Effectiveness of an educational intervention on smoking among school adolescents

Efetividade de uma intervenção educacional em tabagismo entre adolescentes escolares

Abstract

The aim of the present study was to evaluate the effectiveness of an educational program on smoking, developed by the Brazilian Cancer Institute, among adolescents from the city of Pelotas, Brazil. Out of 46 public schools in the city, 32 were sampled and randomized into the intervention or control group. In both phases of the study (pre- and post-intervention), 7th and 8th grade students responded to a questionnaire, and had a sample of urine collected for cotinine analysis. The educational intervention lasted for six months. The outcome variables were: "self-reported smoking within the previous 30 days" and "cotinine concentration in the urine (categorized into ≥10 ng/ml and ≥30 ng/ml). No effects of the intervention were observed for any of the behavioral outcomes, although knowledge about the harmful effects of smoking increased in the intervention group. In summary, the intervention was not effective to produce behavioral changes, but led to an increase in knowledge about smoking.

Keywords: Smoking, Tobacco, Cotinine, Adolescent, Intervention Studies, Randomized Controlled Trial

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Resumo

O objetivo do estudo foi avaliar a efetividade de um programa educacional sobre tabagismo desenvolvido pelo Instituto Nacional do Câncer em adolescentes escolares de Pelotas, RS. Das 46 escolas públicas da cidade, 32 foram sorteadas aleatoriamente e, posteriormente, randomizadas em grupo controle ou intervenção. Em ambas as fases do estudo (pré e pós-intervenção), os estudantes de 7ª e 8ª série responderam a um questionário, e uma amostra de urina foi coletada para análise de cotinina. A intervenção educativa teve duração de seis meses. Os desfechos estudados foram: "auto-relato de uso de cigarros nos últimos 30 dias" e "concentração de cotinina na urina (categorizada em ≥10 ng/ml e ≥30 ng/ml)". A intervenção não provocou mudança na prevalência de tabagismo, tanto mensurado por auto-relato como pela concentração de cotinina. No entanto, o conhecimento dos alunos acerca dos malefícios do cigarro aumentou no grupo intervenção. Em resumo, não houve efetividade da intervenção educacional para mudanças de comportamento, mas houve melhora no conhecimento dos prejuízos do fumo.

Descritores: tabagismo, tabaco, cotinina, adolescente, estudos de intervenção, ensaio clínico controlado aleatório.

Introduction

Smoking is the main cause of avoidable diseases and premature disabilities in developed countries[1]. According to the World Health Organization (WHO), by the year 2020, there will have occurred 10 million deaths from diseases associated with tobacco, of which 70% of these will be in developing countries[2].

The majority of smoking adults begin their tobacco consumption and the resulting dependence on nicotine during adolescence[3]. Several studies have shown high prevalences of smoking in this age group[4,5,6].

Data from the Global Youth Tobacco Survey, conducted with school children aged between 13 and 15 years, in 132 countries, between 1999 and 2005, showed a percentage of 8.9% of smoking in the last 30 days[6], while this percentage was 9.5%[2] between 2000 and 2007. The *I Levantamento Domiciliar* (1st Household Survey) on psychotropic drugs, performed in 2001 in Brazil, showed that 15.7% of adolescents had used tobacco in life, between the ages of 12 and 17 years[7].

The majority of smoking prevention or cessation programs in adolescence are developed in schools. The Centers for Disease Control (CDC) recommend that smoking prevention programs in schools be one of the components of a wide control program of tobacco use[1,8]. In a systematic literature review, authors concluded that, through randomized study selection, interventions that use the social influence model with other components (parents, community and media) can improve program effectiveness[9]. However, certain interventions applied to students were not found to be effective[10, 11].

