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Longitudinal evaluation of a smoking prevention program for adolescents

ABSTRACT

OBJECTIVE: To evaluate a smoking prevention program for adolescents.

METHODS: The program was conducted between 1999 and 2002, in schools of the district of Lisboa, Portugal. The program integrated activities in the school, family and community. This was a longitudinal quasi-experimental study, based on Community Intervention Trial, with randomly defined control conditions (CC) and intervention conditions (IC). A total of four questionnaires were applied in the beginning of the 7th(T1), 8th(T2) and 9th(T3) and in the end of the 9th(T4) school grades, to 1,205 adolescents, aged 13 years on average, of which 57% were girls and 55% were included in the IC. Exposure to prevention activities, psychosocial determinants of smoking and behavior were the variables considered in the evaluation of the program. Variance analysis and logistic regression were used to test the differences between the two study conditions.

RESULTS: IC obtained better results in the smoking psychosocial determinants and in behavior. At the end of the project, 41.8% of participants in the IC and 53.3% of those in the CC had tried tobacco (OR = 0.62; CI95% 0.49;0.80), while those who became regular smokers totaled 8.0% and 12.4%, respectively (OR = 0.59; CI95% 0.40;0.87).

CONCLUSIONS: The program reduced the initiation of smoking and regular smoking. Results appeared in the second year and improved in the third. Effectiveness of smoking prevention programs depends on a continuous implementation throughout adolescence and on the integration of measures aimed to reach adolescents directly and indirectly through their social context (school, family and community).

DESCRIPTORS: Adolescent. Tobacco Control Campaigns. Smoking, prevention & control. Program Evaluation. Longitudinal Studies.

INTRODUCTION

Approximately 80% of smokers start consuming tobacco during adolescence.[6,24] In Portugal and in Western countries, smoking initiation usually occurs between the ages of 11 and 15.[15,24] The earlier the initiation, the more severe the dependence will be, whose symptoms appear soon after the first puffs of smoke,[7,11] the more difficult it will be to stop smoking, the longer one will be a smoker and the greater the harm to health.[10,24] Tobacco use in adolescence is also associated with consumption of other drugs, other behavioral problems, emotional disorders and relational difficulties.[13,16]

Thus, smoking prevention programs aimed at adolescents are relevant, because they prevent or delay smoking initiation and the acquisition of a regular smoking behavior.[24]

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The European Smoking prevention Framework Approach (ESFA) program developed and tested a smoking prevention program for adolescents aged between 12 and 15 years, in six European countries.[8,9] This program was based on the Attitude, Social influence and self-Efficacy model (ASE) model,[9] which integrates contributions from Social Learning Theory,[3] Reasoned Action[2] and Planned Behavior[1] Models and the persuasive communication approach.[19] These models postulate that behavior is determined by intention, other proximal or psychosocial variables (attitudes, social influence and self-efficacy) and more distal variables (such as biological and demographic ones). Studies on the ESFA Project have concluded that their results remained below what was expected – only Portugal, Spain and Finland achieved positive results.[8]

Inconsistent results from the ESFA Project bring up the debate on the usefulness of such programs. Several authors have raised questions about their effectiveness and support the idea that they should be disregarded.[23,27] In contrast, others argue that the program's success depends on certain conditions, namely: the guarantee of sufficient resources, their application during a long period of time, the use of interactive strategies and a comprehensive approach that integrates the more relevant contexts of adolescent life – the family, the school and the community.[18,22,25] Taking into consideration the importance of these programs to control smoking and its consequences, it is necessary to study and improve their effectiveness.

This paper presents the evaluation of the ESFA project in Portugal, broadening the evaluation of the project on the European level that had already been published.[8] The purpose of the current study is to evaluate the smoking prevention program conducted in Portugal, bringing more development to the program activities than the European study, and including more psychosocial variables to better assess the first impact of this exposure and their effect on smoking behavior progress.

METHODS

The ESFA Project developed, implemented and assessed a smoking prevention program aimed at adolescents enrolled in the 7th, 8th and 9th school grades. The objective was, at the end of the three years of the project, to have 10% fewer regular smokers in the intervention condition than in the control condition.[9,a] What stood out in the ESFA Project was the implementation of a multi-dimensional program, involving adolescents with activities performed on an individual (in the classroom), school, family and community levels.

The investigation followed the principles of "community intervention trial", equivalent to the "controlled randomized trial" of clinical investigations on the community level.[5] A *quasi-experimental* study was then conducted, randomly selecting areas (groups of neighboring cities) to define control and intervention conditions. A total of two areas with comparable sociogeographic characteristics were established, although physically separated from each other to prevent results from being contaminated. In these areas, there were 64 schools, all invited to participate, and of which 25 met the two criteria established for inclusion: a letter of adherence signed by the Executive Director and the designation of a school-contact teacher for project management.

Through random selection, the southern area became the control condition (11 schools from the counties of Moita, Seixal and Barreiro) and the northern area became the intervention condition (14 schools from the counties of Loures and Odivelas), both situated in the District of Lisbon, Portugal. All 7th grade classes of these 25 schools participated. The schools that did not participate argued they were busy with other activities or had no availability to participate in another project, and they were not distinguished from those that integrated the project in terms of location (urban/rural) or socioeconomic characteristics of the school community.

