Evaluation of the effectiveness of a smoking prevention program based on the ‘Life Skills Training’ approach

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Received on May 31, 2011; accepted on April 25, 2013

Abstract

Our objective was to verify the effectiveness of a program based on the Life Skills Training approach with a greater extent than usual, not applied by teachers and a very high degree of reliability regarding the implementation of the expected content. Twenty-eight secondary schools in Granada (Spain) were randomly assigned to the intervention or control group. The students in the intervention group received 21 one-hour sessions in the first year and 12 one-hour sessions in the second year, whereas those in the control group received no health education or preventive sessions. Students completed questionnaires before and after the first year of sessions, before and after the second year, and at 1 year after the program. All five questionnaires were completed by 77% of the 1048 students initially enrolled in the study. The results suggest that the program had no preventive effects either immediately or at 1 year after its application. Application of the Life Skills Training approach does not appear to prevent the onset of smoking but may prove effective for avoiding escalation of the consumption levels of tobacco or other problematic drugs.

Introduction

Tobacco consumption continues to be a major cause of disease and death [1]. Over the past 40 years, the application of prevention programs has been the main strategy for reducing the rate of consumption among children and adolescents [2]. In the 1970s and 1980s, most of these programs adopted the so-called Social Influences Approach, which focuses on endowing young people with skills that allow them to resist the pressure to smoke from their peers and the media [3]. The poor results obtained by most of these programs led to the emergence of a new approach, called Life Skills Training, based on providing adolescents with a wide range of skills to successfully meet the challenges they face [4].

The effectiveness of school-based tobacco prevention programs is currently under debate [5]. Various studies found little or no evidence of the effectiveness of the life skills approach [6–8], whereas others attributed the poor preventive outcomes to an inadequate duration of the program, which was usually 5–10 sessions [9], or to the poor implementation of the program, most frequently by teachers after a brief training period [10, 11]. It has also been questioned whether teachers are the best agents for applying preventive programs, given the reluctance by some members of the profession, some of whom are smokers, to play this role and the consequent negative effects on the reliability of the program implementation [11–13]. The aim of this study was to examine the possible adverse influence of these factors on the effectiveness of a preventive program based on life training skills by running a 2-year program to be
implemented by well-trained non-teachers with a rigorous control over adherence to the implementation protocol.

**Methods**

**Sample selection**

Twenty-eight secondary schools were randomly selected from among all public and state-funded private schools in the city of Granada (Spain). Toward the end of the academic year before the start of the preventive program, data were gathered on the tobacco consumption of all pupils in the third year of secondary education (equivalent to ninth grade in the United States) at the selected schools, as detailed below (see ‘Tobacco consumption assessment’). Each school was assigned a ‘tobacco consumption rate’, i.e. the sum of the mean percentages of sporadic, monthly, weekly and daily smokers among its ninth-grade students, and the 28 schools were ranked according to their rate. The ‘alternate ranks’ [14] procedure was then applied to assign schools to the intervention or control group, randomly assigning the school with the highest tobacco consumption rate to one of these groups and then assigning the remaining schools according to their ranking, using the formula ABBAABBA. In the next academic year, all seventh-grade classes in each selected school participated in the study. Approval for the study was obtained from the review board of the Ministry of Education of the Autonomous Government of Andalusia. The primary guardians were informed of the objectives of the research and none refused the participation of their child (a passive consent procedure was used) (Fig. 1).

**Participants**

The sample comprised 1048 school students who voluntarily participated in the study (566 in control group and 482 in intervention group). The age ranged from 10 to 14 years; the mean age [±standard deviation (SD)] was 11.02 ± 0.5 years in the control group and 11.05 ± 0.5 years in the intervention group. The two groups significantly differed in gender distribution, with 59.3% females in the control group versus 40.8% in the intervention group ($\chi^2 = 14.280, P < 0.005$). Maximum participant cooperation was achieved (100%).

