



# Role of smoking intention in tobacco use reduction: A mediation analysis of an effective classroom-based prevention/cessation intervention for adolescents<sup>☆</sup>

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## HIGHLIGHTS

- We test smoking intention as a mediator of a tobacco use cessation program.
- Is the first Spanish study that explored intention as a mediator of Project EX
- Project EX had a significant effect on smoking intention.
- Indirect effects indicated that Project EX reduced tobacco consumption.

## ARTICLE INFO

**Keywords:**  
Intention  
Project EX  
Tobacco  
Adolescents  
Mediation analysis

## ABSTRACT

**Introduction:** Although some school-based tobacco cessation and prevention programs have been proven to be effective, there remains a lack of understanding of how these programs succeed.

**Methods:** This longitudinal study aimed to test smoking intention as a mediator of Project EX's intervention efficacy to reduce tobacco use. Using a computerized random number generator, six high schools located in the Mediterranean coast were randomly selected to participate in the program condition (Spanish version of Project EX) or the waiting-list control group with baseline, immediate-posttest, and 12-month follow-up assessments. At baseline, 685 adolescents aged 14–20 years (mean age: 14.87; *SD* = 0.92; 47.4% were females) were evaluated using self-administered tests of tobacco, and smoking intention. A biomarker of smoke inhalation, a measurement of exhaled carbon monoxide (ECM), was used. Mediation analyses were conducted using the PROCESS v2.12 macro for Windows.

**Results:** Project EX had a significant effect on smoking intention. Indirect effects indicated that Project EX reduced the ECM level, and number of cigarettes used. **Conclusions:** This is the first Spanish study that explored intention as a mediator of the long-term efficacy of Project EX to reduce tobacco use in adolescents. Results suggested that interventions that reduce consumption intention at short-term are more likely to be successful in decreasing tobacco use in the long-term.

## 1. Introduction

Drug use is a public health problem in developed countries and is one of the leading causes that disturb coexistence in families and society (Rodríguez-Puente et al., 2016). The World Health Organization (WHO, 2014) reported that approximately 320,000 young people aged 15–29 years died from alcohol-related causes, and tobacco consumption is the leading preventive cause of early death. The latest national survey on drug use among secondary school students in Spain (Spanish Drugs

Observatory, 2016a) revealed that 76.8% of students aged 14–18 years have consumed alcohol in the previous year (68.2% in the previous month), 31.4% have smoked tobacco (25.9% in the previous month), and 25.4% have used cannabis (18.6% in the previous month). It is estimated that 40% of Spanish adolescents have consumed two or more substances in the last year (Spanish Drugs Observatory, 2016b). This tendency, known as “polydrug use,” is associated with increased risks for health and psychosocial development, compared to the use of a single substance (McKelvey, Ramo, Delucchi, & Rubinstein, 2017;

<sup>☆</sup> This research was supported by the Spanish Department of Economy and Competitiveness (PSI2011-26819).

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Míguez & Becoña, 2015).

Motivations that lead adolescents to consume substances are diverse and include the interaction of genetic and environmental factors (Cogollo-Milanés & de La Hoz-Restrepo, 2010). Low-risk perception, sensation seeking, and peer acceptance facilitate adolescent risk behaviors (Latorre, Cámara, & García, 2014). From a social psychology perspective, behavioral intentions have had, and continue to have, a profound weight in predicting and explaining health behaviors. The theory of planned action (TPA) proposed by Ajzen (1991) has been used in several areas with success and offers an excellent predictive capacity in relation to drug use. The TPA postulates that drug consumption is predicted directly by the intention to use drugs. Attitudes, subjective norms, and perceived behavioral control are precursors of this intention. According to a study by Morell-Gomis, Irlés, and León (2017) with Spanish adolescents aged 15–18 years, the stronger the intention to use drugs, the more likely that behavior will be performed, as Currently, there are several programs for prevention and cessation of substance use for adolescents. Project EX (Sussman et al., 2004) is the only empirically-validated, school-based smoking-cessation intervention for adolescents in Spain. Project EX has proven to be effective in reducing tobacco consumption in adolescents aged 13–19 years (Espada, González, Guillén-Riquelme, Sun, & Sussman, 2014; Espada, González, Orgilés, & Sussman, 2016). A significantly higher 30-day intent-to-treat rate was found for adolescents who attended the program compared to an equivalent control group.

