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Perceived Social Acceptability and Longitudinal Trends in Adolescent Cigarette Smoking

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Abstract

The current study uses methods from social network analysis to predict longitudinal trends in adolescent cigarette smoking based on perceived social acceptability from friends, in addition to typical measures of peer influence (e.g., self-reported cigarette use of friends). By concurrently investigating the role of perceived social acceptability of smoking and peer influence, the current study offers new insight into the mechanisms through which peers influence adolescent smoking. Two waves of data from five high schools within one US school district ($n = 1563$) were used. Stochastic actor-based models simultaneously estimated changes in smoking predicted by perceived social acceptability and peer influence. Findings demonstrate that adolescents with higher perceived social acceptability of cigarette use increased cigarette smoking over time. Conversely, support for peer influence on smoking was not found after controlling for the effects of perceived social acceptability. The results suggest that perceived social acceptability regarding cigarette smoking rather than self-report of cigarette use among friends is predictive of future smoking behavior. Consequently, the findings highlight the need for prevention efforts to take into account the multifaceted dynamics between adolescent smoking and friendships. Programs that address peer influence alone, without considering peer mechanisms such as perceived social acceptability, are at risk of ignoring critical avenues for prevention.

Keywords Social networks · Smoking · Perceived social acceptability

Cigarette smoking is primarily initiated and established during adolescence (Orlando et al. 2004; U.S. Department of Health and Human Services (USDHHS) 2012), and despite declines in adolescent smoking in recent years, over 3200 youth aged 18 or younger begin smoking daily (Centers for Disease Control and Prevention (CDC) 2017). Cigarette smoking remains the leading preventable cause of death in the USA (CDC 2016), and as a result, remains a critical public health concern. Thus, the identification of malleable targets for reducing overall rates of cigarette smoking is crucial for prevention efforts.

Peer relations are important socializing processes for many health behaviors (Burk et al. 2007; Umberson and Montez 2010), and adolescence marks a particularly vulnerable developmental stage for social influences (Steinberg and Monohan 2007; Brechwald and Prinstein 2011). In addition, developmental theories (Bronfenbrenner and Morris 2006) suggest that the socio-contextual environment shapes adolescent development, such that there is a continuous, bidirectional interaction between individual characteristics and socio-contextual factors. Adolescent friendships are one of the most salient relationships during adolescence (Parker et al. 2006), and are thus uniquely situated to impact adolescent health behavior.

Although a myriad of factors contribute to adolescent smoking, previous research has consistently demonstrated that adolescents are influenced by the cigarette use of their friends (see Simons-Morton and Farhat 2010 for a review). Adolescents have been shown to form friendships based around shared smoking habits (Green et al. 2013; Wang

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et al. 2016) and alter their smoking based on their friends' actual (Schaefer et al. 2012; Wang et al. 2016) or perceived (Hoffman et al. 2007; Fujimoto and Valente 2012) smoking patterns.

However, it is also known that some substances are perceived as more socially acceptable (Kulesza et al. 2013), particularly during adolescence (Eisenberg et al. 2014). Cigarette smoking, specifically, has shown overall declines in social acceptability in recent decades (Cummings and Proctor 2014). In addition, low levels of perceived social acceptability of smoking have been shown to predict success in smoking cessation interventions for adolescents (Bricker et al. 2010). Further, perceived sibling approval of smoking is associated with future smoking in adolescents (Brown et al. 2010). Yet, no research to date has considered the role of perceived acceptability of smoking when examining social influence from friends on cigarette smoking.

Social Influence and Cigarette Smoking

Advances in the field of social network analysis allow researchers to explicitly examine the extent to which adolescent friendships influence smoking behavior, and at the same time, how smoking impacts friendship formation. Importantly, social network methods overcome three critical limitations of alternative methodology. First, the inherent interdependence of data between friendship partners violates assumptions of independence, thus precluding the use of conventional statistical techniques. Second, alternative methods focus on dyadic relationships without controlling for effects of the larger social network in which these dyadic relationships are embedded. Several structural properties of social relationships (i.e., the way individuals within a social network are connected) are known to play a role in subsequent relationship ties. For example, friendships are more likely to form when two individuals have a friend in common (Snijders et al. 2007). Third, conventional methods do not account for unobserved changes between observation periods resulting from the dynamic nature of relationships and behavior. Social network methods have been specifically designed to overcome these methodological complexities. These methods embed adolescents within their peer network and predict both social and behavioral outcomes (e.g., friendship and smoking). They specifically incorporate the structure and interdependence of social network data into the statistical modeling process and are thus well situated to investigate the dynamic relationship between adolescent friendships and health behavior.

