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## A longitudinal study into the reciprocal effects of identities and smoking behaviour: Findings from the ITC Netherlands Survey

E. Meijer<sup>a,b,\*</sup>, B. Van den Putte<sup>c,d</sup>, W.A. Gebhardt<sup>a,\*\*</sup>, C. Van Laar<sup>e,\*\*\*</sup>, Z. Bakk<sup>f</sup>, A. Dijkstra<sup>g</sup>, G.T. Fong<sup>h,i,j</sup>, R. West<sup>k</sup>, M.C. Willemsen<sup>l,m</sup>

<sup>a</sup> Health, Medical and Neuropsychology, Leiden University, Leiden, The Netherlands

<sup>b</sup> Public Health and Primary Care, Leiden University Medical Center, Leiden, The Netherlands

<sup>c</sup> University of Amsterdam, Amsterdam School of Communication Research, Amsterdam, The Netherlands

<sup>d</sup> Trimbos Institute, Netherlands Institute for Mental Health and Addiction, Utrecht, The Netherlands

<sup>e</sup> Social and Cultural Psychology, University of Leuven, Leuven, Belgium

<sup>f</sup> Section of Methodology and Statistics, Department of Psychology, Leiden University, Leiden, The Netherlands

<sup>g</sup> Department of Social Psychology, University of Groningen, Groningen, The Netherlands

<sup>h</sup> Department of Psychology, University of Waterloo, Waterloo, Canada

<sup>i</sup> School of Public Health and Health Systems, University of Waterloo, Waterloo, Ontario, Canada

<sup>j</sup> Ontario Institute for Cancer Research, Toronto, Canada

<sup>k</sup> Health Behaviour Research Centre, Department of Epidemiology and Public Health, University College London, London, United Kingdom

<sup>l</sup> Department of Health Promotion, CAPHRI, Maastricht University, Maastricht, The Netherlands

<sup>m</sup> Dutch Alliance for a Smoke Free Society, The Hague, The Netherlands

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### ABSTRACT

**Objective:** Although it has been found that identity constructs related to smoking are associated with changes in smoking behaviour, the direction of causal associations is as yet unclear. This study aims to clarify the nature and direction of these associations.

**Methods:** In this longitudinal study we examined the reciprocal relations between identity constructs (i.e., smoker self-identity, quitter self-identity and smoker group-identity), intention to quit and smoking and quitting behaviour among a sample of 1036 smokers and ex-smokers, using cross-lagged structural equation modelling. Moreover, we tested whether these relations differed by socio-economic status (SES).

**Results:** Identity and smoking behaviour were reciprocally related in that intention to quit and smoking behaviour consistently predicted identity change, and identity predicted (changes in) intentions to quit and smoking behaviour. Behaviour appears more important for identity change than identity for behaviour change. Furthermore, quitter self-identity appears more important than smoker self- and group-identity. Relationships did not differ significantly between SES-groups. The findings were replicated using a cross-validation sample.

**Conclusion:** Results imply that changing smoking behaviour may be a vehicle to change smoking-related identity. Moreover, strengthening identification with quitting is more crucial for quit success than decreasing smoker identities. The finding that behaviour may be more important for identity than vice versa, if replicated, may call for additions to identity theories.

### 1. Introduction

People are motivated to behave in line with their identity. PRIME theory (PRIME stands for plans, responses, impulses, motivation and evaluation) defines identity as thoughts, feelings and images we have of ourselves. It is one of several theories that recognise that identity can be a particularly powerful influence on behaviour (West, 2006). Identity

can be based on behaviours, such that particular behaviours are important for the way that people perceive themselves (i.e., self-identity). In addition to identification with behaviours, the social identity approach states that people may derive an important part of who they are from their memberships in groups or social categories (Tajfel and Turner, 1979; Turner et al., 1987), that is, their social identity (or group-identity). People are likely to behave according to the group's

\* Corresponding author. Health, Medical and Neuropsychology, Leiden University, PO Box 9555, 2300RB Leiden, The Netherlands.

\*\* Corresponding author.

\*\*\* Corresponding author.

E-mail addresses: [e.meijer@fsw.leidenuniv.nl](mailto:e.meijer@fsw.leidenuniv.nl) (E. Meijer), [gebhardt@fsw.leidenuniv.nl](mailto:gebhardt@fsw.leidenuniv.nl) (W.A. Gebhardt), [colette.vanlaar@kuleuven.be](mailto:colette.vanlaar@kuleuven.be) (C. Van Laar).

social norms when their group identification is strong (Tajfel and Turner, 1979, 1986). People not only hold perceptions of the self in the present, but in addition have views on who they may become in the future (Barreto and Frazier, 2012).

Research on smoking and identity typically examines “self-identity” and “group-identity”. Self-identity in relation to smoking refers to the importance of behaviours such as smoking and quitting for how individuals perceive themselves (e.g., ‘Smoking is important for who I am’). Whereas group-identity is very similar to the construct of social identity, self-identity can be seen as a part of personal identity as defined in the social identity approach (i.e., an individuals’ perception of the self as a unique person that is different from others). Although it has been shown that both self- and group identity are related to smoking behaviour and smoking cessation, the (causal) direction is as yet unclear. Therefore, applying a three-wave cross-lagged model, we examined whether these identities affect smoking behaviour, or vice versa, or that identity and smoking (cessation) behaviour are reciprocally related.

