HHS Public Access

Author manuscript

J Smok Cessat. Author manuscript; available in PMC 2021 March 30.

Published in final edited form as:

J Smok Cessat. 2019 March ; 14(1): 1–11. doi:10.1017/jsc.2018.7.

The Role of the Subjective Importance of Smoking (SIMS) in Cessation and Abstinence

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Abstract

Introduction: Each year about two thirds of U.S. smokers make a quit attempt. Yet, less than 5% remain abstinent three months post-quit date. One factor that may affect abstinence is negative feelings about the self-associated with being a smoker (disequilibrium), particularly if smoking is important to the sense of self and one is trying to quit.

Aims: We evaluated a multivariate structural equation model proposing that smoking's subjective importance to a smoker would influence carbon monoxide verified smoking abstinence at 24 weeks (post-quit date). Further, we assessed whether the relation would be moderated by the smoker's experience of disequilibrium.

Methods: Participants were 440 regular smokers taking part in a clinical trial assessing the effectiveness of different durations of nicotine replacement therapy use. Participants completed the subjective importance of smoking survey at baseline and were assessed for carbon monoxide verified seven-day point prevalence abstinence at 24 weeks

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Conflicts of Interest

Dr. Schnoll is a consultant for the products Buprion (Zyban) and Verenicline (Chantix). Further, he receives supplies of Verenicline/placebo for trials. No other authors in this study have any conflicts of interest to report.

Ethical Standards

The authors assert that all procedures contributing to this work comply with the ethical standards of the relevant national and institutional committees on human experimentation and with the Helsinki Declaration of 1975, as revised in 2008.

Results: Using exploratory structural equation modelling, the subjective importance of smoking was associated with point prevalence abstinence at 24 weeks, but only for smokers with high disequilibrium.

Conclusions: The results of this study suggest that experiencing negative feelings about being a smoker could motivate smokers to remain abstinent, despite the importance of smoking to the smoker's sense of self.

Despite vast evidence and public information concerning its consequences, and the proliferation of policies limiting access, cigarette smoking remains the leading preventable cause of death and disease in the United States (Danaei et al., 2009; Grunberg & Barry, 2015; Islami, Ward et al., 2015). Indeed, smoking prevalence is 15% among U.S. adults, and as high as 26% among adults living below the poverty line (CDC, 2015). Each year about two thirds of U.S. smokers make a quit attempt (Agaku, King, Dube, Control, & Prevention, 2014; Lavinghouze & Malarcher, 2016; Rafful et al., 2013). Of those, less than 5% remain abstinent three-months post quit (Rafful et al., 2013; Zhu, Lee, Zhuang, Gamst, & Wolfson, 2012; Zhuang, Gamst, Cummins, Wolfson, &Zhu, 2015).

Factors associated with unsuccessful quitting include nicotine dependence, poor mental health, low social support for quitting, stress and lower self-efficacy beliefs about quitting (Cobb et al., 2014; Hiscock, Bauld, Amos, Fidler, & Munafo, 2012; Lukowski, Morris, Young, & Tinkelman, 2015; Raupach, Brown, Herbec, Brose, & West, 2014; Smit, Hoving, Schelleman-Offermans, West, & de Vries, 2014). Another factor that may influence abstinence is the subjective importance of cigarettes and cigarette smoking to a smoker's conception of self (self-concept). If cigarette smoking is experienced as an essential characteristic of the self-concept, this belief may affect readiness to quit, quit attempts and successful quitting, as quitting smoking would be akin to losing a significant facet of who one conceives the self to be as a person. The results of research suggest that smokers' self-conceptions of cigarettes and smoking affect success in quitting, and abstinence (Berg et al., 2010; Gibbons & Gerrard, 1995; Lindgren, Neighbors, Gasser, Ramirez, & Cvencek, 2016; Pulvers et al., 2013; Shadel & Mermelstein, 1996; van den Putte, Yzer, Willemsen, & de Bruijn, 2009). Indeed, findings of such research suggest that becoming a non-smoker involves adopting a non-smoker identity (Lindgren et al., 2016; Tombor, Shahab, Brown, & West, 2013; Tombor et al., 2015; Vangeli & West, 2012). This task is especially salient given the increased prevalence of smoking bans (Meijer, Gebhardt, Dijkstra, Willemsen, & Van Laar, 2015). Thus, given the public health burden (Jha & Peto, 2014) and the high rate of relapse, along with the relation of self-concept to behaviour change (Dudovitz, Li, & Chung, 2013; Frazier et al., 2015; Hensel, Fortenberry, O'Sullivan, & Orr, 2011; Stephens, Markus, & Fryberg, 2012; Thomas, 2007), we sought to better understand how smokers' conceptions of cigarettes and cigarette smoking, in relation to self-concept, affect abstinence in a cohort of smokers participating in a smoking cessation study.

