

An Investigation of the Relationship Between Identifying as a Smoker and Urges to Smoke Among Young Adult Combustible Cigarette Smokers

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Identifying as a smoker and urges to smoke are 2 predictors of persistent combustible cigarette smoking. We investigated the relationship between them. Specifically, grounded in PRIME Theory (West & Brown, 2013), we investigated whether a smoker identity and urges to smoke predict each other over time independent of their relationships with smoking behavior. At 3 yearly time points, young adult combustible cigarette smokers ($N = 286$) completed assessments of endorsement and importance of identifying as a smoker as well as smoking behavior; during the subsequent week at the first 2 time points, participants repeatedly completed assessments of momentary smoking urge intensity and current social situation in randomly prompted ecological momentary assessments (EMA). Within time points, greater endorsement of identifying as a smoker predicted more intense momentary urges to smoke, particularly when in the presence of other people than when alone. Across time points, both elevated and elevating levels of smoker identity endorsement predicted increases in average smoking urge intensity; vice versa, both elevated and elevating levels of average smoking urge intensity predicted increases in smoker identity endorsement and importance. All relationships were independent of smoking behavior. These findings add to our understanding of persistent combustible cigarette smoking, as they indicate that a smoker identity and urges to smoke contribute to each other independent of their relationships with smoking behavior.

Keywords: smoker identity, craving, urges, smoking




Although its prevalence has decreased (Substance Abuse and Mental Health Services Administration, 2017), persistent (i.e., ongoing, without cessation) combustible cigarette smoking (i.e., smoking traditional tobacco cigarettes; from here forward, “smoking”) is a major contributor to morbidity and early mortality (United States Department of Health & Human Services, 2014). Understanding why it occurs remains a priority. A smoker identity (Hertel & Mermelstein, 2012; Lindgren, Neighbors, Gasser, Ramirez, & Cvencek, 2017; Meijer, Gebhardt, Dijkstra, Willemssen, & van Laar, 2015; Shadel & Mermelstein, 1996; van den

Putte, Yzer, Willemsen, & de Bruijn, 2009) and urges to smoke (Sayette, 2016) are two predictors of smoking. Investigating the relationship between them sheds light on its occurrence. PRIME theory (West & Brown, 2013) is a motivational explanation of smoking that posits a relationship between a smoker identity and urges to smoke. Grounded in this theory, we investigated whether a smoker identity and urges to smoke predicted each other over time independent of their relationships with smoking behavior.

A Smoker Identity as a Cause of Urges to Smoke

According to PRIME Theory (West & Brown, 2013), a smoking urge is a consciously experienced impulse to smoke that arises as soon as that impulse does not translate into smoking (e.g., due to a competing smoking inhibition). It is associated with the activation of a cognitive schema for the sequence of events that smoking comprises. It is one of a hierarchically organized set of five motivational causes of smoking. It is lower in the hierarchy—below, from top to bottom, in order, (a) plans to smoke, (b) positive evaluations of smoking (positive beliefs about smoking based on judgments of its positive value), and (c) motives to smoke (wanting to smoke based on anticipated pleasure from smoking or needing to smoke based on anticipated relief brought about by smoking), and above reflex-like responding—because it is relatively more difficult to control and has a relatively stronger impact on smoking than the causes above it in the hierarchy. Importantly,

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there are causal dynamics between it and the other causes in the hierarchy.

From a PRIME Theory perspective (West & Brown, 2013), identifying as a smoker is labeling, or categorizing oneself as someone who smokes. As such, it establishes the perception of being similar to others who smoke and different from others who do not smoke. Broadly, it is a self-belief, and even more broadly, it is a mental representation of the self. Beyond categorizing oneself as a smoker, one can have various construals and feelings about the identity. For example, it can be liked (Tombor, Shahab, Brown, & West, 2013). It is one component of identity overall, along with other mental representations of the self, including other self-beliefs and self-images, as well as construals and feelings about those other mental representations. It, along with its construals and feelings, can be chronic and persist but also change. (Hertel & Mermelstein, 2012; Hertel & Mermelstein, 2016; Meijer et al., 2018; Meijer et al., 2017; Shadel, Mermelstein, & Borrelli, 1996).

PRIME Theory (West & Brown, 2013) articulates a relationship between a smoker identity and urges to smoke. The theory suggests that identifying as a smoker can induce urges to smoke, and that it does so indirectly through its influence on the motivational causes that are above an urge to smoke in the hierarchy of motivational causes of smoking. For instance, identifying as a smoker can invoke a motive to smoke, which in turn can result in an urge to smoke. This effect is in service of the desire for self-consistency (see also Festinger, 1957; Markus, 1977; Markus & Wurf, 1987; Mazar, Amir, & Ariely, 2008; Swann, 1983). It can have this influence once it is activated, and the nature of the influence is in part dependent on how it is construed.

This hypothesized influence of identifying as a smoker on urges to smoke has received empirical support. In a study of adult regular smokers, Shadel and Cervone (2006) experimentally tested the influence of a smoker identity on craving a cigarette (from a PRIME Theory perspective, a strong form of an urge). Participants' abstainer and smoker identities were primed by presentation of synonyms of personal attributes that the participants idiosyncratically associated with those identities. In comparison to priming an abstainer identity (e.g., with synonyms of "happy" or "understanding"), priming a smoker identity (e.g., with synonyms of "relaxed" or "guilty") resulted in a stronger craving for a cigarette. Thus, data to date indicate support for the hypothesis that identifying as a smoker induces urges to smoke. Although this hypothesis has received empirical support, it has not been extensively tested. We sought to test it further.

Evidence also indirectly supports the notion that construals of identifying as a smoker can invoke urges to smoke. A study of adult smokers showed that liking being a smoker was associated with a more positive evaluation of smoking (Tombor et al., 2013). A positive evaluation of smoking can translate to a motive to smoke, and ultimately an urge to smoke. We also sought to evaluate directly the relationship between construals of identifying as a smoker and urges to smoke.