### 1.1. Identity as precursor of smoking and quitting behaviour

Most studies on smoking (cessation) and identity focused on identity as a precursor of behaviour. This work has clearly shown that identity is important for quit intentions (a key predictor of quitting; Smit et al., 2014; Vangeli et al., 2011) as well as smoking and quitting behaviour, even when controlling for important factors such as nicotine dependence (Hertel and Mermelstein, 2012; Høie et al., 2010; Meijer et al., 2015; Meijer et al., 2016; Moan and Rise, 2005, 2006; Tombor et al., 2013; Van den Putte et al., 2009). Smokers who identify more with smoking as a behaviour or with the group of smokers have weaker quit intentions, are less likely to quit, and may even increase their smoking. In contrast, smokers who identify more with quitting, non-smoking, or non-smokers have stronger quit intentions and are also more likely to attempt to quit. In line with the above findings, the social identity model of cessation maintenance (Frings and Albery, 2015) and the social identity model of recovery (Best et al., 2015) propose that stronger (social) identification as ‘recovering addict’ facilitates recovery from addiction. Notably, whereas relations between identity and smoking behaviour are typically examined in prospective designs, allowing for interpretations regarding directionality, associations between identity and quit intention are usually investigated cross-sectionally, such that the direction remains unclear (Meijer et al., 2015). In sum, previous work suggests that identity affects smoking behaviour (see West, 2006).

### 1.2. Smoking and quitting behaviour as precursor of identity

However, other studies suggest a reversed causal order: people base their self-conceptualizations on behaviours that they frequently engage in, such that the behaviour is perceived to show who they are (Bem, 1972). With regard to smoking, two studies indeed suggest that smoking behaviour affects smoking-related identities. Specifically, after participating in a smoking cessation program, successful ex-smokers came to perceive themselves more as non-smokers and less as smokers (Shadel et al., 1996). Furthermore, increases in smoking behaviour are associated with subsequent increases in smoker self-identity among adolescent smokers (Hertel and Mermelstein, 2016).

### 1.3. Reciprocal relations between identity and smoking and quitting behaviour

Finally, retrospective qualitative studies showed that smoking became increasingly less important to the way ex-smokers perceived themselves as they learned to live without smoking (Brown, 1996; Luck and Beagan, 2015; Vangeli and West, 2012), suggesting that identity change and smoking behaviour change go hand in hand (cf. identity

shift theory; Kearney & O’Sullivan, 2003). Similarly, identity theory states that people act in line with their identity, but at the same time identity may change to match behaviour (Stets and Burke, 2003). Moreover, the social identity model of recovery (Best et al., 2015) acknowledges that successful behaviour change may reinforce recovery identities.

### 1.4. Socio-economic status

Smoking is more prevalent and persistent among those with lower socio-economic status (e.g., Bricard et al., 2016; Pisinger et al., 2011; Reid et al., 2010). Evidence also suggests that identity and identity dynamics differ with SES. A large-scale longitudinal study showed that lower-SES smokers (vs. middle and higher-SES) and lower-SES ex-smokers (vs. middle-SES) identify more with smoking (Meijer et al., 2017). In addition, higher-SES smokers and ex-smokers move away from a smoking identity and toward a quitting identity more quickly than their lower-SES counterparts. Correspondingly, other work showed that lower-SES smokers have more difficulty picturing themselves as non-smokers than higher-SES smokers, whereas the relation between non-smoker self-identity and quit intention was stronger among lower-SES than higher-SES smokers (Meijer et al., 2015). This suggests that non-smoker self-identities may be particularly key for smoking cessation among lower-SES smokers, although SES did not moderate relations between identity and quit intention in another study (Meijer et al., 2016).

### 1.5. The current study

In sum, previous work showed that identity is important for smoking behaviour and vice versa, and that other variables such as SES may possibly influence this relationship. However, it is as yet unclear *how* identity changes and behaviour changes over time are associated, and what the role of quit intention is. The current longitudinal study examined and compared unique relations between identity constructs at the self- and group-level (i.e., smoker self-identity, quitter self-identity and smoker group-identity), quit intention and smoking behaviour among a large sample of smokers and ex-smokers. Cross-lagged structural equation modelling was applied to investigate and compare these relations and cross-validation was used to assess generalizability of results. The following research questions were addressed (RQs):

1. Do smoker self-identity, quitter self-identity and smoker group-identity predict changes in smoking behaviour over time (RQ1)?
2. Does smoking behaviour predict changes in smoker self-identity, quitter self-identity and smoker group-identity over time (RQ2)?
3. Do quitter self-identity, smoker self-identity and smoker group-identity predict changes in quit intention over time (RQ3)?
4. Does quit intention predict changes in quitter self-identity, smoker self-identity and smoker group-identity over time (RQ4)?
5. Do identity constructs and quit intention uniquely predict smoking behaviour one year later (RQ5)?
6. Are relations between identity (intention) and smoking behaviour mediated by intention (identity; RQ6)?
7. Do associations over time between identity, quit intention, and behaviour differ between lower, middle and higher-SES groups (RQ7)?

## 2. Method

### 2.1. Participants

This study is part of the International Tobacco Control Policy Evaluation Project ([www.itcproject.org](http://www.itcproject.org)) (Fong et al., 2006). Data used for the current study were collected annually in the International Tobacco Control (ITC) Netherlands Survey from 2009 to 2014 (from now waves 1–6, respectively). The ITC Netherlands Survey is the only ITC

Survey that assesses identity. The same larger dataset was used in one other study that examined a different set of questions and variables, namely psychosocial correlates of change in smoker and quitter self-identity (Meijer et al., 2017). Participants in the current study were aged 16 or older, and were smokers or ex-smokers at enrolment. Participants who smoked at least monthly and had smoked at least 100 cigarettes in their lifetime were considered as smokers, and those who had smoked monthly and had smoked at least 100 cigarettes but were now abstinent were considered as ex-smokers. Participants who dropped out of the study were replaced, from the same sampling frame, in order to maintain sample size. Surveys were administered online or by telephone by a research firm. The ITC Netherlands Surveys were cleared for ethics by the Human Research Ethics Committee of the University of Waterloo. The sample is representative of the Dutch population of smokers (Nagelhout et al., 2010, 2016).