The questionnaire was applied four times to all schools: in the beginning of the 7th grade, in 1999/2000 (T1); in the beginning of the 8th grade, in 2000/2001 (T2); in the beginning of the 9th grade, in 2001/2002 (T3); and in the end of the 9th grade, in 2001/2002 (T4). The application was conducted during the time of one class (60 minutes) by teachers qualified in a training course and supported by a strict protocol.

In T1, 3,133 adolescents responded to the questionnaire, of which 69 were excluded (~2% of the total number). A total of 3,064 cases remained, of which 1,205 (~40%) responded to the four questionnaires and were thus included in the study. The majority of lost cases changed schools, missed the school year or were absent on the days when the questionnaire was applied.

For each year and country, program objectives and goals to be applied in the intervention schools were developed, including activities on four levels: individual (class), school, family and community.

Among the activities applied on an individual level (class), the "Querer é Poder I" (There's a Will, There's a Way - 1) program,[b] applied to the 7th grade, and the

[a] This Project involved six countries of the European Union (Denmark, Finland, Holland, Portugal, Spain and the United Kingdom), each with their Project Manager and a Contractor. One team from the Maastricht University (Holland) coordinated this project at the European level. The project was funded by the European Commission and participating countries.

[b] Vitória PD, Simões-Raposo C, Peixoto FA, Pais Clemente M. Querer é poder I – Programa de prevenção do tabagismo para o 3º Ciclo do ensino básico – manual do professor. Lisboa: Ministério da Saúde, Conselho de Prevenção do Tabagismo; 2000.

"Querer é Poder II" (There's a Will, There's a Way - 2) program,[c] applied to the 8th grade, stood out, each with six structured lessons to be implemented in curricular lessons by school teachers, previously qualified in an intensive training course (48 hours). The "Querer é Poder I" Program[b] focused on the impact of smoking on health and how to avoid smoking, with an interactive and collaborative approach, stimulating participation and the involvement of students since the beginning. One of the lessons proposed an assignment to be done at home with the family, an activity that showed high adherence. The "Querer é Poder II"[c] Program had characteristics similar to the previous one, although focused on passive smoking, its effects and how to prevent exposure to this risk. In the 9th year, aiming to boost the work previously performed, the "7OK! Program"[d] was applied, a game conducted by peers, during two classes of 60 minutes. These instructors had participated in a qualification course with seven sessions and their activity with the classes was followed by the teachers.

In the school, the intervention included a letter of adherence sent by the Executive Director, which symbolized the commitment of the school, the designation of at least one school contact teacher linked to the project and a grant of ~1,250€ per year. School contact teachers from the experimental schools participated in a training course (48 hours) and their task was to manage the project in the school, including the application of the questionnaire to the students and the completion of other evaluation forms. A school tobacco policy was promoted, in line with the Portuguese Law prohibiting smoking in schools, which was either unknown or disrespected. A survey on this Law was conducted in the experimental schools (n = 1,811) and more than 50% of respondents did not know or were not adequately informed about the Law.[26] In the last year of the project, the Programa Turmas Sem Fumantes (Smoke Free Class Program) was implemented in the majority of intervention schools, which consisted in a contest in which classes performed scored activities and only those classes where all students were or became non-smokers could participate.

On the family level, activities from the "Querer é Poder I" (test of knowledge about smoking to be responded by the adolescent and one of their parents at home) and "Querer é Poder II" Programs (structured interview about passive smoking conducted by students who asked questions to their parents) were conducted. In addition, regular correspondence about the project was sent to the households, including newsletters illustrated with photographs of the activities performed and two brochures aimed at the parents ("How to help your child to be smoke free" and "How to quit smoking").

On the community level, a local advisory board was formed, including health professionals, autarchy technicians and others, to support project implementation. A pilot program with a proactive approach and brief counseling based on pharmacies was conducted.[e] Posters and other materials were distributed and events were held (for example, the celebration of the National Non-Smokers Day and the World No Tobacco Day, including the presence of Ministry of Health authorities in some cases, such as the Minister of Health), which had a great impact on the local and national media.

The questionnaire was based on previous studies.[8,9,17] The protocol of application guaranteed participants' confidentiality. The questionnaire was comprised of four categories of variables: sociodemographic and other risk behaviors (the distal determinants of behavior); exposure to intervention; intention to smoke, attitude, social influence and self-efficacy (psychosocial or proximal determinants of behavior); and smoking behavior.

Sociodemographic variables and risk behaviors were divided into categorical and ordinal variables. The first were sex, place of origin, religion, living with both parents, being allowed to smoke at home, other risk behaviors and smoking behavior (has never smoked, has initiated smoking, and regularly smokes). Ordinal variables were age, money available to spend, alcohol consumption and smoking behavior (Table 1).

The variables used to measure exposure to interventions were the number of lessons on smoking, tobacco-related themes discussed in classes, general idea about the lessons, evaluation of the activities conducted in the classes, amount of activities in the school, amount of activities out of the school, speaking about tobacco at home, tobacco-related themes discussed at home, and school policy on tobacco control (Table 2).

