Tobacco dependence and smoking cessation: The mediating role of smoker and ex-smoker self-concepts

Juan Manuel Falomir-Pichastor[a],[*], Jérôme Blondé[a], Olivier Desrichard[a], Max Felder[b], Gisana Riedo[b], Laura Folly[b]

[a] *University of Geneva, Switzerland*
[b] *Behaviour Change Lab, Switzerland*

HIGHLIGHTS

- We examined the role of smokers' self-concept in tobacco dependence.
- We used longitudinal data based on a 6-month smoking cessation intervention.
- We assessed smokers' dependence, self-concept, and smoking status.
- Dependence was negatively associated with smoking abstinence.
- Changes in self-concept mediated the relationship between dependence and abstinence.

ARTICLE INFO

ABSTRACT

Tobacco dependence is a complex phenomenon in which physical and psychological components go hand in hand, and it is often considered as one of the major barriers to quit smoking. However, we still need to increase our understanding of the processes through which tobacco dependence relates to smoking cessation. This research aimed to investigating whether changes in smoker versus ex-smoker (abstainer) self-concept account for the association between tobacco dependence and successful smoking cessation. We used longitudinal data drawn from the evaluation of a smoking cessation intervention. A sample of smokers enrolled in the program filled in a questionnaire at the beginning of the intervention (baseline: N = 779), 6 months later (i.e., at the end of the intervention: T1, N = 532), and 9 months later (T2; N = 387). We assessed tobacco dependence (baseline), smoker versus ex-smoker self-concept (baseline, T1, and T2) and smoking status (baseline, T1 and T2). Tobacco dependence was negatively associated with smoking cessation maintenance, and this effect was mediated by changes in self-concept: The greater tobacco dependence, the lower the likelihood that former smokers develop an ex-smoker self-concept during the program, which results in relapse at T1 or T2. Successful smoking cessation interventions should provide strategies preventing the negative effects of tobacco dependence on identity transition.

1. Introduction

Tobacco dependence is often considered as one of the major barriers to smoking cessation. It is associated with an urgent and uncontrollable need to smoke and decreases smokers' chances of success when they attempt to quit (Etter, 2005; John, Meyer, Hapke, Rumpf, & Schumann, 2004; Vangeli, Stapleton, Smit, Borland, & West, 2011). However, some studies have shown that smokers with a high dependence may also be motivated to quit (Perski, Herd, West, & Brown, 2019) and have success when trying to quit (Etter, 2005). Thus, tobacco dependence does not

consistently predict smokers' quit efforts, and further research is needed to better understand the processes through which it relates to smoking cessation. The present research contributes to this effort by examining whether changes in smokers' self-concept mediate the effect of tobacco dependence on successful smoking cessation.

2. Tobacco dependence and smokers' self-concept

A great deal of research has shown a reciprocal relationship between identity and behavior (e.g., Cast, 2003): identity is built from

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[*] Corresponding author.
E-mail address: Juan.Falomir@unige.ch (J.M. Falomir-Pichastor).

perceived behavior that individuals engage in, and behavior reflects identity (i.e., individuals behave in ways consistent with their identity). This general understanding is consistent with different theoretical perspectives, such as the identity theory (Stets, 2006), the self-perception theory (Bem, 1972), and the social identity theory (Tajfel & Turner, 1979)[1]. Accordingly, research has shown that smoking constitutes a salient and relevant behavior related to one's self-concept (Choi, Choi, & Rifon, 2010; Dupont et al., 2015; Meijer, Gebhardt, Dijkstra, Willemsen, & Van Laar, 2015; Tombor, Shahab, Brown, & West, 2013).

Adolescents often start smoking to reach a specific identity as a smoker (Chassin, Presson, Sherman, & Edwards, 1990; Falomir-Pichastor et al., 2007). Moreover, smoking is related to individuals' identity. For instance, smoker identity is positively related to smoking frequency and the number of years one has been smoking (Choi et al., 2010; Levinson et al., 2007). Research has also shown that smoker identity contributes to smoking escalation, irrespective of other relevant factors such as smoking motives, smoking expectancies, and novelty seeking (Hertel & Mermelstein, 2012). Finally, smoking regulations and antismoking norms also strengthen smoker identity as a central element of self-concept (Falomir-Pichastor & Mugny, 2004), as they force smokers to deal with a deviant and stigmatized social identity (Stuber, Galea, & Link, 2008).