### 2.1.1. Initial analyses

For the initial analyses, data from 2012 to 2014 (waves 4–6) were used. Given changes in antismoking regulation in the Netherlands over time, these data were considered more relevant than less recent data. Wave 4 had 2022 participants (1604 smokers), wave 5 had 1970 participants (1531 smokers) and wave 6 had 2008 participants (1569 smokers). For the analyses the 1389 participants who participated in all three waves were used (69% of wave 4 participants). Responders (i.e., wave 4 participants who also completed waves 5 and 6) and drop-outs (i.e., those who did not complete waves 5 and 6) did not differ significantly on SES, smoking status, identity constructs, quit intention, cigarettes per day and quit success at wave 4. Responders were more likely to be female and were older than drop-outs (see Supplement A). Participants were included in the analyses if they had full data for all variables in the respective model (see Statistical Analyses; see Supplement B for participant characteristics). Given that the sample was large enough for a cross-lagged analysis on the complete data, we did not use imputation strategies for missing data.

### 2.1.2. Cross-validation

The models based on waves 4–6 were cross-validated using data from 2009 to 2011 (waves 1–3), with 2012 participants at wave 1 (1763 smokers), 2060 participants at wave 2 (1723 smokers), and 2101 participants at wave 3 (1672 smokers), see Statistical analyses for specifics. Of the 2012 participants at wave 1, 1104 (55%) also participated in waves 2 and 3. Responders and drop-outs did not differ significantly on smoking status (smoker/ex-smoker), age, identity constructs, quit intention and quit success at wave 1. Responders were more likely to be female, to have lower SES, and to smoke more cigarettes per day than drop-outs (see Supplement C).

## 2.2. Measures

Identity constructs and quit success were measured among smokers

and ex-smokers, and quit intention was measured among smokers only (see Table 1 for means, standard deviations and missing values for identity, quit success and quit intention).

### 2.2.1. Identity (initial analyses waves 4–6; cross-validation analyses waves 1–3)

Variables were recoded such that higher scores indicated stronger identity. Scales were made for each identity construct and wave by averaging scores on the individual items.

**2.2.1.1. Smoker self-identity.** Smoker self-identity was measured with two items for smokers and ex-smokers: ‘To [continue smoking/start smoking again] would fit with who you are’ and ‘To [continue smoking/start smoking again] would fit with how you want to live’, with answers ranging from [1] ‘strongly agree’ to [5] ‘strongly disagree’ ( $r = .82, .85$  and  $.85$  at waves 4, 5 and 6, respectively).

**2.2.1.2. Quitter self-identity.** Similarly, quitter self-identity was measured with two items for smokers and ex-smokers (e.g., ‘To [quit smoking/stay quit] within the next six months would fit with who you are’), with answers ranging from [1] ‘strongly agree’ to [5] ‘strongly disagree’ ( $r = .83, .84$ , and  $.83$  at waves 4, 5 and 6, respectively).

**2.2.1.3. Smoker group-identity.** Smoker group-identity was measured with two items, i.e. for smokers: ‘You feel connected to other (“other” omitted for ex-smokers) smokers’ and ‘You feel at home in the company of other (“other” omitted for ex-smokers) smokers’, with answers ranging from [1] ‘strongly agree’ to [5] ‘strongly disagree’ ( $r = .62, .63$ , and  $.64$  at waves 4, 5 and 6, respectively).

### 2.2.2. Quit success (initial analyses waves 4–6; cross-validation analyses waves 1–3)

Participants were first asked whether they had attempted to quit in the last year, and if so, whether they were smoking again. Participants who had not attempted to quit or had relapsed were asked whether they smoked daily, at least weekly, or at least monthly. Participants who were abstinent were asked when their current quit attempt had started. This information was used to calculate the quit success variable, with [1] ‘daily smoker’, [2] ‘weekly smoker’, [3] ‘monthly smoker’, [4] ‘quit in the last month’, [5] ‘quit one to six months ago’, [6] ‘quit more than six months ago’, and [7] ‘abstinent since last survey’. Quit success had no missing values. Results were very similar when quit success was recoded into [1] daily smoker, [2] weekly/monthly smoker, and [3] quit in the last months/one to six months ago/more than six months ago, or abstinent since last survey.

### 2.2.3. Quit intention (initial analyses waves 4 and 5; cross-validation analyses waves 1 and 2)

Quit intention was measured with one item, ‘Are you planning to quit smoking within the next 6 months?’ Answer categories ranged from

**Table 1**  
Means, standard deviations and missing values of variables used in Model 1 and 2.

	M (SD)								
	Model 1 (N=1036)			Model 2 (N=768)			Missing values		
	Wave 4	Wave 5	Wave 6	Wave 4	Wave 5	Wave 6	Wave 4	Wave 5	Wave 6
Smoker self-identity	2.74 (1.08)	2.68 (1.10)	2.63 (1.15)	3.10 (.91)	3.09 (.93)		89	86	87
Quitter self-identity	3.17 (1.13)	3.23 (1.15)	3.27 (1.20)	2.79 (.95)	2.80 (.96)		114	134	138
Smoker group-identity	3.33 (.81)	3.33 (.83)	3.31 (.90)	3.46 (.77)	3.47 (.78)		61	58	62
Quit success	1.99 (1.72)	2.20 (1.88)	2.86 (2.60)			1.55 (1.45)	0	0	0
Quit intention				2.55 (1.11)	2.60 (1.15)		23 <sup>a</sup>	18 <sup>a</sup>	

Note. Participants with full data were included in the models. Missing values are counted among participants who participated in waves 4–6.

<sup>a</sup> Counted among participants who smoked at waves 4 and 5.

[1] ‘very likely’ to [5] ‘very unlikely’. This variable was recoded, such that higher scores indicated stronger quit intention.

2.2.4. SES (initial analyses wave 4; cross-validation analyses wave 1)

Highest attained educational level was used to measure SES (see Schaap and Kunst, 2009). Answer categories ranged from [1] ‘no degree’ to [7] ‘university master’, and [8] ‘do not know/do not want to say’ (recoded as missing). In accordance with other ITC papers, SES was converted into lower (no degree, lower pre-vocational secondary education), middle (middle pre-vocational education, secondary education second stage) and higher SES (senior general secondary education and pre-university education, higher professional education and university bachelor, university master). SES was missing for 15 participants at wave 4.