**Procedure**

The program was implemented in secondary school students during their first and second years (equivalent to ninth and eighth grades in the US education system). During the academic year before implementation of the program, 48 university psychology students volunteered to be program monitors and took part in auditions in a 20-min role play as monitors of a social skills class for an imaginary group of adolescents (the students received the script in advance). The 20 volunteers showing the best performances in these auditions then underwent a 9-month program monitor training course, comprising weekly 90-min sessions on the program content and providing training in verbal and non-verbal functional skills for interacting with groups of young people. Role play and feedback via video recordings played a major role in their training. At 15 days before the first year of the program and 15 days before the second year, the monitors participated in an intensive 7-day course (7 hours per day).

The content of each program session was written in a direct style, and the monitors received a script that set out everything to be said and done during the session. The script also included notes on the ways to react to various situations that might arise during the session (e.g. the students’ questions, comments and reactions).

The monitors were required to complete a questionnaire after each program session to assess their adherence to the implementation protocol, indicating whether or not they had included each topic scheduled to be addressed in the session. In addition, two research directors attended one program session every week, with no advance warning, using the aforementioned questionnaire to evaluate the adherence of the monitor to the program. Each monitor was evaluated on three occasions in each of the 2 years of the study.
Effectiveness of a smoking prevention program

Fig. 1. Study design.
The program consisted of 24 one-hour sessions in the first year and 12 one-hour sessions in the second, with two extra sessions each year for evaluating the tobacco consumption of the participants. There was an average of 15 students per group. One session was held every week throughout the academic year with the exception of Christmas and Easter holiday periods. Each session was implemented by two monitors who were permanently assigned to the same group of students. The program included the following elements: training in social skills, training in problem solving, enhancement of self-esteem, correction of overestimations of tobacco consumption, preparation for facing puberty-related physical changes without stress and information on the effects of tobacco consumption on health. The complete scripts used in each session can be found in [15]. A ‘master class’ approach was avoided at all times, the adolescents were constantly encouraged to participate and there was a frequent use of role play. Moreover, particular attention was placed on homework to facilitate generalization.

Adolescents at the schools in the control group received no type of planned preventive intervention or information on health education. The educational authorities did not authorize any other activity related to health education in any school participating in this program during the study period.

In five schools located in socioeconomically disadvantaged neighborhoods, the ‘Good Behavior Game’ technique was used in the program sessions to control disruptive behavior and encourage attendance of the adolescents [16]. The ‘Good Behavior Game’ proved to be a very effective strategy to achieve both objectives. Thus, the average percentage attendance at meetings was 96% in all schools and 91% in those who applied the ‘Good Behavior Game’.

**Tobacco consumption assessment**

Tobacco consumption was assessed by administering a questionnaire that also included questions on other health-related habits. The item on tobacco consumption was designed to include all possible situations in this regard, following the progressive pattern characteristic of the tobacco habit. A ‘Bogus Pipeline’ procedure was used for the questionnaire administration. First, the participants watched a video showing saliva samples being taken from a group of adolescents and subjected to a colorimetric test to detect whether the saliva sample came from a smoker or a non-smoker. Then, each participant was given a test tube and cotton wool, identical to the items seen in the video and were asked to place the cotton wool in their mouth while they began to complete the questionnaire. After 3 min, they were asked to place the cotton wool in the test tube and attach it to the questionnaire with adhesive tape. In reality, these samples were not analysed.

The questionnaire was anonymous, with the participants only writing their gender and date of birth to generate an identification code for subsequent analyses. The confidential and anonymous nature of the data gathered in the questionnaire was emphasized verbally to the participants and clearly stated in the header of the questionnaire. The item on tobacco consumption was placed at the end of the questionnaire on the grounds that emotional reactions to the question might be reduced by the time the adolescent reached it. Neither teachers nor the monitors of the groups were present when the questionnaire was administered by monitors from other groups or schools. It has been demonstrated that these measures increase the reliability of reports by young people on their tobacco consumption [17, 18].