Whereas this research informs about the reciprocal relationship between smoking and smoker identity, in the present research we contend that tobacco dependence may strengthen this link. Indeed, smoking frequency, which contributes to nurturing smoker identity (Hertel & Mermelstein, 2012), is intrinsically associated with tobacco dependence (Etter, 2005; Stuber et al., 2008). Furthermore, the extent to which we infer who we are from what we do is strengthened by internal attributions to one's behavior (Bem, 1972). Firstly, tobacco dependence indicates the existence of internal motives for smoking (Berg et al., 2013; Chassin, Presson, Rose, & Sherman, 2007), which are associated with a greater development of a smoker identity (Hertel & Mermelstein, 2016). Secondly, outcomes related to tobacco dependence such as withdrawal symptoms, a perceived lack of capacity to refrain from smoking, or previous failures to stop smoking, may increase the feeling that smoker identity (rather than non-smoker, ex-smoker, or abstainer identities) constitutes a central part of self-concept.

Accordingly, there are reasons to hypothesize that a higher tobacco dependence is related to a stronger identity as a smoker, and a weaker (future) identity as an ex-smoker or abstainer. Direct evidence in support of this hypothesis comes from research showing that tobacco dependence is positively correlated to a stronger smoker identity (Dupont et al., 2015; Meijer et al., 2015), and even a more positive smoker identity (Tombor et al., 2013). Indirect evidence can be found in research showing that regular users of fitness revealed symptoms of dependence (e.g., withdrawal, loss of control) when a cessation of exercise means that they are unable to meet other' expectations about body image, which subsequently reinforces their exerciser identity (Banbery, Groves, & Biscomb, 2012).

3. Smokers' identity and smoking cessation

Past research has shown that smokers' identity is related to motivation to quit and successful smoking cessation, and that smoking

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[1] It is worthwhile noting that these theoretical perspectives conceptualize identity in different ways and consider that the social context in which behaviour takes place (e.g., social interactions and intergroup relations) actually shapes the identity-behavior link. However, a review of these different perspectives and the role of social context in identity development and behaviour is beyond the present work. For the sake of simplicity and clarity, we employ here identity and self-concept interchangeably and define them merely as the image that people have about themselves, even though this does not always reflect the way each of the theories we refer to in the present paper may specifically define identity.

cessation parallels changes in smokers' identity. Smoker identity is related to intention to quit (Falomir-Pichastor & Invernizzi, 1999), as well as to defensive evaluation of antismoking messages (Falomir-Pichastor & Mugny, 2004; Freeman, Hennessy, & Marzullo, 2001). Smokers with stronger non-smoker identities have stronger intentions to quit and are more likely to attempt (Meijer et al., 2015). A stronger quitting identity predicts greater intentions to quit, and both quitter and smoker identities are related to actual quitting attempts (Van den Putte, Yzer, Willemsen, & Bruijn, 2009). Furthermore, chances of being abstinent at the end of a smoking cessation program are higher among participants with lower scores of smoker identity but higher scores of abstainer identity (Shadel & Mermelstein, 1996). Indeed, smoker identity (but not ex-smoker identity) is associated with higher relapses (Buckingham, Frings, & Albery, 2013).

Moreover, other studies suggest that changes in identity are intrinsic and necessary to behavior change in general (Kearney & O'Sullivan, 2003), and smoking cessation more particularly. For instance, a process of change from a smoker self-concept to an ex-smoker self-concept and finally to a non-smoker self-concept was observed 1 year later among smokers who quit smoking (Vangeli & West, 2012; Vangeli, Stapleton, & West, 2010). In a sample of smokers who quit within a smoking cessation program, abstainers (those who did not smoke at the end of the program and 1 year later) showed a decrease in their smoker identity and an increase in their abstainer identity as assessed at week 7 and week 9 after the beginning of the program (Shadel, Mermelstein, & Borrelli, 1996). However, this pattern was not observed among smokers who relapsed. Thus, a significant body of research indicates that identity changes parallel smoking cessation. However, no previous research has investigated whether these changes specifically account for the effect of tobacco dependence on smoking cessation.

