

## Smoke reduction and cessation with psychological interventions: A randomized clinical trial

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The purpose of our research is to investigate the effectiveness of three types of psychological interventions in both the prevention (Study 1) and treatment (Study 2) of tobacco addiction. Both studies implied a pragmatic parallel-group research design, participants being randomly allocated in one of the three arms of the study in an unblinded manner. The first study consists of 62 occasional, adolescent smokers who were selected according to the criteria proposed and tested in The Framingham Study (Gordon et al., 1975). They were randomly allocated to receive either: (a) an informative intervention; (b) an action and coping planning intervention; (c) an intervention that combined the two aforementioned types in tobacco smoking cessation or (d) a passive control group. Our second study was conducted on a sample of 62 participants who were addicted to cigarette smoking (according to Gordon et al., 1975 and to the DSM IV-R criteria – APA, 2000) between the ages of 23-25 and was aimed at assessing the effectiveness of the same three interventions in tobacco smoking cessation versus a control group. Our findings revealed that the combined intervention was the most efficient longitudinally in both prevention and treatment of nicotine addiction when compared to a control group and to the other two types of intervention. The results are discussed in the light of their contribution to the prevention and treatment of tobacco addiction.

Keywords: randomized trial, nicotine addiction prevention, smoking cessation, coping planning interventions, action planning interventions, informative interventions.

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### Introduction

A study conducted in 2011 by the Ministry of Health of Romania in collaboration with the World Health Organization (Global Adult Tobacco Survey – GATS) shows that in Romania the smoking of tobacco cigarettes is one of the most socially acceptable high risk health behavior. The results reported by GATS show that, in 2011 in Romania, smoking was highly prevalent - 26.7% (4.85 million Romanians). Almost a quarter (24.3%) of people aged 15 and over smoked nicotine cigarettes daily, while 2.4% was occasional smokers. The highest rates of smoking were found among Romanians aged 25 to 44 (36.3%); 43.1% started to smoke daily from the ages 17-19, 21.7% of which took up daily smoking at when they were 15 or 16 years old, and only 18.1% started smoking after the age of 20. No significant differences in education were found. Among people addicted to nicotine cigarettes (smoked the first cigarette in the first five minutes after

waking up), 62.6% tried to quit without specialized assistance, 16.4% resorted to nicotine replacement therapy, 2.7% used prescription medication, and 2.8% resorted to counseling services (2.8%). A third of smokers (33.6%) do not wish to quit smoking, with 39.2% of them thinking that smoking does not put their health at risk, while another 38.3% of them thinking that they cannot quit smoking.

The data presented above essentially shows a very high prevalence of smoking among Romanians, inversely proportional to the level of information they have on the health risks associated with this habit. What is worrying with respect to the statistical data presented is the low quality of counseling services to quit smoking (GATS, 2011) and the scarce knowledge among the Romanian population regarding the major health risks of smoking. All of these aspects constitute incentives to motivate empirical research to find the most cost-effective and efficient interventions for smoking cessation that could be implemented in high numbers in Romania.

*Psycho-physiological aspects of nicotine addiction*

Nicotine addiction involves components - both physical and psychological- that contribute to developing tolerance to the drug, and to creating multiple individualized barriers to quitting smoking (Levinthal, 2002). *Physical dependence* denominates a state that results from the chronic use of an addictive substance which, in time, becomes a normal part of the central nervous system (Glick & Maisonneuve, 1998; Jaffe, 1985). *Psychological dependence* refers to repeatedly using a drug in order to avoid the physical symptoms of withdrawal. As nicotine increases dopamine levels in the brain's reward circuits, it is abused by the smoker in order to keep experiencing the positive reinforcement it provides. Moreover, since it has a direct effect on the nucleus accumbens, nicotine consumption becomes a reward-oriented behavior (Brown & Lichtenstein, 1980; Carboni, Silvagni, Rolando, & Di Chiara, 1999; Halikas, 1997; Volkow, Wang, Fowler, Logan, Gatley, Wong, Hitzemann, & Pappas, 1999).

*Theoretical models of health behavior change*

Behavior change has long been a central objective in health psychology and it has been conceptualized in various ways via different theoretical models. *The social cognitive theory* (Bandura, 1986; Perry, Barnowski, & Parcel, 1990) posits that human functioning can be explained through the interaction of three factors (the behavior, the environmental context, and personality factors) and as a result, behavioral change can be successfully achieved by increasing a person's self-efficacy and by modeling their environment. *The theory of planned behavior* (Ajzen, 1991; Armitage, & Conner, 2001; Grizzell, 2007) proposes that behavioral change is the outcome of the interaction between *the individual's attitudes towards said behavior or the subjective norms* (the individual's perceptions of what others think he/she should do and his/her inclination to comply with these perceptions) and *the individual's perceived behavioral control* (the self-perceived degree of difficulty in the ability to engage in that behavior). These three psychological aspects lead to *forming the intention* to undergo the behavior change which leads to the actual behavior change, as intention is considered to be the best predictor of behavior change (Ajzen, 1991). *The transtheoretical model* (Prochaska, Johnson, & Lee, 1998) posits that changing a behavior implies progressing through six stages: precontemplation of change, contemplation, preparation, action, maintenance, and termination. The authors point out that therapeutic intervention for behavior change should take into account the stage of change in which the person currently is.

*Types of interventions in treating nicotine addiction and in preventing relapses*

The interventions cater to the characteristics of the targeted population by taking into account the stage of change in which the individual is currently in, and by offering volitive (*action planning and coping planning interventions*) and motivational (*informative intervention*) support. Also, the informative intervention offers detailed and comprehensive information in order to fill the knowledge gaps of the targeted population. In regard to the targeted behavior - nicotine cigarette smoking - the three

interventions also take into account its psychological addictiveness, being therefore aimed at breaking the behavior-reward sequence by replacing smoking as a pleasurable behavior with other behaviors that offer satisfaction to the subject.