The *Instituto Nacional do Câncer no Brasil* (INCA – Brazilian Cancer Institute), connected to Brazil's Health Ministry, has proposed an educational intervention to fight smoking among adolescents, in schools. This intervention is performed by qualifying facilitators on a state level through

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INCA, when the content of the program is passed on to school representatives (such as pedagogical coordinators) and so on, successively, until the teachers themselves are qualified. This qualification aims to pass on knowledge and audiovisual material about smoking to be subsequently used in schools. The present study was performed with the objective of measuring the effectiveness of such intervention program in a representative sample of public school adolescents, aged between 13 and 14 years, in the city of Pelotas, RS, Brazil.

Methods

Study design and sample

The study design was a randomized intervention conducted in a sample of schools of Pelotas, a city located in Southern Brazil. Of all the 46 public schools of this city, a sample with probability proportional to the size of 32 schools was selected to obtain a sample size of 2,200 students of the 7th and 8th grades, once the target population of the study was comprised of adolescents aged 13 and 14 years exclusively. Calculation of the sample size was based on data of a previous study performed in public schools[12], where the mean proportion of smokers in the age group of this study was found to be 21.8%. To detect a reduction in smoking from 22% to 11%, considering a mean of 68 students per school, power of 80% and 95% confidence level, 32 schools were necessary to achieve a total sample size of 2,200 students.

After the selection of these 32 schools, the respective directors were contacted. In each selected school, all 7th and 8th grade classes were included. All students of the selected classes responded to the questionnaire, although those who were not in the age group of this study were not included in the data analysis. Of all 32 schools, 12 were randomly included for the control group and 16 for the intervention group.

The study protocol was approved by the *Comitê de Ética da Faculdade de Medicina*

da Universidade Federal de Pelotas (Pelotas Federal University School of Medicine Research Ethics Committee – OF.061/2003). Individual data of students and teachers remained anonymous. Authors declared there were no conflicts of interest.

After approval of schools to participate in the study, the study logistics was explained to teachers and students, without mentioning the objective of the intervention. Parents or those responsible for the students were requested to sign an informed consent form; the lack thereof was a criterion for exclusion from this study.

Pre-intervention phase

Pre-intervention data were collected between April and May 2004. Each student responded to a questionnaire and one urine sample was collected in the school itself and maintained in a freezer at -20°C to analyze cotinine at the end of the study. The time between urine sample collection in the school and its subsequent storing in the freezer did not surpass eight hours. The cotinine analysis technique was high-efficiency liquid chromatography (Agilent chromatographer, series 1,100, equipped with an ultraviolet detector and 20-mL manual injector).

The questionnaire used was the same of the "VIGESCOLA" program – the Brazilian version of the Global Youth Tobacco Survey (GYTS) [13]. This is a self-administered questionnaire, aimed at adolescents in schools and lasting approximately 45 minutes, which has been applied in several countries with the support of the World Health Organization (WHO) and the Centers for Disease Control and Prevention (CDC). The variables associated with smoking were as follows: exposure to anti-tobacco messages and cigarette advertisements inside and outside the school, knowledge about smoking, current smoker and having smoked at any time in life, using self-reporting and cotinine measurement. In addition, demographic (age and sex) and socioeconomic variables (according

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to the criteria of the *Associação Brasileira de Empresas de Pesquisa* - ABEP – Brazilian Market Research Association – 2003 version, based on 2000) were analyzed (www.abep.org). This variable was categorized into three groups: high (ABEP's classes A and B), average (class C) and low socioeconomic levels (classes D and E).

Intervention

After randomization of groups, teachers of the intervention group schools (16 schools) were locally qualified by four INCA professionals, who had traveled to the city of Pelotas. The intervention was based on the "*Saber Saúde*" (Know about Health) program, which was presented to the 7th and 8th grade teachers during the qualification training. This program lasted nine hours, divided into two periods (two mornings and/or afternoons), and it was comprised of the following: lectures on the national tobacco control program, methodological guidance to implement the intervention contents, reading and discussion of the book entitled "*O Câncer e seus Fatores de Risco: Doenças que a Educação pode Evitar*" (Cancer and its Risk Factors: Diseases that can be Avoided by Education); discussion about the process evaluation instruments; and group dynamics with videos and presentation of educational materials, such as folders, posters, videos and books. The qualification training was held on June 3rd and 4th, 2004.