Attitudes were assessed using questions about beliefs in the advantages and disadvantages of smoking. Questions about the advantages of smoking ("it calms my nerves", "it makes me feel confident in a group" and "it makes me feel relaxed") were responded in a Likert-type scale with seven points (between "does not help very much" = -3 and "helps very much" = 3). Responses to the questions about disadvantages of smoking ("it is bad for health", "it is stupid", "it is wrong") were coded according to four points (between

[c] Vitória PD, Simões-Raposo C, Peixoto FA, Pais Clemente M. Querer é poder II – Programa de prevenção do tabagismo passivo para o 3º Ciclo do ensino básico – manual do professor. Lisboa: Ministério da Saúde, Conselho de Prevenção do Tabagismo; 2001.
[d] Vitória PD, Simões-Raposo C, Peixoto FA, Lopes LR, Pais Clemente M. Programa 7 OK!– Manual e jogo: Programa interpares para a prevenção do tabagismo e das dependências. Lisboa: Ministério da Saúde, Conselho de Prevenção do Tabagismo; 2002.
[e] Vitória PD, Simões-Raposo C, Peixoto FA, Pais Clemente M. Projecto de prevenção do tabagismo com base nas farmácias. Actas do 4o Congresso Nacional de Psicologia da Saúde. Lisboa: Instituto Superior de Psicologia Aplicada; 2002.

"no"/"I don't know" = 0 and "very much" = 4). A total of two scales resulted from these questions: smoking pros (Cronbach's α between 0.55 for T2 and 0.61 for T3) and smoking cons (Cronbach's α between 0.69 for T2 and 0.76 for T4).

Social influence was evaluated according to the subjective norm (what others expect one to do), direct pressure to smoke and descriptive norm (what others do). Questions about the subjective norm were "My father (mother, best friend, friends) thinks that…", with responses varying in a scale with seven points (between "I certainly shouldn't smoke" = -3 and "I certainly should smoke" = 3).

A total of two scales were constructed, parents and peers, with Cronbach's α for parents varying between 0.83 for T3 and 0.88 for T2 and T4, while those of peers ranged between 0.82 for T3 and 0.85 for T4. Direct pressure to smoke was measured with the following questions: "Have you ever felt pressure from your father to smoke (mother, best friend, friends)?". Responses were coded between "never" = 0 and "many times" = 4. A total of two scales were constructed with Cronbach's α for parents between 0.86 for T1 and 0.83 for T4 and those for peers between 0.70 for T1 and 0.61 for T3 and T4. Questions aimed at evaluating the descriptive norm (or perception of behavior) were as follows: "Does your father (mother, best friend) smoke?" where possible answers were "no" = 0 and "yes" = 1; "Do your friends smoke?", where responses varied between "Almost nobody smokes" = 0 and "Almost everybody smokes" = 4. This variable did not enable the construction of scales, because Cronbach's α values were very low.

Self-efficacy to refuse smoking was measured using three questions ("Can you not smoke… when you are among others who smoke?", "… when you feel upset?" and "… on the way from school to home?"), with responses distributed in a scale with seven points, varying from "I'm absolutely sure that I'll smoke" (= -3) and "I'm absolutely sure I won't smoke" (= 3). The three items were grouped in a scale with Cronbach's α between 0.86 for T2 and 0.89 for T3 and T4.

Intention to smoke was assessed according to two questions (intention to smoke in the next year and in the future) and the categories of responses varied between "certainly not" (= -3) and "certainly yes" (= 3). A scale of intention of smoking was constructed with Cronbach's α between 0.77 for T1 and 0.88 for T4.

Smoking behavior was measured by five questions whose responses were cross-validated.[17] Participants were classified in the process of smoking behavior acquisition according to three points: never smokers (0 = has never been a smoker, not even a puff), not regular smokers (1 = has already started to smoke, although not regularly) and regular smokers (2 = smokes one or more cigarettes per week and has smoked more than 100 cigarettes throughout life).

Data analysis included the characterization of the study sample and its comparison with the sample of lost cases or dropouts (other participants in T1 who had not responded to one of the four questionnaires), using Chi-square and t-tests. Next, differences between control and intervention conditions were analyzed in the sociodemographic and risk behavior variables, using the same tests.

The differences in exposure to program activities were analyzed in both conditions, throughout the four questionnaires, using t-tests.

Changes of psychosocial variables (attitude, social influence, self-efficacy and intention) in both conditions were compared using adjusted means (controlling for age and smoking behavior in T1) or Chi-square tests.

Progress of smoking behavior in control and intervention conditions was compared in three parallel analysis: 1) comparison of smoking behavior in both conditions, in each of the four moments; 2) separate analysis, for both conditions, of the never smokers', initiated smokers' and regular smokers' progress, in the transitions from T1 to T2, from T2 to T3, and from T3 to T4; and 3) chances of never smokers in T1 starting smoking in T2, T3 and T4 (comparing the intervention and control conditions), and, in addition, the chances of not regular smokers in T1 becoming regular smokers in T2, T3 and T4 (again, comparing the intervention and control conditions).

The project was approved by the School General Council and the Executive Director formalized adherence by sending a letter to the National Project Manager. As participants were under age, a letter was sent to parents, informing them about the project to be conducted, the voluntary nature of participation and the anonymity and confidentiality of data.