Social network data utilize friendship nominations, wherein adolescents are asked to identify peers from their school whom they consider to be a friend. Subsequently, friend influence is measured as the predicted probability of an adolescent changing his or her smoking behavior dependent on the level of smoking reported among his or her friends (Ripley et al. 2018). Friend influence, therefore, is conceptualized as the actual smoking behavior among an adolescent's friends and measured from the obtained friendship nominations. Empirical research supports friend influence on cigarette smoking occurring in this manner (Schaefer et al. 2012; Wang et al. 2016); however, existing research has neglected to control for the effect of perceived social acceptability of smoking when examining the peer mechanisms surrounding adolescent smoking.

Therefore, the main goal of the current study is to concurrently investigate the role of perceived social acceptability and peer influence (e.g., level of smoking among an adolescent's friends) on longitudinal patterns in cigarette use within a large sample of US high school adolescents. Using recent advances in social network analysis, the study explicitly examines the extent to which perceived social acceptability and smoking behavior within adolescent peer groups (e.g., peer influence) independently contribute to changes in smoking. Although peer influence from a social network perspective is widely researched (Simons-Morton and Farhat 2010), the current study is novel in that it examines the impact of perceived social acceptability alongside the typical measure of peer influence. By illuminating the peer mechanisms associated with smoking, the study offers valuable insight into effective design of prevention programs. For example, perceived social acceptability as predictive of smoking behavior suggests prevention strategies focused on altering beliefs about smoking and the idea that peers approve of this behavior.

Method

Participants and Procedure

The current study uses data from students within five high schools in one school district in Los Angeles, CA. The data come from the Social Network Study (Valente et al. 2013), a longitudinal social network study aimed at examining the relationship between social networks and health behaviors. The sample consists of all five high schools in the district and is composed of 10th grade students interviewed in October 2010 and again in May 2011. The sample is a predominately Hispanic/Latino school district with 75–90% of students qualifying for free or reduced lunch. Of the total eligible 10th grade students, 88% returned valid parental consent forms. The proposed study is based on 1563 students who completed the survey at Wave I and Wave II. Five separate social networks of peer relationships were constructed from the obtained data, representing the five high schools in the district. Models were first run separately for each school, and results were then combined using recommended meta-analysis techniques (Snijders et al. 2007; Ripley et al. 2018). By

aggregating the results, the study assesses variability across the schools while allowing for the findings to generalize to the entire sample (Snijders et al. 2007; Ripley et al. 2018).

Measures

Friendship Ties

Sociometric data (i.e., friendship nominations) collected at Wave I and Wave II compose the friendship measure. Adolescents were asked to identify up to seven close friends from a provided roster of students in 10th grade. ID codes were used to link adolescents to nominated friends, thus creating grade-level friendship networks, as well as allowing for behavioral data to be collected directly from adolescents. In this way, friendships are restricted to those occurring within the school in which the adolescent is enrolled, and each school represents a complete social network (i.e., the social network is delimited by a clearly defined boundary, such as enrollment in a specific school). Complete network data is a requirement of the present analyses (Snijders et al. 2010), and therefore, models were run independently on each school prior to aggregating the results.

