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UNDERSTANDING HOW A SMOKING CESSATION INTERVENTION CHANGES BELIEFS, SELF-EFFICACY AND INTENTION TO QUIT. A SECONDARY ANALYSIS OF A PRAGMATIC RANDOMIZED CONTROLLED TRIAL

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Comments to the editor: This report complements our previous paper published in Addiction "Intervention study for smoking cessation in Spanish college students: pragmatic randomized controlled trial" (1). The current paper aims to understand how and why the intervention was effective, and focusses on the most relevant intermediate outcomes of the process of quitting: changes in self-efficacy, beliefs and intention to stop smoking. These three variables were chosen because they are identified as proximal intrapersonal determinants of complex behavior changes in young adult and tobacco use, being essential predictors of initiation or quitting in adolescents and young adults. Thereby, this study provides further understanding of how and why a multi-component intervention based on the Theory of Triadic Influence, tailored to the college student,

was effective in increasing smoking cessation among college students (smoking cessation incidence was 21.1% in the intervention group compared with 6.6%).

References:

1. Pardavila-Belio MI, García-Vivar C, Pimenta AM, Canga-Armayor A, Pueyo-Garrigues S, Canga-Armayor N. Intervention study for smoking cessation in Spanish college students: pragmatic randomized controlled trial. Addiction 2015; 110(10):1676-83. doi: 10.1111/add.13009. Epub 2015 Jul 2.

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ABSTRACT

Background: Although beliefs, self-efficacy and intention to quit have been identified as proximal predictors of initiation or quitting in young adults, few studies have studied how these variables change after a smoking cessation intervention.

Purpose: To evaluate the changes in the beliefs, self-efficacy and intention to avoid smoking, and determine if these are potential mediators in quitting, following a smoking cessation intervention, aimed at tobacco-dependent college students.

Design: Single-blind, pragmatic randomized controlled trial with a 6-month follow-up.

Method: A total of 255 smoker students were recruited from September 2013 to February 2014. Participants were randomly assigned to intervention group (n=133) or to control group (n=122). The students in the intervention group received a multi-component intervention based on the Theory of Triadic Influence. The strategies of this program consisted of a 50-minute motivational interview conducted by a nurse and online self-help material. The follow-up included a reinforcing e-mail and group therapy. The smoking-related Self-efficacy, Belief and Intention scale was used to assess outcomes.

Results: Intention to quit smoking is partial moderator explaining 36.2% of the total effects in smoking cessation incidence. At 6-month follow-up, the differences in the mean scores of self-efficacy and intention related to stopping smoking were significantly higher in the intervention than in the control group.

Conclusions: A multicomponent intervention based on the Theory of Triadic Influence, tailored to college students positively increased the self-efficacy to avoid smoking, and the intention to quit, suggesting intention as potential mediator of quitting.

Key words: Cessation program; Self-efficacy; Beliefs; Intention; Quitting; College student.

INTRODUCTION

The Organization for Economic Co-operation and Development (OECD) showed that 36% of young adults are expected to graduate from higher education at least once before reaching the age of 30 [1]. In Spain, approximately a million and a half students are enrolled in universities [2], representing 26% of the young adult population [3]. Cigarette smoking among college students is a matter of particular concern because their smoking prevalence (34.9%) [4] is higher than that of the non-college young adults (27.7%) [5]. Several studies characterize college as a period of smoking transitions, including smoking initiation and smoking consolidation [6-8]. Although most college students believe that they are going to stop smoking before 30 or upon becoming parents [9-10], 30% of them will have difficulty in quitting and will remain addicted for decades [11].

Assisting college students to quit tobacco is an important public health goal. In order to provide effective assistance for smoking cessation, programs must be adapted to student characteristics, such as their belief that tobacco use has positive effects on their health (e.g. stress relief) [12-13]; in addition, the different factors that influence successful quitting among this population must be determined [14-15].

Bully et al [16] suggest that the intervention strategies must be based on behavioral change theories. Thereby the researchers and practitioners can understand how and why the smoking cessation programs succeed or fail. In this study, our intervention was based on the Theory of Triadic Influence (TTI). This theory, based on more than 20 years of research, integrates variables and processes from sociological and psychological theories, giving rise to a meta-theory that describes and explains the aspects that influence the acquisition of certain behaviors, thus offering an ecological approach to change [17-18]. Furthermore, the theory has been validated in young

smokers [18], and is considered as the most relevant theory to understand both onset and cessation of smoking [19].

The TTI [18-19] suggested that tobacco use is motivated by three sets of factors: personal aspects such as motivation, self-concept and self-efficacy; an interpersonal-social aspect such as social normative beliefs; and a cultural-environmental aspect such as attitudes towards tobacco. These sets of factors exert an influence on the intentions and decisions related to tobacco [18]. Moreover, previous research has tested that the principal mediators in TTI are the self-efficacy (the ability to avoid smoking in tempting situations) and beliefs (such as the social and emotional expectation of smoking), and these directly influence the intentions to begin or quit smoking [18-20].

The main results of our study showed that a multi-component intervention based on TTI, tailored to the college student was effective in increasing smoking cessation among college students [21]. The result of the intervention was very promising; the biochemically validated smoking cessation (according to urine cotinine) incidence was 21.1% in the intervention group compared with 6.6% in the control group. To fully understand how the intervention worked, it is important to further explore its impact on the behavioral change components described above [22]. We hypothesize that the effect of a complex intervention, such as tobacco cessation depends on self-efficacy, beliefs, and intention to quit. Firstly, in order to determine if these factors exerted any influence on smoking cessation incidence we explore the total effect in quitting explained by them. Secondly, this study focused on evaluating the changes in self-efficacy, beliefs and intention to stop smoking, after a smoking cessation intervention aimed at college student smokers.