*The action planning intervention* (Leventhal, Singer, & Jones, 1965), is basically synonymous with intention implementation (Gollwitzer, 1999, consisting in linking the sequence of behaviors required in order to reach one's objective to certain environmental cues by establishing when, where and how to act toward initiating action in the desired direction. Moreover, action planning can help avoid problems with persistence, as the underlying mechanisms leading to the implementation of the behavioral intention can remain effective even in the absence of complete self-control. People who make action plans are more likely to act in their desired direction (Gollwitzer & Brandstätter, 1997) and engage in the planned behavior sooner (Orbell & Sheeran, 2000) compared to those who do not engage in action planning. Numerous benefits in multiple healthcare areas have arisen from action planning, such as increased screenings for cervical cancer (Orbell & Sheeran, 2000), breast self-examinations (Luszczynska & Schwarzer, 2003), adherence to a healthy diet (Verplanken & Faes, 1999), and engagement in regular physical exercise (Sniehotta, Scholz, & Schwarzer, 2005). There have only been a few studies (e.g. Luszczynska & Schwarzer, 2003) in which the effectiveness of action planning was investigated over a period longer than a few weeks. The results of these studies showed that, while action planning assists individuals in intention implementation, their habitual responses and high stress situations (such as deadlines at work) can interfere with successfully carrying out the planned behavior.

*The coping planning intervention* (Sniehotta, Schwarzer, Scholz, & Schüz, 2005) can help a person to overcome barriers and to cope with hardships firstly by anticipating situations that put the performance of the desired behavior at risk and secondly by planning the coping strategies in detail. Coping planning involves mentally simulating a high-risk situation which would normally trigger an undesired behavioral response (e.g. smoke a cigarette) and pairing it with adequate coping strategies (e.g. "If I feel tense when I get home from work, I will go for a jog in order to calm down, instead of smoking a cigarette"). By deciding in advance what the best strategy is in overcoming unwanted influences (internal or external) on the desired action (Gollwitzer, 1999), people can act toward acquiring new, desired behaviors even when less than ideal circumstances threaten to evoke a counter-intentional behavior. In a research on how to improve people's adherence to physical exercise (Simkin & Gross, 1994), the experimenters asked a sample of women with a sedentary lifestyle who planned to take up physical exercise, to describe in detail how they will manage 10 high-risk situations (bad mood, lack of time, bad weather, tiredness, etc.) that could endanger their intention to carry out the newly acquired behavior. The women who came up with the fewest coping strategies had the highest number of relapses (Simkin & Gross, 1994).

Coping planning and action planning are conceptualized as two separate constructs. Action planning is meant to facilitate initiating and carrying out a certain action, while coping planning is meant to inhibit

distractions that could derail a person from their set goal. While the content and purpose of these two types of strategies are different, the underlying mnemonic, attentional, and perceptual mechanisms are assumed to be essentially the same (Sniehotta et al., 2005). In the case of action planning, no expert advice is needed, since the modalities of action (when, where, how) can be taught through a simple intervention (Leventhal et al., 1965). Coping planning, as a distraction-inhibiting strategy, requires putting some thought into both the high risk situations for a specific subject, and the most effective alternative behavioral responses, which means drawing from personal experience. Both action planning and coping planning are addressed to individuals who are at the preparation stage of behavior change, offering support in the maintenance of the implemented change (Sniehotta et al., 2005).

*Informative interventions* are addressed to individuals who are in the precontemplation and contemplation stages of change. In regard to health-risk behavior change, focusing on education was shown to have positive effects in changing pro-smoking perceptions (Freedman, Nelson, & Feldman, 2012). In the specific case of nicotine addiction, smokers in Romania are often not familiar with the wide range of negative consequences that smoking has on their health, as the results of GATS (2011) clearly shows, hence we assume that informative interventions will have positive effects on people at different stages as well.

### Study 1

The aim of this study is to test the effectiveness of three types of interventions on occasional smokers. Our general objective is to identify the most effective strategy in preventing the development of tobacco addiction among high school pupils who are occasional smokers. Since repeated nicotine use gradually leads to addiction, designing and testing prevention interventions is a more economic and a healthier alternative to treating addiction once it has developed. Therefore, the first objective of this research is to test the effectiveness of an informative intervention, which can be implemented by the school counselor or a teacher, as no formal training is required. The second objective is to test the effectiveness of an intervention consisting in action planning and coping planning, which is usually employed in treating addiction. However, we chose to test its effectiveness in preventing addiction development, as it focuses on adherence to a structured program (one focused on setting personal objectives) and on identifying individual triggers and strategies to overcome them - which addresses the specific emotional needs of this age group. In order to implement this type of intervention, formal training is required, as an understanding of the underlying psychological mechanisms is needed. Consequently, it can only be applied by a school counselor. Another objective is to test the combined effect of the two aforementioned interventions, which would both cover participants' current knowledge gaps on the health risks of nicotine smoking, and also integrate them into an action planning and coping planning program. The advantages of this intervention rest upon its increased complexity (it has a broader action spectrum), and the disadvantages refer to the need to invest more time

resources and formal training of the person implementing them. One last objective is to longitudinally compare the effectiveness of the three interventions (at three, and, respectively, six weeks after they are implemented). For these aforementioned purposes, we investigated the following hypotheses: *H1*: The three types of interventions will reduce the average number of nicotine cigarettes smoked by participants. *H2*: The combined intervention (informative, action and coping planning) will generate the highest cessation rate at both moments of measurement (after three, respectively, six weeks). *H3*: The informative intervention will generate higher cessation rates as compared to the action and coping planning intervention.