Project EX has shown substantial evidence of efficacy for quitting smoking among adolescents from the U.S. (Sussman, 2012; Sussman et al., 2004; Sussman, Dent, & Lichtman, 2001), Russia (Idrisov et al., 2013), China (Zheng et al., 2004), Thailand (Chansastitporn et al., 2016), and Spain (Espada et al., 2014; Espada, González, Orgilés, Morales, & Sussman, 2016). However, mechanisms that are underlying this intervention's effects are barely known. Mediation analysis is especially useful to learn how interventions work by identifying the variables that have the greatest influence on efficacy, and what other variables are relevant to achieve the goal of the intervention (MacKinnon, 2008). For example, McCuller, Sussman, Wapner, Dent, and Weiss (2006) analyzed the role of motivation to quit as a mediator variable of Project EX. Compared to a control group, adolescents who received the program were more likely to exhibit greater motivation to quit tobacco use, and were more likely to quit smoking. The authors concluded that motivation is a plausible mediator of the cessation program's efficacy. Bricker et al. (2010) examined whether the outcomes of a smoking cessation intervention trial, with a large sample of adolescents, were mediated by social cognitive theory processes, and concluded that self-efficacy to resist smoking is a possible mediator of the intervention's effect on smoking cessation. More recently, González, Espada, Orgilés, Morales, and Sussman (2016) tested nicotine dependence as a mediator of Project EX's effect. The program indirectly decreased the tobacco consumption at the 12-month follow-up through decreasing the level of nicotine dependency in the short-term.

Motivation, self-efficacy, and nicotine dependence have proven to be mediators of the efficacy of Project EX to reduce and quit smoking. However, more evidence is needed on what mechanisms are underlying this intervention's effects in the long-term. Since Project EX is a smoking cessation program, its efficacy has been explored in terms of tobacco measures. The objective of the current study was to analyze intention to smoke in the future as a mediator of Project EX's intervention efficacy to reduce tobacco consumption in Spanish adolescents. In accordance with the TPB, intention was a predictor of drug consumption. Based on this theoretical model, we hypothesized that the participation in the program will decrease intention to smoke in the future compared to the control group. Likewise, intention to smoke in the future would mediate the effect of Project EX on self-reported and biological measures of tobacco cessation in the long-term. Previous studies revealed that if the motivation to quit smoking increased, there would be a temporary reduction in dependence on nicotine, or if self-efficacy to resist smoking

in stressful situations was relatively high, young smokers would be more likely to quit smoking in teen cessation programs. In the present classroom/cessation program, we examined whether the program facilitates change on deciding not to smoke. This variable is separate from affect-laden variables as were the previously targeted mediators. The results of this study provided more evidence of the mechanisms underlying the long-term efficacy of Project EX to lead adolescents to quit smoking.

## 2. Methods

### 2.1. Participants

Previously collected sample of schools and students was used to this study (Espada, González, Orgilés, Morales, & Sussman, 2016; González, Espada, Orgilés, Soto, & Sussman, 2015). The sample comprised 685 smoker adolescents aged 14 to 20 years ( $M = 14.87$ ;  $SD = 0.92$ ; 47.4% were females) at baseline. Participants were high school students recruited from six centers in the province of Alicante (Spain). Schools were randomly assigned to the intervention condition ( $n = 351$ ) and control group ( $n = 334$ ). Most participants were Spanish (91.8%) and the remaining hailed from other countries, including Morocco (2%), Ecuador (1.5%), Colombia (0.9%), Romania (0.9%). Middle socioeconomic status was predominant. Participants were living with both parents in most cases (81.1%), while 10.29% were living with their mothers in the baseline assessment (Table 2).