RESEARCH DESIGN AND METHODS

Research design

This was a single-blind, pragmatic randomized controlled trial. In this study, participants were randomly assigned to intervention or control groups using a computer-generated allocation

method. More details are described elsewhere [21].

Study population

This study was conducted on two different campuses of the University of Navarra, located in two urban cities in northern Spain. The study aimed to recruit students smoking at the time but was advertised among the whole undergraduate and masters student population (n=8,050) for the academic year 2013-14, as a register of current smokers does not exist.

Recruitment

An informative session was held in each of the schools where the trial was to take place, informing the dean regarding the purpose and design of the study.

The recruitment period was from September 2013 through February 2014. During this period all undergraduate or masters students were sent an email, inviting them to participate in the study. A member of the research team explained the study to students in all classes of each program. In addition, information booths manned by the investigators were set up on each university campus. Furthermore, the study was advertised on the university's signboard, newspaper and website. The strategy to increase success in recruiting candidates for the study is described in detail elsewhere [21].

Inclusion and exclusion criteria

The inclusion criterion was being an undergraduate or masters' student, aged 18–24 years, who smoked an average of at least one cigarette a week within the last 6 months [23]. The exclusion criterion was being a former smoker.

Intervention and control protocols

Intervention group

Participants randomized to the intervention group received a multicomponent intervention based on previous recommendations made in the Surgeon General's report [12] and the online support

program for smoking prevention and cessation tailored for young adults established by the US Department of Health and Human Services [24]. In addition, the TTI informed the different strategies of this program. Table 1 shows a summary of the strategies of the multicomponent intervention focused on the three main mediator of TTI (self-efficacy, beliefs, and intention).

The first session was a face-to-face 50-minute meeting [motivational interviewing (MI)] consistent with the methods of Herman & Fanhlander [25]. During the interview, in order to improve student's intention to quit, the nurse used reflective listening to stress positive change discussions. She remained non-confrontational, but continued to direct the conversation towards developing discrepancy and resolving ambivalence, influencing students' beliefs. The nurse sought to reinforce the decision as well as increase students' self-efficacy to avoid smoking, when elaborating a personal plan for changing smoking behavior for each participant who was prepared to stop smoking. In these sessions, the participants were invited to read the self-help material available on their college Moodle platform. This online self-help material focused on: (1) decisions; (2) moods; (3) social life; (4) smoking health effects; and (5) quitting. This material can be found in the on-line version of Pardavila et al [21].

The follow-up program was scheduled according to the MI date. It consisted of four contacts: (1) e-mail 15 days before the MI, (2) group therapy 2 months after the MI (60 minutes), (3) a second follow-up visit 4 months after the MI (20 minutes) and (4) a final evaluation (15 minutes), conducted after 6 months [21].

Control group

Participants randomized to the control group received brief advice (5–10minutes) and a self-help pamphlet. All college students received the same input, which clearly advised quitting and highlighted the benefits of doing so. They also received a self-help pamphlet called 'Stop smoking'; written by the Healthy University Project I research team. Before giving brief advice,

the nurse assessed smokers' habits and their willingness to quit. As is usually in this type of studies there were no follow-up sessions for this group. At 6months, the evaluation was carried out (15minutes) [21].

Strategies to maintain fidelity

In order to minimize interventionist effects, the same clinical nurse specialist (CNS) conducted all sessions with both groups. The CNS had 9 years of experience, and she was specially trained in smoking cessation strategies (MI, group therapy, and brief advice). Indeed, her training for the study was intensive, involving around 125 hours. First, the CNS studied the theory related to the different techniques underlying the variety of strategies of both groups, and she discussed this with a two senior study staff. Second, the CNS was trained by viewing videotapes and seeing how an expert member of the study team carried out the different strategies. During this phase of the training, the CNS discussed these clinical examples with two experts. Finally, the CNS delivered intervention and control strategies with a pilot cohort, receiving feedback from principal investigator, and a senior expert with a view to further standardizing these strategies.

In order to increase the adherence to the protocol of both groups and to prevent the CNS from applying some techniques of the intervention group in the control group, an intervention and control manual was developed. The majority of the manual was given over to the data collected protocol and the procedures for the differences strategies.

Study procedures

One member of the research team performed the randomization. This researcher generated a blocked random number sequence, using EpiInfo version 7.0.9.7, and prepared the sealed opaque sequentially numbered envelopes (1–255) with the corresponding condition written inside. Once the student agreed to participate in the study, the envelope was opened to determine the group to which he/she would be assigned. Students were unaware of the randomization scheme and of the

group assignment.

On the first visit, the nurse completed a standardized written questionnaire, collecting demographic information and the student's history of tobacco, including the Fageström Test of Nicotine Dependence (FTND) [26], and the stages of change according to Prochaska's model [27]. Furthermore, the students completed the smoking-related Self-efficacy, Belief, and Intention questionnaire with its assessment scale [28-29].

Prochaska's Stages of Change [27] assess the desire and readiness to quit smoking. In this study to determine the student' stage of change the CNS used two questions. 1) 'Did you quit smoking?' The two possible answers were: 'yes' or 'no'. 2) 'If you make the decision to stop smoking definitely, when would you consider quitting?' There were four possible answers: 'not in the next 6 months', 'yes, in the next 6 months', 'yes, in the next 30 days' and 'I cannot pinpoint the exact time'. According to their responses, students were classified into: precontemplation [period in which smokers were not considering quitting smoking (at least not within the next 6 months)]; contemplation (period in which smokers were seriously thinking about quitting smoking within the next 6 months); preparation (period when smokers were seriously thinking about quitting smoking within the next month and had also tried to quit smoking during the past year) [21].