Variable selection was guided by theory proposing that a key function of the self is to adapt self-conceptions and behaviour to the social rules (constraints) of one's contexts in order to minimize psychological distress (Rodriguez, 2000). Motivated by the work of Piaget (Piaget, 1951) and Epstein (Epstein, 1973), Rodriguez proposed that when behaviour and self-

concept fit contextual constraints, the individual experiences equilibrium and change is perceived as unnecessary, such as when a smoker who attributes great importance to smoking is in a smoking-friendly setting. Conversely, when fit is poor, it is proposed that the individual experiences psychological distress (disequilibrium), such as when the contradiction between a high subjective importance of smoking (SIMS) and the health and social consequences of smoking is made salient. It is the experience of disequilibrium that is proposed to be a key motivator for change, and it is the ability to tolerate disequilibrium that is proposed to be responsible for the maintenance of behaviour change, a process termed psychoadaptation.

Consistent with the role of disequilibrium in psychoadaptation, the purpose of this study was to assess whether disequilibrium moderates the relation between the SIMS to a cigarette smoker's self-concept and smoking abstinence at 24 weeks post quit. We proposed that for smokers experiencing higher versus lower disequilibrium at baseline (greater understanding of the contradiction between high SIMS and smoking's health and social consequences), SIMS would be associated with higher abstinence 24 weeks post quit.

Methods

Participants

Participants were 447 adult smokers (Mean age = 47 years, SD = 11.92; 51% Female; 44% White), smoking on average 17 cigarettes/day (SD = 8.36) pre quit, taking part in a randomized controlled trial evaluating the efficacy of long-versus short-term nicotine replacement therapy (NRT) using nicotine patches (Schnoll et al., 2015). Sample demographics for the $n = 440$ participants with complete data on all predictor variables are presented in (Table 1).

Procedures

At baseline (prior to randomisation to one of three NRT durations) (see main study for details, Schnoll et al., 2015), all participants completed a battery of measures assessing demographics, smoking and nicotine dependence, prior quit attempts and psychological traits and states (anhedonia, anxiety and positive and negative affect), along with the SIMS measure.

Instrumentation

The subjective importance of smoking (SIMS).—The SIMS is a 14-item measure developed to assess the psychological importance of cigarettes and cigarette smoking to a smoker. Its development followed from prior research demonstrating relations between smoking up-take and specific facets of self-concept (Rodriguez & Audrain-McGovern, 2005; Rodriguez, Dunton, Tscherne, & Sass, 2008), and theory suggesting the role of self-concept in the regulation of behaviour and affect (Epstein, 1973; Masterson, 1985; Piaget, 1951; Rodriguez, 2000).

Development of the SIMS took place in three phases. In the first, 17 items were generated based on unstructured interviews with adults smoking ≥ 20 cigarettes/day, and in

consultation with other University of Pennsylvania tobacco researchers. The SIMS was then administered to a convenience sample of 94 young adult smokers in Quebec, Canada (50% female; 83% White; mean age 21, SD = 0.45; cigarettes/week = 57, SD = 34.83; age first smoked = 14, SD = 2.04) (O'Loughlin et al., 2015). Results suggested that the SIMS is poorly suited for smokers smoking < 10 cigarettes/day.

The SIMS was next administered to a sample of 202 Southeastern Pennsylvania adult daily cigarette smokers with no intention to quit (Mean age 31 years, SD = 8.07) taking part in a study to better understand their opinions on tobacco product advertising (Strasser et al., 2011). The SIMS was administered once as part of a baseline smoking history battery. The aim of this phase was to assess the distribution of the SIMS in a sample of smokers smoking more cigarettes per day and for longer than the Quebec sample (cigarettes/day = 17, SD = 5.72; years smoked 13, SD = 6.81). Although there was greater variability than the Quebec sample, the response probabilities for several items were highly skewed to 'False' (six-point False-True scale). Discussion with two co-authors (AS & RS) resulted in revising or removing several items. The present study represents the third phase of testing, and includes 14 of the 17 original items, and revisions. See (Tables 3 and 4) for the items.

Nicotine dependence.—Nicotine Dependence was assessed with the 7 - item Fagerstrom Test for Nicotine Dependence (Heatherton, Kozlowski, Frecker, & FAGER-STROM, 1991); Cronbach's Coefficient Alpha (Alpha) = 0.540. We assessed nicotine dependence as it should be positively and strongly correlated with SIMS given cigarettes are nicotine delivery devices.

Psychological correlates.—The Positive and Negative Affect Scale (20 items) was used to assess positive and negative affect (Watson, Clark, & Tellegen, 1988), Alpha = 0.823; the Snaith-Hamilton Pleasure Scale (14 items) was used to assess anhedonia (inability to experience pleasure) (Snaith et al., 1995), Alpha = 0.933; The 21-item Beck Anxiety Inventory was used to assess Anxiety symptoms (Beck, Epstein, Brown, & Steer, 1988), Alpha = 0.885. These variables were selected for their possible positive and negative relations to SIMS, and for assessment of construct validity.

Demographic variables.—We controlled for the demographic variables sex, race, education, marital status and income.