Our hypotheses are theoretically supported by the literature on the effectiveness of the three types of interventions (informative, action and coping planning) on both pro-health behavior change (Leventhal et al., 1965; Sheeran & Orbell, 2000; Luszczynska & Schwarzer, 2003; Verplanken & Faes, 1999; Sniehotta, Scholz, & Schwarzer, 2005) and on characteristics of the participants given by the stage of change they are in, according to the transtheoretical model (Prochaska, Johnson & Lee, 1998). The participants in this study were in the precontemplation / contemplation stage, which pointed to their need to become motivated to quit smoking by learning about the health risks associated to it. Moreover, the GATS research conducted in 2011 shows a general scarcity of knowledge about the health risks associated to tobacco smoking among the Romanian population. In conclusion, we expect the informative intervention to generate a higher cessation rate compared to the action and coping planning intervention, and also, we expect that the combined intervention will generate a higher cessation rate than both the informative intervention and the action and coping planning intervention, since it promotes the health behavior change by sustaining both motivation and volition.

#### *Trial design*

We used a 4 x 3 mixed experimental design -a between subjects variable - the *type of intervention* (informative intervention - A, action and coping planning intervention - B and combined A and B intervention (C), as well as a passive control group) and a within subject variable - the *moment of measuring* (baseline, after 3 weeks follow-up, and after six weeks follow-up). An open pragmatic superiority trial was conducted in a single location in Huși, Romania to test the effect on two dependent variables -the *average number of cigarettes smoked a day*, and the *cessation rate* - lack of smoking (not even a puff) over a period of seven days.

#### *Participants*

The participants in this study were 62 high school pupils between the ages 17-19, grades XI-XII who could be considered as occasional smokers (less than 10 cigarettes / day) according to the Framingham Study (Gordon, Kannel, McGee, & Dawber, 1975). Our participants' confidentiality was ensured by recruiting them with the help of a person that did not take any other part in the experiment, and they were financially rewarded for their participation to this study upon its completion. The recruiter went to all the classrooms that were assigned to the 11th and 12th grade students and, in the absence of teachers, asked if students who smoked occasionally (less

than ten cigarettes a day, each day for at least six months) would like to participate in a study regarding smoking and socialization. The initial number of students checked for eligibility was 454. They were told they would be financially rewarded if they participated all throughout the study and invited the next day at another location where they would meet with the experimenters. In order to further ensure their anonymous participation, students were not asked to state their intention to participate right then (so as their colleagues to remain unaware of their smoking habit) and they were also asked to create an anonymous e-mail address in which to not mention any personal data that could lead to their identification for the purpose of contacting them in the future.

Out of the 454 students informed of the eligibility criteria for participating in this study, 62 of them came to the proposed location. Once they arrived at the location where the study took place, two experimenters checked whether all of the pupils were at the precontemplation / contemplation stage, by asking them if they intended to quit smoking and when. All 62 students declared they met the required criteria by show of hands and were handed a confidentiality agreement signed by the two experimenters which guaranteed their anonymity. Participants were informed about the true purpose of the study (of comparing different kinds of interventions) and asked to not disclose the content of the intervention that they received to their classmates from the other experimental conditions. The pupils were randomly assigned to the experimental conditions by drawing lots and separated in four different rooms. Also, the experimenter mentioned that the financial reward (10 RON) would be awarded to them if they answered to both e-mails which were sent to check their smoking behavior at three and six weeks after the experiment.

After three weeks, participants were contacted via e-mail and asked to state how many cigarettes they smoked, on average, each day, and whether they were successful in not smoking (not even a puff) in the last seven days. The same procedure was followed after six weeks. All 62 participants followed up with answering to both our e-mails and asked to come again at the same location in order to receive their financial reward. None of the participants were excluded from the analysis.

#### *Instruments*

*The informative intervention* consisted in providing our participants with: a. objective data regarding the substances contained by nicotine cigarettes and their effects on the human body; b. information regarding the types of diseases associated to cigarette smoking; c. benefits of quitting smoking. Participants were given this material in the form of a brief informative manual, and the data was also presented orally to them by the experimenter. During and after the oral presentation, participants were invited to ask for further clarification should they not understand something, and they were also encouraged to ask for further reading material on this topic via e-mail if the experimenter's knowledge on certain aspects should prove to be insufficient. The material given to participants was also presented orally because previous studies showed that informative interventions have the best effects in the face-to-face condition (Prochaska, Delucchi, & Hall, 2004).

*The action planning intervention* was made according to the theoretical model proposed by Sniehotta, Schwarzer, Scholz and Schüz (2005). It consisted in planning for the place, moment and manner in which the smoking cessation would happen. Before the action planning began, participants stated their intentions to quit smoking (in the following six months, according to the stage of change they were in: precontemplation or contemplation) with the purpose of making a commitment to the experimenter (authority figure) and to the other participants (people of the same age, classmates or friends).

*The coping planning intervention* was created according to the same theoretical model proposed by Sniehotta et al. (2005) and it consisted in the mental simulation of surmounting anticipated obstacles to action - that is, anticipating the specific situations that are likely to put one at the risk of failing in carrying out the desired behavior (not smoking, in this case), and planning in detail for the alternative behavioral responses to these potential future high risk situations. Our participants received a booklet which gave them some examples of high-risk situations which affect smokers after they quit, in the sense that they trigger a powerful craving sensation. Their task was to come up with behaviors alternative to smoking that they could perform if those five situations arose. The next part of the booklet was a journal they were asked to fill out with their own personal high-risk situations - by drawing on their past experience - and with strategies of overcoming each one, every day until their quitting date. They were also presented with some general strategies which may replace the health-risk behavior with a pro-health behavior.

*The combined intervention* consisted in implementing both the informative intervention and the action planning and coping planning intervention, while the control group received no intervention.