The smoking-related Self-efficacy, Belief and Intention assessment scale was used before and after a smoking cessation intervention. This scale, as TTI hypothesizes, assumes that smoking-related self-efficacy and beliefs have direct effects on intention to continue smoking [30]. It consists of a 17-item questionnaire, classified into 3 dimensions: self-efficacy to avoid smoking with 4 items (e.g.: if your friends offer you a cigarette, are you able not to smoke?); smoking-related beliefs (that included the TTI dimensions of beliefs and attitudes) with 10 items (e.g.: Do you believe cigarette smoking can help people relax?); and intention to stop smoking with 3 items (e.g.: Do you think you will smoke a cigarette at any time during the next year?). The score for each item varies from 1 (definitely yes) to

4 (definitely no) [27-28]. High scores indicate a higher self-efficacy to avoid smoking, a protective smoking-related belief and greater intention to quit. The scale had not been validated into Spanish. Consequently, a process of back-translation with two bilingual people was undertaken. Lastly, to decide on the final Spanish version of the scale, both English versions (original and back translated), were compared item by item by a panel of experts to evaluate whether they measured the same [31]. The internal consistency for all items of the scale in the sample was 0.68.

At 6 months after the initial interview, all students were interviewed again by the same nurse and the smoking-related Self-efficacy, Belief, and Intention questionnaire was once again completed.

Outcome measures

The outcome measures in the study were the difference in the mean of self-efficacy to avoid smoking, smoking-related beliefs and intention to quit smoking between intervention and control subjects; the difference in the mean of those variables pre- and post-intervention or control program; and the proportion of the total effect of smoking cessation explained by self-efficacy to avoid smoking, smoking-related beliefs, and intention to stop smoking.

Statistical analysis

Baseline data were reported as mean [standard deviation (SD)] appropriate for continuous variables. Categorical variables were reported as percentages (n, %).

The data were analysed on an intention-to-treat basis, including in the analysis all participants who had an outcome measured regardless of whether they had completed all sessions [32].

The proportion of the total effect of smoking cessation explained by self-efficacy to avoid smoking, smoking-related beliefs, and intention to stop smoking was obtained by the ratio of the unadjusted to the adjusted by self-efficacy, beliefs, or intention relative risk [33]. We used bootstrap to calculate the 95% confidence interval for the proportion of total effect of each mediator.

Changes within groups were analyses with paired t-tests; differences between groups were assessed with analysis of covariance (ANCOVA). To obtain unbiased results, these analyses were adjusted for all baseline variables and site. These analyses were also made with the students that did not quit smoking.

The analyses were performed using Stata version 11.1 (StataCorp, College Station, TX, USA). Statistical significance was set at 5% (P-values<0.05, based on two-tailed tests).

Ethical considerations

Ethical approval was sought and granted by the University of Navarra Research Ethics Committee (reference number=055/2013). Informed consent was obtained from all the students participating in the trial.

RESULTS

Participants

The flow-chart for the evaluation of study participants is shown in Figure 1. In total, 8,050 students, from 14 schools and 46 degree programs, were invited to take part in the research. Of those invited, 359 students agreed to participate; 255 of those who agreed to participate (age range=18–24 years) met the inclusion criteria. Reasons for ineligibility were: did not smoke (n=2), refused to participate (n=4), and unsuccessful attempts to contact (n=98). The 255 participants who met the inclusion criteria were randomized to the intervention group (n=133) or the control group (n=122). In the intervention group 83 (62.4%) completed all sessions, 24 (18.1%) attended o three sessions, and 26 (19.6%) only participated in the MI. Furthermore, 108 (81.2%) participants from the intervention group, and 101 (82.9%) from the control group attended the evaluation sessions. Of the 255 subjects enrolled in the trial, 225 (88.2%) completed the 6-month follow-up. The remaining 30 were lost to follow-up, 19 in the intervention group and 11 in the control group.

Baseline characteristics

Table 2 shows the participants' characteristics by group.

Self-efficacy to avoid smoking, Smoking-related beliefs and Intention to stop smoking outcomes

The total effect of the intervention on smoking cessation versus the control group was equal to a relative risk of 3.21 (95% CI= 1.52 to 6.78; p =0.002). After adjusting for the difference of self-efficacy to avoid smoking, and intention to stop smoking the relative risk decreased to 2.69 (95% CI= 1.33 to 5.44; p =0.006), and 2.41 (95% CI = 1.22 to 4.75; p=0.011), respectively. Nevertheless, the difference in smoking-related beliefs increased to 3.33 (95% CI= 1.58 to 6.98; p=0.001). Thus, the percent of excess risk of the intervention group on smoking cessation explained by the difference of intention to stop smoking scores was 36.1% (95 % CI= 4.4% to 72.08%). However, the percent of excess risk of the intervention group on smoking cessation explained by the differences of smoking-related belief and the difference of self-efficacy to avoid smoking scores was -5.30% (95% CI= -9.10% to 21.00%), and 23.5% (95% CI = -4.7% to 57.6%), respectively. These percentages of excess risk were not statistically significant.

Table 3 shows the differences in the mean of self-efficacy, belief and intention related to smoking scores before and after the smoking cessation program. Furthermore, Table 4 shows the comparisons between self-efficacy, belief, and intention related to smoking at 6-month follow-up. Table 5 shows the differences in the mean of self-efficacy, belief and intention related to smoking scores before and after the smoking cessation program among the 189 students who were not identified as quitters. Analysis of the differences in the mean scores between groups revealed a significant main effect only for intention to stop smoking in favour of the intervention group (mean [95% confidence internal (CI)], p score: unadjusted difference 0.67 (0.14 to 1.20), 0.014; adjusted difference: 0.60 (0.04 to 1.15), 0.037).