RESULTS

Mean age of participants was 13.1 years (SD = 0.77), of which 57% were girls and 55% were in the intervention condition (Table 1). The majority (89%) of participants were born in Portugal, 57% were Catholic, 81% lived with both parents, 83% could not smoke at home, and 71% did not manifest other risk behaviors (Table 1).

In T1, there was a significant difference ($p < 0.05$) between the study sample and the lost cases sample in the majority of variables. In general, the study sample had more never smokers, and fewer not regular smokers and regular smokers (Table 1).

The study sample was divided into control (n = 542, 45%) and intervention (n = 663, 55%), without differences in the majority of variables considered in T1,

Table 1. Comparison between the study sample and the lost cases sample and between control and intervention conditions in T1. Lisbon, Portugal, 1999-2002.

Variable	Total sample at T1 (n = 3,064) % [a]	Comparison		p	Comparison		p
		Lost cases sample (n = 1,859) % [a]	Study sample (T1 to T4) (n = 1,205) % [a]		Control condition (n = 542) % [a]	Intervention condition (n = 663) % [a]	
Condition							
Control (Intervention)	46.5	47.5	45.0	ns	-	-	-
Sex							
Boy (Girl)	48.9	52.8	42.9	***	41.9	43.7	ns
Origin							
Portugal (Other countries)	83.8	80.5	88.9	***	89.1	88.7	ns
Religion							
Catholic (Other / Without religion)	53.3	51.3	56.5	**	54.1	58.5	ns
Live with both parents							
Yes (No)	74.8	70.8	81.0	***	79.7	82.1	ns
Allowed to smoke at home if one wants							
No (Yes)	81.3	80.5	82.5	ns	82.1	82.8	ns
Other risk behaviors							
No (Yes)	60.8	54.5	70.5	***	69.7	71.2	ns
Smoking behavior							
Never smoker	71.3	64.0	82.7	***	-	-	-
Not regular smoker	24.0	29.5	15.4				
Regular smoker	4.7	6.5	1.8				
	Mean (SD)	Mean (SD)	Mean (SD)		Mean (SD)	Mean (SD)	
Age (10.8 to 16.8 years)	13.50 (1.07)	13.70 (1.16)	13.10 (0.77)	***	13.00 (0.67)	13.20 (0.83)	***
Money available to spend / week [b]	3.20 (1.84)	3.30 (1.93)	3.00 (1.66)	***	3.10 (1.65)	3.00 (1.67)	ns
Alcohol consumption [c]	1.40 (0.89)	1.50 (1.00)	1.20 (0.64)	***	1.20 (0.70)	1.20 (0.60)	ns
Smoking behavior [d]	0.33 (0.56)	0.43 (0.61)	0.19 (0.44)	***	-	-	

* $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$; [a] In the dichotomous variables, the Table shows the percentage of the first category; [b] (0 = 0€, 1 = 0-2,5€, 2 = 2,5€-5€, 3 = 5€-7,5€, 4 = 7,5€-10€, 5 = 10€-12,5€, 6 = 12,5€-15€, 7 = more than 15€); [c] (0 = never, 1 = sometimes, 2 = less than one time per month, 3 = not weekly, but more than one time per month, 4 = at least one time per month; [d] Never smoker = 0; Not regular smoker = 1; Regular smoker = 2.

except for age, which was higher in the intervention condition. This variable had a recognized impact on smoking behavior, through which it was controlled in the majority of analyses. In T1, the control condition had access to more lessons on smoking and a stronger school tobacco policy (Table 2).

In general, control and intervention conditions showed differences in exposure to program activities, always favorable to the intervention condition. School tobacco policy was the only variable without significant difference at the end of the project, in which the control condition had an advantage at baseline. The difference in the amount of smoking-related themes discussed at home stopped being significant in the third year. The general evaluation of lessons on smoking and their contribution to change what students thought about smoking were better assessed in the intervention condition.

The results confirm that the intervention plan defined was fulfilled: approximately six lessons on smoking in the first year, six lessons in the second year, and two in the third year, with almost double the number of themes dealt with, compared to the number of lessons. School activities increased in the second year and decreased in the third year. Activities out of the school were fewer and decreased with time. The number of smoking-related themes discussed at home was almost the same in these three years. School policy measures increased in the second year and slightly decreased in the third year.

As expected, T1 did not reveal differences between the two samples, in terms of psychosocial determinants of behavior, except for the descriptive norm of friends, which showed a higher value in the control condition (Table 3).

Table 2. Comparison of exposure to prevention activities in T1, T2, T3 and T4 between control (n = 542) and intervention conditions (n = 663). Lisbon, Portugal, 1999-2002.