2.3. Statistical Analyses

Analyses were performed in R statistical software (R Core Team, 2014), using the sem function of the lavaan package version 0.5–20 (Rosseel, 2012). As some variables were not normally distributed, robust maximum likelihood estimation (MLR) was used. In addition, fixed.x was set to false to incorporate covariances between exogenous variables. For the remainder, the default settings of the lavaan sem function were used.

We split the data in waves 1-3 and 4-6, which allowed us to cross-validate the models and include a large number of participants. Specifically, we could have included only 400 participants in Model 1 and 36 participants in Model 2 if we had used all six waves. Two models were fitted using data from waves 4-6. In Model 1, to examine RQ1 and RQ2, cross-lagged relations between identity constructs and quit success were estimated (see Fig. 1 for the final model). Identity constructs and quit success were measured at waves 4, 5 and 6. In addition, Model 2 estimated cross-lagged relations between identity constructs and quit intention, to examine RQ3 and RQ4 (See Fig. 2 for final model). Moreover, to answer RQ5, identity constructs and quit intention were simultaneously used to predict quit success in the prediction part of Model 2. To examine RQ6, the significance of indirect paths was tested. For Model 2 identity constructs and quit intention from waves 4 and 5 were used, and quit success from wave 6. Quit intention was measured among smokers only, such that only participants who smoked at waves 4 and 5 were included in this model. Participants could be smokers or ex-smokers at wave 6.

Both Model 1 and 2 were estimated in several steps (cf. Martens and

Haase, 2006) in order to find the best fitting model. First, baseline models were fitted with autoregressions and covariances (between variables assessed at the same wave only; Model A), autoregressions and covariances plus cross-lagged paths from identity to quit success/intention (Model B), autoregressions and covariances plus cross-lagged paths from quit success/intention to identity (Model C), and with autoregressions and covariances plus reciprocal cross-lagged paths from quit success/intention to identity, and vice versa (Model D). The inclusion of autoregressive effects allowed for prediction of change in one construct by another construct. To examine whether model fit differed significantly between the models  $\chi^2$ -difference tests were used. AIC values were used to compare the models, with lower AIC values indicating better fit. Moreover, the significance of model parameters and  $\chi^2$ , CFI, RMSEA, SRMR, and AIC were examined to assess model fit. Chi-square, CFI and RMSEA values were robust values (SRMR and AIC are not corrected when robust estimation is used). Non-significant model  $\chi^2$ -values indicate that the model does not deviate significantly from the data, although  $\chi^2$ -values are often significant in large samples. In addition, according to Hu and Bentler (1999), CFI values  $\geq .95$ , SRMR values  $\leq .08$ , and RMSEA values  $\leq .06$  indicate good fit.

Second, the best fitting model (i.e., Model A, B, C or D) was selected and non-significant regression paths and covariances were removed to make the model more parsimonious, using a *p*-value of .20 as the cut-off value (cf. Burkholder and Harlow, 2003). Third, to further increase parsimony, in Model 1 it was tested whether autoregressive and cross-lagged parameters could be restricted to be equal across waves (cf. Meyers et al., 2015), which also allowed us to examine whether the strength of relationships differed significantly with time. This was not applicable for Model 2 because autoregressive and cross-lagged paths were estimated between two waves. As before,  $\chi^2$ -difference tests were used to examine whether restrictions could be applied without decreasing model fit. Models were fitted using unstandardized data. The figures show standardized regression coefficients, which may differ slightly despite being restricted to be equal across waves (see Supplements D and E for non-standardized regression coefficients). Finally, if model fit was still unsatisfactory, additional regression paths were included based on modification indices, until adequate model fit was obtained. Only predictions of variables by variables that were measured at an earlier wave were included (e.g., wave 6 predicted by wave 5). Importantly, adding parameters based on modification indices may decrease generalizability beyond the specific sample (e.g., Burkholder and Harlow, 2003). Generalizability was therefore estimated by cross-validating both final models (i.e., Model 1 and 2), using

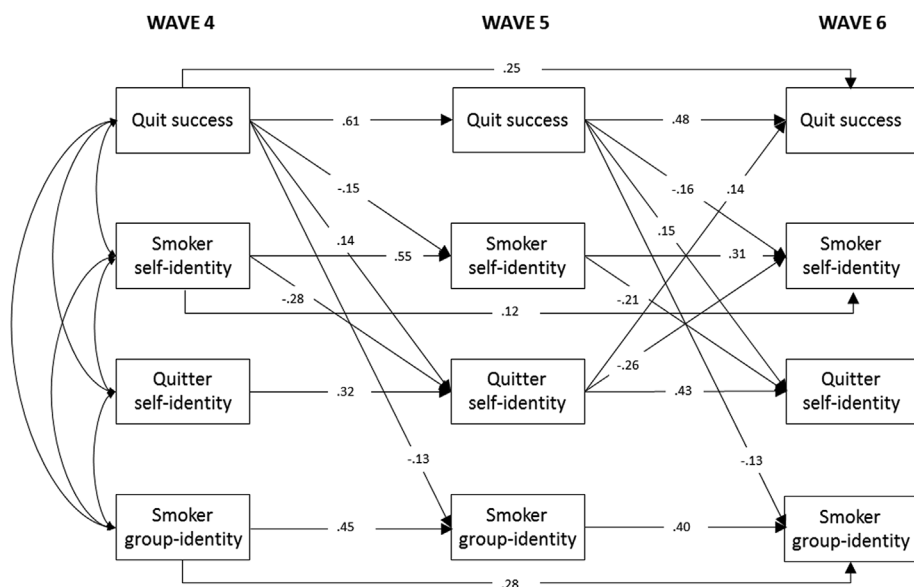


Fig. 1. Graphic representation of final Model 1 (quit success and identity) with standardized coefficients (N = 1036). All paths are significant at  $p < .05$ . For ease of presentation, covariances at waves 5 and 6 are omitted.