Point prevalence abstinence.—Our outcome variable was carbon monoxide (CO) verified 7-day point prevalence abstinence (PPA) at 24 weeks (Schnoll et al., 2015). We used this PPA measure as it was the more proximal (to quit date) of two measures taken (24 weeks and 52 weeks). Given that the SIMS was only measured at baseline, and the SIMS would likely change over time, it would be more likely to represent how the smoker feels about smoking (with respect to the Self) at a 24 than 52 weeks.

Disequilibrium.—We employed the single item 'Smoking makes me feel bad about myself' as an indicator of disequilibrium. We used a single indicator for purposes of parsimony. Further, it allowed us to efficiently divide our sample into higher and lower levels of disequilibrium, permitting for the assessment of moderation; does the effect of the

SIMS on PPA differ by disequilibrium? As this item had a six-point rating scale (False, Mostly False, More False than True, More True than False, Mostly True, True), we considered participants selecting a 'False' option to have low disequilibrium, whereas participants selecting a True option to have high disequilibrium. To assess the item's validity as a measure of disequilibrium, we conducted bivariate correlation analysis between disequilibrium and nicotine dependence and positive affect (discriminant validity) and negative affect and anxiety (convergent validity). As expected, disequilibrium was significantly and positively associated with negative affect ($r = 0.185$, $p > 0.0001$) and anxiety ($r = 0.218$, $p < 0.0001$). By contrast, it was uncorrelated with nicotine dependence ($r = -0.055$, $p = 0.244$) and positive affect ($r = 0.012$, $p > 0.807$). These findings support the construct validity of our indicator of disequilibrium.

Other covariates.—We also controlled for prior quit attempts lasting at least 24 hours (a proxy for motivation to quit smoking; binary 0 = none, 1 = at least one) and treatment assignment (binary 0 = standard, 1 = extended).

Analysis

We employed exploratory structural equation modelling (ESEM) to analyse the data. ESEM is a structural equation modelling (SEM) method that allows researchers to combine exploratory factor analysis (EFA) and confirmatory factor analysis (CFA) in a single model (Asparouhov & Muthén, 2009; Marsh et al., 2009). As such, it permits assessment of the internal EFA and cross structure (discriminant and convergent validity) of a measure in a single study. ESEM is a hybrid method that borrows from EFA and CFA, along with SEM (Asparouhov & Muthén, 2009; Marsh et al., 2009). Unlike CFA which restricts items to load on a single factor, ESEM allows items to load on multiple factors, which is a more realistic assumption (Marsh et al., 2009). The process involves several steps. In the first, EFA is conducted to identify the number of factors best representing the relations amongst the measured variables. We will consider a factor reliable if it contains ≥ four loadings ≥ 0.60 (Stevens, 2002). In the second step, covariates are added to the model to assess convergent and discriminant validity. In the third, one may assess the association of covariates to the measured variables (i.e., factor indicator variables) using model modification indices. (Figure 1) is a general description of our ESEM. We used SPSS 24 software for descriptive statistics and M*plus* 7.0 software for the ESEM analysis.

Given the ordinal nature of the SIMS variables, model parameter estimation employed a weighted least squares estimation technique (WLSMV) with robust standard errors, and a mean and variance adjusted chi-square (χ^2) test statistic (Muthén, du Toit, & Spisic, 1997; Muthén & Muthén, 1998–2004). We evaluated our multivariate models for fit to the observed data using multiple indicators of model performance, including the χ^2 test, comparative fit index (CFI), weighted root mean square residual (WRMR), standardized root mean squared residual (SRMR) and root mean squared error of approximation (RMSEA) (Jackson, Gillaspy, & Purc-Stephenson, 2009), along with substantive criteria (e.g., interpretability of factors). Heuristics for acceptable fit were: CFI, WRMR, SRMR and RMSEA, > 0.95, < 0.90, < 0.08, and < 0.10, respectively (Kenny, 2015). To account for missing data, M*plus* estimates mean, variance and covariance parameters using a full

information maximum likelihood (FIML) estimating procedure which employs the expectation maximization (EM) algorithm, assuming data are missing at random (Muthén, 1998–2004a; 1998–2004b). This only accounts for missing data on the dependent variables. Thus, cases with missing data on the covariates are not included in the analysis.

Results

Descriptive Statistics

Means and standard deviations for continuous variables, and frequency distributions and proportions for categorical variables are presented in (Table 1). Independent samples t-tests and χ^2 analyses were employed to assess differences between participants with high (n = 212) and low (n = 228) disequilibrium. Of note, females reported greater disequilibrium than males, $\chi^2_{(1, n=440)}$ =12.166, $p < 0.0005$. Further, those reporting greater disequilibrium scored significantly higher on anxiety ($t_{(421.94)}$, = −3.88, p=0.0001) and negative affect ($t_{(441)}$, = −3.72, p = 0.0002), but lower on anhedonia ($t_{(435.65)}$, = 2.69, p = 0.0074).