Activities	T1			T2			T3			T4		
	Control	Intervention		Control	Intervention		Control	Intervention		Control	Intervention	p
Number of lessons on smoking[a]	0.69 (0.97)	0.56 (0.86)	*	0.70 (1.05)	3.21 (1.49)	***	0.80 (1.07)	3.29 (1.48)	***	0.37 (0.80)	1.35 (1.40)	***
Tobacco-related themes discussed in the lessons[b]	1.53 (1.78)	1.41 (1.67)	ns	1.82 (1.65)	5.08 (2.46)	***	1.98 (2.29)	5.53 (2.59)	***	1.00 (1.89)	2.85 (2.87)	***
General assessment of lessons?[c]	-	-	-	3.56 (0.80)	4.39 (0.73)	***	3.58 (0.81)	4.11 (0.80)	***	3.29 (0.64)	3.72 (0.84)	***
Did lessons change ideas?[d]	-	-	-	3.30 (1.12)	3.81 (1.34)	***	3.08 (1.15)	3.49 (1.32)	***	2.96 (0.88)	3.25 (1.26)	***
Number of activities in the school[e]	-	-	-	0.45 (0.79)	1.40 (0.96)	***	0.50 (0.82)	3.07 (1.71)	***	0.34 (0.69)	1.95 (1.77)	***
Number of activities outside the school[f]	-	-	-	1.04 (1.57)	1.24 (1.48)	*	0.77 (1.40)	1.06 (1.45)	***	0.49 (1.03)	0.68 (1.21)	**
Talking about tobacco at home[g]	1.58 (1.63)	1.62 (1.67)	ns	1.98 (1.67)	2.61 (1.50)	***	1.95 (1.67)	2.61 (1.42)	***	2.04 (1.62)	2.21 (1.56)	ns
Tobacco-related themes discussed at home[h]	1.59 (1.61)	1.60 (1.58)	ns	1.76 (1.58)	2.57 (1.97)	***	1.91 (1.77)	2.72 (2.24)	***	2.06 (1.83)	2.33 (2.17)	*
Tobacco control policy in the school[i]	1.38 (0.69)	1.29 (0.71)	*	1.32 (0.77)	1.24 (0.79)	ns	1.40 (0.73)	1.39 (0.74)	ns	1.35 (0.69)	1.33 (0.70)	ns

* p < 0,05; ** p < 0,01; *** p < 0,001

[a] 0 classes = 0; 1-2 classes = 1, 3-4 = 2, 5-6 = 3; 7-8 = 4; 9-10 = 5;+10 = 6. [b] Between 0 and 13. [c] I did not like at all = 1; I did not like = 2; I don't know = 3; I liked = 4; I liked a lot = 5. [d] No, nothing = 1; Not much = 2; I don't know = 3; a little = 4; a lot = 5. [e] Between 0 - 7. [f] Between 0 - 9. [g] Never = 0; Yes, but not last year = 1; once = 2; sometimes = 3; often = 4; very often = 5. [h] Between 0 - 10. [i] Weak (smoking allowed) = 0; strong (smoking allowed only in one or two places) = 1; very strong (smoking not allowed) = 2..

Beliefs in the advantages of smoking showed results close to zero in both samples and significant differences in these variables only appeared in T4. Among the beliefs against smoking, results in T1 were high in both samples, decreasing in the control condition and remaining the same in the intervention condition. The differences in these variables between both conditions appeared in T2 and became more relevant in T3 and T4.

The results of social influence were divided between the effects in favor of the intervention condition and absence of effects. Subjective norms of peers and especially of parents had negative results at baseline that were maintained throughout time, without differences between the two conditions. The direct pressure of parents was close to zero and progressed towards zero (protective of smoking), without a distinction between conditions. Direct pressure from peers was also close to zero, although with values higher than those of parents, progressing towards the risk of smoking and with values significantly higher in the control condition in T2, T3 and T4. The descriptive norm of friends showed values favorable to the intervention condition, and the difference became more significant throughout the three years. Perception of the father's and mother's behavior did not differ in the four moments, nor between conditions. Perception of the best friend's behavior increased substantially in T2 and T3 and it stabilized in T4, and the intervention condition showed better results than those of the control condition in T3 and T4.

Self-efficacy to refuse smoking decreased throughout the four questionnaires, with a significant difference between conditions in T4.

Values were negative for intention to smoke, with a tendency to increase that stopped in T4 in the intervention condition. There were significant differences between the two conditions in T4.

Smoking behavior increased during the four years of the project, especially in the first years (Table 4). In the control condition, the initiation rate more than doubled between T1 and T2, it increased 45% between T2 and T3, and it increased 12% between T3 and T4.

Differences in behavior between intervention and control conditions were not significant in T1, although the rates of initiated smokers and regular smokers in the intervention condition had been higher (Table 4).

In the transition from T1 to T2, there was a significant difference in cases that remained never smokers, with an advantage of the intervention condition (78.6% and 84.7%; $p < 0.05$). However, this partial difference is not sufficient to observe significant differences between the two conditions in T2 (Table 4).

In the transition from T2 to T3, the differences observed were not significant either. However, in T3, the adjusted mean of smoking behavior in the control condition was

significantly higher than that of the intervention condition (M.Aj of control = 0.59 *versus* M.Aj of intervention = 0.52; $F_{(1, 1202)} = 3.91$; $p < 0.05$).

In the transition from T3 to T4, more never smokers in the control condition began this habit (21.8% against 13.7% in the intervention condition; $\chi^2_{(1)} = 7.22$; $p < 0.05$). There were also more not regular smokers who changed to regular smokers in the control condition (13.1% *vs* 7.5%; $\chi^2_{(1)} = 3.97$; $p < 0.05$) and fewer regular smokers who changed their status, although the difference was not significant (8.7% *vs* 20.8%; $\chi^2_{(1)} = 2.79$; *ns*). In T4, the adjusted mean of smoking behavior in the control condition was significantly higher (0.75 *vs* 0.61; $F_{(1, 1202)} = 13.28$; $p < 0.001$) and this difference increased, when compared to T3.