At the end of the training, the educational materials that were going to be used by teachers in the following six months were distributed to all intervention group schools. A total of two teachers (out of more than 100) of the intervention group schools were control school teachers. There was no anti-smoking program in these schools, in the period of study.

Implementation of the intervention

A total of two INCA members returned to the city of Pelotas in September 2004 and visited all the 16 schools of the intervention group to evaluate and emphasize the implementation of the intervention. The INCA team was accompanied by three researchers of the local group of study. In each school, the coordinator of educational activities was interviewed according to a standardized protocol to record the implementation of the intervention. In addition, in each school, it was observed whether posters had been fixed and the stock of educational materials was checked.

To evaluate implementation, the INCA developed a report on the application of the intervention program in 16 schools. Based on this report, a score was designed by the local team. This score was based on the percentage of schools that followed 13 items: 1) Did the school receive and distribute the material to students?; 2) Did the teachers discuss the topics in the classroom?; 3) Did the teachers use the books provided by the INCA?; 4) Did the teachers use the videos provided by the INCA?; 5) Did the teachers offer the activities recommended by the INCA?; 6) Did the school and its coordination support the intervention?; 7) Was the school principal present in the qualification training sessions?; 8) Was the intervention program included in the class plan?; 9) Were the parents involved with the project?; 10) Did the school commemorate the "National Day against Tobacco?"; 11) Did the school put up smoking prevention posters?; 12) Did the school put up project posters?; 13) Did the school put up no smoking signs?. The score was obtained by adding positive responses to each of the questions above. In addition to these 13 items, an extra point was added when more than 80% of the school teachers had participated in training sessions.

Post-intervention

The post-intervention phase was conducted in early November 2004, in the 32 schools of the study. The same instruments were re-applied to students, with a new urine sample being collected from them.

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Main outcomes

Smoking among students was defined as the use of cigarettes in the previous 30 days, dichotomized into "yes" and "no", and cotinine dose in urine within two cut-off points (≥ 10ng/ml and ≥ 30ng/ml).

Statistical analysis

Data were double entered into the Epi-Info 6.0, with automatic checking of consistency and amplitude, validated and transferred to the Stata 9.0 statistical package. Descriptive and crude analyses were conducted in the Stata. Once adolescents were organized in 32 schools and the observations were not independent, the analysis was performed by considering the sample design effect. This analysis was conducted based on the intention to treat, comparing outcomes according to the randomized original groups, regardless of the fact that an adolescent received intervention or not. Logistic regression was used to test differences between the intervention and control groups, in relation to the outcome.

The nature of the intervention and sampling protocol resulted in two sample levels. In a second approach to data analysis, multilevel analysis was used (MLWIN software), which not only considers the nature of data per cluster, but also enables the estimation of how much of the global effect of the intervention can be explained by the school level.

To take into consideration possible differences in program implementation in the intervention group among schools, a non-randomized exploratory analysis was conducted to investigate whether a "dose-response" effect of the intervention could be associated with the outcomes. This "dose-response" effect was evaluated using the strength of the intervention. Based on the report prepared by the INCA team during their visit to each school, approximately in the middle of the study, the local team of researchers classified each of the 16 intervention group schools into four categories of intensity of intervention: "very low", "low", "average" and "high". For the following analysis, the quality of intervention was divided into three categories: "low", "average" and "high". Control group schools received a zero score. These scores were treated as an ordinal independent variable and their association with the main outcomes of self-reported smoking (current smoker) and cotinine ≥ 30 ng/ml was tested.

Results

In the pre-intervention phase, the response rate for the questionnaire was high among students. Of all 2,327 eligible students, 2,209 were interviewed, resulting in a non-response rate of only 5.1%. The response rate among students in the post-intervention phase was 93.5% in the control group (1,071 of the 1,146), 93.6% in the intervention group (995 of the 1,063) and 93.5% for the study as a whole (2,066 of the 2,209) (Figure 1).