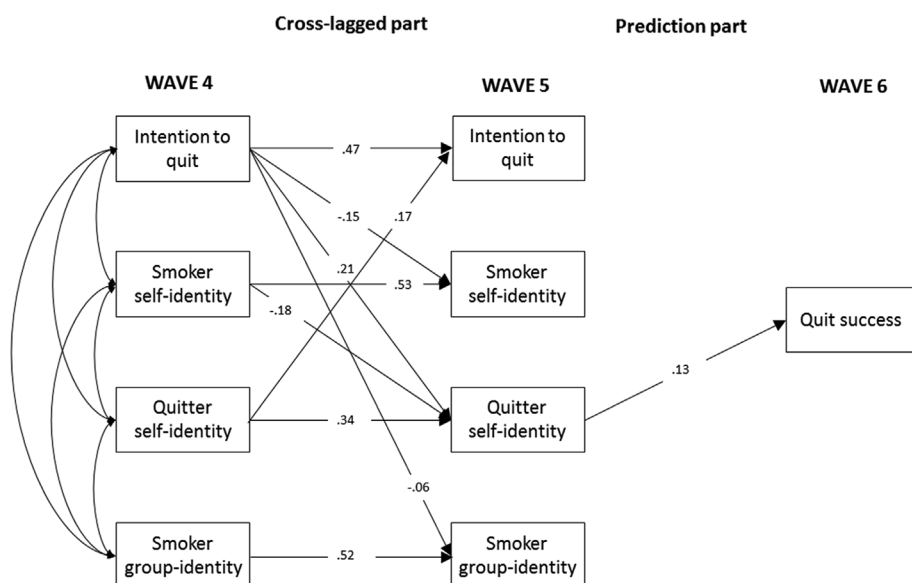


Fig. 2. Graphic representation of final Model 2 (quit intention, identity and smoking behaviour) with standardized coefficients ( $N=768$ ). All paths are significant at  $p < .05$ . For ease of presentation, covariances at wave 5 are omitted.

data from waves 1–3. Of the participants who were included in the initial samples for Model 1 and 2, 400 (39%) and 255 (33%), respectively, were also included in the cross-validation samples for these models. As a follow-up analysis, we checked whether cross-validation results were the same when these participants were excluded (results summarized below and detailed results available upon request).

To test RQ7, multiple-group analyses were performed on Models 1 and 2 to examine whether relations between identity, quit intention and quit success differed with SES. First, a model without any equality restrictions on model parameters between groups (i.e. configural invariance) was fitted, and regression coefficients were subsequently restricted to be equal between SES-groups. AIC values and  $\chi^2$ -difference tests were used to compare the models. Non-significant  $\chi^2$ -difference tests indicated that regression coefficients did not differ significantly between the groups.

### 3. Results

#### 3.1. Preliminary analyses

Correlations between the variables that were used in the models were examined first (see Supplement F). Almost all correlations were significant and in the expected direction. Smoker self- and group-identity correlated positively, and both smoker identity constructs correlated negatively with quitter self-identity. Furthermore, quit success -where higher scores indicate longer abstinence-correlated negatively with smoker identities and positively with quitter self-identity. Stronger quit intention was related to weaker smoker self- and group-identities, stronger quitter self-identities and more successful quitting.

#### 3.2. Model 1 (RQ1, RQ2 and RQ7)

##### 3.2.1. Model selection and specification

Model C (i.e., only cross-lagged paths predicting identity from quit success) was selected as the best fitting model. Specifically, Model B (i.e., only cross-lagged paths predicting quit success from identity), Model C (i.e., only cross-lagged paths predicting identity from behaviour) and Model D (i.e., cross-lagged paths predicting identity from behaviour and vice versa) all had significantly better fit than model A (i.e., only autoregressions and covariances; see Table 2). Model fit did not differ significantly between Models C and D ( $p = .08$ ). In contrast to Model C, Model D also included cross-lagged paths predicting behaviour from identity, but none of these paths were significant ( $p$ -values

all  $\geq .19$ ). In other words, identity did not significantly predict quit success beyond autoregressive effects of quit success between waves in Model D. Model C was selected as the best model because it was more parsimonious than Model D, and contained no non-significant regression coefficients. Next, the non-significant covariance between quitter self-identity and smoker group-identity at wave 5 was removed ( $-.02$ ,  $p = .33$ ). Further analyses showed that the autoregressive paths for smoker group-identity and the cross-lagged paths predicting smoker group-identity from quit success could be set equal across waves. That is, the strength of the relationships between these variables between waves 4 and 5 did not differ significantly from the strength of the associations between waves 5 and 6. Finally, regression paths (see Supplement D) were added based on modification indices to improve model fit.

##### 3.2.2. Final model

The final model had adequate fit and is shown in Fig. 1 (see Table 2A for fit indices, and Supplement D for model parameters). Model  $\chi^2$  was significant, but this is common in large samples ( $\chi^2(30) = 153.46$ ,  $p < .001$ ). Average identity and quit success were relatively stable over time, as indicated by relatively strong autoregressive effects. In addition, the stability of smoker group-identity was equal across waves. Furthermore, quit success predicted identity, such that those who were lower at quit success (at wave 4 or 5) had increased smoker self-identities, decreased quitter self-identities and increased smoker group-identities one year later (at wave 5 or 6, respectively). Cross-lagged effects of quit success on smoker group-identity were equal across waves. Furthermore, stronger quitter self-identity at wave 5 predicted quit success at wave 6, but other identity constructs did not predict quit success. Finally, quitter self-identity and smoker self-identity predicted each other. Specifically, stronger smoker self-identity (at wave 4) predicted decreased quitter self-identity one year later (at wave 5), and stronger quitter self-identity (at wave 5) predicted decreased smoker self-identity one year later (at wave 6).