DISCUSSION

This study suggests that intention to quit smoking is partial moderator explaining 36.2% of the total effects in smoking cessation incidence. Furthermore, the result of this research show that a structured multicomponent program based on TTI, and conducted at a university can achieve a significant change in self-efficacy to avoid smoking and intentions related to stop smoking of the college student compared to control ones.

Studies into multicomponent interventions associate an increased self-efficacy to avoid smoking with greater success in quitting [34-35]. However, previous research has not identified which component of the intervention has been able to influence the increase in self-efficacy in college student smokers. We suggest that the principal component that has an impact on the increase in self-efficacy is MI. More specifically, MI strategies as feedback emphasise personal responsibility, and an empathetic counselling style increases self-efficacy [36]. This statement is consistent with the findings from our research, and the results of previous studies that used MI for smoking cessation in this target population [37], in diabetes patients [38], and in smoker adolescents with psychiatric disorders [39].

Another component of the intervention that could increase the perceived self-efficacy to avoid smoking is group therapy. This component encouraged participants to initiate discussion of their motivations, concerns, and difficulties during the smoking process. These discussions helped the students to realize that their experience during the smoking cessation was similar to that of other colleagues. In addition, these discussions help them identify some strategies that other students performed (e.g. if they had an urge to smoking, calling a friend or playing a phone game). This could increase their perceived self-efficacy as Washington [40] shows in study conducted with Chemically Dependent women.

The control group also increases their self-efficacy to avoid smoking. These results are similar to the Brown *et al.* [39] research in adolescent with psychiatric disorders, but contrary to the Bolger

et al. [37] study with college students. The principal differences of Brown *et al.* [39] and our study with Bolger *et al.* [37] research was that the participants in the control group received 5-10 minutes of advice to quit smoking and a self-help pamphlet whereas Bolger *et al.* [37] provided participants with their expired CO level (score) as a motivational strategy, and information and pamphlet about smoking-related risks.

Although self-efficacy to avoid smoking increased significantly, the percent of excess risk was no statistically significant, suggesting that the change of self-efficacy might reflect rather than mediate in a successful quitting. These results are similar to the meta-analysis on self-efficacy and smoking cessation that found that controlling for smoking status substantially reduced the relationship between self-efficacy and smoking [41].

On the other hand, both groups experienced an increase in beliefs but this did not seem to explain the difference in the cessation outcomes. In contrast, the association between belief and increase in the effect in smoking cessation is no significate. This could be explained by the fact that in the control group both the brief advice and the self-help material were tailored to smoking-related beliefs, while in the intervention group only the on-line self-help program focused on this dimension.

Our clinical experience in developing the research suggests to us that many of the college students have a low risk perception of smoking. The student did not perceive tobacco as harmful for their health and their life expectancy. Moreover, they saw the youthfulness as a time for smoking without risk, because they will stop smoking before their graduation or before becoming parents. They perceived a positive benefit in consuming tobacco such as gaining more friends or becoming more relaxed. These considerations are similar to those reported in previous studies [9-10,12,42-43].

Another reason that could-explain the effectiveness of this intervention is that the intention to stop smoking also increased. Based on this result, and on our clinical experience, the MI appeared to be

more effective for changing the intentions to stop smoking than brief advice. This could be explained because MI is a client-centered, directive method for enhancing intrinsic motivation to change by exploring and resolving ambivalence [36,44-45]. In addition, the basis of MI is that people are autonomous therefore, the healthcare clinicians adopts a collaborator rather than a paternalistic role [44]. In our previous study, the relationship between both (participants and nurse) was based on confidence, freedom and not on judgment. Furthermore, the nurse was trained in MI procedures, and followed a specific protocol tailored to the youth characteristics [21].

In addition, MI is based on the theoretical stages of change, which help the health professional to determine how ready a student is prepared to quit [46], and to improve the progress through these stages [47]. As a result, the effect of MI on intention to quit is in the progress through the stages of the change model. The main findings of our RCT revealed that individuals who received the intervention moved further along the active stages of change [21]. These results are consistent with previous studies with college students who used MI as a strategy [25,48]. Even though the use of the stages of change model in smoking cessation is questioned [49-50], the results of this study suggest that there is a relationship between the intention to quit and the progression in the stages of change. As this study results shows, the increases on the intention to stop smoking may not necessarily correspond with behavior change, however some studies showed that the students who moved to more active stages of change obtained more positive results in terms of smoking cessation [21,27,35, 51].

Furthermore, the mean in all mediators' outcomes was increased in the control group at 6-month follow-up; these increases were statistically significant. These results indicated the potential benefit of brief advice given by a health professional. The challenge as to whether or not this brief advice is beneficial depends on the possibility of being able to offer said advice to college students on a routine basis [52].

Five main limitations in this study need to be acknowledged. First, the finding provided by this research is only applicable in college students. Secondly, the study was conducted on a single university and there may have been some contamination between the groups despite the fact that they made a written commitment to refrain from speaking about the study until it was finished. The difference in self-efficacy to avoid smoking and in intention to stop smoking between groups suggests that if this bias had occurred, the rate was low. Third, nearly 11.8% of the participants in the study were lost during the follow-up, and 37.6% of the subjects randomized to the intervention group did not receive the complete protocol. However, a common drawback of studies, and in educational programs conducted in community-based clinical settings, is the low compliance of subjects with the intervention protocol. In our study, this was related to time issues and loss of interest in participating in the research trial. Nevertheless, the rate of lost subjects is lower than in other studies with this population. Our loss during the follow-up was less than 20%, which means there was no significant risk of bias [53]. This could be explained because one member of the research team contacted participants by phone and e-mail for the final evaluation. Fourth, we did not record the different sessions of the intervention group, and thus it is impossible to verify the fidelity. In contrast, we applied preplanned strategies that were used to maintain the fidelity of the intervention. Specifically in the design, CNS training, and the intervention delivery. Fifth, the scale for assessing smoking-related Self-efficacy, Belief and Intention was not validated in Spanish at the time of the study. However, a rigorous process of back translation and comparison of both English versions by experts was developed in order to obtain a final Spanish version [54]. Internal consistency for a Spanish version of the Scale was questionable (α=0.68). Nevertheless, alpha Cronbach of 0.60 is considered acceptable to exploratory studies [54]. Furthermore, the English version of the scale had been validated to assess young smoker's ability to avoid smoking in emotional or social situations; to measure their associated belief toward smoking; and to evaluate