Multivariate Modelling

Exploratory factor analysis (EFA).—The EFA was assessed using models with one to four factors to represent the 14 ordinal SIMS observed variables, using a Geomin oblique rotation method (Table 2). The χ^2 statistic dropped with the addition of each factor to the model, although remaining significant across all models. However, the interpretability of the factor loadings beyond a single factor was difficult as several items loaded high on the multiple factors (See Table 3 for factor loadings, items, and their communalities for the four factor solution). Given only one eigenvalue > 1 (λ_1=8.339) accounting for 60% of the variance, along with a scree plot (eigenvalue plot) elbow at 2 (also suggesting one factor), and 12 loadings ≥ 0.60, we selected the single factor solution as the best solution for these data. This model fit the data fairly well, $\chi^2_{(n=447, df=77)}$ = 457.928, $p < 0.0001$; CFI = 0.957, RMSEA = 0.105 (95%CI = 0.096, 0.115), SRMR = 0.053, with CFI and SRMR indicating good fit but RMSEA suggesting less than adequate fit (Kenny, Kaniskan, & McCoach, 2015). Assessing the source of model misspecification (separate EFA for levels of disequilibrium) suggests the misfit is due to the item ‘cigarettes help me get through hard times’, which did not load significantly for higher disequilibrium. RMSEA for high disequilibrium was 0.122 (90% CI = 0.087, 0.155), whereas RMSEA for low disequilibrium was 0.069 (90% CI = 0.046, 0.091). Nevertheless, we believe the one factor solution is optimal for these data based on substantive and empirical criteria. The items, factor loadings, and communalities for the single-factor solution are presented in (Table 4).

Exploratory Structural Equation Modelling (ESEM)

We next added covariates to the multivariate model to assess their relations to SIMS and PPA at 24 weeks, and to test whether relations differ by disequilibrium. This also allowed us to measure the convergent and discriminant validity of the SIMS, a weighted factor score. The two-group model also fit the data fairly well, $\chi^2_{(n=443, df=560)}$ = 782.243, $p < 0.0001$; CFI = 0.974, RMSEA = 0.042 (90%CI = 0.035, 0.049; probability RMSEA ≤ 0.05 = 0.965), WRMR = 1.259. The model results with unstandardized path coefficients, standard errors, z-statistics, and p values are presented in (Table 5). Standardized path coefficients for

significant model effects are presented graphically in (Figure 2). We present significant effects only for sake of parsimony.

Subjective Importance of Smoking (SIMS)

Nicotine dependence was associated with an increase in SIMS among smokers reporting both high ($b = 0.132$, z = 3.049, $p = 0.002$) and low ($b = 0.165$, z = 4.337, $p < 0.0001$) disequilibrium, with no difference in the effect ($p > 0.05$). However, negative affect was associated with higher SIMS for participants reporting high disequilibrium ($b = 0.041$, z = 2.495, $p = 0.013$), and not related to SIMS among participants reporting low disequilibrium ($p = 0.748$). This between-group difference in effects was significant, $\chi^2_{(1, n = 561)} = 5.062$, $p = 0.0245$, suggesting that disequilibrium moderates the relation between negative affect and SIMS. There were no other significant relations between any of the remaining covariates and SIMS, when exploring group differences. Although SIMS is not a specific measure of nicotine dependence, the stronger relation between SIMS and nicotine dependence supports its construct validity as individuals who place a high subjective importance on smoking are likely to have higher nicotine dependence. Further, the significant relation of negative affect with SIMS amongst participants experiencing high versus low disequilibrium supports the construct validity of the proposed role of disequilibrium as a possible mechanism of change in the smoking cessation process, as predicted by psychoadaptation.

Point prevalence abstinence (PPA).—For participants reporting high disequilibrium, SIMS was positively associated with PPA at 24 weeks ($b = 0.203$, z = 2.114, $p = 0.034$), whereas the relation was not significant ($p = 0.753$) for participants reporting low disequilibrium. This difference in the effect of SIMS on PPA was significant, $\chi^2_{(1, N = 440)} = 4.416$, $p = 0.0356$, suggesting that disequilibrium moderates the effect of the SIMS on abstinence at 24 weeks; individuals experiencing greater disequilibrium are more likely to have remained abstinent at 24 weeks than individuals with lower disequilibrium. There were no significant between-group differences for the relations of the covariates and PPA at 24-weeks.

Discussion

The purpose of the present study was to assess whether negative feelings about the self, associated with smoking, moderated the effect of the SIMS on PPA at 24 weeks post quit in a sample of participants involved in a NRT treatment study. Guided by theory proposing that behaviour change is motivated by a desire to reduce the psychological distress resulting from experiences contradicting beliefs about the self (Rodriguez, 2000), we proposed that when cigarette smokers encounter such information (whether voluntarily or serendipitously), the consequence is a feeling of negativity about the self (disequilibrium in Piagetian vernacular, Piaget, 1951) and motivation to either adapt one's conceptions and behaviour to fit the new information or eschew such disconfirming information and continue smoking.