Urges to Smoke as a Cause of a Smoker Identity

Tenets of PRIME Theory suggest that urges to smoke can cause identifying as a smoker. It is thought that experiences, such as urges, can be stored in memory and subsequently influence mental

representations; moreover, a smoker identity is malleable (West & Brown, 2013). Findings to date support this notion. For example, studies among adolescents and young adults who smoked found that identifying as a smoker was partly based on the perception of being addicted to smoking (Mermelstein & the Tobacco Control Network Writing Group, 1999; Tombor et al., 2015), which is a perception that is associated with experiencing smoking urges (Berg et al., 2013). In addition, a study of adults who smoked showed that craving a cigarette activated prosmoking beliefs (Nordgren & Chou, 2011; Nordgren, van der Pligt, & van Harreveld, 2006); smoker identity was not assessed, but it is possible that it was activated given that it is a prosmoking belief. Repeated activation of a smoker identity might contribute to its development. These findings indicate that smoking urges can influence smoker identity, but more evaluation of this relationship is needed.

Current Study: Predicting a Smoker Identity and Smoking Urges Over Time

In the current observational study, grounded in PRIME Theory, we evaluated whether a smoker identity predicts smoking urges across time and vice versa, whether smoking urges predict a smoker identity across time. Theoretically, these relationships emerge independent of relationships with behavior, so we evaluated whether these relationships emerged while controlling for smoking behavior.

We also tested whether identifying as a smoker more strongly predicted urges to smoke over time when it is more strongly activated, as PRIME theory indicates that the influence of a smoker identity on urges to smoke is contingent on it being activated (West & Brown, 2013). Notably, the test of the relationship between a smoker identity and a cigarette craving in Shadel and Cervone (2006) involved activation of the identity. We tested whether our predicted relationship was stronger in two different social situations that might activate identifying as a smoker—being around others and being around others who are smoking. Being around others involves processing similarities to and differences from them. Moreover, mental representations of the self are activated by stimuli that are specific to them (Frings & Albery, 2017; Frings, Collins, Long, Pinto, & Albery, 2016). Thus, being around others might activate identity at large, perhaps including a smoker identity, and being around others who are smoking might more specifically and more strongly activate a smoker identity than merely being around others.

In addition, we investigated whether the perception that identifying as a smoker is an important part of one's identity and urges to smoke predicted each other over time independent of their relationships with identifying as a smoker. We considered smoker identity importance as a construal of a smoker identity. Theory and evidence from investigations of identifying with drinking also indicate that smoker identity importance is distinct from smoker identity and might independently relate to smoking urges (Hertel, Peterson, & Lindgren, 2019). Our predictions were in tandem with our predictions about identifying as a smoker.

We tested our predictions with observational data collected from young adults in a longitudinal study of smoking patterns. At three yearly time points, identifying as a smoker was assessed once with a paper-and-pencil survey. Then, at the first two time points, over the course of the subsequent week, momentary smoking urge

intensity was repeatedly assessed with randomly prompted ecological momentary assessment (EMA). Because urges to smoke are momentary, it was advantageous to assess them with EMA. Each identity assessment included an assessment of smoker identity endorsement and importance as well as smoking behavior. Each urge assessment included an assessment of the social situation.

In all, we tested six hypotheses. We controlled for smoking behavior in each test. According to PRIME theory, identifying as a smoker induces urges to smoke. Thus, observationally, a smoker identity should predict the intensity of smoking urges over time.

Hypothesis 1: Within time points, greater endorsement and importance of identifying as a smoker predicts more intense momentary smoking urges.

Hypothesis 2: Across time points, *increases* in the endorsement and importance of identifying as a smoker predict increases in the average intensity of smoking urges.

In addition, the more strongly a smoker identity is activated, the more strongly it should induce urges to smoke. Thus, observationally, smoker identity should more strongly predict the intensity of smoking urges over time in social situations that are likely to activate it.

Hypothesis 3: Within time points, greater endorsement and importance of identifying as a smoker predicts more intense momentary smoking urges more so in the presence of other people compared to when alone.

Hypothesis 4: Within time points, greater endorsement and importance of identifying as a smoker predicts more intense momentary smoking urges more so in the presence of other people who are smoking compared to when in the presence of other people who are not smoking.

Finally, evidence indicates that a smoker identity can be induced by urges to smoke. Thus, observationally, the intensity of smoking urges should predict identifying as a smoker over time.

Hypothesis 5: Across time points, more intense smoking urges, on average, at one time point predict increases in the endorsement and importance of identifying as a smoker.

Hypothesis 6: Across time points, *increases* in the average intensity of smoking urges predict increases in the endorsement and importance of identifying as a smoker.

Method

Participants

Participants included in this investigation came from a larger longitudinal study of the social and emotional contexts of adolescent and young adult smoking. All 9th and 10th graders (14- to 16-year-olds) from 16 Chicago metropolitan-area schools ($N = 12,970$) completed screening surveys querying their smoking behaviors, with eligible participants and their parents ($n = 3,654$) receiving mailed invitations to participate in the larger longitudinal study. Of 1,344 students initially agreeing to participate, a final

sample of 1,263 (94.0%) students provided assent and parental consent prior to completing baseline data collection. All participants completed paper-and-pencil surveys, while subsets completed multiple project components, including in-person interviews, family interviews, psychophysiological assessments, and weeklong EMA assessment periods. We report here on paper-and-pencil survey data collected at years 5, 6, and 7 and EMA data collected at years 5 and 6. Data collection occurred from the year 2011 through the year 2013. There were 286 participants in our sample. Participants included those who participated in EMA at year 5 ($n = 305$) or year 6 ($n = 273$) ($n = 271$ at both years) and, among them, those who reported smoking at least one cigarette in the past 30 days at year 5 ($n = 270$) or year 6 ($n = 245$) ($n = 229$ at both years). Participants included in this sample were $M = 21.3$ ($SD = 0.76$) years old at the 5-year assessment and were predominantly female (54.2%), White (77.3%; Black 13.3%; More than one race 4.2%; Asian 3.2%; Pacific Islander 1.4%; American Indian/Alaskan Native 0.7%), and non-Hispanic/Latino (83.94%).