4. Overview and hypotheses

While previous studies have largely examined the relationship between tobacco dependence and quitting behaviours, as well as how smoker identity is related to smoking cessation, no research has been interested in the possibility that identity processes can account for the relationship between tobacco dependence and quitting behaviours. Thus, the contribution of our research is to extend past literature by examining whether changes in self-concept mediate the effect of tobacco dependence on the likelihood of remaining an abstainer among smokers enrolled in a smoking cessation program, as well as the chances of relapsing 9 months after quitting. Firstly, we expected that baseline tobacco dependence reduces smokers' chances of remaining abstinent at the end of the program (H1). Secondly, we expected tobacco dependence to reduce successful smoking cessation by preventing the transition from a smoker self-concept to an ex-smoker self-concept. Accordingly, we predicted that changes in former smokers' self-concept from baseline to the end of the program and later mediate the effect of dependence on smoking status (H2).

5. Method

5.1. Smoking cessation program

This study used longitudinal data drawn from the evaluation of a smoking cessation intervention (*J'arrête de fumer*' [I quit smoking]) conducted in Switzerland in 2016. This was a free cessation intervention run on Facebook, conducted by the CIPRET-Valais, and supported by the Swiss Tobacco Control Fund. During a two-month recruitment period prior to the start of the program, participants liked the Facebook page, publicly announced their desire to quit on March 20, and tried to quit together on this day. Not all participants succeeded in quitting at this point, but they were all included in the program. During a 6-month period participants received via Facebook at least one daily advice, and had the possibility of benefiting from a personalized follow-up. To

evaluate program efficacy, a sample of participants in the program was recruited through Facebook. This evaluation involved assessments at the beginning of the program (baseline), and at 3 months (middle of the program), 6 months (end of the program), and 9 months (3 months after the end of the program) follow-ups.[2] In the present study, we specifically focus on tobacco dependence, smoker identity and smoking status obtained at baseline (T0), at the end of the program (6 months later; T1), and three months after the end of the program (9 months later; T2).

5.2. Participants and procedure

Participants in the smoking cessation program were offered to participate in the evaluation of the intervention. To avoid motivation bias, a draw was organized among participants who filled in all the questionnaires, regardless of whether they failed or did successfully in their attempt. Participation in the evaluation program was voluntary and only consisted in fulfilling a questionnaire at different time points. Participants' informed consent was obtained before starting the questionnaire, and strict confidentiality was assured. The Ethics Committee of the Faculty of Psychology and Educational Sciences of the University of Geneva approved the use of this anonymized data.

From the 820 participants initially retained for the program evaluation, 779 filled in the questionnaire at T0 (baseline), and 408 of them successfully quitted at the beginning of the program. At the end of the program (6 months later) 532 participants (145 abstainers) filled in the new questionnaire (T1). Finally, 387 participants (144 abstainers) filled in a questionnaire 3 months after the end of the program (T2). Tables 1 and 2 display demographic information. Participants indicated their tobacco dependence, smoking status, and smoker versus ex-smoker identity at T0. In T1 and T2, we again assessed identity and smoking status.

5.3. Measures

Tobacco dependence. Tobacco dependence was assessed through the Fagerström Test for Cigarette Dependence (FTCD; Fagerström, 2012; for details, see Table 1).

Smoker versus *ex-smoker identity.* Smoker/ex-smoker identity was assessed in two different ways. At T0 and T2, the same three items were used to measure both smoker and ex-smoker identity ('Do you really feel smoker/ex-smoker?', 'Do you identify with smokers/ex-smokers?' and 'Being a smoker/ex-smoker is important to you?'; 1 = 'Not at all' to 7 = 'Absolutely'). These measures were already used in previous studies examining smoker identity (e.g., Falomir-Pichastor & Invernizzi, 1999) and refer to commonly used items in assessment of identity (see Leach et al., 2008). First we computed an average score of smoker identity and ex-smoker identity and, second, we computed a difference score (ex-smoker identity minus smoker identity). Because of required restrictions in the questionnaire length, at T1 participants' self-concept was assessed using a single bipolar assessment that opposed Smoker identity (1) to Ex-smoker identity (7).

Smoking status. At each questionnaire participants indicated their smoking status by selecting one of the following five options: 'I hold without smoking', 'I'm still trying to quit completely, but there are still times when I smoke', 'I gave up quitting, but I consume less tobacco than before', 'I gave up quitting and I have resumed my previous consumption, and 'I gave up stopping and I smoke more than before'. Smoking status was coded as +1 if participants selected the first option, and as −1 if they selected any of the remaining options.