We conducted the present analysis in two phases. We first assessed the factor structure of the measure we developed to better understand the SIMS, and then assessed whether disequilibrium moderated the relation between smoking's subjective importance and abstinence 24-weeks post quit. The results support the plausibility of the theoretical model

tested in relation to smoking and abstinence. Indeed, it appears that although smoking may have a greater subjective importance for smokers higher in nicotine dependence, the experience of disequilibrium could motivate smokers to remain abstinent despite smoking's subjective importance. When coupled with other findings supporting the possible role of self-conceptions and identity in the smoking cessation process (Berg et al., 2010; Gibbons & Gerrard, 1995; Lindgren et al., 2016; Pulvers et al., 2013; Shadel & Mermelstein, 1996; Tombor et al., 2013; Tombor et al., 2015; van den Putte et al., 2009; Vangeli & West, 2012), this finding supports recommendations for a more comprehensive program of research to identify the role of self-conceptions related to substance use behaviours (Lindgren et al., 2016). Such research may not only validate these findings, but suggest directions for incorporating self-concept into smoking cessation initiatives.

Self-concept formation involves identifying with activities that become important to the individual (Wigfield & Karpathian, 1991). These activities come to define who one is, not just what one can do. Self-concept formation is a continuing process that is particularly salient during significant life change, such as quitting smoking (Tombor et al., 2013; Tombor et al., 2015; Vangeli & West, 2012). As smoking cessation involves the loss of a key facet of the smoker's sense of self, identification of alternatively rewarding activities to replace cigarettes and cigarette smoking and to help re-define the self as a non-smoker would be essential to a smoking cessation initiative. Our findings support this supposition, as individuals with high SIMS and who experienced greater disequilibrium were more likely to remain abstinent at 24-weeks post quit. This suggests that efforts to personalize the negative consequences as smoking may trigger disequilibrium and that this may result in the smoker being more likely to remain abstinent post quit. However, without replacing the void left by the absence of cigarettes with alternatively rewarding activities (e.g., exercise and hobbies), relapse is highly likely. Only carefully designed and controlled studies can assess the validity of these speculations. Given the current high relapse rate (Rafful et al., 2013; Zhu et al., 2012; Zhuang et al., 2015), and smoking-related morbidity and mortality (Danaei et al., 2009; Grunberg & Barry, 2015; Islami, Torre, & Jemal, 2015; Islami, Ward et al., 2015), this research is essential.

Limitations

There are several limitations to the results of this study. First, the SIMS was only measured at baseline, precluding exploration of change with changes in smoking behaviour. Second, the SIMS was added to an existing study designed to assess the effectiveness of prolonged NRT use, and not specifically to assess its validity and reliability. Indeed, in all three studies reported here, the SIMS was added to ongoing smoking cohort studies. Future studies assessing the SIMS and its role in smoking cessation need to be designed and conducted specifically for this purpose. Third, as the SIMS was added to an existing study, we could not include other measures related to cessation success and SIMS, including self-efficacy and motivation to quit. However, we used prior quit attempts as a proxy for motivation to quit. Finally, this study employed weighted not summated SIMS factor scoring, which makes clinical use difficult.

Conclusions

The findings of this study suggest the need for further research to evaluate how the SIMS may impact smoking cessation interventions. Including the SIMS in the battery of tests administered at baseline and follow up may allow for a better understanding of how self-conceptions alter or are altered by changes in smoking status.

Acknowledgements

We would like to thank the staff of the University of Montreal and the University of Pennsylvania who provided time and effort to the studies used in the validation process of the SIMS.

Financial Support

This research was supported by a grant from the National Institute on Drug Abuse to Dr. Schnoll (R01 DA025078).