Procedure

At years 5, 6, and 7, participants completed paper-and-pencil surveys. At years 5 and 6, EMA weeks immediately followed completion of the paper-and-pencil surveys. Participants selected for the EMA portion of the study received training prior to the EMA week on how to use handheld computers (Palm Pilot, Tungsten E2). Handheld computers were programmed with multiple interview types, including random interviews. We report here on data from these random interviews. Participants completed seven full days of data collection, receiving between 5 and 7 daily random interview prompts. All interviews were time-stamped and recorded, including missed, delayed, or abandoned interviews. Devices included suspend (i.e., suppress random prompts) and delay (i.e., briefly defer random prompt) features to facilitate compliance. If participants did not respond to a random interview prompt within three minutes, then they missed the interview. Participants could defer a random interview for up to 20 min. Participants recorded when they smoked, and they did not receive a random interview prompt until at least 20 min after doing so. Random interview prompts were delivered throughout the day except for adjustments based on other contingencies (e.g., recent smoking, suspensions of the program when unable to respond). Across these two years of data collection, participants completed 21,487 random interviews ($M = 69.99$, range 12–108). The study was approved by the University of Illinois at Chicago Institutional Review Board.

Measures

Demographics. Demographics included self-reported age, gender, and race/ethnicity.

Nicotine dependence. Nicotine dependence was assessed in the years 5, 6, and 7 paper-and-pencil surveys among those who reported smoking at least one cigarette in the past 30 days. The tobacco module of the self-administered *Composite International Diagnostic Interview* (CIDI) assessed the seven criteria for nicotine dependence specified in the Diagnostic and Statistical Manual, Fourth Edition (American Psychiatric Association, 1994), (i.e., tolerance, withdrawal, smoking more/longer than intended, failure

to cut back, high engagement in smoking-related activities, reduced engagement in other important activities, physical and emotional consequences). We dichotomized endorsement of dependence symptoms. Withdrawal was coded as present when participants endorsed smoking to reduce withdrawal symptoms *or* reported at least four other withdrawal symptoms. Participants were coded as meeting the remaining criteria upon endorsing one or more corresponding symptoms. We indexed severity of nicotine dependence as a count of DSM criteria met by each participant, with a range of 0 to 7. Higher counts indicated more criteria met and more dependence. Notably, neither craving nor urge assessments were included in this index, which meant that there was a clearer distinction between the urge and dependence variables.

Daily smoking rate. Daily smoking rate was assessed in the years 5, 6, and 7 paper-and-pencil surveys. We computed daily smoking over the past 30 days by first multiplying participants' self-reported number of days smoked in the prior 30 days by the self-reported average number of cigarettes smoked on those days, and then dividing that product by 30. Daily smoking rates ranged from 0 to 35 and 0 to 25 in the 5- and 6-year waves, respectively.

Smoker identity. Two items were used to assess endorsement of identifying as a smoker ("How much is being a smoker part of who you are? How much do others know you as a smoker?"). Five items were used to assess potential construal dimensions, including certainty (How certain are you that being a smoker is part of who you are? How certain are you that you are known as a smoker?) and importance (How important is it to you that being a smoker is part of who you are? How important is it for you to be known as a smoker? How important are cigarettes in your life?). The two endorsement items were modified versions of items from the smoker self-concept scale, which assesses smoker identity endorsement (Shadel & Mermelstein, 1996); for space and fatigue reasons in the extensive paper-and-pencil survey that included many measures, not all of the items from that scale were included. Two of the items ("How much is being a smoker part of who you are? How important are cigarettes in your life?") formed the smoker identity assessment in survey data collected earlier in the larger longitudinal study, and were reported on in Hertel and Mermelstein (2016). The other five items were new for the assessments at years 5, 6, and 7 that we report on here. The item, "How important are cigarettes in your life?" was assessed on a 1 (*not at all important*) to 4 (*very important*) scale, whereas all other items were assessed on a 1 (*not at all*) to 4 (*a lot*) scale. Exploratory factor analysis (maximum likelihood, oblimin rotation) revealed two subscales. The smoker identity endorsement subscale included the two endorsement items, the two certainty items, and the item about the importance of cigarettes (α year 5 = .84, year 6 = .86, and year 7 = .88). The smoker identity importance scale included the other two importance items (Spearman-Brown r year 5 = .53, year 6 = .66, year 7 = .75). Within each subscale, responses were averaged, and higher scores represented greater endorsement or importance. Given low scale-point response-inflation and strong positive skew, smoker identity importance was dichotomized, where 0 = not at all important 1 = at least somewhat important.

Social exposure and exposure to others smoking. During each EMA interview, participants responded to a single item ("Are you with others?"; responses: alone/alone-others nearby/with others). Those who reported being with others or being alone with others nearby additionally reported whether these other individuals

were smoking ("Are any of these people smoking?"; responses: yes/no). Out of these responses, we constructed a *social exposure* variable [0 = alone ($n = 8570$ events), 1 = around/with others who were not smoking ($n = 10,828$ events)] and an *exposure to others smoking* variable [(0 = around/with others who were not smoking), ($n = 10,828$ events), 1 = around/with others who were smoking ($n = 2089$ events)]. The social exposure variable specifically isolated being around others versus not being around others, free of confounding with variability in exposure to others smoking. The exposure to others smoking variable specifically isolated being exposed to others smoking versus not being exposed to others smoking *when* being around others, free of confounding with variability in being around others.