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[2] A detailed description of the program and its evaluation can be obtained from Folly, Riedo, Felder, Falomir-Pichastor, and Desrichard (2016).

Table 1
Summary statistics at the beginning of the program (T0).

	N	(%)
Sex		
Female	577	(74.1%)
Male	202	(25.9%)
Professional status		
Worker	496	(63.7%)
Stay-at-home	72	(9.2%)
Student	55	(7.1%)
Unemployed	90	(11.6%)
Retiree	12	(1.5%)
Other	54	(6.9%)
Use of nicotine substitutes:		
Any	537	(68.9%)
Before the program	49	(6.3%)
Started with the program	192	(24.6%)
Type of nicotine substitutes:		
e-cig (with nicotine)	67	(8.6%)
e-cig (without nicotine)	64	(8.2%)
Chewing-gums	91	(11.7%)
Patches	73	(9.4%)

	M	(SD)
Age	37.00	(11.25)
Age of 1st cigarette	17.16	(4.30)
Daily average consumption before the program: (1 = 0; 2 = 1–9; 3 = 10–15; 4 = 16–20; 5 = 20–30; 6 = > 30)		
Manufactured cigarettes	3.40	(1.35)
Hand-made cigarettes	1.33	(0.83)
Pipe	1.02	(0.24)
Cigar	1.12	(0.61)
Cigarillos	1.06	(0.40)
Other	1.06	(0.35)

Tobacco dependence measure (FTND; response code between parentheses)

How soon after you wake up do you smoke your first cigarette?		
Within 5 min. (3)	188	(24.1%)
6–30 min. (2)	330	(42.4%)
31–60 min. (1)	143	(18.4%)
After 60 min. (0)	115	(14.8%)
Do you find it difficult to refrain from smoking in places where it is forbidden?		
Yes (1)	157	(20.2%)
No (0)	619	(79.5%)
Which cigarette would you hate giving up?		
The first in the morning (1)	460	(59.1%)
Any other (0)	316	(40.6%)
How many cigarettes a day do you smoke? (Computed from 'Daily average consumption')		
> 31 (3)	39	(5%)
21–30 (2)	151	(19.4%)
11–20 (1)	459	(58.9%)
< 10 (0)	130	(16.7%)
Do you smoke more frequently during the first hours after waking than during the rest of the day?		
Yes (1)	239	(30.7%)
No (0)	537	(68.9%)
Do you still smoke even if you are so sick that you are in bed most of the day?		
Yes (1)	382	(49%)
No (0)	394	(50.6)

6. Results

6.1. Data analyses

Information about sample characteristics is presented in Table 1. We initially conducted correlation analyses to examine the link between the investigated predictors (see Table 2). We then conducted logistic regression analyses to examine whether each predictor individually was significantly related to smoking status at T1 and at T2, after controlling for smoking status at T0 (−1 = smoker and +1 = abstainer). Results are summarized in Table 3. Then, we conducted a series of bootstrap analyses for indirect effects using SPSS macro for multiple mediation (level of confidence: 95%; 5000 bootstrap resamples; Preacher & Hayes, 2008). Results are presented in Table 4.

Table 2
Means, Standard Deviations, and correlations between the variables across T0, T1, and T2.