Cigarette Smoking

Cigarette smoking was assessed through four items measuring self-reported use of cigarettes. A composite ordinal smoking score (0 = not susceptible, 1 = susceptible, 2 = ever smoker, 3 = past-month smoker, 4 = daily smoker) was created in order to meet modeling requirements (Ripley et al. 2018) and remain consistent with previous use of this data (Huang et al. 2014). In addition, given the overall low level of smoking in the sample (see Table 2), the scaling of the variable was deemed appropriate for capturing variability in the data (Ripley et al. 2018). Further, susceptibility to smoking is an important precursor to smoking (Spelman et al. 2009), with recent findings suggesting that Hispanic youth are particularly susceptible to smoking (El-Toukhy et al. 2016). Thus, the smoking measure not only reflects current smoking status but also captures susceptibility to future use. The use of the cigarette smoking variable in creating measures of peer influence and friendship formation based on similarity in smoking is discussed in the model selection section below and also within Table 1. It is important to note that cigarette smoking was assessed for all adolescents in the sample, with individual scores used both in measuring level of smoking among adolescent friendship groups, as well as predicting individual outcomes.

Perceived Social Acceptability

Perceived social acceptability of cigarette smoking was measured through two questions. Adolescents were asked to indicate how many of their five best friends would (a) think it is ok for someone their age to smoke and (b) be unfriendly toward them if they smoked. Responses ranged from 0 (none of them) to 3 (all of them). The two questions were recoded into dichotomous indicators based on at least one friend endorsing acceptability of smoking. Items were summed, creating a social acceptability variable that ranged from 0 to 2, thus meeting statistical modeling requirements (Ripley et al. 2018). The measure captures perceived peer approval of smoking among one's peer group. Importantly, the perceived social acceptability variable is distinct from the actual smoking behavior of friends, which is represented by the peer influence effect discussed below.

Demographic Control Variables

In order to provide accurate estimates of associations between adolescent friendships and cigarette smoking, potential predictors associated with friendship formation and smoking were controlled (Steglich et al. 2010). Friendships typically form based around shared demographic characteristics (McPherson et al. 2001), and thus gender and Hispanic ethnicity were included as control variables for friendship formation. Gender was also used as a basic demographic control variable for cigarette smoking. Research has identified academic grades, adolescent drinking, and parental smoking as common predictors of adolescent smoking (Wellman et al. 2016), and thus each was tested as potential control variables in the current study. Established forward model selection procedures (described in Burk et al. 2007; Snijders et al. 2010), which test if a variable significantly contributes to model fit, were used to test all parameters and build the final models.

Analysis

Rigorous methods from social network analysis were used to capture the dynamics between adolescent friendships and cigarette smoking. Longitudinal stochastic actor-based models (SABs; Snijders et al. 2010) specified using SIENA version 4.0 (Ripley et al. 2018) were used to analyze changes in friendship and smoking behavior across the two measurement occasions. SABs are particularly useful for analyzing social network data due to their ability to model these dynamic processes while simultaneously accounting for the effects of friendship network structure and individual and dyadic attributes (Snijders et al. 2010). In the current study, the overall modeling process determines the probabilities associated with changes in friendship and changes in cigarette smoking from Wave I to Wave II. Intensive computer simulations impute

Table 1 Interpretation of parameters in final models

Parameter	Interpretation
Friendship network dynamics	
Outdegree	Tendency to have outgoing ties
Reciprocity	Tendency to reciprocate friendship choices
Transitive triplets	Tendency of adolescents to become friends with adolescents their friends are already connected to
3 cycles	Tendency to form ties with a friendship nominator's nominator
Indegree popularity squared	Tendency to nominate individuals with high in-degrees
Outdegree popularity squared	Tendency to nominate individuals with high outdegrees
Gender similarity	Preference for friendships with individuals of same gender
Hispanic similarity	Tendency to become friends with individuals of your same ethnicity
Smoking ego	Effect of smoking on number of friends chosen
Smoking alter	Effect of smoking on number of incoming friend nominations
Smoking similarity *(peer selection)*	Friend selection based on similarity in smoking
Behavior dynamics	
Linear shape	Overall tendency of weight control
Quadratic shape	Quadratic shape of weight control
Average similarity on smoking *(peer influence)*	Tendency to adopt level of smoking of friends
Effect from perceived social acceptability	Effect of level of perceived social acceptability on adolescent smoking
Effect from academic grades	Effect of grades on smoking
Effect from gender	Effect of gender on smoking
Effect from alcohol use	Comorbid alcohol use and smoking
Effect from parental smoking	Effect of parental smoking on adolescent smoking

likely change trajectories between waves based on the included parameters, and the algorithm is carried out until simulated data adequately represent the observed data (Snijders et al. 2007; Snijders et al. 2010).