In the baseline questionnaire, the experimental conditions were equivalent in terms of the sociodemographic variables, and the primary outcomes were analyzed, except for the self-reported number of daily cigarettes ( $p = .003$ ), number of cigarettes smoked within the last seven days ( $p = .008$ ), and number of cigarettes smoked in the last month ( $p = .016$ ). However, no differences were found between the groups in the biological measure consisting of ECM (CO) level. Differences between both experimental conditions were controlled in the analyses.

### 2.2. Measures

Participants were evaluated at pretest, posttest, and 12-month follow-up using paper-and-pencil questionnaires. Demographic variables included gender, age (years), nationality (born in Spain, or immigrated to Spain from another country), and current living situation.

Smoking behavior was assessed with fill-in-the-blank items asking, "How many cigarettes have you smoked in the last week (7 days)?" and "How many cigarettes have you smoked in the last month (30 days)?" The assessment-day smoking behavior was measured with the item: "Did you smoked today?". To assess smoking intention (Fagan et al., 2007) students were assessed with the question "How likely is it that you will smoke cigarettes in the next 12 months?" with response categories measured on a five-point Likert scale format (1 = Definitely not, 2 = Probably not, 3 = A little likely, 4 = Somewhat likely, and 5 = Very likely). High scores on this scale imply higher consumption risk. Expired CO was assessed using a breath CO monitor to validate self-reported assessment-day smoking (Micro + Smokerlyzer; Bedfont Technical Instruments, Kent, UK, <http://www.bedfont.com/ch/smokerlyzer/micro>, accessed October 19, 2017) at pretest, posttest, and follow-up evaluations. The cut-off points established between 1 and 4 h after smoking are: for smokers 10 or more CO ppm, for sporadic smokers between 6 and 10 ppm of CO, and for non-smokers less of 6 CO ppm.

### 2.3. Intervention

The Project EX curriculum is closely adapted from the original program developed in the United States (Sun, Miyano, Rohrbach, Dent, & Sussman, 2007; Sussman et al., 2001). The learning activities included strategies to quit smoking and learning skills for non-smoking

**Table 1**  
Project EX sessions and objectives.

Session name	Contents
Orientation	<ul style="list-style-type: none"> <li>Imparts the ground rules for the group and discusses reasons for quitting tobacco</li> </ul>
Tobacco affects your life	<ul style="list-style-type: none"> <li>Discusses how tobacco use can cause, rather than relieve stress</li> </ul>
Health dangers of tobacco use	<ul style="list-style-type: none"> <li>Discusses the harmful substances in tobacco and how it can injure one's body</li> </ul>
Quitting step 1-Making a commitment about not using tobacco	<ul style="list-style-type: none"> <li>Discusses addiction to tobacco. Methods of quitting smoking, and physical and psychological aspects of withdrawal are discussed</li> </ul>
Quitting step 2-Managing withdrawal symptoms	<ul style="list-style-type: none"> <li>Discusses more about nicotine, addiction, and strategies of avoiding addiction or managing withdrawal symptoms. Psychological coping includes self-forgiveness and avoiding false expectations regarding how quitting will and will not affect one's life</li> </ul>
Taking care of healthy body	<ul style="list-style-type: none"> <li>Involves learning lifestyle balance strategies, including weight control and practicing a "yoga activity"</li> </ul>
Taking care of your piece of mind	<ul style="list-style-type: none"> <li>Involves learning more coping strategies, including assertiveness training and anger management. Participants also learn the "lefting feelings pass" mediation activity.</li> </ul>
Not smoking again: commitment and avoiding relapse	<ul style="list-style-type: none"> <li>Involves learning means to avoid using tobacco, and mentions how topics covered could be applicable to other substances</li> </ul>

**Table 2**  
Baseline characteristics and reports of substance use measures at 12-month follow-up of participating Spanish adolescents by experimental condition.