Based on the 15 responses to the item on tobacco consumption, the participants were grouped into one of the following eight categories:

- **Non-smokers**: individuals who have never tried tobacco.
- **Non-repeat triers**: individuals who have taken a few draws or smoked a cigarette once or on very few occasions but have not smoked again.
- **Triers**: individuals who have taken a few draws or smoked a cigarette once or on very few occasions in the recent past (i.e. it cannot be ascertained whether or not they continue to smoke).
Sporadic smokers: individuals who smoke less than once a month.
Monthly smokers: individuals who smoke at least once a month, but who go for more than a week without a cigarette.
Weekly smokers: individuals who smoke at least once a week, but who go for more than a day without a cigarette.
Daily smokers: individuals who smoke at least one cigarette every day.
Former smokers: individuals who had smoked at least once a month but stopped the habit at least one month ago.

The questionnaire and these categories were validated in a previous study in which the self-reports of young people on smoking were compared with their salivary thiocyanate concentrations [19].

In the non-parametrical analysis (Mann–Whitney $U$ test), the ‘tobacco consumption’ variable was treated as an ordinal variable by excluding the data for participants classified as ‘former smokers’, who were very few in number (see Table I). We also decided not to analyse the effect of the program on participants who were smokers due to the small number of individuals in this category.

Results

Assessment of attrition bias
Over the course of the study, 23% of the participants were lost to the program (21.5% in the intervention group versus 23.6% in control group, $\chi^2 = 0.976$, $P > 0.05$), fulfilling the requirement for losses <30% [20, 21]. The absence of a significant difference in percentage loss between the groups supports the internal and external validity of the study.

The tobacco consumption rate was significantly lower in participants who completed the program than in those who abandoned it ($U = 12.219.50$, $P < 0.05$), consistent with findings reported in the majority of published studies. There was no significant gender difference among the participants lost to the program (50.5% males versus 49.5% females).

### Table I.

<table>
<thead>
<tr>
<th>Evaluations</th>
<th>Year 1 pre-intervention</th>
<th>Year 1 post-intervention</th>
<th>Year 2 pre-intervention</th>
<th>Year 2 post-intervention</th>
<th>Follow-up</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Experimental</td>
<td>Control</td>
<td>Experimental</td>
<td>Control</td>
<td>Control</td>
</tr>
<tr>
<td></td>
<td>(N = 482)</td>
<td>(N = 566)</td>
<td>(N = 462)</td>
<td>(N = 549)</td>
<td>(N = 499)</td>
</tr>
<tr>
<td>Non-smokers</td>
<td>76.2</td>
<td>79.8</td>
<td>62.3</td>
<td>77.4</td>
<td>62.5</td>
</tr>
<tr>
<td>Non-repeat triers</td>
<td>16.8</td>
<td>14.2</td>
<td>22.6</td>
<td>18.0</td>
<td>20.5</td>
</tr>
<tr>
<td>Triers</td>
<td>2.1</td>
<td>3.1</td>
<td>7.5</td>
<td>8.3</td>
<td>9.2</td>
</tr>
<tr>
<td>Sporadic</td>
<td>3.5</td>
<td>3.6</td>
<td>2.7</td>
<td>3.6</td>
<td>4.1</td>
</tr>
<tr>
<td>Monthly</td>
<td>0.7</td>
<td>0.4</td>
<td>0.7</td>
<td>0.8</td>
<td>0.8</td>
</tr>
<tr>
<td>Weekly</td>
<td>0.0</td>
<td>0.4</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>Daily</td>
<td>0.7</td>
<td>0.8</td>
<td>0.7</td>
<td>0.8</td>
<td>0.7</td>
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<tr>
<td>Former</td>
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<td>0.8</td>
<td>0.7</td>
<td>0.8</td>
<td>0.7</td>
</tr>
</tbody>
</table>
The data for 11 participants who joined the program after the start of its implementation were not included in the analysis.