their intention to stop smoking [28]. Based on this, we considered this scale to be adequate for this study.

This study has theoretical, methodological and practical strengths. One of the primary strengths of this study was the evaluation of the self-efficacy, beliefs and intention related to quitting smoking as potentials mediators. These results explained how and why college students stop smoking. Furthermore, the conceptual model of the scale for assessing smoking-related Self-efficacy, Belief and Intention is based on the fact that a certain type of behavior is more likely to occur if three conditions are met: one has the necessary skills to perform said behavior; there are no environmental constraints against performing said behavior; and if a strong intention to perform the behavior exists [28]. These assumptions are similar to TTI principles [18]. More specifically, this theory takes into account the fact that the main pathways of behavioral change are self-efficacy, belief, attitudes toward behavior and decision or intention. Finally, this study could help clinicians understand the process of change, and based on this design, be able to improve intervention, or replicate this intervention in other contexts.

In conclusion, a multicomponent intervention based on the Theory of Triadic Influence, tailored to college students positively increased the self-efficacy to avoid smoking, and the intention to quit, suggesting intention as potential mediator of quitting. Furthermore, the finding of this study provides strategies for improving the smoking cessation process in college students. In addition, the results of this research suggest that MI should be included in smoking cessation interventions. Nevertheless, further research is recommended to test the changes in self-efficacy to avoid smoking, belief related with tobacco use and intention to quit with the addiction across a variety of population groups.

REFERENCES

1. OECD. Education at a Glance: OECD indicators. OECD Publishing, Paris; 2016

2. M. de Educación, Cultura y Deporte. Datos y Cifras del Sistema Universitario Español. Curso 2015-2016. 2016. Available at: https://sede.educacion.gob.es/publiventa/d/21461/19/1. Accessibility verified August 3, 2017

3. M. de Educación, Cultura y Deporte. Panorama de la educación. Indicadores de la OCDE 2016. 2016. Available at: http://www.mecd.gob.es/dctm/inee/eag/panorama2016okkk.pdf?documentId=0901e72b8223 6f2b. Accessibility verified August 3,2017

4. Varela-Mato V, Cancela JM, Ayan C, Martín V, Molina A. Lifestyle and health among Spanish university students: differences by gender and academic discipline. Int J Environ Res Public Health. 2012; 9(8): 2728-2741.

5. Observatorio Español sobre Drogas y Toxicomanías (OEDT). Encuesta domiciliaria sobre el consumo de alcohol y drogas en España. 2015. Available at: http://www.pnsd.msssi.gob.es/profesionales/sistemasInformacion/sistemaInformacion/encues tas_EDADES.htm. Accessibility verified August 3, 2017

6. Bernat DH, Klein EG, Forster JL. Smoking Initiation during Adulthood: A longitudinal Study of Population-Based Cohort. J Adolesc Health. 2012; 51(5): 497-502.

7. Freedman KS, Nelson NM, Feldman LL. Smoking initiation among young adults in the United States and Canada, 1998-2010: a systematic review. Prev Chronic Dis. 2012; 9: E05.

8. Brown JA. Review of the Evidence on Technology-Based Interventions for the Treatment of Tobacco Dependence in College Health. Worldviews Evid Based Nurs. 2013; 10 (3): 150-162.

9. Aryal UR, Lohani SP. Perceived benefits and health risks of cigarette smoking among young adults: insights from a cross-sectional study. Tob Induc Dis. 2015; 13(1):22

10. Hoeppner BB, Bidwell LC, Colby SM, Barnett NP. Smoking patterns and their relationship to drinking among first-year College students. Nicotine Tob Res. 2014; 16(6):743-752.

11. Centers for Disease Control and Prevention. Best Practices for Comprehensive Tobacco Control Programs-2014. Atlanta: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion, Office on Smoking and Health; 2014

12. US Department of Health and Human Services. Preventing Tobacco Use among Youth and Young Adults: A Report of the Surgeon General. Atlanta, GA: US Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion, Office on Smoking and Health; 2012.

13. Ordás B, Fernández D, Ordóñez C, et al. Changes in use, knowledge, beliefs and attitudes relating to tobacco among nursing and physiotherapy students: a 10-year analysis. J Adv Nurs. 2015;71(10):2326-2337.

14. Lee HS, Catley D, Harris KJ. Improving understanding of the quitting process: psychological predictors of quit attempts versus smoking cessation maintenance among college students. Subst Use Misuse. 2014; 49(10):1332-1339.

15. Michie S, Brown J, Geraghty AW, et al. Development of StopAdvisor: A theory-based interactive internet-based smoking cessation intervention. Transl Behav Med. 2012; 2(3):263-275

16. Bully P, Sánchez Á, Zabaleta-del-Olmo E, Pombo H, Grandes G. Evidence from interventions based on theoretical models for lifestyle modification (physical activity, diet, alcohol and tobacco use) in primary care settings: A systematic review. Prev Med. 2015; 76 suppl: 76-93.