Smoking urge. During each EMA interview, we assessed momentary smoking urge intensity with one item ("Right now: I have an urge for a cigarette") with responses ranging from 0 ("Not at All") to 10 ("Very Much"), where higher numbers represented more of an intense urge. Across all interviews, participant mean smoking urge intensity was $M = 4.13$ ($SD = 3.24$). Distributional properties (skew = 0.54; kurtosis = -1.25) facilitated modeling using a Gaussian (normal) distribution. For analyses across time points, we computed average smoking urge intensity level across the week at years 5 and 6.

Data Analysis Plan

We conducted event-level, in-the-moment analyses within time points with combined data from years 5 and 6 for hypotheses 1, 3, and 4; for these analyses, we used linear mixed-effects models (LMEM; Hedeker, 2005). Separately, we also conducted analyses across time points with data from years 5, 6, and 7 for hypotheses 2, 5, and 6; for these analyses, we used linear and logistic regression models as well as LMEM. These different techniques were appropriate for the different tests (e.g., LMEM for analyzing outcomes as a function of event-level change or for analyzing outcomes as a function of change in predictors across time and different outcome distributions e.g., logistic regression for analyzing the dichotomous smoker identity importance as an outcome). For LMEM, we structured the data such that each row represented one random interview for one participant. In addition, we fit models with unstructured covariance matrices and estimated random intercepts to account for subject-level clustering in smoking urge intensity. To evaluate the independent and interactive influences of smoker identity endorsement and importance and either (a) social exposure or (b) exposure to others smoking on momentary smoking urge intensity, we conducted two linear mixed-effects models that regressed the focal outcome (smoking urge intensity) onto subject-level covariates (nicotine dependence, daily smoking rate), focal predictors (smoker identity endorsement and importance, social exposure, exposure to others smoking) and the cross-level interactions between smoker identity endorsement and importance and either social exposure or exposure to others smoking. Thus, focal effects were (a) the relationships between subject-level smoker identity endorsement and importance and momentary smoking urge intensity; (b) the relationship between momentary social exposure or exposure to others smoking and momentary smoking urge intensity; and (c) the moderating influence of either momentary social exposure or exposure to others smoking on the relationship between subject-level smoker identity endorsement and importance

and momentary smoking urge intensity. For longitudinal analyses, we used LMEM's to examine whether changes in average smoking urge intensity from years 5 to 6 were predicted by changes in smoker identity endorsement and importance from years 5 to 6 as well as whether changes in smoker identity endorsement and importance from years 6 to 7 were predicted by changes in average smoking urge intensity from years 5 to 6. In all cases, random-intercept only models fit the data best. We also used linear and logistic regression analyses to evaluate whether smoker identity endorsement and importance at years 6 or 7 as well as change in smoker identity endorsement and importance between years 5 and 6 and years 6 and 7 were predicted by average smoking urge intensity at years 5 or 6, respectively. Given that we controlled for nicotine dependence, participants were included in an analysis if they had a nicotine dependence score (and thus, also had reported smoking in the past 30 days). The effect size, f^2 , was calculated according to Selya, Rose, Dierker, Hedeker, and Mermelstein (2012).

Results

Descriptive Statistics

Descriptive statistics for the focal variables across all years are in Table 1, and correlations between the focal variables at year 5 are in Table 2. Correlations at each time point were typically moderately large and large, with the exception of moderately weak correlations of smoker identity importance with smoking urge intensity, nicotine dependence, and daily smoking rate.

Hypotheses 1, 3, 4: Smoker Identity Predicting Momentary Smoking Urge Intensity Within Time Point

We hypothesized that, within time points, greater smoker identity endorsement and importance predicts more intense momentary smoking urges. We also hypothesized that these relationships would be stronger (a) in the presence of other people compared to

when alone and (b) in the presence of other people who are smoking compared to when in the presence of other people who are not smoking. Results from the LMEM predicting within time points momentary smoking urge intensity from subject-level smoker identity endorsement and importance, momentary social exposure, and their cross-level interactions are presented in Table 3. The ICC representing the proportion of variance attributable to subject-level clustering in smoking urge intensity was 0.46. More nicotine dependence and higher daily smoking rates were associated with stronger momentary smoking urge intensity. Smoker identity importance was significantly negatively associated with momentary smoking urge intensity in this LMEM. However, follow-up analyses revealed that smoker identity importance was acting as a suppressor for smoker identity endorsement. It demonstrated positive zero-order correlations with both smoker identity endorsement ($r = .42$) and smoking urge intensity ($r = .42$), had a negative regression weight in the LMEM, and increased the magnitude of the main effect of smoker identity endorsement when included (see Table 3) versus excluded (estimate = 0.02; $SE = 0.01$; $p = .25$) from the model. Smoker identity endorsement was marginally positively associated with momentary smoking urge intensity; event-level social exposure was associated with increased momentary smoking urge intensity. A significant cross-level interaction qualified these effects such that the positive association between smoker identity endorsement and momentary smoking urge intensity was stronger during social exposure.

Results from the LMEM predicting momentary smoking urge intensity within time point from subject-level smoker identity endorsement and importance, momentary exposure to others smoking, and their cross-level interactions are also presented in Table 3. The directionality and significance of covariates matched those of the model examining social exposure, including the suppressor effect observed for smoker identity importance. Smoker identity endorsement was significantly, positively associated with momentary smoking urge intensity. Momentary exposure to others smoking was associated with higher smoking urge intensity. A marginally significant cross-level interaction qualified these effects such that the relationship between smoker identity endorsement and momentary smoking urge intensity was weaker during exposure to others smoking.