According to the multilevel analysis, it was observed that school level variability was extremely low and not statistically significant for the outcome studied, and that the result was identical to that obtained by the traditional method. Thus, data from the complex multilevel model are not shown in this study.

Evaluation of the implementation

The result of the score obtained from the INCA report was as follows: the zero value indicated no implementation, while the value 14 indicated perfect implementation. One out of the 16 schools achieved a score 1, revealing "very poor" implementation; three achieved a score 3 or 4 ("poor" implementation); five obtained a score from 5 to 7 ("average" implementation); and seven achieved a score from 8 to 10 ("good" implementation). This classification on four levels was arbitrary, following the score obtained.

Adherence of teachers to the training program was 70%. Evaluation of the intervention in the middle of the period by the INCA team showed that, according to semi-
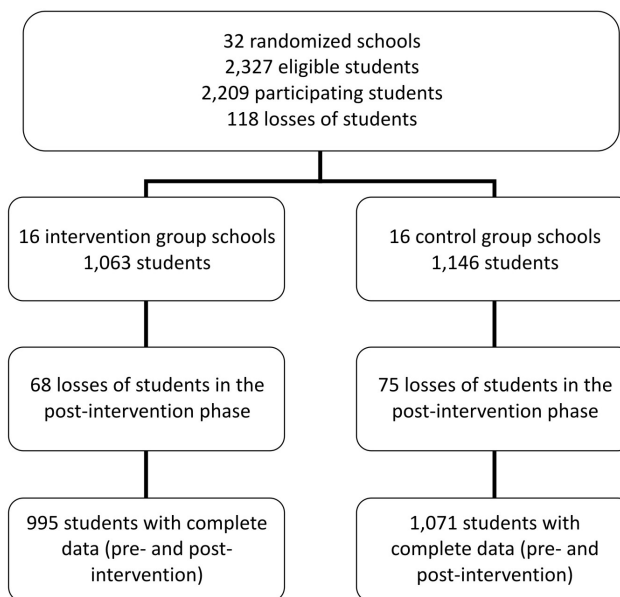
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                    ┌──────────────────────────────────┐
                    │     32 randomized schools        │
                    │   2,327 eligible students        │
                    │  2,209 participating students    │
                    │     118 losses of students       │
                    └──────────────────────────────────┘
                         │                      │
         ┌───────────────────────────┐  ┌───────────────────────────┐
         │ 16 intervention group      │  │ 16 control group schools  │
         │ schools                    │  │ 1,146 students            │
         │ 1,063 students             │  │                           │
         └───────────────────────────┘  └───────────────────────────┘
                     │                              │
         ┌───────────────────────────┐  ┌───────────────────────────┐
         │ 68 losses of students in   │  │ 75 losses of students in  │
         │ the post-intervention      │  │ the post-intervention     │
         │ phase                      │  │ phase                     │
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         ┌───────────────────────────┐  ┌───────────────────────────┐
         │ 995 students with complete │  │ 1,071 students with       │
         │ data (pre- and post-       │  │ complete data (pre- and   │
         │ intervention)              │  │ post-intervention)        │
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Figure 1 - Flowchart of the smoking intervention study among students. Pelotas, Brazil.

quantitative criteria, none of the schools was classified as excellent, 75% were classified as having applied a high or average level of intervention, 18% as low level and 6% as very low. This evaluation indicated that the quality of intervention was adequate in three out of every four schools.

Comparability between groups in the pre-intervention phase

Intervention and control groups were very similar in terms of sex, age and socioeconomic level. The percentage of boys in the control group was 44.3%, whereas that of the intervention group was 44.4%. The percentage of students aged 13 years was 50.1% in the control group and 49.3% in the intervention group. The percentage of students in the socioeconomic groups A and B, according to the ABEP classification, was 33.0% in the control group and 33.5% in the intervention group.

Knowledge associated with smoking in students

Table 1 shows the students' perception of the implementation of the intervention.