17. Flay BR. Understanding environmental, situational and intrapersonal risk and protective factors for youth tobacco use: the Theory of Triadic Influence. Nicotine Tob Res. 1999; 1 Suppl 2:S111-4; discussion 569-570.

18. Flay BR, Snyder FJ, Petraitis J. The theory of triadic influence. In: DiClemente R. J., Crosby

R. A., Kegler M. C., editors. Emerging Theories in Health Promotion Practice and Research, 2nd ed. San Francisco, CA: Jossey-Bass; 2009: 451–510.

19. Holman LR, Bricker JB, Comstock BA. Psychological predictors of male smokeless tobacco use initiation and cessation: a 16-year longitudinal study. Addiction. 2013; 108(7):1327-1335.

20. Sterling K, Ford K, Park H, Diamond P, McAlister A. Assessing the invariance of smoking-related self-efficacy, beliefs, and intention among high school current smokers. Subst Use Misuse. 2013; 48(7):477-483.

21. Pardavila-Belio MI, García-Vivar C, Pimenta AM, Canga-Armayor A, Pueyo-Garrigues S, Canga-Armayor N. Intervention study for smoking cessation in Spanish college students: pragmatic randomized controlled trial. Addiction. 2015; 110(10):1676-83.

22. Martinez C, Fernandez E. Commentary on Pardavila-Belio et al. (2015): Reporting on randomized control trials or giving details on how the cake was made--the list of ingredients and the implementation process. Addiction. 2015;110(10):1684-1685.

23. Stanton A., Grimshaw G.M. Tobacco cessation interventions for young people. Cochrane Database Syst Rev. 2013; 23; 8: CD003289.

24. US Department of Health and Human Services. Smokefree Teen, 2012. Available at: https://teen.smokefree.gov/ Accessibility verified August 4, 2017

25. Herman KC, Fahnlander BA. Motivational intervention to reduce cigarette smoking among college students: overview and exploratory investigation. J College Counselling. 2003; 6: 46–55.

26. Heatherson TF, Kozlowski LT, Frecker RC, Fageström KL. The Fagerström Test for Nicotine Dependence: a revision of the Fagerström Tolerance Questionnaire. Br J Addict. 1991; 86: 1119–1127.

27. Prochaska JO, DiClemente CC. Stages and processes of self-change of smoking: toward an

integrative model of change. J Consult Clin Psychol. 1983; 51: 390–395.

28. Ford KH, Diamond PM, Kelder SH, Sterling KL, McAlister AL. Validation of scales measuring attitudes, self-efficacy, and intention related to smoking among middle school students. Psychol Addict Behav. 2009; 23(2):271-278.

29. Sterling KL, Ford KH, Park H, McAlister AL. Scales of smoking-related self-efficacy, beliefs, and intention: assessing measurement invariance among intermittent and daily high school smokers. Am J Health Promot. 2014; 28(5): 310-5.

30. Landrum Sterling K, Diamond PM, Dolan Mullen P, Pallonen U, Ford KH, McAlister AL. Smoking-related self-efficacy, beliefs, and intention: assessing factorial validity and structural relationships in 9th-12th grade current smokers. Addict Behav. 2007;32(9):1863-1876.

31. Pegalajar J, Acosta A, Castillo M, Higueras L, Padilla JL. Spanish Adaptation of the Memory Characteristics Questionnaire (MCQ). Span J Psychol. 2015;18:e101.

32. Elkins MR1, Moseley AM2. Intention-to-treat analysis. J Physiother. 2015;61(3):165-167. doi: 10.1016/j.jphys.2015.05.013.

33. Kaufman JS, Maclehose RF, Kaufman S. A further critique of the analytic strategy of adjusting for covariates to identify biologic mediation. Epidemiol Perspect Innov. 2004. 8;1(1):4.

34. Cupertino AP, Berg C, Gajewski B, et al. Change in self-efficacy, autonomous and controlled motivation predicting smoking. J Health Psychol. 2012; 17(5):640-652.

35. Mujika A, Forbes A, Canga N, et al. Motivational interviewing as a smoking cessation strategy with nurses: an exploratory randomized controlled trial. Int J Nurs Stud. 2014; 51: 1074–1082.

36. Miller W. R., Rollnick S. La entrevista Motivacional [Motivational Interviewing]. Ediciones Paidós Ibérica: Barcelona; 2008.

37. Bolger K, Carter K, Curtin L, Martz DM, Gagnon SG, Michael KD. Motivational interviewing for smoking cessation among college students. J College Stud Psychother. 2010; 24(2): 116-

129.

38. Chen SM, Creedy D, Lin HS, Wollin J. Effects of motivational interviewing intervention on self-management, psychological and glycemic outcomes in type 2 diabetes: a randomized controlled trial. Int J Nurs Stud 2012; 49(6):637-644.

39. Brown RA, Ramsey SE, Strong DR, et al. Effects of motivational interviewing on smoking cessation in adolescents with psychiatric disorders. Tob Control. 2003; 12 Suppl 4:IV3-10.

40. Washington OG. Effects of group therapy on chemically dependent women's self-efficacy. J Nurs Scholarsh. 2000;32(4):347-352.

41. Gwaltney CJ, Metrik J, Kahler CW, Shiffman S. Self-efficacy and smoking cessation: a meta-analysis. Psychol Addict Behav. 2009; 23(1):56-66.

42. Murphy-Hoefer R, Griffith R., Pederson LL, Crossett L, Iyer SR, Hiller MD. A review of interventions to reduce tobacco use in colleges and universities. Am J Prev Med. 2005; 28(2): 188-200.