*The average number of cigarettes* smoked a day was assessed via self-reports provided by participants before the interventions, and after three and six weeks after the intervention. All self-reports were submitted via e-mail.

*Cessation rate* was operationalized as „not smoking (not even a puff) in the last seven days”, according to Donatelle, Prows, Champeau, Hudson, 2000; Stretcher, Kreuter, Den Boer, Kubrin, Hospers, & Skinner, 1994; Tonstad, Tonnesen, Hajek, Williams, Billing, Reeves, 2006; Toobert, Hampson, Glasgow, 2000. Self-reports were provided by participants via e-mail three and six weeks after the interventions.

## **Results and Discussion**

Two Chi-Squared Tests revealed that the type of intervention our participants underwent had significant effects on their cessation rates ( $p < 0.05$ ); the cessation rate was highest for the participants who took part in the combined intervention both three weeks and six weeks after it, followed by the cessation rate of the participants in the informative intervention, the cessation rate of the participants in the action and coping planning intervention and, respectively, by the cessation rate of the participants in the control group, as shown in Table 1.

Three Cochran's Q Tests showed that the initial cessation rate of the participants changed significantly ( $p < 0.05$ ) at three weeks, and, respectively, at six weeks only

for the participants who underwent the combined intervention and the informative intervention (Table 1). We conducted nine post-hoc McNemar's Tests using Bonferroni adjusted alpha levels of .016 per test (.05/3) which revealed that the cessation rates of the participants

who underwent the informative and the combined interventions were significantly lower compared to their initial cessation rates both three and six weeks after the interventions (Table 1).

Table 1. Results of Chi-Square Tests, Cochran's Q Tests, McNemar's Tests, Shapiro-Wilk Tests, Kruskal-Wallis Tests, Friedman Tests and Wilcoxon Tests for Study 1

	<i>Informative intervention</i>	<i>Action and coping planning intervention</i>	<i>Combined intervention</i>	<i>Control group</i>
<i>Chi-Square tests result<sup>a</sup>: <math>\chi_{(3)} = 19,10^{**}</math>, <math>V = 0,55^{**}</math></i>				
Quit rate 2 <sup>a</sup>	33.33%	14.30%	52.4%	0%
<i>Chi-Square tests result<sup>b</sup>: <math>\chi_{(3)} = 20,35^{**}</math>, <math>V = 0,57^{**}</math></i>				
Quit rate 3 <sup>b</sup>	35.30%	5.90%	58.80%	0%
<i>Cochran's Q tests results</i>				
Quit rate 1 <sup>c</sup>	0%	0%	0%	0%
Quit rate 2 <sup>a</sup>	46.6%	18.75%	68.75%	0%
Quit rate 3 <sup>b</sup>	40%	6.25%	62.5%	0%
	$Q_{(2)} = 12.28^*$	$Q_{(2)} = 4.66$	$Q_{(2)} = 20.18^{**}$	-
<i>Post Hoc McNemar's tests results</i>				
Quit rate 1 <sup>c</sup> – Quit rate 2 <sup>a</sup>	$\chi_{(1)} = 5.14^*$	$\chi_{(1)} = 1.33$	$\chi_{(1)} = 9.09^{***}$	$\chi_{(1)} = 0$
Quit rate 1 <sup>c</sup> – Quit rate 3 <sup>b</sup>	$\chi_{(1)} = 4.16^*$	$\chi_{(1)} = 0$	$\chi_{(1)} = 8.1^{***}$	$\chi_{(1)} = 0$
Quit rate 2 <sup>a</sup> – Quit rate 3 <sup>b</sup>	$\chi_{(1)} = 0$	$\chi_{(1)} = 0$	$\chi_{(1)} = 0$	$\chi_{(1)} = 0$
<i>Shapiro-Wilk tests results</i>				
No. cigarettes/ day 1 <sup>d</sup>	S-W = 0.94 df = 15	S-W = 0.34 df = 16	S-W = 0.90 df = 16	S-W = 0.88 df = 15
No. cigarettes/ day 2 <sup>e</sup>	S-W = 0.79 df = 15*	S-W = 0.91 df = 16	S-W = 0.60 df = 16**	S-W = 0.89 df = 15
No. cigarettes/ day 3 <sup>f</sup>	S-W = 0.81 df = 15*	S-W = 0.90 df = 16	S-W = 0.67 df = 16**	S-W = 0.93 df = 15
<i>Kruskal-Wallis tests results<sup>e</sup> <math>H(3) = 15.89^{***}</math></i>				
Mean Rank <sup>e</sup>	25.30	34.06	21.94	45.17
<i>Kruskal-Wallis tests results<sup>f</sup> <math>H(3) = 16.76^f</math></i>				
Mean Rank <sup>f</sup>	24.17	38.63	20.84	42.67
<i>Friedman tests results</i>				
Mean RankNo. cigarettes/ day 1 <sup>d</sup>	2.53	2.13	2.47	1.97
Mean RankNo. cigarettes/ day 2 <sup>e</sup>	1.53	1.47	1.66	2.03
Mean RankNo. cigarettes/ day 3 <sup>f</sup>	1.93	2.41	1.88	2
	$\chi^2_{(2)} = 9.5^*$	$\chi^2_{(2)} = 10.30^*$	$\chi^2_{(2)} = 7.87^*$	$\chi^2_{(2)} = 0,051$
<i>Wilcoxon tests results</i>				
No. cigarettes/ day 1 <sup>d</sup>	T = 3***	T = 10.5***	T = 7.5 ***	T = 26.5
No. cigarettes/ day 1 <sup>e</sup>	r = -0.76	r = -0.61	r = -0.74	r = -0.12
No. cigarettes/ day 1 <sup>d</sup>	T = 11***	T = 22	T = 10***	T = 32
No. cigarettes/ day 1 <sup>f</sup>	r = -0.72	r = -0.01	r = -0.66	r = -0.12
No. cigarettes/ day 1 <sup>e</sup>	T = 15*	T = 55***	T = 3	T = 20
No. cigarettes/ day 1 <sup>f</sup>	r = -0.53	r = -0.55	r = -0.33	r = -0.07