##### 3.2.3. Multiple-group analyses

Multiple-group analyses showed that regression coefficients did not differ significantly between lower, middle and higher-SES groups (RQ7). Specifically, the  $\chi^2$ -difference test was non-significant when the baseline multiple-group model without between-group equality restrictions was compared with the multiple-group model with regression coefficients set equal between SES-groups ( $\chi^2(38) = 44.98$ ,  $p = .20$ ).

**Table 2A**  
Model 1: Fit of models for quit success and identity (N = 1036).

Model	Description	Fit Measures					χ <sup>2</sup> -difference tests		
		df	χ <sup>2</sup>	CFI	RMSEA	SRMR	AIC	Model comparison	χ <sup>2</sup> statistic
1A	Autoregressions and covariances	40	803.08	.845	.136	.194	33017.42		
1B	Cross-lagged paths: identity to behaviour	34	757.72	.853	.143	.178	32998.68	1B vs. 1A	χ <sup>2</sup> (6) = 30.63, p < .001
1C	Cross-lagged paths: behaviour to identity	34	574.75	.890	.124	.117	32767.92	1C vs. 1A	χ <sup>2</sup> (6) = 234.90, p < .001
1D	Bidirectional cross-lagged paths	28	547.57	.894	.134	.108	32768.48	1D vs. 1A	χ <sup>2</sup> (12) = 257.71, p < .001
								1D vs. 1C	χ <sup>2</sup> (6) = 11.39, p = .08
Final	Trimmed model 1C + additional paths	30	153.46	.975	.063	.060	32273.27	Final vs. 1C	χ <sup>2</sup> (4) = 351.44, p < .001

3.2.4. Cross-validation

The final model was cross-validated using data from 828 participants from waves 1-3. The cross-validated model had satisfactory fit according to the CFI (.948) and SRMR (.073), but the RMSEA was slightly higher than considered acceptable (.083). Model χ<sup>2</sup> was significant, but this is common in large samples (χ<sup>2</sup>(30) = 199.82, p < .001). All paths of the final model, including the paths that were added based on the modification indices, were significant in the cross-validated model. Cross-validation results were largely similar when only participants who were not included in the initial sample were used for cross-validation (N = 428). However, the relation between quitter self-identity (w2) and smoker self-identity (w3) became marginally significant (β = -.11, p = .06), and the relation between quitter self-identity (w2) and quit success (w3) became non-significant (β = .07, p = .16), likely due to lower power.

3.3. Model 2 (RQ3-RQ7)

3.3.1. Model selection and specification

Results for Model 2 showed that Model D (i.e., reciprocal cross-lagged paths from identity to quit intention) fitted the data significantly better than Model A, B and C (see Table 2). Two non-significant cross-lagged regression paths (p-values > .20) were removed to make the model more parsimonious: quit intention (w5) regressed on smoker group-identity (w4; β = .00, p = .99), and smoker self-identity (w4; β = -.05, p = .24). In addition, three non-significant regression paths were removed; predicting quit success (w6) from quit intention (w5; β = .03, p = .51), smoker self-identity (w5; β = .02, p = .74) and smoker group-identity (w5; β = -.01, p = .86). Finally, the covariances between quitter self-identity (w5) and smoker group-identity (w5; .01, p = .78), and between quit intention (w5) and smoker group-identity (w5; -.02, p = .36) were removed. One regression path, predicting quitter self-identity (w5) from smoker self-identity (w4), was added to improve model fit.

3.3.2. Final model

The final model had adequate fit (see Table 2B and Fig. 2; see Supplement E for model parameters). Model χ<sup>2</sup> was again significant (χ<sup>2</sup>(15) = 50.72, p < .001). Results showed that identity constructs and quit intention were relatively stable between wave 4 and 5. Stronger

quitter self-identity at wave 4 predicted increased quit intention at wave 5, and stronger quit intention at wave 4 predicted increased quitter self-identity, and decreased smoker self- and group-identity at wave 5. Stronger smoker self-identity at wave 4 predicted weaker quitter self-identity at wave 5. Furthermore, stronger quitter self-identity at wave 5 predicted quit success at wave 6. Analysis of indirect effects showed that stronger quit intention (w4) predicted more quit success (w6) through stronger quitter self-identity (w5), β = .03, p < .01. Moreover, quitter self-identity (w4) predicted quit success (w6) through quitter self-identity (w5), β = .05, p < .01. Finally, smoker self-identity (w4) predicted quit success (w6) through quitter self-identity, such that weaker smoker self-identity at wave 4 was associated with stronger quitter self-identity at wave 5, which in turn predicted quit success at wave 6, β = -.02, p < .01.

3.3.3. Multiple-group analyses

Multiple-group analyses examined whether regression coefficients differed with SES (RQ7). The non-significant χ<sup>2</sup> difference test showed that the model without between-group restrictions did not differ significantly from the model with regression coefficients restricted to be equal (χ<sup>2</sup>(20) = 24.053, p = .24), which shows that regression coefficients did not differ significantly between SES-groups.

3.3.4. Cross-validation

The final model was cross-validated using data from 681 participants from waves 1-3. As before, the χ<sup>2</sup> indicated that the model deviated from the data (χ<sup>2</sup>(15) = 71.83, p < .001). CFI (.961) and SRMR (.038) values indicated good fit, but the RMSEA value was slightly higher than considered acceptable (.075). Almost all significant regression coefficients remained significant in the cross-validated model, except for smoker group-identity (w2) regressed on quit intention (w1). All indirect effects were significant. Results were similar when we excluded participants who were included in the initial sample (N = 426). However, we now found a significant relation between group-identity (w2) regressed on quit intention (w1; β = -.09, p = .02), and the relation between quitter self-identity (w1) and intention to quit (w2) became marginally significant (β = .09, p = .08).