In T1, the prevalence of never smokers and not regular smokers was slightly higher in the control condition, without a significant difference (Table 5). With regard to the control condition the adjusted chance of smoking initiation occurring in the intervention condition was 0.64 ($p < 0.01$) between T1 and T2, 0.70 ($p < 0.01$) between T1 and T3, and 0.62 ($p < 0.000$) between T1 and T4. The difference in adjusted chances between the control condition and the intervention condition in terms of the progress from not regular smokers to regular smokers was significant in T4 (12.4% in the control condition, 8.0% in the intervention condition, OR = 0.59; $p < 0.000$).

In the control condition, 91.3% of regular smokers in T3 maintained this status in T4 (table 4), against 79.2% in the intervention condition. The high value of these rates confirms that, once one becomes a regular smoker, it is difficult to change this behavior.

DISCUSSION

The results found in the present study confirm that the incidence of smoking initiation in this age group is high, especially in the first year, and that this incidence becomes lower in the following years. These results are in line with that of the other studies published on the peak age of smoking initiation[15,24] and emphasize the need for prevention programs aimed at adolescents in this age group.

Reports of intervention condition participants on the exposure to program activities indicate that their implementation occurred as established in the plan and shows differences that are favorable to the intervention condition throughout the three years of the project. This set of results supports the hypothesis that the implementation process of this program was efficient.

With regard to the psychosocial variables, the results indicate that, at this age, the following are observed: neutral pro-smoking beliefs, very high anti-smoking

Table 3. Comparison of adjusted mean effectsa in psychosocial variables, in T1, T2, T3 and T4, between control (n = 542) and intervention conditions (n = 663). Lisbon, Portugal, 1999-2002.

Variable	T1			T2			T3			T4		
	Control	Intervention	p	Control	Intervention	p	Control	Intervention	p	Control	Intervention	p
Pros of smoking[b]	-0.74	-0.67	ns	-0.52	-0.70	ns	0.01	-0.25	ns	0.21	-0.17	**
Cons of smoking[c]	7.70	7.71	ns	7.43	7.71	*	7.01	7.27	*	6.95	7.44	***
Parents' subjective norms[d]	-4.56	-4.49	ns	-4.78	-4.81	ns	-5.02	-5.11	ns	-4.87	-4.93	ns
Peers' subjective norms[d]	-3.61	-3.59	ns	-3.83	-3.98	ns	-3.76	-3.81	ns	-3.79	-3.92	ns
Parents' direct pressure[e]	0.13	0.13	ns	0.05	0.02	ns	0.01	0.02	ns	0.07	0.02	ns
Peers' direct pressure[e]	0.23	0.22	ns	0.38	0.26	**	0.46	0.33	*	0.61	0.46	*
Friends' descriptive norm[f]	0.29	0.21	*	0.48	0.35	*	0.85	0.67	**	1.19	0.80	***
Self-efficacy[g]	7.41	7.43	ns	7.11	7.35	ns	6.05	6.44	ns	5.70	6.31	*
Intention to smoke[h]	-3.14	-3.04	ns	-2.92	-3.07	ns	-2.59	-2.70	ns	-2.45	-2.84	**
	%	%		%	%		%	%		%	%	
Father's behavior – does not smoke	57.4	58.8	ns	57.4	60.3	ns	58.7	62.0	ns	59.2	61.5	ns
Mother's behavior – does not smoke	79.2	78.9	ns	77.9	79.2	ns	78.6	78.9	ns	78.8	79.2	ns
Best friend's behavior – does not smoke	94.8	95.6	ns	89.9	91.9	ns	83.8	87.8	*	80.4	86.9	**

* $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$

[a] Adjusted mean considers age and smoking at T1 as co-variables. [b] Between -9 and +9. [c] Between 0 and +9. [d] Between –6 and +6. [e] Between 0 and +8. [f] Almost nobody smokes = 0; less than half = 1; half = 2; more than half = 3; and almost everyone smokes = 4. g Between -9 and +9. [h] Between -6 and +6.

Table 4. Smoking behavior results: mean of smoking behavior and transitions between categories in each of the three years of the project between control (n = 542) and intervention conditions (n = 663). Lisbon, Portugal, 1999-2002.

Behavior	T1		T2		T3		T4	
	Control	Intervention	Control	Intervention	Control	Intervention	Control	Intervention
Transitions	T1 → T2		T2 → T3		T3 → T4			
1. Never smoker (%)	83.8	81.9	65.9	69.4	50.6	55.7	39.1	47.7
Do not change (%)	78.6	84.7	76.8	80.2	77.4	85.6		
Change 1→2 (%)	20.5	14.5	22.7	18.0	21.5	13.6		
Change 1→3 (%)	[0.9]	[0.7]	0.6	1.7	[1.1]	[0.8]		
	$\chi^2(1)^{ab} = 6.17^{**}$		$\chi^2(2)^{a} = 4.75$ns		$\chi^2(1)^{ac} = 7.22^{**}$			
2. Not regular smoker (%)	14.6	16.1	31.0	27.5	41.0	36.3	47.2	42.8
Do not change (%)	92.4	90.7	82.7	86.3	86.9	92.5		
Change 2→3 (%)	7.6	9.3	17.3	13.7	13.1	7.5		
	$\chi^2(1)^{d} = 0.18$ns		$\chi^2(1)^{d} = 0.83$ns		$\chi^2(1)^{d} = 3.97^{*}$			
3. Regular smoker (%)	1.7	2.0	3.1	3.2	8.5	8.0	13.7	9.5
Do not change (%)	77.8	53.8	88.2	95.2	91.3	79.2		
Change 3→2 (%)	22.2	46.2	11.8	4.8	8.7	20.8		
	-[f]		-[f]		$\chi^2(1)^{e} = 2.79$ns			
M.Aj.[g] =	0.19	0.20	0.38	0.33	0.59	0.52	0.75	0.61
F(1, 1202) =	0.11ns		2.69ns		3.91*		13.28***	