43. Tavolacci MP, Ladner J, Grigioni S, Richard L, Villet H, Dechelotte P. Prevalence and association of perceived stress, substance use and behavioral addictions: a cross-sectional study among university students in France, 2009-2011. BMC Public Health. 2013;13:724.

44. Richardson L. Motivational interviewing: helping patients move toward change. J Christ Nurs. 2012; 29(1):18-24; quiz 25-26.

45. Apodaca TR, Longabaugh R. Mechanisms of change in motivational interviewing: a review and preliminary evaluation of the evidence. Addiction. 2009;104(5):705-715.

46. Miller NH. Motivational interviewing as a prelude to coaching in healthcare settings. J Cardiovasc Nurs. 2010; 25(3):247-251.

47. Borland R, Balmford J, Benda P. Population-level effects of automated smoking cessation help programs: a randomized controlled trial. Addiction. 2013; 108(3):618-628.

48. Prokhorov AV, Yost T, Mullin-Jones M, et al. 'Look at your health': outcomes associated with a computer-assisted smoking cessation counseling intervention for community college students. Addict Behav. 2008; 33: 757–761.

49. Riemsma RP, Pattenden J, Bridle C, et al. Systematic review of the effectiveness of stage based interventions to promote smoking cessation. BMJ. 2003; 326(7400):1175-1177.

50. Cahill K, Lancaster T, Green N. Stage-based interventions for smoking cessation. Cochrane Database Syst Rev. 2010; (11):CD004492.

51. Canga N, De Irala J, Vara E, Duaso MJ, Ferrer A, Martínez-González MA. Intervention study for smoking cessation in diabetic patients: a randomized controlled trial in both clinical and primary care settings. Diabetes Care. 2000; 23(10):1455-1460.

52. Stead LF, Buitrago D, Preciado N, Sanchez G, Hartmann-Boyce J, Lancaster T. Physician advice for smoking cessation. Cochrane Database Syst Rev. 2013;(5):CD000165.

53. Thomas R, Perera R. School-based programmes for preventing smoking. Cochrane Database Syst Rev. 2006; (3):CD001293

54. Navarta-Sánchez MV, Senosiain García JM, Riverol M, et al. Factors influencing psychosocial adjustment and quality of life in Parkinson patients and informal caregivers. Qual Life Res. 2016; 25(8):1959-1968.

Table 1: Summary of the strategies of the multicomponent intervention focusing on the main three-mediators of TTI (self-efficacy, beliefs, and intention)

STRATEGY	SELF-EFFICACY	BELIEFS	INTENTION
Motivational interview*			
Rationale		■	
Decisional balance	■	■	■
Nicotine dependence		■	■
Smoking perceived norms		■	■
Financial cost of smoking		■	■
Carbon monoxide feed-back	■		■

STRATEGY	SELF-EFFICACY	BELIEFS	INTENTION
Personal plan for action, and relapse prevention.	■		■
On-line self-help material			
Decisions			■
Moods (stress management)	■		
Social life	■	■	
Smoking health effects		■	
Quitting (plan for action, and relapse prevention)	■		■
Self-monitoring	■		
e-mail Support			
Encouraging decisions	■		■
Improve motivation to quit			■
Seek help from their closest (social support)	■		
Therapy group (12 students)			
Social support	■	■	■
Motivation to quit			■
Social comparison	■	■	■

* The MI was based in the Herman & Fanhlander [25] method.

Fig. 1: Flow of participants throughout the trial.

Invited to participate (n=8050)

Enrollment

Agree to participate (n=359)

Excluded (n= 104)
- Not meeting inclusion criteria (n= 2)
- Declined to participate (n= 4)
- Unable to contact (n= 98)

Randomized (n= 255)

Allocation

Allocated to control group (n= 122)
- Received allocated intervention (n= 122)

Allocated to intervention group (n= 133)
- Received allocated intervention (n= 133)
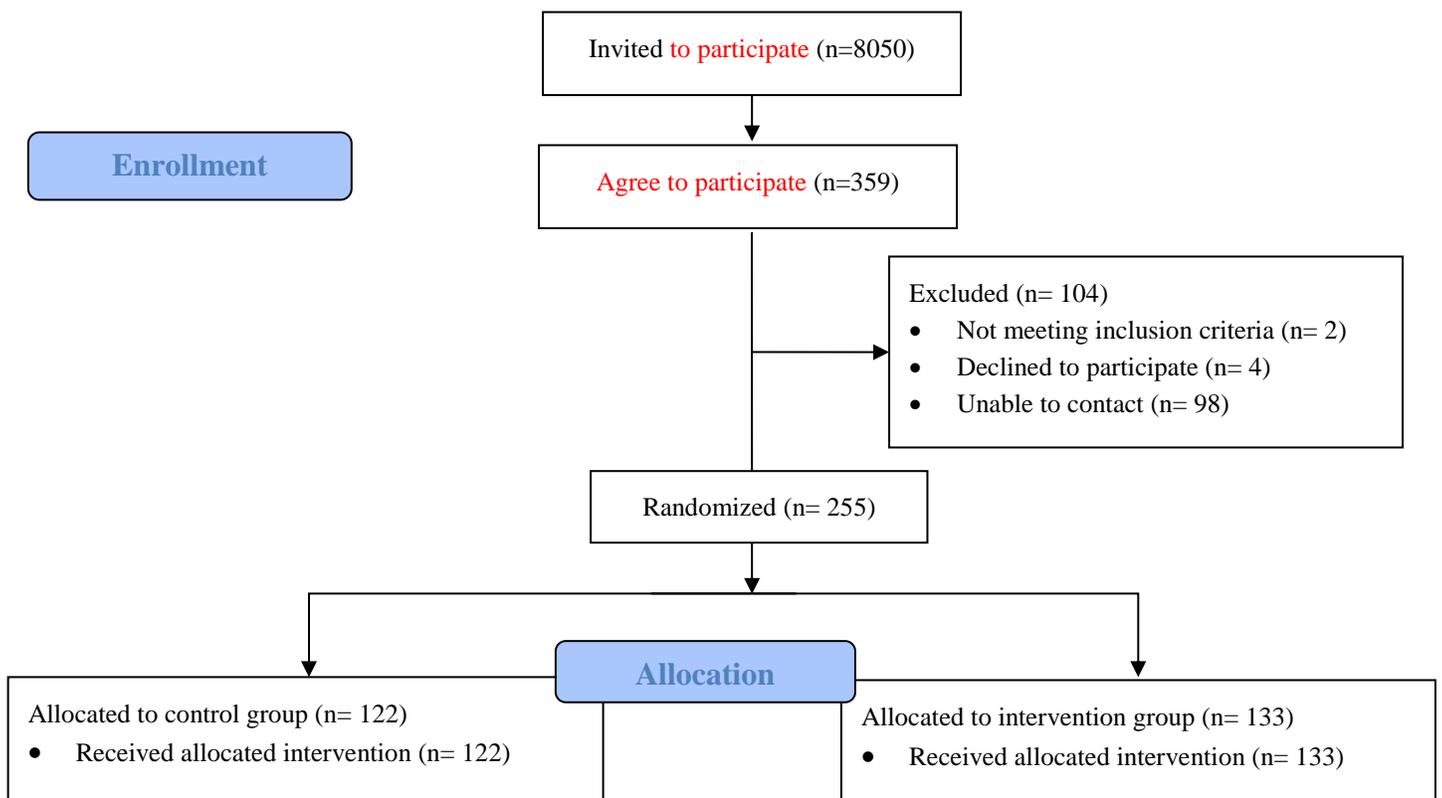
Table 2. Baseline characteristics of participants by groups.