	N	Mean	SD	Cronbach alpha		Dep-T0	SI-T0	ESI-T0	RSI-T0	RSI-T1	SI-T2	ESI-T2
Dependence (Dep-T0) [Min. = 0, Max. = 10]	779	4.47	2.20	–	Pearson Corr. Sig. (2-tailed) N							
Smoker identity (SI-T0) [Min. = 1, Max. = 7]	773	4.31	1.39	0.65	Pearson Corr. Sig. (2-tailed) N	0.221 0.001 773						
Ex-smoker identity (ESI-T0) [Min. = 1, Max. = 7]	773	3.97	1.53	0.62	Pearson Corr. Sig. (2-tailed) N	−0.020 0.584 773	−0.196 0.001 773					
Relative strength of identity (RSI-T0) [Smoker = −6 vs. Ex-smoker = +6]	773	−0.33	2.26	–	Pearson Corr. Sig. (2-tailed) N	−0.149 0.001 773	−0.747 0.001 773	0.798 0.001 773				
Relative strength of identity (RSI-T1) [Smoker = 1 vs. Ex-smoker = 7]	515	3.61	2.16	–	Pearson Corr. Sig. (2-tailed) N	−0.184 0.001 515	−0.200 0.001 514	0.303 0.001 514	0.327 0.001 514			
Smoker identity (SI-T2) [Min. = 1, Max. = 7]	369	3.39	1.76	0.81	Pearson Corr. Sig. (2-tailed) N	0.162 0.002 369	0.333 0.001 369	−0.310 0.001 369	−0.768 0.001 336	−0.768 0.001 336		
Ex-smoker identity (ESI-T2) [Min. = 1, Max. = 7]	369	3.81	2.00	0.78	Pearson Corr. Sig. (2-tailed) N	−0.163 0.002 369	−0.172 0.001 369	0.394 . 0.001 369	0.716 . 0.001 336	0.716 . 0.001 336	−0.715 . 0.001 369	
Relative strength of identity (RSI-T2) [Smoker = −6 vs. Ex-smoker = +6]	369	0.42	3.49	–	Pearson Corr. Sig. (2-tailed) N	−0.176 0.001 369	−0.267 .0.001 369	0.383 .0.001 369	0.412 0.001 369	0.795 0.001 369	−0.916 0.001 369	0.936 0.001 369

Note. N differences are due to missing values. T0 = Beginning of the program; T1 = End of the program (6-month from T0); T2 = 3 months after the end of the program (9-month from T0)

Table 3
Effect of variables on smoking status (−1 = relapser and +1 = abstainer) at T1 (6-month later, at the end of the program) and T2 (9-month after), whilst controlling for smoking status at T0 (−1 = smoker and +1 = abstainer).

	Smoking status at T1 (at the end of the program)							Smoking status at T2 (3 month after the end of the program)						
	N	B	Wald	P	OR (unadj.)	OR (adj.)	OR 95% CI	N	B	Wald	p	OR (unadj.)	OR (adj.)	OR 95% CI
Dependence at T0	517	−0.097	4.26	0.039	0.90	0.91	0.827–0.995	372	−0.096	3.28	0.070	0.91	0.91	0.819–1.008
Smoker Identity at T0	516	−0.084	1.31	0.250	0.90	0.91	0.795–1.062	372	−0.157	3.71	0.054	0.86	0.86	0.729–1.003
Ex-smoker Identity at T0	516	0.017	0.51	0.822	1.36	1.02	0.876–1.181	372	0.071	0.68	0.408	1.45	1.07	0.907–1.272
Relative strength of identity at T0	516	0.041	0.76	0.381	1.19	1.04	0.950–1.144	372	0.090	2.98	0.084	1.24	1.09	0.988–1.211
Relative strength of identity at T1	515	1.251	89.84	0.001	3.96	3.49	2.698–4.526	339	1.03	75.00	0.001	3.19	2.80	2.219–3.536
Smoker Identity at T2								368	−1.50	82.36	0.001	0.21	0.22	0.161–0.308
Ex-smoker Identity at T2								368	1.51	83.73	0.001	5.02	4.54	3.286–6.285
Relative strength of identity at T2								368	1.02	77.68	0.001	2.92	2.77	2.210–3.479

Note. Relative strength of identity = scores of ex-smoker identity minus scores for smoker identity (from −6 to +6), T1: 1 = 'Smoker' and 7 = 'Ex-smoker'.

Table 4
Mediation analyses for the effect of tobacco dependence (T0) on smoking status (−1 = relapser and +1 = abstainer) at T1 (at the end of the program) and T2 (3 months after the end of the program) as a function of the relative strength of ex-smoker identity at T1 and at T2 (relative strength of ex-smoker identity and smoking status at T0 were always introduced as covariate).