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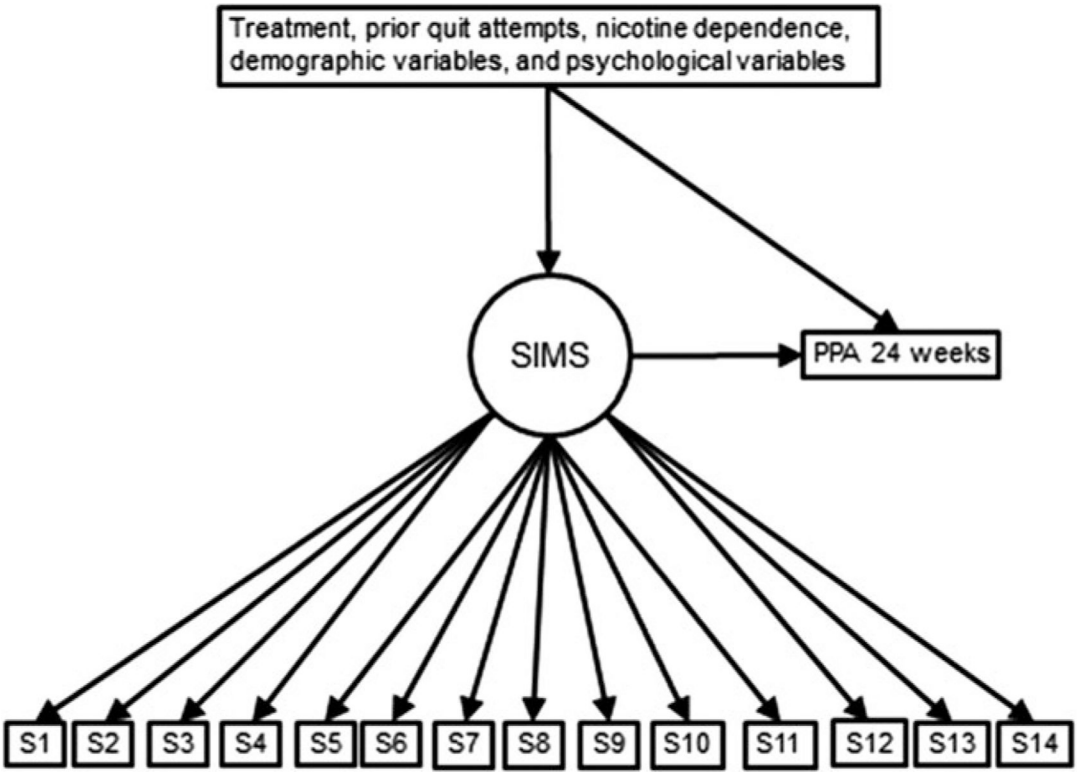

Figure 1.

General ESEM model in this study. Paths from all predictor variables to the latent SIMS variable and the measured point prevalence abstinence (24 weeks) variable are estimated and tested for significance for participants with low and for participants with high disequilibrium. Any differences in effects between the two levels of disequilibrium are tested for significance using a chi-square difference test (applicable to categorical outcome variables).

Paths from the SIMS latent variable to the 14 SIMS variables (S1–S14) are factor loadings resulting from the exploratory factor analysis. Thus, the SIMS is a non-measured variable, and its score for any participant is inferred through scores on the 14 indicator variables.

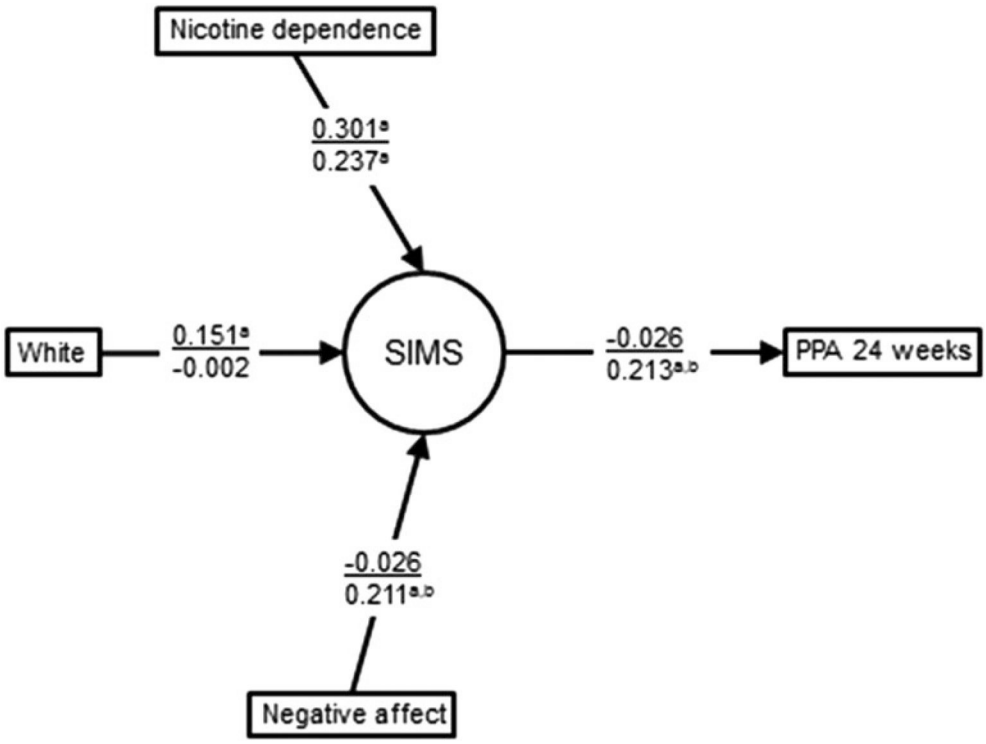

Figure 2.

ESEM with standardized path coefficients for significant model effects. Values above the dividing line represent standardized path coefficients for participants with lower disequilibrium, whereas values below the dividing line are standardized path coefficients for participants with higher disequilibrium.

[a]Significant $p \leq 0.05$.

[b]Significant between group difference.

