perhaps done too soon, especially as all the information and the psychological influences during the maturing of the students, were to be included.

According to Flay (50), it is also difficult to assess effectiveness, because there are methodological problems in the meta-analyses and systematic reviews of school-based smoking prevention programmes.

Indeed, there are also limits in this study. We have only sampled classes from two high schools of the same type, from the same geographical area, thus we cannot generalize the results. However, comparisons were made between students within the schools and thus the results should be indicative.

Moreover, we have followed two groups of students over a period of 3 to 5 years and observed those who became or remained smokers, quitted or never smoked. However, the data to identify the individual student cannot be recovered because of privacy rules, so our analysis is based on the group data ignoring the fact that the same students have been followed up. This will have the effect of biasing the calculated ORs towards the null value 1, thus our estimates of the effect of the SFC will tend to be underestimated. This error is conservative

and thus we are unlikely to find results that are statistically significant when really there is no effect, but we may miss effects that really exist.

This last point is particularly important when interpreting the effect of the presence of smokers in the family. Some studies report that the smoking behaviour of the family is predictive of the starting of tobacco use in adolescents, just as peer influence, while other studies do not (51-55). In the multivariate analysis that we performed for 5<sup>th</sup> year students, we found that to have non smokers in the family seems to have a great effect on the probability of being a non-smoker student; the effect is greater than the participation in the SFC but the sample size is very small, thus interpretation must be cautious.

These findings and the effectiveness of SFC in the long term should be verified by other larger longitudinal studies.

## Riassunto

*I programmi di prevenzione sul tabacco realizzati nelle scuole e finalizzati a de-normalizzarne l'uso tra i giovani, sono efficaci nel lungo periodo? Un esempio dalla "Smoke Free Class Competition" in Italia*

Il fumo di tabacco tra i giovani desta molte preoccupazioni perchè è frequentemente associato al divenire fumatori regolari, all'essere dipendenti dalla nicotina e ad avere difficoltà nello smettere. I giovani "agganciati" dal tabacco, sostituendosi ai fumatori che smettono di fumare o muoiono, permettono all'industria di mantenere i profitti. Se le nuove generazioni non fumassero, come raccomandato dalle strategie "tobacco endgame" (cioè di fine corsa), "l'epidemia di tabacco", finirebbe in alcune decadi.

I programmi di prevenzione del tabagismo indirizzati ai giovani e organizzati dalle scuole hanno lo scopo di prevenire o ritardare il consumo di tabacco. Tra questi programmi è stato molto usato in Europa lo "Smoke Free Class Competition" (SFC). Gli studi che ne hanno valutato l'efficacia, solo nel breve/medio termine, cioè dopo 6-18 mesi, hanno però riportato risultati contrastanti. Lo scopo del presente lavoro è stato quello di valutarne l'efficacia nel lungo periodo, cioè dopo 3-5 anni, per

permettere ai giovani di maturare e di interiorizzare l'esperienza e i suoi contenuti. Sono state casualmente selezionate quindici classi da due Istituti di scuola media superiore della provincia di Bologna, che regolarmente proponevano lo SFC agli studenti del primo anno; 382 studenti (174 partecipanti allo SFC e 208 controlli) sono stati seguiti retrospettivamente e hanno compilato un questionario sulla loro "storia di fumo". Alla fine dell'ultimo anno di scuola superiore (5 anni dopo aver partecipato allo SFC), la percentuale di studenti che hanno riferito essere fumatori regolari è stata più bassa tra gli studenti che hanno partecipato allo SFC rispetto ai controlli: 13,5% vs 32,9% ( $p=0.03$ ). Analizzando le "storie di fumo", sono stati osservati ORs statisticamente protettivi alla fine del 1° e del 5° anno per gli studenti che hanno partecipato allo SFC: 0,42 (95% IC 0,19-0,93) e 0,32 (95% IC 0,11-0,91) rispettivamente. L'assenza di fumatori in famiglia è un altro fattore importante e associato in maniera statisticamente significativa con l'essere uno studente non fumatore. Questi risultati forniscono indicazioni importanti a sostegno di un effetto positivo dello SFC nel ridurre la prevalenza di fumatori nel lungo periodo (5 anni).

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Corresponding author: Maria Sofia Cattaruzza, Department of Public Health and Infectious Diseases, Sapienza University of Rome, P.le Aldo Moro, 5 00185 Rome, Italy  
e-mail: [mariasofia.cattaruzza@uniroma1.it](mailto:mariasofia.cattaruzza@uniroma1.it)