**Table 2B**  
Model 2: Fit of models for quit intention, identity and smoking behaviour (N = 768).

Model	Description	Fit Measures					χ <sup>2</sup> -difference tests		
		df	χ <sup>2</sup>	CFI	RMSEA	SRMR	AIC	Model comparison	χ <sup>2</sup> statistic
1A	Autoregressions and covariances	16	156.35	.906	.107	.093	16663.79		
1B	Cross-lagged paths: identity to behaviour	13	116.83	.930	.102	.068	16626.56	1B vs. 1A	χ <sup>2</sup> (3) = 41.47, p < .001
1C	Cross-lagged paths: behaviour to identity	13	90.56	.948	.088	.051	16586.81	1C vs. 1A	χ <sup>2</sup> (3) = 60.00, p < .001
1D	Bidirectional cross-lagged paths	10	71.49	.959	.089	.040	16573.42	1D vs. 1A	χ <sup>2</sup> (6) = 84.74, p < .001
								1D vs. 1B	χ <sup>2</sup> (3) = 43.05, p < .001
								1D vs. 1C	χ <sup>2</sup> (3) = 18.77, p < .001
Final	Trimmed model 1D + additional path	15	50.72	.976	.056	.031	16534.87	Final vs. 1D	χ <sup>2</sup> (5) = 28.83, p < .001

#### 4. Discussion

This large-scale longitudinal study examined relations between identity (i.e., smoker self-identity, quitter self-identity and smoker group-identity), quit intention and quit success among smokers and ex-smokers, and tested whether these relations differ with socio-economic status (SES). Cross-lagged structural equation modelling was used because it allowed for examination of the research questions, and cross-validation was used to test generalizability of the findings. Indeed, results held up very well in the cross-validation sample, thereby demonstrating the stability of results over the six years of the Dutch cohort.

The results provide new insights in the direction of relations between identity, quit intention and quit success, and show that quit success and intention consistently predict identity change. Specifically, quit success predicts changes in identity one year later, such that quit success is associated with decreased smoker self- and group-identity and increased quitter self-identity (Model 1). Moreover, stronger quit intention is associated with increased quitter self-identity and decreased smoker self-identity one year later (Model 2). These findings were replicated using the cross-validation data. Stronger quit intention is also associated with decreased smoker group-identity one year later in the initial sample (Model 2), but not in the cross-validation sample. In addition, quitter self-identity seems to be more important for quit intention and smoking behaviour than smoker identities. Specifically, cross-lagged paths show that stronger quitter self-identity predicts more quit success (Model 1) and increased quit intention (Model 2) beyond autoregressive effects (e.g., the effect of quit success at T-1 on quit success at T), while smoker identities do not. Furthermore, stronger quitter self-identity directly predicts quit success one year later, but smoker identities (and quit intention) do not (Model 2).

Results thus suggest that behaviour and identity are reciprocally related (cf. Kearney & O'Sullivan, 2003; Stets and Burke, 2003). Quit intention and quit success predict changes in all three identity constructs (i.e., quitter self-identity and smoker self- and group-identity), and quitter self-identity predicts changes in quit intention and quit success. Thus, behaviour may be more important for changes in identity than the other way around. Correspondingly, previous work by Hertel and Mermelstein (2016) and Shadel et al. (1996) showed that behaviour is related to subsequent smoking identities (see Fotuhi et al., 2013 for similar changes in functional beliefs supporting smoking following smoking cessation). If this finding will be replicated in future work on smoking and (health) behaviour more broadly, this has theoretical implications. That is, the impact of behaviour on identity may then be explicitly incorporated in theories about identity that focus on the importance of identity for behaviour, such as the social identity approach (Turner et al., 1987) and PRIME Theory (West, 2006). However, the simultaneous inclusion of the three identity constructs in the current analyses might have decreased the ability of each individual identity construct to predict intention and behaviour (i.e., they may explain the same share of variance in intention/behaviour), whereas this was not the case for reversed relationships (i.e., intention/behaviour as predictor of each identity construct).

Importantly, results suggest that quitter self-identity is more relevant for quitting than smoker identities. This is in line with previous work among smokers suggesting that identification with the 'possible self' (see Markus and Nurius, 1986) as a quitter or non-smoker is more important for quitting than identification with the 'current self' as a smoker (Meijer et al., 2015, 2016). However, it appears to contradict other previous work among smokers that showed that smoker identity is related to intention and subsequent behaviour (e.g., Hertel and Mermelstein, 2012; Høie et al., 2010; Moan and Rise, 2005, 2006; Tombor et al., 2013; Van den Putte et al., 2009). An explanation is that most previous studies showing effects of smoker identity did not take quitter identity into account, such that smoker identity might not have been predictive if quitter identity had been controlled for. One study

that included both smoker and quitter self-identity showed that smoker self-identity predicted quit attempts, whereas quitter self-identity predicted quit attempts and quit intention (Van den Putte et al., 2009). In our previous study (Meijer et al., 2017), in which we used the same larger dataset for a different set of questions, no significant changes were found in quitter self-identity among smokers and ex-smokers over time, although there was individual variability in quitter self-identity change. Smoker self-identity did increase over time among smokers, and decreased among ex-smokers. One reason for this discrepancy between the two studies might be that the previous one did not include people with changing smoking status across waves (e.g., smoker, ex-smoker, smoker at subsequent waves), whereas they were included in the current study. It therefore appears that a stronger quitter self-identity may be particularly important for initiating changes in behaviour, whereas –after a quit attempt– a reduction in smoker self-identity is more important.

Finally, this study provided new insight into the dynamics between identities over time, and consistently showed that those with stronger smoker self-identities move away from identification with quitting (i.e., have weaker quitter self-identities one year later). We also found some evidence that a stronger quitter self-identity is related to a subsequent decrease in identification with smoking, but this was only found in Model 1. It thus appears that the constellation of identities may become more consistent over time. Furthermore, the analyses showed that the contributions of behaviour to smoker group-identity, and smoker group-identity itself, were stable over time.