**Adherence to implementation protocol**
A mean of 95% (SD = 0.3) of the program content was effectively addressed in the sessions according to the monitors’ self-reports and a mean of 88% (SD = 0.7) according to the research directors’ evaluations.

**Effects of the program**
Table I shows the self-reported tobacco consumption of the participants at the five evaluation time points. These results indicate that the program had no effect on their tobacco consumption. No significant difference in tobacco consumption rate between the intervention and control groups was observed at the end of the 2-year program (U = 119640.00, P > 0.05) or at the follow-up evaluation 1 year later (U = 10 163.50, P > 0.05).

This lack of effectiveness was corroborated by the results of the survival analysis. Two dimensions of smoking behavior were analysed: Lifetime (at least one draw of a cigarette on one occasion versus never smoked) and Current (at least one cigarette per month versus never smoked or former smoker). Given that participants within the same school (cluster) share common characteristics, their survival times may be correlated. A cluster design was adopted in our analysis because of this potential trend for children within the same school to have more similar ‘responses’ in comparison to those from different schools. In this situation, statistical methods to test the effect of treatment using independent survival data should modify the variance to accommodate potential intracluster correlations within and between treatment groups [22, 23]. The effects of clustering in survival data are frequently addressed by using frailty models, in which an unobserved random effect is shared by all members of a cluster [24], inducing dependence. Frailty models are extensions of the proportional hazards model, e.g. the Cox model [25]. In these models, the recurrent event times can be right-censored, as in the case of our analysis. Our model included a frailty factor shared by the subunits in the same cluster and a covariate (treatment indicator). We obtained P-values of 0.77 for Lifetime Smoking and 0.79 for Current Smoking for the covariate treatment, indicating that the program had no effect on the hazard function.

The equality of marginal survival distributions under the frailty model was tested by using a Wald-type statistic with the penalized log-likelihood procedure [23], which gave two-sided P-values of 0.1 (0.999) for Lifetime Smoking and 0.08 (0.997) for Current Smoking. These P-values indicate that there were no significant differences in survival distribution between the intervention and control groups.

A frailty model constructed with two covariates, program and sex, obtained P-values of 0.88 for Lifetime Smoking and 0.73 for Current Smoking, which also indicate that the program had a negligible effect.

Figures 2 and 3 depict the marginal survival functions of the two match types. The survival and frailtypack packages of the R v. 2.15.2 program were used for these analyses [26].

**Discussion**
In this study, a 2-year anti-tobacco preventive program with well-trained monitors who were not teachers proved ineffective in school students in the seventh and eighth grades. These results suggest that the poor results obtained by programs based on life skills training may not have been attributable to the short duration of the programs, to the lack of training of monitors or to the use of teachers in this role, as has been proposed.

The extended duration of our life skills training program and the large number of sessions may likely have been inadequate to achieve significant advances in the acquisition of the necessary skills by young people with the greatest needs and at highest risk of initiating the smoking habit. In our view, one reason for the failure of these programs may be the insufficient attention paid to a factor that could be
Critical in determining whether or not young people start to smoke, i.e. their interest in acquiring behavioral features that they associate with adults. The physical changes associated with puberty result in an abrupt body transformation. This metamorphosis faces pubescents with the major challenge of a rapid adjustment in behavioral patterns to ensure that they remain in keeping with their body morphology. One of the behaviors most clearly reserved for adults is the smoking habit. ‘Children don’t smoke’; therefore, smoking may appear to be a highly attractive option to an adolescent interested in incorporating traits associated with adulthood [27]. In the majority of preventive programs based on the Life Skills Training approach, the issue of smoking as a behavior associated with adulthood is only addressed by the activity on the overestimation of consumption by adults. This activity is indeed important, because it contests the view that smoking is a generalized behavior typical of adulthood. However, in our experience, this activity is highly challenging, given that many young people refuse to accept the truth about smoking prevalence among adults and do not believe the data presented to them. It is also possible that they do not understand the statistical concepts used (percentages, averages). In fact, we refrained from the use of percentages in the present program and only expressed data in absolute terms (e.g. ‘only 38 out of every 100 adults smoke on a daily basis’). We also included a session that familiarized them with the idea that we can sometimes hold mistaken beliefs and that our senses can play