Hypothesis 2: Smoker Identity Predicting Smoking Urge Intensity Across Time Points

We hypothesized that increases in smoker identity endorsement and importance predict increases in smoking urge intensity, on average, across time points. Results from longitudinal analyses that tested this hypothesis are presented in Table 4.¹ Increases in smoker identity endorsement from years 5 to 6 were significantly associated with increases in smoking urge intensity, on average, from years 5 to 6. Changes in smoker identity importance were not associated with changes in smoking urge intensity. Smoker iden-

Table 1
Descriptive Statistics for Focal Variables at Years 5, 6, and 7

Variable	Year 5	Year 6	Year 7
Smoker identity endorsement			
<i>M</i>	2.20	2.13	2.09
<i>SD</i>	0.82	0.82	0.87
<i>n</i>	286	271	269
Smoker identity importance			
%	23.08%	23.25%	20.45%
<i>n</i>	286	271	269
Smoking urge intensity (week)			
<i>M</i>	4.42	4.28	X
<i>SD</i>	2.40	2.30	
<i>n</i>	284	256	
Nicotine dependence			
<i>M</i>	4.27	4.23	X
<i>SD</i>	2.00	2.02	
<i>n</i>	270	245	
Daily smoking rate			
<i>M</i>	5.59	5.25	X
<i>SD</i>	6.14	5.79	
<i>n</i>	286	272	

¹ We also conducted longitudinal analyses for smoking urge intensity when alone, smoking urge intensity during social exposure, and smoking urge intensity during exposure to others smoking. We did not test for differences in the strengths of the associations, and differences were negligible. By and large the relationships replicated the overall smoking urge intensity relationships.

Table 2
Correlations Between Focal Variables at Year 5

Variable	Smoker identity endorsement	Smoker identity importance	Smoking urge intensity (week)	Nicotine dependence	Daily smoking rate
Smoker identity endorsement					
<i>r</i>	1	.42	.52	.53	.56
<i>p</i>		<.001	<.001	<.001	<.001
<i>n</i>		286	284	270	286
Smoker identity importance					
<i>r</i>		1	.22	.28	.14
<i>p</i>			<.001	<.001	.018
<i>n</i>			284	270	286
Smoking urge intensity (week)					
<i>r</i>			1	.56	.53
<i>p</i>				<.001	<.001
<i>n</i>				268	285
Nicotine dependence					
<i>r</i>				1	.41
<i>p</i>					<.001
<i>n</i>					270
Daily smoking rate					
<i>r</i>					1
<i>p</i>					
<i>n</i>					

tity importance again appeared to act as a suppressor [*r* with concurrent smoker identity endorsement = .42, *r* with future smoking urge intensity = .24, increase of estimate of smoker identity endorsement with its inclusion from 0.54 to 0.56 (*SE* = 0.13; *p* < .001)].

Hypotheses 5, 6: Smoking Urge Intensity Predicting Smoker Identity Across Time Points

We hypothesized that more intense smoking urges, on average, predict increases in smoker identity endorsement and importance across time points. In addition, we hypothesized that, across time points, increases in smoking urge intensity, on average, predict increases in smoker identity endorsement and importance. Results from analyses that tested these hypotheses are in Tables 5 and 6, respectively. Our analyses tested change in smoker identity endorsement. For smoker identity importance, given dichotomization (0 = not at all important, 1 = at least somewhat important), we tested changes in whether identifying as a smoker was considered at least somewhat important. All of the relationships were positive. More intense smoking urges on average at years 5 and 6 not only predicted greater smoker identity endorsement at years 6 and 7, but also increases in smoker identity endorsement from years 5 to 6 and years 6 to 7, respectively. Average smoking urge intensity increases from year 5 to 6 were associated with increases in smoker identity endorsement from year 6 to 7. Average smoking urge intensity at year 5 did not predict changes from considering identifying as a smoker not at all important to considering it at least somewhat important at year 6 or changes from considering identifying as a smoker not at all important to considering it at least somewhat important from year 5 to year 6. However, more intense smoking urges on average at year 6 predicted changes from considering identifying as a smoker not at all important to considering it at least somewhat important at year 7 as well as

shifts from considering identifying as a smoker not at all important to considering it at least somewhat important from year 6 to year 7. Finally, increases in average smoking urge intensity from year 5 to year 6 were associated with shifts from considering identifying as a smoker not at all important to considering it at least somewhat important from year 6 to year 7. Generally, stronger smoking urge intensity levels were associated with greater endorsement of identifying as a smoker and shifts from considering identifying as a smoker not at all important to considering it at least somewhat important.

Relationships Between Smoker Identity and Exposure to Others Smoking

Given the attenuated relationship between smoker identity endorsement and momentary smoking urge intensity during exposure to others smoking, we were curious about the relationship between smoker identity endorsement and exposure to others smoking. Relationships between smoker identity endorsement and smoking urge intensity during exposure to others smoking might have been attenuated because those with more of a smoker identity were more likely to enter into situations in which they were exposed to others smoking, thereby restricting range for observing relationships. We examined correlations between smoker identity endorsement and (a) compared to number of events alone, number of events around others who were not smoking as well as (b) compared to number of events when around others who were not smoking, number of events when around others who were smoking. Smoker identity endorsement was significantly, positively correlated with number of events around others who were smoking, $r(281) = .33$, $p < .001$ at year 5 and $r(252) = .21$, $p < .001$ at year 6. Greater smoker identity endorsement was associated with more often being in the presence of other people smoking.