* $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$

[a] Comparison between CC and CI, of the progress from Tn to Tn+1 of participants who never smoked in Tn.

[b] Both spaces in the lower line, with values shown between brackets, were excluded from the analysis because they had an expected value below 5. Considering the total of participants who do not change or change from position 1 to 2, 79.3% do not change in the CC, while 85.3% do not change in the IC.

[c] Both spaces in the lower line, with values shown between brackets, were excluded from the analysis because they had an expected value below 5. Considering the total of participants who do not change or change from position 1 to 2, 78.2% do not change in the CC, while 86.3% do not change in the CI.

[d] Comparison of progress from T1 to T2 between CC and CI of participants who initiated smoking in Tn.

[e] Comparison of progress from T1 to T2 between CC and CI of participants who were regular smokers in Tn.

[f] Insufficient number of cases to calculate $\chi 2$.

[g] Adjusted mean, considering age in T1 as a co-variable. Never smoker = 0; Not regular smoker = 1; Regular smoker = 2.

beliefs, low social influence in favor of smoking, high self-efficacy to refuse smoking and reduced intention to smoke in the future. These results tend to favor the prevention of the smoking behavior, except in the case of pro-smoking beliefs, which show a certain risk of acquiring this behavior. On the other hand, the longitudinal analysis of data indicates a progress of these variables towards the risk of smoking acquisition. In the intervention condition, this tendency was less relevant and also inverted in certain variables (for example, beliefs against smoking and intention to smoke). These sociocognitive variables seem to be the most sensitive to an intervention such as the one performed by this program.

Comparing control and intervention conditions, the former achieved better results in attitudes (smoking pros and cons), certain social influence variables (direct peer pressure, descriptive norm of friends and behavior of best friend), self-efficacy and intention to smoke. Social influence variables with better results refer to the peers, many of whom will also have been targeted by the program.

Regarding smoking behavior, there were no differences between control and intervention conditions at T1. Differences began to appear in T2 (after one year of the program), although only in the rate of the transition of never smokers to not regular smokers. The results improved in T3, with a lower rate of initiation in the intervention condition and higher rate of change of the regular smoker status, and they increased in T4, with higher rates of never smokers and lower rates of not regular and regular smokers. These results indicate that the intervention resulted in better progress in psychosocial variables and in smoking behavior in the intervention condition. Smoking initiation and the acquisition was lower in this condition. It can be concluded that this program was effective in Portugal, confirming results from other studies already published on the ESFA Project[8] and supporting the usefulness of school-based smoking prevention programs for adolescents.[18,22,25]

Although effective, this program could be improved in certain aspects. The intervention condition has better results in all variables used to measure intervention exposure (except in the school policy). This consistency

Table 5. Smoking behavior results: never smokers in T1 who became initiated smokers and non-smokers in T1 who became regular smokers. Lisbon, Portugal, 1999-2002. (control: n = 542; intervention: n = 663)

Behavior	N in T1	Control (%)	Intervention (%)	Odds ratio[a] (95%CI)	p
Never smokers in T1	1,205	83.8	81.9	1.06 (0.78;1.44)	0.714
Not regular smokers in T1	1,205	98.3	98.0	1.05 (0.44;2.50)	0.912
Never smokers in T1 who became initiated smokers in T2	997	21.4	15.3	0.64 (0.46;0.90)	0.008
Not regular smokers in T1 who became regular smokers in T2	1,183	1.9	2.2	1.15 (0.50;2.62)	0.740
Never smokers in T1 who became initiated smokers in T3	997	39.6	32.0	0.70 (0.54;0.92)	0.009
Not regular smokers in T1 who became regular smokers in T3	1,183	7.3	6.6	0.86 (0.54;1.35)	0.497
Never smokers in T1 who became initiated smokers in T4	997	53.3	41.8	0.62 (0.49;0.80)	0.000
Not regular smokers in T1 who became regular smokers in T4	1,183	12.4	8.0	0.59 (0.40;0.87)	0.008

[a] Odds ratio calculated while controlling for age.

of results is not observed in the assessment of the program impact on the psychosocial variables. In these variables, it should be emphasized how the measures are placed at baseline. For example, pro-smoking beliefs tend towards values close to zero (neutral), although their values should be negative. This result suggests the need for more efficient strategies to negatively affect these beliefs and, at the same time, to show alternatives to adolescents so that these advantages can be obtained (for example, to calm one's nerves, to increase one's sense of confidence in a group and to feel relaxed).