Models were estimated separately for each school, and results were then combined via recommended meta-analysis techniques in order to test parameter means and variances across the sample (Snijders et al. 2007; Ripley et al. 2018). For detailed descriptions of SAB models, including methodological advances over conventional techniques, see Snijders et al. (2010) and Steglich et al. (2010). Interested readers can find technical descriptions of the two meta-analysis techniques in Hedges and Olkin (1985), Snijders and Baerveldt (2003), and Ripley et al. (2018).

Model Selection Procedures

In the current study, theoretical considerations and established forward model selection procedures (Schweinberger 2012; Snijders et al. 2010) were used in model building. A complete list of all parameters retained in the final model, along with their interpretation, is presented in Table 1. In order to provide accurate estimates of associations between adolescent friendships and cigarette smoking, control variables associated with friendship formation and smoking were included (Steglich et al. 2010).

Effects Used to Predict Friendship Formation Endogenous network effects, or basic tendencies known to influence friendship formation (e.g., reciprocity; Snijders 2001; van de Bunt et al. 1999), were included as structural control variables for friendship changes. Similarly, given the high priority of peer relations during adolescence, two prototypical effects related to social status (e.g., indegree popularity) were included as control variables for friendship formation. The models also included parameters for the effect of cigarette smoking on the likelihood of sending friendship nominations (i.e., smoking ego), receiving friendship nominations (i.e., smoking alter), and forming friendships based on similar smoking patterns (e.g., peer selection).

Effects Used to Predict Cigarette Smoking The models tested for peer influence on cigarette smoking through the average similarity effect, or the tendency of adolescents to adopt levels of cigarette smoking similar to their friends. In this way, peer influence is measured through the obtained friendship nominations, allowing for adolescent self-report of smoking behavior. Similarly, perceived social acceptability was included as a potential predictor of changes in smoking. Thus, the two

theoretical variables of interest, peer influence and perceived social acceptability, were simultaneously estimated, thereby controlling each effect for the other. Figure 1 presents a conceptual model of the social and behavioral processes tested in the final analysis.

Missing Data

Missing data due to item non-response was imputed by the SIENA software but treated as non-informative in parameter estimation (Huisman and Steglich 2008). In this method, missingness in dependent behavioral variables is treated with imputation of previously observed values if missingness occurs at Wave II and imputation of values from Wave II if missingness occurs at the first observation. Missingness in both observations results in imputation of the observation-wise mode of the variable. Missing covariate data is treated by using the sample mean. Due to relatively small sample size per school, adolescents were excluded from the sample if they did not participate in both Wave I and Wave II.

Results

Friendship, smoking, and covariate characteristics of the sample are presented in Table 2. The sample was evenly split on gender, with an average age of 15. Nearly 65% of the sample reported Hispanic ethnicity. Cigarette smoking levels remained largely stable from Wave I to Wave II. Average perceived social acceptability of smoking was low (0.78), with scores dispersed relatively evenly across the scale. Adolescents reported approximately 3.5 friends at both measurement occasions, and the Jaccard Index, a measure of stability in friendships, ranged from 0.27 to 0.32. Indices above 0.2 are recommended to accurately estimate effects (Snijders et al. 2010). Pearson correlations were used to assess the relationship between the constructs of perceived social acceptability of smoking and peer influence (e.g., level of smoking among an adolescent's friends). A significant, although small, correlation between adolescent perceived social acceptability of smoking and smoking among an adolescent's friends ($r = 0.21$, $p < .001$, df 5942) was found. The correlation between adolescent perceived social acceptability and an adolescent's own self-reported smoking behavior was much stronger ($r = 0.46$, $p < .001$, df 6534).

Predicting Friendship and Smoking Evolution

Table 3 presents results from the final model. Results from both sets of meta-analyses are displayed; however, given that the sample schools represent the entire population of schools within the district, outcomes from the Fisher one-sided test (α/2–0.025) are described (Ripley et al. 2018). A chi-square test with 4 degrees of freedom (N-1) was used to test for parameter variances between schools. Schools were comparable across all included parameters, with the exception of two endogenous network parameters.