Characteristics	EG (n = 351)	CG (n = 334)	Total (N = 685)	Test statistics <sup>a</sup>
No. (%) female	172 (52.9)	153 (47.1)	325 (47.4)	0.70
Mean Age (years) (SD)	14.84 (0.83)	14.90 (1)	14.87 (0.92)	0.85
Nationality				
Spanish	316 (90)	313 (93.7)	629 (91.8)	3.09
Other	35 (10)	21 (6.3)	56 (8.2)	
Live with... (%)				
Both parents	289 (82.8)	262 (79.4)	551 (81.1)	2.26
Mother	35 (10)	34 (10.3)	69 (10.29)	
Father	3 (0.9)	5 (1.5)	8 (1.2)	
Mother or father for sometime	19 (5)	25 (7.6)	44 (6.5)	
Other people	3 (0.9)	4 (1.2)	7 (1)	
Age of first cigarette smoked	13.30 (2.26)	12.87 (2.60)	13.06 (2.46)	-1.13

SD = Standard Deviation; EG = Experimental group; CG = control group.  
<sup>a</sup> Significance tested using t-test for continuous variables and  $\chi^2$  test for categorical variables.

maintenance, with an interactive methodology based on motivation. The methodology of Project EX in Spain can be found in Espada et al. (2014); Sussman, Miyano, Rohrbach, Dent, and Sun (2007); and Sussman, Miyano, Rohrbach, Dent, and Sun (2010). The sessions and the objectives of the program are shown in Table 1.

**2.4. Procedure**

Two translators were responsible for the translation of the original version of the Project EX program content to Spanish. In addition to language adaptations, some changes were made in the Project EX program to adapt it to Spanish culture.

We contacted a convenience sample of 45 schools from 17 towns in the province of Alicante in the southeast coast of Spain. After a first meeting with the school boards to present the objectives of the intervention, a total of six high schools from three cities [Elche (n = 4), Crevillente (n = 1), and San Vicente (n = 1)] agreed to participate. The reasons for non-recruitment were no response (72%), responded back to us after a first meeting with a statement of no interest (18%) and inability to be able to implement the study during the school day (10%). The schools recruited were randomly assigned to one of two experimental conditions: treatment or standard care (control). More details of the study can be found in Espada et al. (2014); González et al. (2015); and González, Espada, Orgilés, and Sussman (2017).

The intervention was controlled so that it was carried out in accordance with previous training that the implementers received

(described in Espada et al., 2014).

**2.4.1. Statistical analyses**

Descriptive and attrition analyses were conducted using SPSS v.25, and mediation analyses were carried out using SPSS PROCESS v.3 macro (Hayes, 2013). The analyses were run with whole sample (N = 685) in order to use an intention-to-treat approach, that consists of analyzing data from all participants randomized to treatment, regardless of their level of treatment received or protocol adherence (Gupta, 2011; Kruse et al., 2002). We analyzed potential sampling biases associated with attrition at the posttest and at the 12-month follow-up across experimental conditions (external invalidity) and as a function of condition (internal invalidity) by comparing the sample that dropped out at the posttest and at 12-month follow-up and the participants that were retained in the study in each assessment. Predictors included age, gender, nationality (e.g., Spanish or not), current living situation, smoking intention, number of cigarettes smoked in the last month, and ECM level.