Table 3
Parameter Estimates of LMEM Regressing Momentary Smoking Urge Intensity Onto Subject-Level Smoker Identity Endorsement and Importance and Event-Level Social Exposure and Exposure to Others Smoking

Predictor variables	Estimate	SE	<i>p</i>	<i>f</i> ²
Social exposure				
Intercept	3.01	0.15	—	—
Nicotine dependence	0.21	0.02	<.001	.003
Daily smoking rate	0.09	0.01	<.001	.002
Smoker identity importance	−0.24	0.08	.002	.001
Smoker identity endorsement	0.03	0.01	.078	.000
Social exposure	0.15	0.04	<.001	.001
Smoker Identity Endorsement × Social Exposure	0.03	0.01	.002	.001
Exposure to others smoking				
Intercept	3.20	0.17	—	—
Nicotine dependence	0.21	0.03	<.001	.003
Daily smoking rate	0.09	0.01	<.001	.002
Smoker identity importance	−0.42	0.10	<.001	.002
Smoker identity endorsement	0.11	0.02	<.001	.002
Exposure to others smoking	0.48	0.07	<.001	.004
Smoker Identity Endorsement × Exposure to Others Smoking	−0.03	0.02	.066	.000

Note. LMEM = linear mixed-effects models; *n* = 283, no. of observations = 16,504.

Discussion

Grounded in PRIME Theory (West & Brown, 2013), we sought to evaluate whether identifying as a smoker and urges to smoke predict each other over time independent of their relationships with smoking behavior. We tested six different hypotheses. We tested these hypotheses with observational data collected from young adult cigarette smokers. Greater smoker identity endorsement predicted more intense momentary urges to smoke within time points (supporting Hypothesis 1), and increases in smoker identity endorsement predicted increases in average smoking urge intensity across time points (supporting Hypothesis 2). In addition, greater smoker identity endorsement predicted more intense momentary urges to smoke particularly when around others as opposed to being alone within time points (supporting Hypothesis 3). Moreover, more intense smoking urges on average (as well as increases in the intensity of smoking urges on average) predicted increases in smoker identity endorsement as well as a shift from considering smoker identity not at all important to considering it at least somewhat important across time points (supporting Hypotheses 5 and 6). All of these findings controlled for nicotine dependence and smoking rate, and thus, the relationships were independent of relationships with smoking behavior.

Table 4
Prediction of Change in Smoking Urge Intensity From Year 5 to Year 6 by Smoker Identity From Year 5 to Year 6

Predictor variables	γ	SE	<i>t</i>	<i>p</i>	<i>f</i> ²
Wave	−0.10	0.12	−0.87	.383	.00
Nicotine dependence	0.29	0.05	6.36	<.001	.12
Daily smoking rate	0.11	0.02	6.70	<.001	.11
Smoker identity importance	−0.13	0.18	−0.70	.483	.00
Smoker identity endorsement	0.56	0.13	4.23	<.001	.02

Note. *n* = 285, no. of observations = 498.

This investigation supports and contributes to the development of PRIME Theory. The findings that identifying as a smoker predicted urges to smoke supports the notion that a smoker identity can induce smoking urges; the finding that it did so more strongly when in the presence of others as opposed to alone supports the tenet that it does so more strongly when it is activated. The findings also add to the previous finding that priming a smoker identity results in a stronger craving for a cigarette than priming an abstainer identity (Shadel & Cervone, 2006). Moreover, the findings advance our understanding of the sources of urges to smoke. Previous research showed that urges to smoke are associated with cigarette attentional bias (Field, Munafò, & Franken, 2009), opportunities to smoke a cigarette (Field & Cox, 2008; Tiffany, 2010), smoking cues (Carter & Tiffany, 1999; Field & Cox, 2008; Tiffany, 2010), withdrawal (Tiffany, 2010), and negative affect (Heckman et al., 2013; Tiffany, 2010). In addition, the findings that smoking urges predicted smoker identity endorsement and importance support the notion that smoking urges induce a smoker identity and its construals. The findings also extend prior work that suggested that urges to smoke might spur the development of a smoker identity (Berg et al., 2013; Mermelstein & the Tobacco Control Network Writing Group, 1999; Nordgren & Chou, 2011; Nordgren et al., 2006; Tombor et al., 2015). Moreover, these findings add to our knowledge about the sources of a smoker identity. Previous studies have demonstrated that greater endorsement of identifying as a smoker is predicted by more smoking, more nicotine dependence, more positive expectations about the consequences of smoking, and more motives for smoking (Hertel & Mermelstein, 2012; Hertel & Mermelstein, 2016), as well as lower SES, less negative feelings about the self for being a smoker (Meijer et al., 2017), weaker intentions to quit smoking, and less success at quitting smoking (Meijer et al., 2018; Shadel et al., 1996). Beyond the current findings, we also contributed the ideas that a smoker identity can be activated in social settings and, in particular, settings with other people smoking, and that smoker

Table 5
Prediction of Smoker Identity Endorsement at Years 6 and 7 by Smoking Urge Intensity at Years 5 and 6