Note. <sup>a</sup>Quit rate three weeks after the intervention. <sup>b</sup>Quit rate six weeks after the intervention. <sup>c</sup>Quit rate before intervention. <sup>d</sup>Number of cigarettes a day smoked by our participants before the intervention. <sup>e</sup>Number of cigarettes a day smoked by our participants three weeks after the intervention. <sup>f</sup>Number of cigarettes a day smoked by our participants six weeks after the intervention \*p < 0.05, two-tailed. \*\*p < 0.001, two-tailed. \*\*\*p < 0.016, two-tailed (Bonferroni correction).

Table 2. Results of Mann-Whitney Tests for Study 1

<b>Type of intervention</b>	<b>Mean rank and coefficients three weeks after the interventions</b>		<b>Mean rank and coefficients six weeks after the interventions</b>	
Informative intervention	13.43		11.90	
Action and coping planning intervention	18.41	U = 81.5, r = -0.27	19.84	U = 58.5*, r = -0.44
Informative intervention	17.37		17.37	
Combined intervention	14.72	U = 99.5, r = -0.16	14.72	U = 99.5, r = -0.15
Informative intervention	10.50		10.90	
Control group	20.50	U = 37.5**, r = -0.57	20.10	U = 43.5**, r = -0.52
Action and coping planning intervention	20.00		21.06	
Combined intervention	13.00	U = 72*, r = -0.39	11.94	U = 55**, r = -0.50
Action and coping planning intervention	12.66		14.72	
Control group	19.57	U = 66.5*, r = -0.38	17.37	U = 99.5*, r = -0.14
Combined intervention	11.22		11.19	
Control group	21.10	U = 43.5**, r = -0.55	21.13	U = 43**, r = -0.55

\*p < 0.05, two-tailed. \*\*p < 0.008, two-tailed (Bonferroni correction)

In order to investigate the assumption of normality for our experimental conditions, we conducted a series of Shapiro-Wilk Tests of normality on the reported number of cigarettes smoked a day by our participants; their results showed that the assumption of normality was not met for all experimental conditions,  $p < 0.05$  (Table 1), which lead us to analyze these sets of data with non-parametric tests. The group that was exposed to the informative intervention ( $N = 15$ ) smoked, on average, 6.13 cigarettes a day initially ( $SD = 2.17$ ), 3.07 cigarettes a day after three weeks ( $SD = 3.71$ ) and, respectively, 3.53 cigarettes a day after six weeks ( $SD = 3.87$ ). The group that was exposed to the action and coping planning intervention ( $N = 16$ ) smoked, on average, 6.94 cigarettes a day initially ( $SD = 1.53$ ), 5 cigarettes a day after three weeks ( $SD = 3.58$ ) and, respectively, 6.81 cigarettes a day after six weeks ( $SD = 2.71$ ). The group that was exposed to the combined intervention ( $N = 16$ ) smoked, on average, 6.31 cigarettes a day initially ( $SD = 2.18$ ), 2.31 cigarettes a day after three weeks ( $SD = 4.03$ ) and, respectively, 2.69 cigarettes a day after six weeks ( $SD = 4.03$ ). The group that was exposed to the control intervention ( $N = 15$ ) smoked, on average, 7.53 cigarettes a day initially ( $SD = 1.36$ ), 7.67 cigarettes a day after three weeks ( $SD = 1.35$ ) and, respectively, 7.73 cigarettes a day after six weeks ( $SD = 1.58$ ).

The type of intervention our participants went through had significant effects on the number of cigarettes they smoked a day both three and six weeks after the interventions took place ( $p < 0.05$ ), as revealed by the results of two Kruskal-Wallis Tests (Table 1). We conducted twelve post-hoc Mann-Whitney Tests using Bonferroni adjusted alpha levels of .008 per test (.05/6) which revealed that participants in the control group smoked significantly more cigarettes a day than participants in the informative intervention and participants in the combined intervention both three and six weeks after the interventions took place (Table 2).

Four Friedman Tests showed that the number of cigarettes our participants smoked daily before the interventions changed significantly ( $p < 0.05$ ) at three weeks, and, respectively, at six weeks only after they participated in the informative intervention, in the action and coping planning intervention and, respectively, in the combined intervention (Table 1). We conducted twelve post-hoc Wilcoxon Tests using Bonferroni adjusted alpha levels of .016 per test (.05/3) which revealed that the participants who smoked significantly fewer cigarettes a day both three and six weeks after the interventions took place underwent either the informative intervention or the combined one (Table 1).

## Study 2

The aim of this study is to test the efficiency of the same three types of interventions that were implemented in Study 1 (the informative intervention, the action planning and coping planning intervention, and the combined intervention – the informative intervention and the action planning and coping planning intervention) on nicotine addicts. The general objective is to identify the most effective strategy in treating nicotine addiction among university students who are addicted to cigarette smoking – they have been smoking over ten cigarettes a day each day, for a period of at least 12 months. The specific objectives

of this study coincide to those of the first study. For this purpose, we investigated the following hypotheses: *H1*: The three types of interventions will reduce the average number of nicotine cigarettes smoked by participants. *H2*: The combined intervention (informative, action and coping planning) will generate the highest cessation rate at both moments of measurement (after three, respectively, six weeks). *H3*: The action and coping planning intervention will generate higher cessation rates compared to the informative intervention.