In the current study mediation depended on the extent to which Project EX (X) (compared to the control group) reduces the intention to smoke in the future in the posttest (M) and the extent to which this effect reduces biological tobacco measures (Y) at 12-month post-implementation. The generic model of mediation (number 4) proposed by Hayes (2013) was used, as shown in Fig. 1. Experimental condition (dummy variable: experimental or control group) was set as the predictor (X). Independent models were calculated for each primary outcome (Y) in the 12-month follow-up: ECM level (model 1), number of daily cigarettes (model 2), number of cigarettes smoked within the last seven days (model 3), and number of cigarettes smoked in the last month (model 4). Analyses were controlled for gender, age, school, and baseline measures. We used bootstrapping (5000 samples) method, a powerful technique highly recommended when samples are small and an absence of non-normality (Hayes, 2013). Changes in smoking intention (posttest measure) were assigned as the mediator (M) in all four models. The process involved the following steps: 1) we initially tested the effect of the intervention (compared to the control group) on the intention to smoke in the future at the posttest (Path  $\alpha$ ); 2) effect of intention to smoke in the future at posttest (M) on each primary outcome (Y) at the 12-month post-intervention was analyzed (Path  $\beta$ ), and 3) we finally examined whether intention to smoke in the future mediated the effect of Project EX on smoking cessation at 12-month follow-up. Mediation effects (also called indirect effect) were estimated as a product of regression weight linking X-Y through M, following Hayes (2013). The product of coefficient approach was applied, as recommended by Preacher and Hayes (2008). Significant mediation effects were considered when confidence interval (CI) for indirect effects do not include zero. Significant criterion was  $p \leq .05$ .

**Table 3** Self-report of tobacco and smoking intention (as mediator) by experimental condition and assessment period.

	Baseline			Posttest			12-month Follow-up			
	EG (N = 351)	CG (N = 334)	T <sub>test</sub> <sup>a</sup>	EG (N = 286)	CG (N = 301)	T <sub>test</sub>	EG (N = 350)	CG (N = 333)	T <sub>test</sub>	d
			d			d				
Potential mediator mean ( ± ) SD	1.34 (0.88)	1.54 (1.11)	-2.57*	1.26 (0.78)	1.43 (1.01)	-2.19*	1.35 (0.90)	1.75 (1.29)	-4.66***	0.35
Smoking intention										
Outcomes mean ( ± ) SD										
Exhaled carbon monoxide (CO) level (0–20) <sup>b</sup>	1.48 (0.78)	1.65 (1.91)	-1.59	1.41 (1.05)	1.74 (1.73)	-2.77**	1.20 (0.84)	1.25 (1.39)	-0.55	0.04
Number of daily cigarettes	0.16 (0.99)	0.59 (2.30)	-3.15**	0.11 (0.84)	0.89 (6.24)	-2.10*	0.22 (1.21)	0.76 (2.85)	-3.14**	0.24
Number of cigarettes smoked within the last 7 days	0.82 (4.90)	3 (13.73)	-2.77**	0.69 (6.05)	5.10 (42.53)	-1.73	1.45 (7.06)	4.90 (19.13)	-3.09**	0.23
Number of cigarettes smoked in the last month	0.24 (1.17)	0.76 (3.66)	-2.81**	0.16 (0.98)	0.70 (2.37)	-2.68**	0.39 (1.73)	0.88 (2.62)	-3.31**	0.22

EG = Experimental group; CG = control group.  
SD = Standard Deviation.

\*  $p < .05$ .

\*\*  $p < .01$ .

\*\*\*  $p < .001$ .

<sup>a</sup> Significance tested using t-test for continuous variables and  $\chi^2$  test for categorical.

<sup>b</sup> Scores on exhaled carbon monoxide (CO) ranged from 0 to 20 at baseline, from 0 to 19 at posttest and from 0 to 11 at 12-month follow-up.

### 3. Results

#### 3.1. Attrition

External validity analyses indicated that there were differences in age and smoking intention between those who dropped out and those who were retained in the posttest. Compared to participants that dropped out, those who were retained in the posttest were slightly younger ( $OR = 0.69$ ,  $CI = 0.54, 0.88$ ) and less likely to smoke in the future ( $OR = 0.73$ ,  $CI = 0.60, 0.90$ ). Differences in these variables were controlled in the analysis. There were no differences in age, gender, smoking intention, and ECM level among adolescents who were retained in the 12-month follow-up and those who were not.