Fig. 2. Kaplan–Meier curves for time to current smoking.
tricks on us in the evaluation of certain dimensions. Thus, to facilitate acceptance of the true prevalence of smoking among adults, we included activities related to the anchoring and adjustment heuristic [28], inducing the participants to overestimate sizes and distances and exposing them to striking optical illusions. Unfortunately, we did not evaluate whether these activities increased the participants’ recognition of the true prevalence of smoking among adults.

At any rate, even though young people may come to accept the validity of the data on adult tobacco consumption, it appears highly unlikely that this information in isolation would be sufficient to break the link between tobacco smoking and adulthood. Moreover, although the number of adults who smoke is much lower than the number estimated by young people, it remains relatively high. A more effective measure to disrupt the association between smoking and adulthood may be to reduce or eliminate images of adults smoking in the media (cinema and television) and to prevent smoking by adults in their immediate surroundings (teachers and parents). It would also be beneficial to expose young people to non-smoking adults who can provide attractive role models in the media and in the school setting.

The results of programs based on the Life Skills Training approach have been controversial, with some authors finding no preventive effects [29–32] and others reporting a positive impact [33–35]. However, questions have been raised about the statistical analysis conducted by Botvin and his team in the latter studies, and it has been suggested that the
effects of their programs were in fact negligible or non-existent [36–39]. Furthermore, their programs were always evaluated by the individuals responsible for their implementation, (usually teachers) and it is possible that the students may have been inclined to report their smoking habits in the direction they believed to be expected by the evaluators [40].

The present results suggest that the negative outcomes obtained by this type of program cannot be attributed to an excessively short duration of the intervention or to a lack of adherence to the implementation protocol. Nevertheless, despite the absence of a significant effect in our study, we consider that Life Skills Training programs should consider the need to ensure adherence to the procedure and the benefits of using adequately trained monitors who are not in the employ of the school.

Discrepancies among the results of different programs may also be attributable to the quality of their content. For our program, although pains were taken to carefully design each element in accordance with recommendations in the current literature (social skills training, training in problem solving, health education, etc.), the influence of this factor cannot be ruled out.

Interestingly, our results suggest that the contents of the program might have stimulated the participants’ curiosity to try smoking, although this experimentation did not result in an increase in regular smoking.

The Life Skills Approach may be useful for preventing an escalation of the levels of tobacco consumption or drugs of abuse. Although young people may often start smoking to emulate what they perceive to be adult behavior, they may continue with the smoking habit for other reasons, such as the reduction of stress, the evasion of depressive states of mind and, according to the level of consumption, the avoidance of nicotine withdrawal symptoms [41]. Hence, the acquisition of skills to address the sources of stress and encourage gratifying experiences may prevent young people from escalating their tobacco consumption to levels associated with physical addiction to nicotine. However, as stated above, to ensure that a benefit is obtained by the young people with the lowest levels of these skills (i.e. those theoretically at greatest risk of reaching harmful consumption levels), the programs should be implemented over prolonged time periods in a highly intensive manner, focusing on individuals within programs applied in a group setting. This intensive intervention would centre on the acquisition of general skills in sessions that are not specifically directed at smoking.

The usefulness of this proposed approach requires empirical confirmation and could form the basis of future research.

The main study weakness was the absence of any evaluation of the effect of the program on the skills it was designed to improve, precluding any conclusion in this respect.

Funding

Universidad de Granada.

Conflict of interest statement

None declared.

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6. Johnson KW, Shambien SR, Ogilvie KA et al. Preventing youths’ use of inhalants and other harmful legal products