Table 1

Descriptive statistics

		Smoking-Related Negativity			
		Low (*n* = 230)		High (*n* = 213)	
Variable	**Level**	***N***	**%**	***N***	**%**
Sex **	Male	131	60	86	40
	Female	102	44	128	56
Ethnicity **	Non-European-American	138	60	91	40
	European-American	94	43	123	57
Married	Not Married	191	53	169	47
	Married	42	48	45	52
Income	Lower Income	133	49	140	51
	Higher Income	99	58	73	42
Education **	> High School	134	43	175	57
	≤ High School	99	72	39	28
Point Prevalence Abstinence - 24 weeks	Not abstinent at 24 weeks	178	54	153	46
	Abstinent at 24 weeks	55	47	61	53
		Mean	SD	Mean	SD
Nicotine Dependence (FTND)		5.28	2.00	4.93	1.95
Anxiety *		3.44	5.80	5.75	6.64
Anhedonia *		23.41	7.82	21.58	6.48
Positive affect		35.16	8.43	34.84	7.70
Negative affect **		14.40	5.45	16.34	5.57

* $p < 0.05$.

** $p < 0.01$.

Table 2

Model comparisons exploratory factor analysis

Model	X^2(df), *p* value	CFI	RMSEA (90% CI)	SRMR
One Factor	457.928(77), $p < 0.0001$	0.957	0.105 (0.096, 0.115)	0.053
Two factors	357.158(64), $p < 0.0001$	0.967	0.101 (0.091, 0.112)	0.045
Three Factors	259.633(52), $p < 0.0001$	0.977	0.095 (0.083, 0.106)	0.037
Four Factors	159.396(41), $p < 0.0001$	0.987	0.080 (0.067, 0.094)	0.024

Table 3

Factor loadings and communalities for the four factor solution

Statement	Factor 1	Factor 2	Factor 3	Factor 4	Communalities
Cigarettes help me get through hard times	0.001	0.588	0.275	0.022	0.544
Smoking helps me meet new people	0.049	0.035	0.482	0.015	0.288
I cannot cope without cigarettes	0.398	0.477	0.001	−0.251	0.639
Being a smoker is important to me	0.672	−0.013	0.161	− 0.053	0.658
I cannot see myself not smoking	0.803	−0.154	0.025	−0.16	0.64
Cigarettes are a big part of my identity	0.922	0.015	−0.077	0.104	0.744
Without cigarettes, I couldn't make it	0.48	0.091	0.293	−0.278	0.739
When I am holding a cigarette I feel really competent, like I can do anything	0.156	0.058	0.706	− 0.086	0.769
When I can't smoke I feel like a nobody	−0.001	−0.039	0.86	−0.188	0.782
I would feel really empty without smoking, like I lost an important part of my life	0.4	0.026	0.446	−0.004	0.674
Cigarettes make me feel at ease in new situations	0.016	0.283	0.549	0.199	0.537
Being a smoker means a lot to me	0.684	−0.051	0.253	0.099	0.768
Holding a cigarette makes me feel like I'm in control	0.006	−0.017	0.904	0.292	0.846
Smoking is a big part of who I am	0.869	0.048	0.011	0.407	0.906

Table 4

Distribution of responses to SIMS items divided by disequilibrium, and factor loadings and eigenvalues

		Six-point Scale							
Statement	**Disequilibrium**	**False**	**Mostly False**	**More False than True**	**More True than False**	**Mostly True**	**True**	**Loadings**	**Communalities**
Cigarettes help me get through hard times *	Lower	9.4	6.4	15.9	24.0	21.5	22.7	0.560	0.314
	Higher	3.3	7.9	9.8	24.3	24.3	30.4		
Smoking helps me meet new people *	Lower	55.4	12.0	16.7	9.9	3.9	2.1	0.516	0.266
	Higher	38.3	21.0	16.4	14.0	6.1	4.2		
I cannot cope without cigarettes **	Lower	23.2	16.3	21.9	18.9	10.7	9.0	0.644	0.415
	Higher	14.5	9.8	19.6	28.5	15.0	12.6		
Being a smoker is important to me	Lower	49.4	16.3	18.0	6.9	5.2	4.3	0.796	0.634
	Higher	43.5	16.8	18.2	10.3	6.1	5.1		
I cannot see myself not smoking	Lower	54.1	11.6	13.7	8.6	6.0	6.0	0.732	0.536
	Higher	43.0	16.4	12.6	13.6	4.7	9.8		
Cigarettes are a big part of my identity	Lower	45.1	12.4	15.5	12.4	6.4	8.2	0.829	0.687
	Higher	32.7	13.1	22.9	11.7	9.3	10.3		
Without cigarettes, I couldn't make it ***	Lower	63.9	14.2	11.2	5.6	3.0	2.1	0.506	0.256
	Higher	43.5	15.0	14.0	14.0	7.9	5.6		
When I am holding a cigarette I feel really competent, like I can do anything **	Lower	59.2	10.7	12.4	11.2	1.7	4.7	0.849	0.721
	Higher	42.7	19.2	13.1	11.7	8.0	5.2		
When I can't smoke I feel like a nobody ***	Lower	80.7	9.4	7.3	0.9	0.4	1.3	0.808	0.653
	Higher	62.1	13.6	14.5	3.3	3.3	3.3		
I would feel really empty without smoking, like I lost an important part of my life ***	Lower	60.9	12.9	11.2	7.3	4.3	3.4	0.816	0.666
	Higher	33.2	19.6	14.5	15.0	9.8	7.9		
Cigarettes make me feel at ease in new situations **	Lower	26.6	8.6	14.2	19.7	15.5	15.5	0.662	0.438
	Higher	11.2	11.7	13.6	23.4	23.4	16.8		
Being a smoker means a lot to me	Lower	58.4	13.7	14.2	7.7	3.0	3.0	0.865	0.748
	Higher	47.2	19.6	12.6	9.3	6.1	5.1		
Holding a cigarette makes me feel like I'm in control **	Lower	61.8	9.0	9.4	7.7	4.7	7.3	0.816	0.666
	Higher	43.0	14.0	14.5	14.0	7.0	7.5		
Smoking is a big part of who I am **	Lower	51.1	9.9	12.0	10.7	6.0	10.3	0.849	0.721