The current results provide interesting ground for future work. Notably, the current study included both smokers and ex-smokers, and whereas the identity as a quitter is a possible self for smokers, ex-smokers are more likely to hold a quitter identity as a current self. In contrast, the identity as a smoker is a current self for smokers whereas it is more likely to be a past or (undesired) possible self for ex-smokers, although ex-smokers may still identify with smoking (Vangeli et al., 2010). Work on possible selves has shown that possible selves provide a strong guide for current behaviour, such that people are motivated to behave in ways that help to avoid undesired possible selves and achieve desired possible selves (e.g., Barreto and Frazier, 2012; Markus and Nurius, 1986). In addition, people are motivated to hold a positive current identity and to behave in line with important aspects of how they perceive themselves in the present (e.g., West, 2006). Possible selves and current selves affect behaviour in different ways, and smoker and quitter identities therefore are likely to play different roles for smokers and ex-smokers. Similarly, whereas smokers are likely to perceive other smokers as in-group members, ex-smokers are more likely to categorize smokers as part of an out-group. As with self-identity, people are motivated to maintain a positively valued group identity (Tajfel and Turner, 1979, 1986), and respond differently to social groups depending on whether they perceive themselves as part of these groups or not (e.g., Wenzel et al., 2007). Future research is needed to further examine the roles of possible and current selves as well as in-group and out-group identities in smokers and ex-smokers.

The finding that quit intention does not directly predict quit success (when identity constructs were controlled for) is interesting to examine in future research. Importantly, previous work has shown that whereas quit intention predicts quit attempts, other factors such as self-efficacy and nicotine dependence are more relevant for successful maintenance of quitting (e.g., Smit et al., 2014; Vangeli et al., 2011). This may potentially explain the finding in the current research, as the measure of quit success more strongly resembles maintenance than initiation of quitting. In that case, identity seems more relevant than quit intentions for continued quitting. Moreover, the results show that quit intention indirectly relates to quit success through quitter self-identity. However, a meta-analysis on self-identity (in relation to various health behaviours) and the theory of planned behaviour suggested a contrary mediational effect with quit intention mediating the relation between identity and behaviour (Rise et al., 2010). As quit intention did not

directly predict quit success in our model, mediation of the relation between quitter self-identity and quit success through quit intention was not examined. Unexpectedly, the relations between identity, intention, and behaviour did not differ with SES, which contrasts a study that showed moderation of the relation between non-smoker self-identity and quit intention by SES (Meijer et al., 2015). Still, this previous study did not find moderation for quit attempts, and another study did not find moderation effects of SES on the association between identity and intention (Meijer et al., 2016).

#### 4.1. Limitations

The current study has limitations. First, although the longitudinal design allowed for examination of relations between identity, quit intention and quit success across many years, the one-year between waves prevented analyses of subtle changes, which are likely to occur as part of quitting (e.g., Hughes et al., 2005). Future research may use weekly or daily measurements to capture these finer-grained changes, for example by mobile phones (cf. Scholz et al., 2016). It would also be interesting to know whether change in variables between time points predicts subsequent change in variables at subsequent time points. Second, several identity constructs were included and compared, but the number of items to measure each was small. Unfortunately, comprehensive measurement of many constructs is impossible in large-scale longitudinal studies on representative samples. Relatedly, our measure of group-identity represented ties with smokers, but it may be useful to also include other aspects of group-identification, such as ingroup affect or centrality (Cameron, 2004; Høie et al., 2010; Meijer et al., 2016). In addition, the ITC Netherlands Surveys did not measure quitter group-identity, or other identity aspects (e.g., non-smoker identities) that previous research showed are important (Meijer et al., 2015, 2016). More comprehensive measurement and the inclusion of other identity constructs may show different results, although the importance of identification with quitting is in line with findings from studies that used comprehensive identity measurements (Meijer et al., 2015, 2016). Third, the samples used for the initial analysis and cross-validation might not have been fully representative due to (selective) attrition. However, the samples at individual waves were representative of the Dutch population of smokers (Nagelhout et al., 2010, 2016). Furthermore, Model 2 included only continuing smokers at waves 4 and 5, because quit intention was not measured among ex-smokers. Those who were quit at wave 5, and might have had strong intentions to quit at wave 4, were excluded in this model. Fourth, about one third of the participants included in the initial samples for Model 1 and 2 were also included in the cross-validation samples, such that, in part, the same participants were modelled. However, the majority of participants in the cross-validation samples were not included in the initial samples, and follow-up analyses showed that results were largely similar when these participants were removed from the cross-validation sample.

#### 5. Conclusions

The results have important implications. The finding that behaviour may be more important for identity than vice versa, if replicated, may call for additions to identity theories. Moreover, changing smoking behaviour may be a vehicle to change smoking-related identity, for example through smoking cessation counselling. Furthermore, quitter self-identity appeared more important for quit intentions and smoking behaviour than smoker identities. Future research should therefore investigate ways to strengthen identification with quitting among smokers and ex-smokers, for example through narratives (McAdams and McLean, 2013; Parry et al., 2001; Pennebaker, 2004, 2010) or avatars (Song et al., 2013). Narratives and avatars have successfully been used to strengthen identity in the past. The development of such identity-focused interventions is likely to help more smokers and ex-smokers to move toward quitting smoking and to remain abstinent.

In sum, this study provided important new insights into the longitudinal relationships between identity and smoking cessation, using a large sample of smokers and ex-smokers. Intention and behaviour appear to be more important for identity change than the other way around, but identity remains important in relation to intention and behaviour. Moreover, strengthening identification with quitting among smokers and ex-smokers seems more important for smoking cessation than decreasing identification with smoking or smokers.

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#### Appendix A. Supplementary data

Supplementary data related to this article can be found at <http://dx.doi.org/10.1016/j.socscimed.2017.12.006>.

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