The results reveal that there was a higher percentage of discussion about smoking in the intervention group schools after the application of such, indicating that intervention group teachers in fact passed on the knowledge they had received in the qualification training sessions. These results also show that reporting exposure to the media's smoking advertisements was similar in the intervention and control groups.

Table 2 shows the students' "knowledge" about smoking. The level of knowledge about the risk of active smoking and nicotine's addictive properties in the pre-intervention phase was high (90% or more) in both groups (intervention and control); the effects of the intervention on these variables were not detected. Approximately 40% of the students in both groups believed that stopping smoking is not difficult, and this finding did not change after the intervention. The majority of students said that smoking helps to lose weight and, again, the intervention and control groups showed similar results. The intervention only had an impact on students' knowledge about passive smoking, when the intervention group showed greater knowledge at the end of the study (Table 2).

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Table 1 - Distribution of the sample according to their exposure to anti-smoking messages and to cigarette advertising in and outside school. Pelotas, Brazil - 2004.

Variables	Control Group		Interventio Group		P[1]	P[2]	P[3]
	Pre	Post	Pre	Post			
	%	%	%	%			
Did the teacher discuss about the risks of cigarettes?					0.4	<0.01	<0.01
Yes	25.0	38.4	24.5	80.3			
No	36.1	25.7	38.9	7.3			
I am not sure/ I do not remember	38.9	35.9	36.6	12.4			
Did the teacher discuss about the reasons for adolescents to smoke?					0.2	<0.01	<0.01
Yes	12.6	21.0	13.6	55.9			
No	48.9	37.9	51.7	17.5			
I am not sure/ I do not remember	38.5	41.1	34.7	26.6			
Never	10.8	13.5	12.1	13.7			
In the last 30 days, how many anti-smoking messages did you see in the media?							
Many	57.5	44.7	52.2	45.5	0.03	0.4	0.04
Few	34.3	44.6	38.9	45.3			
None	8.2	10.8	8.9	9.2			
How frequently do you see anti-smoking messages in the school?							
I do not know how to answer	19.2	15.9	19.7	15.0	0.9	0.5	0.55
Many times	13.7	14.2	13.9	13.6			
Sometimes	56.2	56.4	54.3	57.7			
Never	10.8	13.5	12.1	13.7			
How often do you see cigarette advertisements outside the school?							
I do not know how to answer	17.8	14.4	17.7	13.8	0.6	0.5	0.79
Many times	11.7	14.1	11.5	12.0			
Sometimes	53.7	51.5	52.4	55.0			
Never	16.8	19.9	18.4	19.2			

*Chi-square test for heterogeneity; p[1]: baseline; p[2]: post-intervention; p[3]: interaction among time and intervention; ** missing values up to 7.0%

Behavior related to smoking in students

The results for "current smoking" and "smoking at any time of life", based on the questionnaire, and cotinine concentrations are shown in Table 3. There were no significant differences between the control and intervention groups for any of the variables. In addition, no interactions between the time and intervention variables were detected. The percentage of adolescents who reported having smoked in the previous 30 days in the pre-intervention phase was 8.5% in the control group and 6.4% in the intervention group, whereas these percentages were 7.9% and 7.1% in the post-intervention phase, respectively.

Analysis of the dose-response effect

Table 4 shows the odds ratio and their respective 95% confidence intervals, using the quality of intervention as variable of exposure. These data indicate that the lack of effectiveness of the intervention was apparently not associated with its quality for both outcomes.