Social influence showed differences favorable to the intervention condition in the variables associated with peers, although not in those related to parents. The only exception was the subjective norm of peers, also without differences, perhaps because of the negative scores at baseline, which tended to be more negative as the program progressed. This result could be explained by the growing social de-normalization of the smoking, to which this program could have contributed. The same occurred with the subjective norm of parents, that was almost inexistent in both conditions, thus suggesting that this variable is not relevant for prevention anymore. Direct pressure of peers, the descriptive norm of friends and the best friend's behavior increased towards the risk of smoking during the three years of the study, although with differences favorable to the intervention condition. These results suggest that, to improve the effectiveness of prevention programs, it is necessary to implement specific measures to prevent and to stop the smoking behavior in adolescents and go against its trend towards overestimation of peers' smoking behavior.

Self-efficacy and intention to smoke progress towards the risk of smoking throughout the three years, although with better results in the intervention condition, which indicates that prevention programs should continue to address these variables in order to improve effectiveness.

In the first year of program application, the difference between intervention and control conditions in the transitions from never smokers to initiation was already significant, an important result for the prevention purposes. The second year was the only one when the difference between conditions in the transitions from never smokers to initiated smokers was not significant. This was the year in which the key theme of the program at the individual level was passive smoking, while the themes of the previous and following years were avoiding smoking and stopping smoking. Perhaps these differences in themes contributed to this less favorable result, suggesting that the themes of smoking prevention and stopping smoking are more relevant to the program results than those of passive smoking. In the third year, differences were significant and favorable to the intervention in all transitions. In addition to the possible "sleeping effect", reported by De Vries et al,[8] certain aspects of the intervention in T3 could have contributed to this effect: the intervention in classes (individual level) had playful activities (games) and was conducted by peers;[4] the Smoke Free Classes Program required all students in the participating classes to not smoke, preventing smoking initiation and promoting quitting smoking; in the community, there was an extensive awareness program on smoking and quitting smoking based on pharmacies. Although this study did not have an effect on parents' smoking behavior, it could have increased their concern about smoking and their intention to quit smoking, changes that can positively influence adolescents' behavior.

Other hypotheses to explain these program effectiveness results from the comparison between the program conducted in Portugal and those conducted in other countries.[8] In Portugal, classes had more curricular lessons and more activities in class about smoking. The number of lessons has been associated with the success of school-based prevention programs.[21] Other specific characteristics of the Portuguese program were the communication skills training applied to the classes; the long-term training courses for teachers who applied the program to classes and for school contact teachers who manage the program at the school level; the credits attributed in these training courses, which

were useful for career progression; and the peer-led activities implemented by qualified young colleagues with the support of teachers.

In conclusion, the results of the ESFA Project in Portugal suggest that the effectiveness of smoking prevention programs depends on a reasonable number of curricular lessons being performed, with an interactive methodology and with social skills training with several purposes, including the improvement on self-efficacy to refuse smoking. Contents such as how to avoid smoking and how to stop smoking seem to be more relevant than other contents related to passive smoking. The collaboration of adolescents in the application of these lessons could be valuable for the program results. It is also relevant to obtain the collaboration of motivated teachers, and the commitment of the schools enrolled in the program. The qualification of the teachers who help with program implementation and the coordination of their contributions stand out in the Portuguese program and have been associated with its success.[20] Direct incentives for teachers (credits for them to move up in their career) and schools (financial support) promote motivation and commitment. The intervention conducted with families, based on assignments proposed in the school to be performed at home, had good adherence and could promote communication between parents and children. The intervention in the community can indirectly contribute to prevent adolescents' smoking behavior. In the case of social influence variables, the work performed could have increased the perception of social support to non-smoking behavior. Finally, the results strongly suggest the importance of a comprehensive approach (integrating class, school, family and community) and of maintaining these programs throughout adolescence.

This study has some limitations. The first refers to the nearly 60% of adolescents who participated in T1 and did not respond to one of the three following questionnaires, which implied their exclusion from this study. The comparison between included and excluded participants shows differences that, in general, protect the sample of this study from the acquisition of the smoking behavior, which can reduce the external validity of results and conclusions. However, considering the fact that this program is school-based, the study sample will tend to represent the sub-group of adolescents with a regular school career, who attend classes and progress regularly. For the remaining adolescents, it will be necessary to find other accessing points and to adjust the activities to better reach different target groups and realities.

The impossibility of validating self-reported smoking behavior with biochemical measures is another limitation. However, the investigation indicates that adolescents' responses about their smoking behavior are reliable if the conditions of questionnaire application are optimized, namely, by the confidentiality of responses.[12]

With regard to the intervention program, the amount and quality of the work performed outside the school, at family and community levels, did not meet the expectations, nor did the work performed to promote a school tobacco policy more favorable to smoking prevention. The means available were not sufficient to provide the most adequate response on these intervention levels.

Despite these limitations, this study has also several advantages. It was a longitudinal evaluation of a smoking prevention program for adolescents, applied primarily at schools, although with a multi-dimensional approach (individual, school, family and community levels), with intervention and control groups. The results obtained support the usefulness of smoking prevention programs and suggest measures to improve their effectiveness.

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