	Intervention (N=133)	Control (N=122)
Demographic characteristics		
Age, mean (SD)	20.1 (1.7)	20.5 (1.7)
Sex, n (%)		
Male	51 (38.4)	46 (37.7)
Female	82 (61.7)	76 (62.3)
Area of degree, n (%)		
Health sciences	50 (37.6)	61 (50.0)
Social sciences	64 (48.1)	44 (36.1)
Technological sciences	19 (14.3)	17 (13.9)
Residence, n (%)		
With parent	26 (19.6)	41 (33.6)
Residence hall	49 (38.8)	33 (27.1)
House/apartment	58 (43.6)	48 (39.3)
Smoking-Related characteristics		
Daily cigarettes, mean (SD)	9.5 (6.1)	8.7 (5.2)
Years of smoking, mean (SD)	5.6 (2.3)	5.7 (2.4)
FTND, mean (SD)	2.0 (1.7)	2.4 (2.0)
Received previous advice, n (%)		
No	121 (91.0)	101 (82.8)
Yes	12 (9.0)	21 (17.2)
Quit attempts in past year, n (%)		
No	33 (24.8)	34 (27.9)
Yes	100 (75.2)	88 (72.1)
Stages of change (Prochaska's model), n (%)		
Precontemplation	41 (30.8)	47 (37.7)
Contemplation	53 (39.9)	36 (29.5)
Preparation	39 (29.3)	40 (32.8)
Self-efficacy, mean (SD)	8.9 (3.1)	8.9 (3.7)
Belief, mean (SD)	28.3 (4.5)	28.4 (4.3)
Intention related to smoking, mean (SD)	6.1 (1.6)	6.4 (1.8)

FTND (Fagerström Test for Nicotine Dependence); SD: Standard Deviation

Table 3. Differences in the mean of self-efficacy, belief and intention related to smoking scores before and after smoking cessation program

	Intervention	p value*	Control	p value*
	(N=114)		(N=111)	
Self-efficacy, mean (95% CI)	1.85 (1.22 to 2.49)	<0.001	0.83 (0.16 to 1.49)	0.015
Belief, mean (95% CI)	1.89 (0.96 to 2.81)	<0.001	1.82 (1.07 to 2.57)	<0.001
Intentions, mean (95% CI)	1.32 (0.90 to 1.75)	<0.001	0.46 (0.08 to 0.84)	0.018

* p-value from paired Student's t test.

Table 4. Comparisons Self-efficacy, belief, and intention related to smoking at 6-months follow-up.

	Unadjusted difference	p value*	Adjusted difference	p value†
Self-efficacy, mean (95% CI)	1.02 (0.11 to 1.93)	0.029	1.09 (0.13 to 2.06)	0.027
Belief, mean (95% CI)	0.07 (-1.12 to 1.26)	0.913	0.25 (-1.02 to 1.51)	0.702
Intentions, mean (95% CI)	0.87 (0.30 to 1.43)	0.003	0.78 (0.20 to 1.37)	0.009

Note: Estimates and associated statistic refer to differences of mean.* ANCOVA test. † ANCOVA test adjusted for all baselines variables and site (Pamplona or San Sebastian).

Table 5. Differences in the mean of self-efficacy, belief and intention related to smoking scores before and after smoking cessation program in no quitter.

	Intervention	p value*	Control	p value*
	(N= 86)		(N=103)	
Self-efficacy, mean (95% CI)	1.10 (0.50 to 1.70)	0.004	0.40 (-0.22 to 1.02)	0.207
Belief, mean (95% CI)	1.30 (0.24 to 2.36)	0.017	1.78 (0.98 to 2.57)	<0.001
Intentions, mean (95% CI)	0.81 (0.38 to 1.24)	<0.001	0.15 (-0.18 to 0.47)	0.380

* p-value from paired Student's t test.