	Effect of Dependence on Mediator				Effect of Dependence on Smoking Status						
	B	SE	t	p	B	SE	Z	P	Wald	Indirect effect	BCACI[1]
a) Smoking status at T1 (N = 514)											
Dependence (FTCD), Total effect					−0.08	0.04	1.80	0.058	3.57		
Dependence (FTCD), Direct effect					−0.02	0.06	0.41	0.674	0.17		
Relative strength of ex-smoker identity (T1)	−0.13	0.03	3.79	0.001	1.42	0.15	9.11	001	83.13	−0.198*	[−0.310, −0.093]
b) Smoking status at T2 (N = 339)											
Dependence (FTCD), Total effect					−0.10	0.05	1.86	0.062	3.46		
Dependence (FTCD), Direct effect					−0.02	0.07	0.37	0.705	0.14		
Relative strength of ex-smoker identity (T1)	−0.14	0.04	3.25	0.002	1.10	0.13	8.34	0.001	69.68	−0.157*	[−0.269, −0.060]
c) Smoking status at T2 (N = 368)											
Dependence (FTCD), Total effect					−0.10	0.05	1.86	0.061	3.49		
Dependence (FTCD), Direct effect					0.01	0.10	0.11	0.911	0.01		
Relative strength of ex-smoker identity (T2)	−0.20	0.06	2.99	0.003	1.35	0.17	7.63	0.001	58.29	−0.276*	[−0.500, −0.071]

Note. * p < .05. [1]Bias corrected and accelerated for 95% confidence intervals.

6.2. Descriptive statistics

At T0, FTCD is positively correlated to smoker identity (SI) at T0, but not to ex-smoker identity at T0, whereas it is correlated to both identity scores assessed at T2. FTCD was also negatively correlated to the relative strength of ex-smoker (vs. smoker) identity at T0, T1, and T2. Higher FTCD scores were associated with a lower ex-smoker (opposed to smoker) identity. Moreover, smoker and ex-smoker identities

are negatively correlated both at T0 and T2, but this link is stronger for T2.

Finally, as depicted in Table 3, and after controlling for smoking status at T0, higher FTCD scores at T0 predicted significantly smoker status at T1, but only marginally at T2. Overall the stronger dependence was at T0, the lower the likelihood of remaining abstainer at the end of the program. Smoker identity, ex-smoker identity and the relative strength of ex-smoker identity at T0 did not predict smoking status at the end of the program. However, the relative strength of an ex-smoker identity at T1 predicted abstainer status both at T1 and T2. Finally, smoker identity, ex-smoker identity, and the relative strength of ex-smoker identity at T2 predicted smoker status at T2: a greater (lower) ex-smoker (smoker) identity increased the likelihood of remaining abstainer at T2.

6.3. The mediating effect of identity change

Table 4 presents the results of three bootstrap analyses predicting smoking status at T1 and T2. Tobacco dependence (FTCD) was the independent factor. Relative strength of ex-smoker identity at T1 was the mediator for the two first analyses and relative strength of ex-smoker identity at T2 was the mediator for the last analysis on smoking status at T2. To test for the effects of self-concept at T1 and T2 over and above the baseline level of smoker status and self-concept at T0, in all these analyses we introduced smoker status and the relative strength of ex-smoker identity at T0 as covariates.

Given the inclusion of the three covariates, the total effect of dependence on smoking status at T1 and T2 becomes only marginally significant in these three analyses as compared to the previous logistic regression analyses. Regarding smoking status at T1, the first analysis (Table 4, section a) showed that FTCD was negatively related to the relative strength of an ex-smoker identity at T1: higher scores of FTCD were associated to a lower self-perception as an ex-smoker (as opposed to a smoker). Moreover, the direct effect of FTCD on smoking status was not significant or marginally significant when the relative strength of an ex-smoker identity was taken into consideration, whereas the effect of this mediator did. More importantly, the indirect effect of FTCD on smoking status through the relative strength of an ex-smoker identity was significant (see Fig. 1).

Regarding smoking status at T2, first analysis (Table 4, section b) included the relative strength of an ex-smoker identity at T1 as mediator. FTCD at T0 decreased the relative strength of an ex-smoker identity at T1. Furthermore, FTCD's direct effect was not significant or marginally significant, and the relative strength of an ex-smoker identity predicted smoker status. Finally, the FTCD's indirect effect on smoking status through the relative strength of an ex-smoker identity was significant. Put differently, tobacco dependence decreased the chances that participants remained abstainers at T2 (9 months after the beginning of the program), and this effect was mediated by a decrease of the relative strength of an ex-smoker (as opposed to smoker) identity at T1 (see Fig. 2).

The second analysis (Table 4, section c) included the relative

strength of an ex-smoker identity at T2 as the mediator. FTCD at T0 decreased the relative strength of an ex-smoker identity at T2. Moreover, FTCD's direct effect was not significant or marginally significant, and the relative strength of an ex-smoker identity predicted smoker status. Finally, the indirect effect of FTCD on smoking status through the relative strength of an ex-smoker identity was significant (see Fig. 3).