Statement	Disequilibrium	Six-point Scale						Loadings	Communalities
		False	Mostly False	More False than True	More True than False	Mostly True	True		
	Higher	34.6	14.5	17.3	11.2	12.6	9.8		

* $p \leq 0.5$.

** $p \leq 0.01$.

*** $p \leq 0.0001$.

Table 5

Non-standardized results of exploratory structural equation modelling

	SIMS							
	Lower Negativity[a]				Higher Negativity[a]			
	b	**SE**	**z-statistic**	***p* value**	***B***	**SE**	**z-statistic**	***p* value**
Female	0.103	0.158	0.651	0.515	0.15	0.151	0.994	0.32
White	0.336	0.164	2.047	0.041	−0.005	0.157	−0.031	0.975
Married	−0.257	0.206	−1.243	0.214	0.096	0.181	0.531	0.595
FTND	0.165	0.038	4.337	<0.0001	0.132	0.043	3.049	0.002
Anxiety	0.028	0.017	1.582	0.114	−0.004	0.013	−0.286	0.775
Anhedonia	0.009	0.009	0.948	0.343	0.015	0.011	1.364	0.173
Positive affect	−0.012	0.009	−1.396	0.163	−0.012	0.011	−1.115	0.265
Negative affect	−0.006	0.018	−0.321	0.748	0.041	0.016	2.495	0.013
Prior quit attempt	0.117	0.161	0.727	0.467	−0.363	0.209	−1.737	0.082
Treatment	−0.014	0.151	−0.095	0.924	0.07	0.17	0.414	0.679
Low income	0.003	0.169	0.018	0.986	−0.09	0.19	−0.474	0.636
≤ High School	−0.265	0.172	−1.545	0.122	−0.036	0.193	−0.187	0.851
	Point Prevalence Abstinence (PPA)[b]							
	Lower Negativity[a]				Higher Negativity[a]			
	b	**SE**	**z-statistic**	***p* value**	***B***	**SE**	**z-statistic**	***p* value**
SIMS	−0.027	0.085	−0.314	0.753	0.203	0.096	2.114	0.034
Female	0.183	0.224	0.816	0.414	0.034	0.202	0.166	0.868
White	−0.221	0.228	−0.972	0.331	−0.175	0.222	−0.788	0.431
Married	−0.375	0.283	−1.325	0.185	0.033	0.25	0.132	0.895
FTND	−0.083	0.056	−1.485	0.137	−0.02	0.054	−0.368	0.713
Anxiety	−0.007	0.028	−0.255	0.799	0.001	0.02	0.045	0.964
Anhedonia	0.016	0.014	1.13	0.259	0.005	0.017	0.321	0.748
Positive affect	− 0.039	0.013	−2.943	0.003	−0.024	0.013	−1.904	0.057
Negative affect	0.016	0.025	0.653	0.514	−0.018	0.021	−0.861	0.389
Prior quit attempt	−0.075	0.215	−0.349	0.727	0.204	0.283	0.722	0.47

Treatment	0.352	0.223	1.576	0.115	−0.016	0.201	−0.08	0.936
Low Income	−0.654	0.22	−2.972	0.003	−0.048	0.236	−0.203	0.839
≤ High School	0.069	0.231	0.301	0.764	−0.309	0.301	−1.029	0.304

[a]The smoking-related negativity binary variable was generating by cutting the single item ‘Smoking makes me feel bad about myself’ into a lower half and a higher half (responses 1–3 were lower negativity; responses 4–6 were higher negativity).

[b]The outcome point prevalence abstinance variable (biochemically verified) is binary (1 = abstinant at 24 weeks; 0 = not abstinent at 24 weeks). As such, the *b* values represent the log odds of change (i.e., logistic regression).

[c]This difference in the effect of the SIMS factor on PPA at 24 weeks is significant, $p = 0.0405$.