The participants in this study are identified as being in the preparation stage - they intended to take action in the near future, and they may have even formulated a plan, but may not have entirely committed to it. In consequence, we expect the action planning and coping planning intervention to generate higher cessation rates compared to the informative intervention, and also, we expect that the combined intervention will generate higher cessation rates than both the informative intervention and the action and coping planning intervention, since it is more complex and comprises both the informative intervention and the action planning and coping planning intervention.

### Trial design

An open pragmatic superiority trial was conducted in a single site in Iași, Romania. The experimental design used was the same as the one used in Study 1.

### Participants

The participants in this study were 62 university students between the ages 23-25, from the „Al. I. Cuza” University, Iași. They had been smoking more than ten cigarettes a day, each day, for a period of at least 12 months, according to the temporal criterion for a substance dependence listed in the DSM IV-R (APA, 2000). They were also considered nicotine addicts according to the criteria proposed and tested in The Framingham Study (Gordon, Kannel, McGee, & Dawber, 1975). Participants were in the preparation stage, and they were recruited by snowball sampling. The same two experimenters that conducted Study 1 went to the smoking designated areas in the student campuses and asked students who were smoking whether they would like to participate in a 6 weeks study meant to test the efficiency of interventions meant to help them quit smoking, provided they met the aforementioned eligibility criteria. If they decided to participate, they were told they would be financially rewarded with 10 RON upon completion. They were also asked to create an anonymous e-mail address in which to not mention any personal data that could lead to their identification for the purpose of contacting them in the future. Moreover, they were asked to inform other colleagues of theirs who smoked of the eligibility criteria and to ask them if they wanted to participate in our study. All students encountered were provided with the experimenters' e-mail addresses written on small sheets of paper which also mentioned the eligibility criteria for participation to this study. Altogether, we invited 318 students to participate to our study, given they met the eligibility criteria. We chose to not ask them about their smoking habits in the group settings in which we recruited them in order to avoid potential discomfort of admitting to smoking a certain amount of cigarettes in the presence of the other people in the smoking designated areas. The

recruitment lasted from mid January 2013 to mid February 2013.

Once we recruited 62 participants by snowball sampling, we randomly assigned them to each of the four conditions by drawing lots and proceeded to organize meetings with each of the four experimental groups separately. Similarly to Study 1, they were only asked to provide the average number of cigarettes they smoked a day. We checked whether all the participants were in the preparation stage according to the trans-theoretical model by asking them when he/she intended to quit smoking. All participants declared they met the eligibility criteria for this study. Just as in study 1, participants were asked to not disclose the content of the intervention that they received to the other participants in this study, in order to not contaminate the results of our research. After three weeks, participants were contacted via e-mail and asked to state how many cigarettes they smoke, on average, each day, and whether they were successful in not smoking (not even a puff) in the last seven days. The same procedure was followed after six weeks.

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on average, each day, and whether they were successful in not smoking (not even a puff) in the last seven days. The same procedure was followed after six weeks. All 62 participants followed up with answering to both our e-mails and asked to come again at the same location in order to receive their financial reward. None of the participants were excluded from the analysis.

**Instruments**

The instruments are the same as those used in Study 1.

**Results and discussion**

Two Chi-Squared Tests revealed that the type of intervention our participants underwent had significant effects on their cessation rates ( $p < 0.05$ ); the cessation rate was highest for the participants who took part in the combined intervention both three weeks and six weeks after it, followed by the cessation rate of the participants in the action and coping planning intervention, the cessation rate of the participants in the informative intervention and, lastly, by the cessation rate of the participants in the control group, as shown in Table 3.

Table 3. Results of Chi-Square Tests, Cochran's Q Tests, McNemar's Tests, Shapiro-Wilk Tests, Kruskal-Wallis Tests, Friedman Tests and Wilcoxon Tests for Study 2