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Table 2 - Distribution of the sample according to students' knowledge about smoking. Pelotas, Brazil-2004

Variáveis	Control Group		Interventio Group		P¹	P²	P³
	Pre	Post	Pre	Post			
	%	%	%	%			
Is cigarette smoking harmful to health?					0.8	0.9	0.95
Certainly not	3.8	2.5	3.3	2.1			
Probably not	0.2	0.3	0.1	0.3			
Probably yes	5.8	5.0	5.9	5.7			
Certainly yes	90.2	92.2	90.7	91.9			
Nicotine is a drug and it is addictive					0.9	0.7	0.73
True	89.8	90.7	89.3	90.9			
False	10.2	9.3	10.7	9.1			
Is it difficult to stop smoking once you start it?					0.09	0.7	0.69
Certainly not	20.2	21.2	21.2	23.2			
Probably not	18.7	17.0	16.9	14.4			
Probably yes	36.8	38.4	36.5	35.5			
Certainly yes	24.4	23.4	25.4	26.8			
Is it safe to smoke for one to two years, as long as you quit it after this period?					0.3	0.2	0.97
Certainly not	69.2	70.9	71.3	72.8			
Probably not	21.5	20.6	19.4	18.1			
Probably yes	5.2	6.2	6.3	5.8			
Certainly yes	4.0	2.3	2.9	3.2			
Cigarettes cause one to…					0.4	0.3	0.10
Gain weight	7.6	8.1	6.8	8.0			
Lose weight	61.3	61.8	59.2	64.5			
No difference	31.0	30.1	33.9	27.5			
Is passive smoking harmful?					0.4	<0.001	<0.001
Yes	80.5	86.4	79.1	91.7			
No	19.5	13.6	20.9	8.3			
Is secondhand cigarette smoke harmful to you?					<0.01	0.4	0.43
Certainly not	5.9	3.5	5.7	4.1			
Probably not	3.5	2.9	3.7	1.8			
Probably yes	26.6	26.9	28.3	19.9			
Certainly yes	64.0	66.7	62.3	74.1			

*Chi-square test for heterogeneity; p¹: baseline; p²: post-intervention; p³: interaction between time and intervention; ** missing values of up to 7.0%

Discussion

The study of effectiveness of the "*Saber Saúde*" program did not show significant differences in adolescent smoking behavior when using two outcomes: self-reported smoking and urinary cotinine measurement, as described in the "Results" of this study. The results of validation of the study comparing self-reported smoking and nicotine dose point to a sub-reporting of smoking, which has been shown in another study[14].

Similar findings of low effectiveness of smoking prevention programs in ado-

Table 3 - Effectiveness of the intervention on self-reported smoking and measured by cotinine concentration in the control and intervention groups. Pelotas, Brazil-2004.

Variáveis	Control Group		Interventio Group		P[1]	P[2]	P[3]
	Pre	Post	Pre	Post			
	%	%	%	%			
Has smoked at any time in life							
Yes	22.5	27.6	22.5	29.5	0.9	0.3	0.48
No	77.5	72.4	77.5	70.5			
Current smoker							
Yes	8.5	7.9	6.4	7.1	0.07	0.5	0.40
No	91.5	92.1	93.6	92.9			
Cotinine ≥10 ng/ml							
Yes	12.8	12.8	11.8	14.9	0.52	0.19	0.48
No	87.2	87.2	88.2	85.1			
Cotinine ≥30 ng/ml							
Yes	7.1	6.1	6.7	7.0	0.69	0.42	0.84
No	92.9	93.9	93.3	93.0			

* Chi-square test for heterogeneity
p[1]: difference in baseline between intervention and control group
p[2]: difference in post-intervention between intervention and control group
p[3]: interaction between time and intervention

Table 4 - Effect of the intervention, according to the intervention implementation level, based on self-reported smoking and cotinine measurement (>=30 ng/ml) among students.

	Measure of the effect (CI95%) Odds ratio	P value*
Self-reported (current smoking)		0.09
Control	1.00	
Low intensity	0.78 (0.54;1.12)	
Average intensity	0.85 (0.64;1.13)	
High intensity	0.74 (0.49;1.11)	
Cotinine (≥ 30 ng/ml)		0.48
Control	1.00	
Low intensity	1.45 (0.87;2.42)	
Average intensity	1.06 (0.66;1.71)	
High intensity	1.01 (0.53;1.92)	

* Chi-squared test for trend by logistic regression

lescents have been found in many studies[10,15,16,17]. A systematic review of studies evaluating smoking prevention programs in adolescents in schools, with a follow-up of at least one year, found only one study that showed a reduction in the prevalence of smoking in the intervention group, out of the eight studies selected[18].