7. Discussion

Among smokers enrolled in a smoking cessation program, this research tested whether changes in ex-smoker versus smoker identities can mediate the effect of dependence on smoking status at the end of the program (T1) and 3 months later (T2). Results provided consistent support for this hypothesis. Tobacco dependence reduced smokers' success in quitting smoking through changes in the relative strength of an ex-smoker (versus smoker) self-concept: the greater tobacco dependence, the lower the likelihood a smoker develops a self-concept as ex-smoker (as opposed to smoker) during the program, which results in a relapse either at the end of the program (T1; six months later) or three months after the end (T2; nine months later).

7.1. Theoretical relevance and practical implications

Overall, the present findings seem to be consistent with past research showing that smoker and ex-smoker identity are related to motivation to quit (Meijer et al., 2015; Van den Putte et al., 2009) abstinence (Shadel & Mermelstein, 1996), and relapse (Buckingham et al., 2013). However, they also extend these works at least in two ways.

First, our research suggests that tobacco dependence prevents smokers who attempted to quit from developing an ex-smoker (relative to a smoker) identity. Therefore, it seems likely that tobacco dependence increases as smoking experimentation and current smoking increase, a process that can be fueled by smoker identity (Hertel & Mermelstein, 2012). This finding is consistent with research showing that exercise dependence increases as the strength to which one identifies oneself as an exerciser increases (Murray, McKenzie, Newman, & Brown, 2013), and exercise identity also increases as symptoms of dependence when exercise ceased (Banbery et al., 2012; Groves, Biscomb, Nevill, & Matheson, 2008).

Second, the present findings suggest that smokers are not merely dependent on the reinforcement of smoking itself, but also on the reinforcement of a specific identity as a smoker or an ex-smoker. Indeed, smoking cessation should be understood as a complex recovery process (Best et al., 2016) that requires changing one's social networks and meaningful activities in order to negotiate and develop a new recovery-based social identity. However, the present findings also suggest that the cognitive processes often associated with tobacco dependence may actually accomplish identity functions that influence identity transition. For instance, withdrawal symptoms, preference for smoking-related activities, decreased effort or desire to quit may reflect a dependent state upon smoker identity (versus ex-smoker). Since quitting smoking
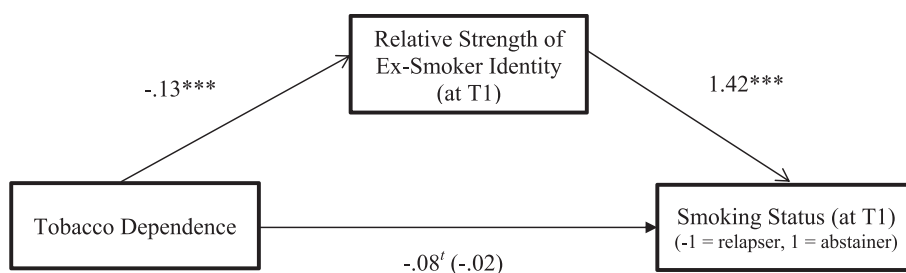

Fig. 1. Mediation of relative strength of ex-smoker identity at T1 in the relationship between tobacco dependence and smoking status at T1. *Note.* $^t p < .10$, ***$p < .001$.
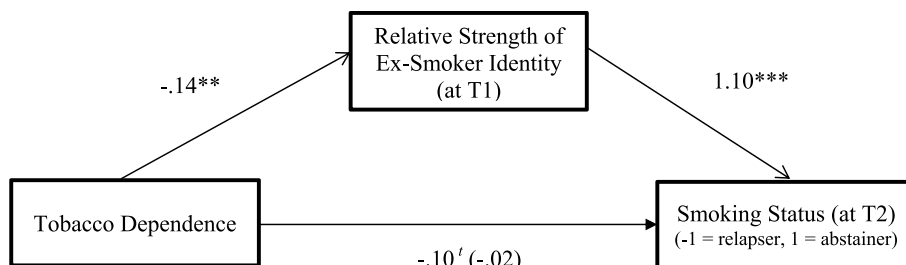
Fig. 2. Mediation of relative strength of ex-smoker identity at T1 in the relationship between tobacco dependence and smoking status at T2. *Note.* $^{t}p < .10$, **$p < .01$, ***$p < .001$.
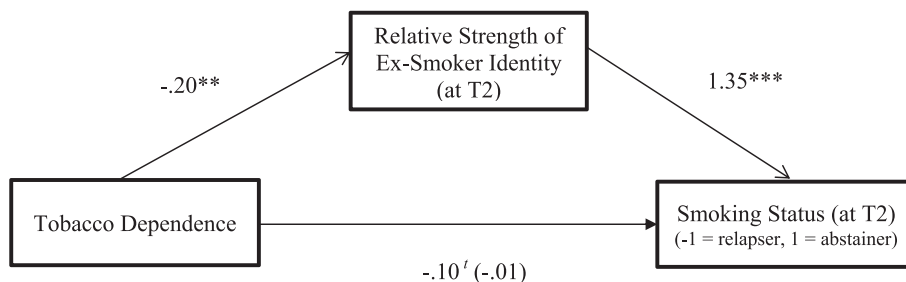