Predictor variables	Year 6					Year 7				
	Level at year 6 (<i>n</i> = 254)					Level at year 7 (<i>n</i> = 224)				
	<i>b</i>	<i>SE</i>	<i>t</i>	<i>p</i>	<i>f</i> ²	<i>b</i>	<i>SE</i>	<i>t</i>	<i>p</i>	<i>f</i> ²
Nicotine dependence	0.04	0.03	1.61	.108	.01	0.08	0.03	2.89	.004	.04
Daily smoking rate	0.04	0.01	5.66	<.001	.13	0.04	0.01	4.10	<.001	.08
Smoker identity importance	0.35	0.10	3.59	<.001	.05	0.29	0.11	2.65	.009	.03
Smoking urge intensity (week)	0.08	0.02	3.38	.001	.05	0.11	0.03	4.36	<.001	.09
	Change in level from year 5 to year 6 (<i>n</i> = 254)					Change in level from year 6 to year 7 (<i>n</i> = 224)				
	<i>b</i>	<i>SE</i>	<i>t</i>	<i>p</i>	<i>f</i> ²	<i>b</i>	<i>SE</i>	<i>t</i>	<i>p</i>	<i>f</i> ²
Smoker identity endorsement	0.45	0.06	7.11	<.001	.20	0.56	0.07	7.71	<.001	.27
Nicotine dependence	0.00	0.02	-0.12	.906	.00	0.04	0.02	1.74	.083	.01
Daily smoking rate	0.02	0.01	3.17	.002	.04	0.02	0.01	1.84	.068	.02
Smoker identity importance	0.11	0.10	1.18	.238	.01	0.07	0.10	0.67	.504	.00
Smoking urge intensity (week)	0.06	0.02	2.75	.006	.03	0.05	0.02	2.08	.039	.02
	Change in smoker identity endorsement from year 6 to year 7 as a function of change in smoking urge intensity from year 5 to year 6 (<i>n</i> = 283)									
	<i>γ</i>	<i>SE</i>	<i>t</i>	<i>p</i>	<i>f</i> ²					
Wave	—	—	—	—	—	0.03	0.05	0.56	.574	.00
Nicotine dependence	—	—	—	—	—	0.05	0.02	2.87	.005	.01
Daily smoking rate	—	—	—	—	—	0.04	0.01	6.23	<.001	.08
Smoker identity importance	—	—	—	—	—	0.19	0.07	2.69	.008	.01
Smoking urge intensity (week)	—	—	—	—	—	0.09	0.02	4.92	<.001	.02

identity importance can be thought of as a construal of identifying as a smoker that relates to smoking urges independently of the identity.

Hypothesis 4 was not supported. Smoker identity endorsement was less strongly positively associated with smoking urge intensity when in the presence of others who were smoking compared to when in the presence of others who were not smoking. This challenges the PRIME theory notion that identifying as a smoker more strongly invokes urges to smoke when it is activated. However, this weaker relationship may have only emerged because greater smoker identity endorsement was associated with more often being in the presence of others who were smoking. This finding is consistent with the notion that behaviors are shaped by self-beliefs (Festinger, 1957; Markus, 1977; Markus & Wurf, 1987; Swann, 1983), and it suggests that there may have been limited variability in smoker identity endorsement to observe a relationship with it in the presence of others smoking. There are several other potential explanations for why there was a muted relationship between smoker identity endorsement and smoking urge intensity when in the presence of others who were smoking compared to when in the presence of others who were not smoking. Being in the presence of others who were smoking may have invoked an urge to smoke, and the intensity of that urge may have been so strong that a relationship between it and smoker identity endorsement was muted. It is also possible that smoking occurred, thereby eliminating an urge to smoke. It also could have been that a stronger relationship between smoker identity endorsement and smoking urges emerged when being around others who were not smoking compared to when being around others who were smok-

ing; being around others who were not smoking could have inhibited smoking, which in turn could have increased urge and ultimately activated identifying as a smoker. Of course, it could also have been the case that being in the presence of others who were smoking did not activate identifying as a smoker. Future studies could further investigate the relationship between a smoker identity and smoking urges in the presence of others smoking, with particular attention paid to observed levels of these variables, whether smoking occurred, and whether identifying as a smoker was activated.

Finally, the findings support the notion that identifying as a smoker and construals of the identity are distinct and relate to smoking urges independent of each other. Factor analysis demonstrated the independence of identifying as a smoker and the perception that the identity is important to one's identity overall. Interestingly, smoker identity assessment items representing another potential construal dimension—one that, together with importance, might broadly represent investment in the identity—loaded on the smoker identity endorsement subscale, perhaps because confidence in the endorsement was not distinguishable from the endorsement. The importance of cigarettes item also loaded on the smoker identity endorsement subscale, perhaps because it was not about importance of the identity, specifically. Generally, smoking urge intensity was more strongly associated with smoker identity endorsement than smoker identity importance. Smoker identity endorsement predicted smoking urge intensity independent of smoker identity importance. Smoker identity importance did not predict smoking urge intensity independent of smoker identity endorsement, and in fact, it acted as a suppressor

Table 6
Prediction of Smoker Identity Importance at Years 6 and 7 by Smoking Urge Intensity at Years 5 and 6

Predictor variables	Year 6					Year 7				
	Level at year 6 (<i>n</i> = 254)					Level at year 7 (<i>n</i> = 224)				
	<i>b</i>	<i>SE</i>	χ^2	<i>p</i>	<i>OR</i>	<i>b</i>	<i>SE</i>	χ^2	<i>p</i>	<i>OR</i>
Nicotine dependence	0.05	0.10	0.22	.640	1.05	0.30	0.11	6.94	.008	1.35
Daily smoking rate	-0.01	0.03	0.15	.699	0.99	-0.06	0.04	3.17	.075	0.94
Smoker identity endorsement	0.76	0.25	9.30	.002	2.13	0.88	0.31	8.20	.004	2.40
Smoking urge intensity (week)	0.10	0.08	1.27	.259	1.10	0.21	0.10	4.14	.042	1.23
	Change in level from year 5 to year 6 (<i>n</i> = 254)					Change in level from year 6 to year 7 (<i>n</i> = 224)				
	<i>b</i>	<i>SE</i>	χ^2	<i>p</i>	<i>OR</i>	<i>b</i>	<i>SE</i>	χ^2	<i>p</i>	<i>OR</i>
Smoker identity importance	0.89	0.36	6.22	.013	2.45	1.96	0.40	23.76	<.001	7.09
Nicotine dependence	0.02	0.10	0.03	.867	1.02	0.27	0.12	4.81	.028	1.30
Daily smoking rate	0.00	0.03	0.00	.969	1.00	-0.06	0.04	2.07	.150	0.95
Smoker identity endorsement	0.53	0.27	3.91	.048	1.70	0.42	0.35	1.48	.224	1.53
Smoking urge intensity (week)	0.10	0.09	1.25	.263	1.10	0.24	0.11	4.53	.033	1.27
	Change in smoker identity importance from year 6 to year 7 as a function of change in smoking urge intensity from year 5 to year 6 (<i>n</i> = 268)									
	γ	<i>SE</i>	<i>t</i>	<i>p</i>	<i>OR</i>					
Wave	—	—	—	—	—	-0.28	0.30	-0.95	.341	0.75
Nicotine dependence	—	—	—	—	—	0.17	0.11	1.57	.119	1.19
Daily smoking rate	—	—	—	—	—	-0.03	0.04	-0.90	.367	0.97
Smoker identity endorsement	—	—	—	—	—	0.84	0.30	2.83	.005	2.31
Smoking urge intensity (week)	—	—	—	—	—	0.24	0.11	2.25	.026	1.27