	<i>Informative intervention</i>	<i>Action and coping planning intervention</i>	<i>Combined intervention</i>	<i>Control group</i>
<i>Chi-Square tests result<sup>a</sup>: <math>\chi_{(3)} = 19.70^{**}</math>, <math>V = 0.56^{**}</math></i>				
Quit rate 2 <sup>a</sup>	11.80%	29.40%	58.80%	0%
<i>Chi-Square tests result<sup>b</sup>: <math>\chi_{(3)} = 13.55^{**}</math>, <math>V = 0.46^*</math></i>				
Quit rate 3 <sup>b</sup>	9.10%	27.30%	63.60%	0%
<i>Cochran's Q tests results</i>				
Quit rate 1 <sup>c</sup>	0%	0%	0%	0%
Quit rate 2 <sup>a</sup>	12.5%	33.33%	66.66%	0%
Quit rate 3 <sup>b</sup>	6.25%	20%	46.6%	0%
	$Q_{(2)} = 3$	$Q_{(2)} = 7.6^*$	$Q_{(2)} = 20.18^{**}$	-
<i>Post Hoc McNemar's tests results</i>				
Quit rate 1 <sup>c</sup> – Quit rate 2 <sup>a</sup>	$\chi_{(1)} = 0.50$	$\chi_{(1)} = 3.20$	$\chi_{(1)} = 8.10^{***}$	$\chi_{(1)} = 0$
Quit rate 1 <sup>c</sup> – Quit rate 3 <sup>b</sup>	$\chi_{(1)} = 0$	$\chi_{(1)} = 1.33$	$\chi_{(1)} = 5.14^{***}$	$\chi_{(1)} = 0$
Quit rate 2 <sup>a</sup> – Quit rate 3 <sup>b</sup>	$\chi_{(1)} = 0$	$\chi_{(1)} = 0.50$	$\chi_{(1)} = 1.33$	$\chi_{(1)} = 0$
<i>Shapiro-Wilk tests results</i>				
No. cigarettes/ day 1 <sup>d</sup>	S-W = 0.77 df = 16*	S-W = 0.82 df = 15*	S-W = 0.74 df = 15*	S-W = 0.80 df = 16*
No. cigarettes/ day 2 <sup>e</sup>	S-W = 0.87 df = 16*	S-W = 0.86 df = 15*	S-W = 0.63 df = 15**	S-W = 0.78 df = 16*
No. cigarettes/ day 3 <sup>f</sup>	S-W = 0.93 df = 16	S-W = 0.80 df = 15*	S-W = 0.76 df = 15*	S-W = 0.78 df = 16*
<i>Kruskal-Wallis tests results<sup>e</sup> <math>H(3) = 26.66^{***}</math></i>				
Mean Rank <sup>e</sup>	25.16	29.73	19.97	50.31
<i>Kruskal-Wallis tests results<sup>f</sup> <math>H(3) = 13.05^{f*}</math></i>				
Mean Rank <sup>f</sup>	27.19	37.87	20.27	40.38
<i>Friedman tests results</i>				
Mean RankNo. cigarettes/ day 1 <sup>d</sup>	2.75	2.67	2.9	2
Mean RankNo. cigarettes/ day 2 <sup>e</sup>	1.13	1.10	1.37	2
Mean RankNo. cigarettes/ day 3 <sup>f</sup>	2.13	2.23	1.73	2
	$\chi^2_{(2)} = 23.72^*$	$\chi^2_{(2)} = 25.06^*$	$\chi^2_{(2)} = 25.08^*$	$\chi^2_{(2)} = 0$
<i>Wilcoxon tests results</i>				
No. cigarettes/ day 1 <sup>d</sup>	$T = 0^{***}$	$T = 0^{***}$	$T = 0^{***}$	$T = 10.5$
No. cigarettes/ day 1 <sup>e</sup>	$r = -0.88$	$r = -0.90$	$r = -0.86$	$r = 0$
No. cigarettes/ day 1 <sup>d</sup>	$T = 102.5^*$	$T = 55^*$	$T = 0^{***}$	$T = 5$
No. cigarettes/ day 1 <sup>f</sup>	$r = -0.79$	$r = -0.82$	$r = -0.82$	$r = 0$
No. cigarettes/ day 1 <sup>e</sup>	$T = 9^{***}$	$T = 78^{***}$	$T = 15^*$	$T = 5$
No. cigarettes/ day 1 <sup>f</sup>	$r = -0.59$	$r = -0.52$	$r = -0.52$	$r = 0$

Note. <sup>a</sup>Quit rate three weeks after the intervention. <sup>b</sup>Quit rate six weeks after the intervention. <sup>c</sup>Quit rate before intervention. <sup>d</sup>Number of cigarettes a day smoked by our participants before the intervention. <sup>e</sup>Number of cigarettes a day smoked by our participants three weeks after the intervention. <sup>f</sup>Number of cigarettes a day smoked by our participants six weeks after the intervention \* $p < 0.05$ , two-tailed. \*\* $p < 0.001$ , two-tailed. \*\*\* $p < 0.016$ , two-tailed (Bonferroni correction).

Table 4. Results of Mann-Whitney Tests for Study 1

Type of intervention	Mean rank and coefficients <b>three weeks</b> after the interventions		Mean rank and coefficients <b>six weeks</b> after the interventions	
Informative intervention	14.44		13.28	
Action and coping planning intervention	17.67	U = 95, r = -0.18	18.90	U = 76.5, r = -0.31
Informative intervention	18.78		18.66	
Combined intervention	13.03	U = 75.5*, r = -0.32	13.17	U = 77.5*, r = -0.30
Informative intervention	8.94		12.25	
Control group	24.06	U = 7, r = -0.82	20.75	U = 60, r = -0.47
Action and coping planning intervention	17.87		18.97	
Combined intervention	13.13	U = 77, r = -0.28	12.03	U = 60.5, r = -0.40
Action and coping planning intervention	10.20		16.00	
Control group	21.44	U = 33*, r = -0.63	16.00	U = 120, r = 0
Combined intervention	9.80		11.07	
Control group	21.81	U = 27**, r = -0.68	20.63	U = 46*, r = -0.53

\* $p < 0.05$ , two-tailed. \*\* $p < 0.008$ , two-tailed (Bonferroni correction)

Three Cochran's Q Tests showed that the initial cessation rate of our participants changed significantly at three weeks and at six weeks only for the participants who underwent the combined intervention and the action and coping planning intervention,  $p < 0.05$  (Table 3). We conducted nine post-hoc McNemar's Tests using Bonferroni adjusted alpha levels of .016 per test (.05/3) which revealed that the cessation rates of the participants who underwent the combined intervention were significantly lower as compared to their initial cessation rates both three and six weeks after the intervention (Table 3).

In order to investigate the assumption of normality for our experimental conditions, we conducted a series of Shapiro-Wilk Tests of normality on the reported number of cigarettes smoked a day by our participants; their results showed that the assumption of normality was not met for all experimental conditions,  $p < 0.05$  (Table 3), which lead us to analyze these data sets with non-parametric tests as well. The group that was exposed to the informative intervention ( $N = 16$ ) smoked, on average, 24.38 cigarettes a day initially ( $SD = 7.5$ ), 7.38 cigarettes a day after three weeks ( $SD = 5.94$ ) and, respectively, 17.31 cigarettes a day after six weeks ( $SD = 11.26$ ). The group that was exposed to the action and coping planning intervention ( $N = 15$ ) smoked, on average, 31.67 cigarettes a day initially ( $SD = 7.94$ ), 12 cigarettes a day after three weeks ( $SD = 10.82$ ) and, respectively, 25.33 cigarettes a day after six weeks ( $SD = 14.57$ ). The group that was exposed to the combined intervention ( $N = 15$ ) smoked, on average, 28.33 cigarettes a day initially ( $SD = 9.19$ ), 7 cigarettes a day after three weeks ( $SD = 12.79$ ) and, respectively, 11.2 cigarettes a day after six weeks ( $SD = 14.52$ ). The group that was exposed to the control intervention ( $N = 16$ ) smoked, on average, 28.13 cigarettes a day initially ( $SD = 7.5$ ), 28.13 cigarettes a day after three weeks ( $SD = 8.34$ ) and, respectively, 28.13 cigarettes a day after six weeks ( $SD = 8.34$ ).