Fig. 3. Mediation of relative strength of ex-smoker identity at T2 in the relationship between tobacco dependence and smoking status at T2. *Note.* $^{t}p < .10$, **$p < .01$, ***$p < .001$.

means a long and difficult identity transition, unconscious processes may work to protect the challenged smoker identity, prevent changes in one's social network and ultimately prevent development of an ex-smoker identity. Investigating which specific identity mechanism explains the observed effect of tobacco dependence on smoking cessation, as well as how this mechanism influences the way smokers negotiate and develop new identities, constitute a promising avenue to improve our understanding of smoking cessation.

The present findings have also important practical implications, as they suggest that interventions should implement strategies preventing the negative effects of dependence. First, cessation interventions should focus on how to facilitate identity transition, notably by diminishing smoker self-concept and enhancing ex-smoker self-concept. Second, given that less dependent smokers more easily develop an ex-smoker identity facilitating smoking cessation, intervention might focus not only on tobacco dependence, but also on perceived dependence. Since subjective dependence can be more malleable than actual dependence, reducing perceived dependence might help smokers initiate identity transition and subsequently quit.

7.2. Limitations and future research

The present results suggest the existence of a negative association between tobacco dependence and smoking cessation that is mediated by changes in self-concept. However, given the longitudinal design, our results do not preclude that the investigated factors could also relate in different ways, and further research should address the causal link between these factors. Another limitation relates to the use of specific measures regarding the relevant variables. FCTD constitutes a uni-dimensional scale that do not cover several important aspects of dependence such as desire or efforts to quit, withdrawal symptoms, smoking more than intended, and the reduction of activities due to tobacco use (Etter, 2008). Therefore, future research should test the mediating role of smoker versus ex-smoker identity with a multidimensional scale (e.g., Shiffman, Waters, & Hickcox, 2004). Similarly, our findings should be replicated with alternative measures of identity (Buckingham et al., 2013; Dupont et al., 2015).

Furthermore, while we provided evidence that the consequences of

tobacco dependence on smoking cessation are driven by identity processes, alternative explanations are conceivable and other factors may be at work. For example, perception of self-efficacy (i.e., perceived abilities to refrain from smoking), may be a relevant candidate to account for why dependence results in maintenance of smoking behaviours (see Etter, 2008; John, Meyer, Rumpf, & Hapke, 2004). This is because dependent smokers realize that they have lost control over their tobacco use and feel unable to give up that they would stop making efforts to cease smoking. Also, considering the relationship between dependence and identity the other way round, it might be plausible that a stronger smoker identity (and a weaker ex-smoker identity) can reduce chances of successful quit attempts through an increase of perceived tobacco dependence. Therefore, future research is needed to investigate alternative factors and paths.

Finally, while we conceptualised smoker identity and identity processes at intra-individual level, it is important to consider that identity and addictive behaviours are also shaped by social factors and social environment (Frings & Albery, 2015; Jetten, Haslam, & Haslam, 2012). This way, smoker identity may also be conceived as derived from membership to a relevant social group. Tobacco dependence might reflect high identification with the in-group and smoking maintenance among highly dependent smokers might reveal a willingness to align on in-group norms. Thus, future studies might worth further exploring the social component of the smoker identity and how it is related to tobacco dependence.

Funding Sources

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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