variable for the prediction of smoking urge intensity by smoker identity endorsement. Together with the findings of Hertel et al. (2019) that drinking identity importance did not relate to alcohol consumption frequency or risk for alcohol use disorder separately from drinking identity endorsement, these findings about smoker identity importance indicate that perhaps the distinction between smoker identity endorsement and smoker identity importance does not have utility. However, smoking urge intensity predicted both smoker identity endorsement and smoker identity importance independent of each other. The majority of responses to the smoker identity importance items were at the low end of the scale. Developing a more sensitive smoker identity importance measure may capture a broader range of responses, reveal a clearer distinction between it and smoker identity endorsement, and allow for more accurately capturing its relationships with other variables. These findings are unique within the literature on smoking. They highlight the multifaceted nature of smoker identity and generalize the findings on the multifaceted nature of drinking identity (Hertel et al., 2019). Future studies could further investigate the independent relationships of smoker identity endorsement and construal of the identity with urges to smoke. In addition to investigating importance of the identity, other construal dimensions could also be investigated. When investigating importance of the identity, attention should be paid to improving measurement.

We tested the effects of merely being around others compared to being alone as well as specifically being around others who were smoking compared to being around others who were not smoking as tests of the effect of smoker identity activation. However, we did not assess identifying as a smoker with EMA, so we do not

know if it was activated to varying degrees across these situations. Regardless, whether identifying as a smoker was activated to varying degrees across these situations deserves further consideration. It is possible that merely being around others did not activate a smoker identity more than being alone because identity overall was not more strongly activated or because, even if identity overall was more strongly activated, identifying as a smoker was not more accessible in memory than other identities (DeMarree, Petty, & Briñol, 2007; Higgins, 1996). Moreover, to the extent that identifying as a smoker was readily accessible in memory, merely being around others compared to being around others who were smoking may have more strongly activated identifying as a smoker because being a smoker was relatively more distinctive in that circumstance (McGuire, McGuire, Child, & Fujioka, 1978). In addition, smoking urges were also thought to activate a smoker identity; smoking urges might have interacted with social circumstances to activate a smoker identity. Future studies could directly measure activation of identifying as a smoker, test this activation under various circumstances and with different cues, and explore the mechanisms of activation.

Finally, future investigations could explore the pathways by which a smoker identity influences smoking urges. According to PRIME theory, a smoker identity influences smoking urges indirectly through plans to smoke, positive evaluations of smoking, and, in particular, motives to smoke. We only investigated the relationship between a smoker identity and smoking urges. It is important to identify the pathways of the relationship in order to gain a full understanding of it.

Though correlational, these findings warrant the consideration that identifying as a smoker is a leverage point for curbing smoking, whereby decreases in identifying as a smoker might result in less smoking. One way to decrease identifying as a smoker is by engaging with it directly. Another way is to increase identifying as a nonsmoker. Our findings suggest that a smoker identity could be decreased by lowering the intensity of smoking urges. Along those lines, it is possible that pharmacotherapy interventions that directly reduce smoking urge intensity (e.g., the nicotine patch) have their impact in part as a function of reducing a smoker identity. Shadel and Cervone (2006) indicates that another way to reduce a smoker identity is to refrain from thinking of personal attributes that are associated with the identifying as a smoker, and, to the contrary, one way to increase a nonsmoker identity is to think of personal attributes that are associated with the identifying as a nonsmoker. More investigations are needed to find additional ways to decrease a smoker identity.

All of these findings should be considered with respect to the nature of the data and the analyses. We had multiple waves of data from a large sample of participants, a reliable measure of smoker identity, repeated momentary assessments of smoking urge intensity, valid isolation of social exposure and exposure to others smoking, and excellent training for and adherence to the EMA protocol. We used data from random EMA prompts. If participants recorded that they smoked, they did not receive a random prompt until at least 20 min had passed. Thereby, it is possible that our findings are relatively free of the influence of immediate smoking. However, we cannot know this for sure. For instance, it is possible that participants completed random prompts relatively soon after smoking or even while smoking, situations that could have occurred in part because participants did not record that they had smoked. There were several limitations. First, we observed non-significant changes in our focal variables across the assessment time points. Second, although the analyses were prospective, the study was observational, and so we cannot draw causal conclusions. Other variables related to smoker identity endorsement and importance as well as smoking urge intensity might have accounted for the relationships we observed. Third, all of the assessments were self-report, which could have undermined the validity of the responses. Fourth, although appropriate from the standpoint of observing development of smoking behavior, our sample was limited to young adult, relatively less frequent, and relatively less regular combustible cigarette smokers. Future studies should seek to demonstrate causal relationships, use objective measures, and evaluate the relationships in samples of more frequent and more regular combustible cigarette smokers.

Our investigation showed that identifying as a smoker and urges to smoke predicted each other over time, independent of their relationships with smoking behavior. These findings suggest that they contribute to each other. Thus, they also indicate that persistent smoking involves a dynamic relationship between identifying as a smoker and urges to smoke, and that suppressing one could help prevent persistent smoking by suppressing the other.

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