Internal validity analyses indicated that 14.3% of the participants in the pretest were not evaluated in the posttest assessment. A higher proportion of participants in the experimental condition dropped out compared to the control group (experimental = 18.9% vs. control = 9.9%;  $\chi^2 = 10.41$ ;  $p = .001$ ) in the posttest. At 12-month follow-up, only 0.3% of the participants in the baseline were not evaluated. No differences were found in the proportion of participants that dropped out in the 12-month follow-up between both experimental conditions ( $\chi^2 = 0.001$ ;  $p = .97$ ).

#### 3.2. Baseline equivalence

Table 3 shows the means and standard deviations of the smoking intention in the future and primary outcomes, and comparison across experimental conditions in each assessment: pretest, posttest, and 12-month follow-up. At baseline, differences between experimental conditions were found in self-reported tobacco measures and smoking intention in the future, except for the objective tobacco measure (CO). In particular, adolescents assigned to the control group reported to smoke more cigarettes daily, within the last 7 days and last month compared to the intervention group. Cohen's *d* effect sizes were small and these differences were controlled in the analyses.

#### 3.3. Mediation

In Table 4, Path  $\alpha$  indicates that the intervention had a significant effect on intention to smoke in the future (M) in the posttest compared to the control group. In the posttest, adolescents who received the intervention were more likely to present lower intention to smoke in the future compared to those who were assigned to the control group. Effect sizes were moderate and similar in all models.

As Path  $\beta$  shows, statistically significant relationships between intention to smoke in the future (M) and primary outcomes (Y) evaluated in the 12-month follow-up were identified ( $p \leq .0001$ ) (Table 4). Adolescents who reported lower intention to smoke in the future in the posttest were more likely to present lower ECM level and report lower tobacco consumption in terms of number of daily cigarettes, number of cigarettes smoked within the last seven days and number of cigarettes smoked in the last month. Effect sizes were moderate for all models. Model 3 (number of cigarettes smoked within the last 7 days) had the highest coefficient, which suggests that the reduction in smoking intention in the future has a greater impact in decreasing the number of cigarettes smoked within the last 7 days compared to the rest of smoking measures. Effect sizes were higher in the models that included as a main outcome the number of cigarettes in a set period of time (number of cigarettes smoked within the last 7 days and number of cigarettes smoked in the last month), while they were lower when including more specific and/or objective tobacco measures (exhaled carbon monoxide (CO) level and number of daily cigarettes).

Indirect effects indicated that the intervention reduced the ECM level ( $ACI = -0.50, -0.09$ ), number of daily cigarettes ( $ACI = -0.127, -0.20$ ), number of cigarettes smoked within the last seven days ( $ACI = -9.28, -1.39$ ), number of cigarettes smoked in the



**Table 4**  
Smoking intention as mediator of the effect of Project EX, compared with a control group, on tobacco by the 12-month follow-up in Spanish adolescents.

Main outcome (Y)	Effect of the intervention (X) on the smoking intention (M) <sup>a</sup>			Effect of smoking intention as a mediator (M) on the main outcome (Y) <sup>b</sup>			Indirect effect of smoking intention as the mediator on the main outcome (Y)
	$\alpha$ Path (SE)	95% CI	p-Value	$\beta$ Path (SE)	95% CI	p-Value	
Model 1	-0.64 (0.19)	-1.03, -0.25	0.001	0.39 (0.04)	0.29, 0.48	< 0.0001	-0.25 [-0.50, -0.09]
Model 2	-0.63 (0.20)	-1.03, -0.23	0.001	0.91 (0.09)	0.72, 1.09	< 0.0001	-0.57 [-0.127, -0.20]
Model 3	-0.64 (0.20)	-1.03, -0.24	0.001	6.42 (0.58)	5.28, 7.56	< 0.0001	-4.12 [-9.28, -1.39]
Model 4	-0.58 (0.19)	-0.96, -0.21	0.002	1.22 (0.09)	1.04, 1.40	< 0.0001	-0.72 [-1.44, -0.27]

The mediation analyses were adjusted for baseline differences between Project EX and the control group, gender, age, baseline value of the mediator and school. Model 1: Main outcome (Y) = Exhaled carbon monoxide (CO) level.