The type of intervention our participants went through had significant effects ( $p < 0.05$ ) on the number of cigarettes they smoked a day both three and six weeks after the interventions took place, as revealed by the results of two Kruskal-Wallis Tests (Table 3). We conducted twelve post-hoc Mann-Whitney Tests using Bonferroni adjusted alpha levels of .008 per test (.05/6) which revealed that participants in the control group smoked significantly more

cigarettes a day than participants in the combined intervention three weeks after the interventions took place (Table 4).

Four Friedman Tests showed that the number of cigarettes our participants smoked daily before the interventions changed significantly ( $p < 0.05$ ) at three weeks, and at six weeks after they participated in the informative intervention, in the action and coping planning intervention and, respectively, in the combined intervention (Table 3). We conducted twelve post-hoc Wilcoxon Tests using Bonferroni adjusted alpha levels of .016 per test (.05/3) which revealed that the participants who smoked significantly fewer cigarettes a day both three and six weeks after the interventions took place underwent the combined one (Table 3).

## General Discussion

One of the most important findings of our research is the longitudinal efficiency of the informative intervention in health behavior change for adolescents. Seeing as our participants in Study 1 were occasional smokers, they were either in the experimentation stage of smoking acquisition (during which adolescents repeatedly, but irregularly try cigarettes over an extended period of time) or in the stage of regular use (the pre-addiction stage, during which smoking is used regularly, over a wide variety of contexts), according to Mayhew, Flay, & Mott, 2000. In these stages, the main predictors of smoking are environmental factors (e.g. parental, sibling, and friends' smoking), which create pro-smoking perceptions that can be changed by modifying social norms and focusing on education (Freedman, Nelson, & Feldman, 2012; Tjora, Hetland, Aarø, & Øverland, 2012). Our informative intervention addressed the pro-smoking perceptions by focusing on educating adolescents regarding the health risks of smoking and attempting to change the pro-smoking social norm widely spread in Romania (GATS, 2011).

However, for the participants in Study 2, the positive effects of the informative intervention wore off six weeks after the intervention. This is probably due to the fact that the weight of the pharmacological properties of the drug as a predictor for its repeated usage is directly proportional to how many times the drug is consumed (Goode, 1999). This physiological side of addiction may be related to the fact



that repeated nicotine stimulation enhances the amount of dopamine released in the *nucleus accumbens*, which both affects their reward circuit and leads to smokers' experiencing agitation and discomfort when the nicotine leaves their system (Cosgrove et al., 2009). Seeing as the intensity of these physiological effects is higher for people who smoke more (and have smoked more in the past), participants in Study 2 needed a more complex intervention to help them with smoking cessation. According to the Trans-theoretical Model of Behavior Change, people in the precontemplation / contemplation stages (as our participants in Study 1, who did not plan on quitting smoking in the near future), respond best to being provided with information and to doubts about the harmlessness of their drug use (Connors, DiClemente, Velasquez, & Donovan, 2012), as our results confirmed. On the other hand, people in the preparation stage (as our participants in Study 2) already plan on quitting smoking and thus respond better at being helped to create a concrete plan of action and to remove personal barriers that may stand in the way of implementing the aforementioned plan (Connors et al., 2012). This explains why the longitudinal efficiency of the action and coping planning intervention was better for our participants in Study 2.

Both our studies revealed that the combined intervention was the most efficient one in smoking cessation and reduction of the number of cigarettes smoked a day. In what regards our participants in Study 2, this is probably due to the characteristics of the Romanian population from which we extracted the sample that took part in our study. The informative component of the combined intervention had significant effects on the participants in the preparation stage because their levels of knowledge regarding the negative impact of smoking were low, assumption supported by the findings reported in GATS, 2011. As for our participants in Study 1, action and coping planning was shown to increase self-efficacy (O'Brien, Bassett, McNair, 2013), a good predictor of smoking cessation in adolescents (Zhu, Sun, Billings, Choi, & Malarcher, 1999), which is why the addition of the action and coping planning to the informative component of the combined intervention proved to be the most efficient strategy in both smoking cessation and smoking reduction.

Another important finding of our research was the longitudinal efficiency of the combined intervention in smoking reduction. Smoking reduction was shown to be a very good predictor of smoking cessation for addicts (Broms, Korhonen, & Kaprio, 2008) and to greatly contribute, in the case of occasional smokers, in preventing addiction (Doubeni, Reed, & DiFranza, 2010). Future research should examine the long-term effects of the combined intervention proposed by us over a more extended period of time.

With regard to the limits of our research, they mainly reside in the manner of measuring cigarette smoking, in the potential inter-individual differences between our participants and in the fact that the snow-ball sampling technique employed in Study 2 limits the generalization of our results. Self-reports were used in assessing the quitting rates among our participants; future research should employ more objective manners of assessing the smoking status of participants, such as the levels of salivary, urinary or serum cotinine (Gan, Cohen, Man, & Sin, 2008;

Perezstable, Benowitz, & Marin, 1995). Moreover, Volkow et al., 1999, revealed that people with fewer dopamine receptors are more vulnerable to drug abuse as compared to people with more dopamine receptors (Volkow et al., 1999). In order to control for these inter-individual differences, future research should be conducted on larger samples of participants.

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