Studies such as those conducted by Perry[19] and Vartiainen et al.[20] revealed a positive effect of the intervention on smoking prevention in adolescents, although not including randomization in the study design. In the study conducted by Botvin[21], 56 schools were randomized into three groups (two intervention groups

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and one control group), and the evaluation of the program was performed six years later, when students were in the 12th grade. The author of this study observed that the prevalence of use of cigarettes in one particular month was 33% in the control group and 26% and 27% in the two intervention groups, representing a statistically significant reduction in smoking in the intervention group.

Randomized studies involving the community[22] or the participation of parents[23], in addition to the school, showed that there was a reduction in the prevalence of smoking in the intervention group. The ASSIST (A Stop Smoking In Schools Trial) intervention program, performed in England and lasting three years, trained students who were leaders in their schools to convince their peers not to smoke and showed a reduction in the risk of being a smoker in the intervention group[24].

In the city of Rio de Janeiro, in Brazil, a non-randomized educational intervention that lasted 18 months was conducted in four schools: two were the aim of an intervention and other two were controls, comprising a pilot program known as "*Prevenção do Uso de Tabaco e Outros Fatores de Risco em Escolas*" (Prevention of Tobacco Use and Other Risk Factors in Schools). The community and the parents were involved in this intervention[25]. Authors concluded that the program had a positive effect by reducing the trend towards smoking, especially "during the year".

The inconsistency of literature data on the effectiveness of smoking prevention programs in adolescents could be due to differences in content and intensity of the programs (number of sessions), evaluation time and selected sample.

The limitations of this study could be associated with the time of evaluation of an intervention of six months, once smoking is a complex behavior that requires a long time to change[26]. Several studies that used longer evaluation times also showed results similar to this study[18,10]. The literature suggests that the effectiveness of adolescent health promotion increases when parents are involved, in addition to community organizations, the media and local health authorities[15, 27, 9].

As previously shown, exposure to anti-tobacco messages from means of communication probably did not interfere with the results of this study.

The present study used a randomized design that guaranteed the comparability of intervention and control groups and prevented selection bias, reflecting the reliability of the results shown. In addition, complex (multilevel) analyses and analyses with simpler procedures (ignoring the first level of schools) were performed, both of which included similar results. Another positive aspect of the study was the low rate of losses in the follow-up of students.

Qualification of the teachers who applied the intervention was directly conducted by the main INCA team and this enabled the implementation to become stronger than it would have been under routine conditions. Normally, the INCA team trains the state team, which, in its turn, train the teachers[28]. Adherence of schools was considered adequate. Based on the students' responses, it was confirmed that teachers had applied the intervention in the classroom. After the INCA visit, in the middle of the semester, teachers became more motivated.

One positive aspect of the "*Saber Saúde*" program was the better knowledge about smoking among adolescents in the intervention group. It is known that knowledge is the first step towards the adoption of healthy behavior[29]. Schools are a channel to better inform and educate adolescents. Their exposure to an educational program can increase their chance of stopping smoking, or even prevent its sporadic or regular use. This could have an important impact on health, in terms of the future morbidity and mortality of these adolescents. In the short term, knowledge may not have been sufficient to change behavior, although this can be achieved in the long term.

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Conclusions and Recommendations

The present study showed a significant improvement in the students' knowledge about passive smoking, which could be relevant in terms of population education and greater acceptance of public health measures, such as those recommended by the Framework Convention on Tobacco Control for smoke-free indoor environments. Despite such greater knowledge, no reduction in the prevalence of smoking among adolescents was observed in this study. The fact that the implementation of the program by schools did not meet the expectations cannot be ignored, although the analyses conducted did not show that the quality of the intervention had influenced the results.

It is recommended that the program should consider involvement of the family and community, instead of restricting this to the schools, in addition to a longer intervention time, which may result in greater program effectiveness.

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