Model 2: Main outcome (Y) = Number of daily cigarettes.

Model 3: Main outcome (Y) = Number of cigarettes smoked within the last 7 days.

Model 4: Main outcome (Y) = Number of cigarettes smoked in the last month.

<sup>a</sup> The  $\alpha$  path is the Project EX's effect on the potential mediator (smoking intention).

<sup>b</sup> The  $\beta$  path is the effect of smoking intention as mediator on the main outcome (Y).

<sup>c</sup> Ind = X - M1 - Y.

<sup>d</sup> Asymmetric Confidence Interval based on Bootstrap method with 5000 replicates.

last month (ACI = -1.44, -0.27), at the 12-month post-intervention indirectly through reducing intention to smoke in the future in the posttest (Table 4). Effect sizes ranged from lower to higher as follows: exhaled carbon monoxide (CO) (model 1), number of daily cigarettes (model 2), number of cigarettes smoked in the last month (model 4) and number of cigarettes smoked within the last 7 days (model 3). Results showed that the intention to smoke in the future is a significant mediator of the effects of Project EX to decrease tobacco consumption in the 12-month follow-up. However, it is important to highlight that its effect is higher when the tobacco measure consisted in reporting the number of cigarettes in a set amount of time (within last 7 days or last one month) compared to more specific and/or objective tobacco measures (exhaled carbon monoxide (CO) and number of daily cigarettes).

#### 4. Discussion

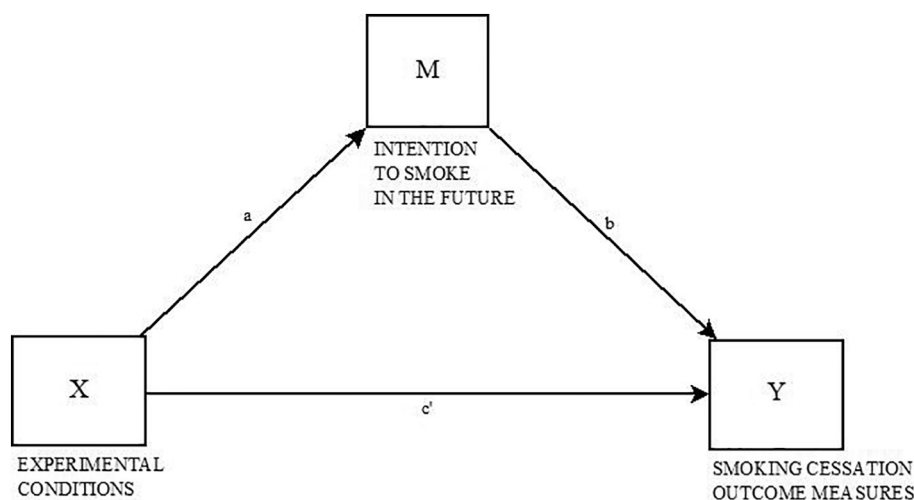
The current study aimed at analyzing intention to smoke in the future as a mediator of Project EX's intervention efficacy to reduce tobacco consumption in the long-term in a sample of Spanish smoker adolescents. Results confirmed that reducing intention to smoke in the future significantly mediates the efficacy of Project EX to reduce tobacco in the long-term. Previous studies that evaluated the efficacy of Project EX in reducing tobacco consumption found similar results in the short-term and in the 12-month assessments (Espada et al., 2015; Espada, González, Orgilés, Morales, & Sussman, 2016).

Several reviews have focused on the efficacy of smoking cessation

and prevention actions targeting adolescents (Grimshaw & Stanton, 2006; Sussman & Sun, 2009; Sussman, Sun, & Dent, 2006; Thomas, McLellan, & Perera, 2013, 2015); however, very few studies have evaluated the efficacy of smoking cessation programs in adolescents (compared to adults); and only 25% of these studies have been conducted outside the United States (Sussman, 2012). While some tobacco use-related prevention programs have been evaluated in Spain (Espada, Orgilés, Méndez, García-Fernández, & Inglés, 2008), only Project EX has been well evaluated for its prevention and cessation effects in the short- and long-term (Espada et al., 2015; González et al., 2015).

Findings indicated that Project EX reduced intention to smoke in the future in smoker adolescents who received the intervention compared to the control group in the posttest. Adolescents who reported lower smoking intention in the posttest were more likely to report a lower number of daily cigarettes and lower number of cigarettes smoked within the last seven days and the last month. An objective measure of tobacco consumption (level of ECM) was consistent with self-reported measures. Consistent with the TPB (Ajzen, 1991), intention to engage in health behaviors (e.g., non-smoking intention) was significantly related to engaging in healthier behaviors in the long-term (e.g., non-smoking). Furthermore, these results support other studies that have confirmed that TPB has a proven predictive capacity in relation to addictions (Rodríguez-Kuri, Díaz-Negrete, Gracia-Gutiérrez de Velasco, Guerrero-Huesca, & Gómez-Maqueo, 2007; Sáiz, 2009; Topa & Moriano, 2010).

Results of the current study have vital implications for smoking cessation in adolescents. A new mediator of the efficacy of an evidence-



**Fig. 1.** Path diagram of the effect of the intervention on smoking cessation outcome measures at 12-month follow-up (Time 3) via intention to smoke in the future (Time 2), after controlling for baseline differences, gender, age, and school.

X: Independent variable. Y: Dependent variable. M: Mediator. a, b, c: Regression coefficients. The 95% CIs for indirect effects were obtained by bootstrapping with 5000 resamples.

based tobacco cessation program was found. This describes mechanisms that are underlying the success of Project EX across countries and complements previous research that identified motivation to quit smoking (McCuller et al., 2006) and nicotine dependence (González et al., 2016) as mediators of Project EX's efficacy.

The present study has at least three strengths. The longitudinal design (including 12-month follow-up) is an important strength, since there is a lack of this type of study in prevention and intervention science. A considerable sample size was used to explore mechanisms that are underlying Project EX's efficacy in the long-term. A biological measure was used, rather than only self-report measures, and provides a more direct indicator of tobacco consumption in this population. Nevertheless, the present study has some limitations. First, although the study involved a large sample, participants were not recruited from a varied geographical origin. It is necessary to expand this study to other regions of the country in order to generalize the results. Second, it is essential to keep in mind that mediation does not imply causality. Baseline differences between experimental and control conditions were controlled in all analyses, the lack of balance (despite randomization) for smoking intention and some main outcomes might have influenced the findings of this study. A higher percentage of participants were lost from the experimental condition compared with the control group, which could have reduced the statistical power of tests of the analysis. Consequently, the results should be interpreted with caution. According to a previous study (García, Pintor, Vázquez, & Álvarez-Zumarraga, 2013), the sample size was determined by the capacity with available funding to implement the trial.

In short, reducing intention to smoke in the future was an important mediator of the efficacy of Project EX to reduce tobacco consumption after 12 months. Based on the findings of the current study, all efforts should be directed at strengthening activities that reduce smoking intention (such as making a commitment about not using tobacco) in the short-term since a positive impact is sufficient to reduce tobacco in the long-term. Future studies should test more complex models to provide a better understanding of the mechanisms underlying the efficacy of tobacco cessation programs. More evidence of the effects of tobacco cessation programs on drugs consumption (not only tobacco) in the long-term is needed to improve drug prevention and treatment initiatives and evaluate them in terms of cost-effectiveness.

## Role of funding sources

This study was supported by the Spanish Department of Economy and Competitiveness (PSI2011-26819).

## Contributors

All authors contributed to the writing and data analysis processes during the preparation of this manuscript.

All authors have read and approved of this manuscript.

## Conflict of interest

There are no conflicts of interest to report.

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