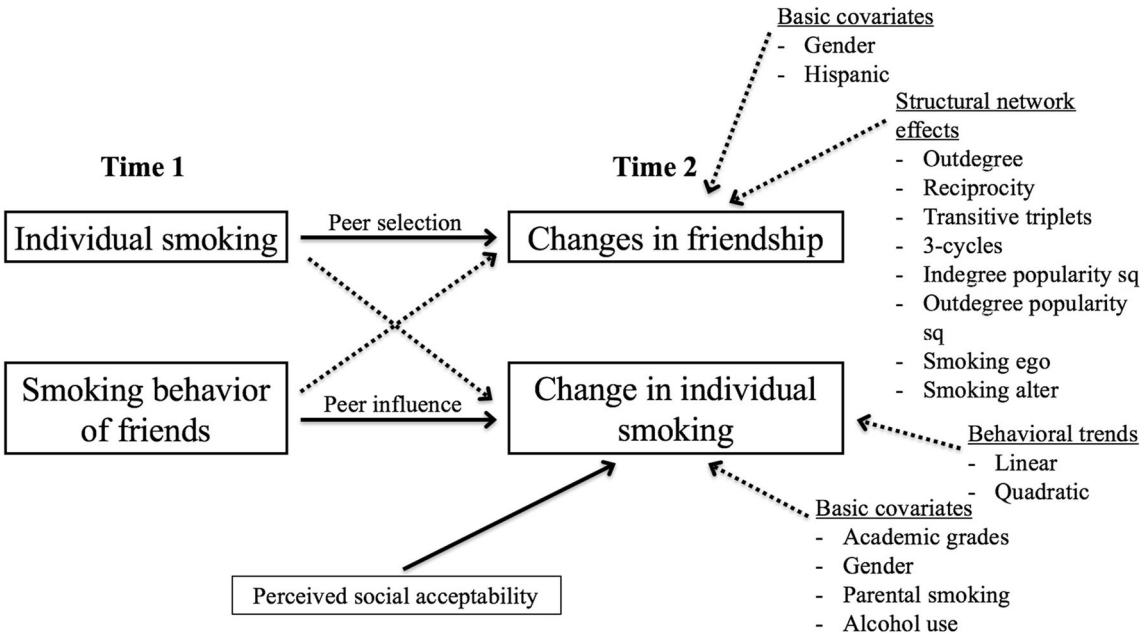

Fig. 1 Conceptual representation of the final model. Peer selection and peer influence effects are estimated for cigarette smoking, while taking into account: (1) perceived social acceptability of smoking, (2) structural network effects, (3) behavioral tendencies, and (4) important covariates for friend selection and smoking development

Table 2 Sample characteristics

Characteristic	Data
Female	48.8%
Hispanic	64.2%
Academic grades, mean (SD)	3.14(0.77)
Parental smoking	26.9%
Adolescent alcohol use, mean (SD)	1.53 (1.47)
Perceived social acceptability, mean (SD)	0.78 (0.83)
0 No acceptability	589 (37.7%)
1 Some acceptability	340 (21.7%)
2 High acceptability	320 (20.5%)
Missing	314 (20.1%)
Cigarette smoking Wave I, mean (SD)	0.76(1.11)
0 Not susceptible	877 (56.1%)
1 Susceptible	143 (9.1%)
2 Ever smoker	217 (13.9%)
3 Past month smoker	89 (5.7%)
4 Daily smoker	35 (2.2%)
Missing	202 (12.9%)
Cigarette smoking Wave 2, mean (SD)	0.76(1.08)
0 Not susceptible	957 (61.2%)
1 Susceptible	138 (8.8%)
2 Ever smoker	253 (16.2%)
3 Past month smoker	84 (5.4%)
4 Daily smoker	37 (2.4%)
Missing	97 (6.2%)
Friendship network	
Wave I average number of friends	3.50
Wave II average number of friends	3.58
Jaccard Index, average stability coefficient	0.29

$N = 1563$

Effects Predicting Friendship Formation

As expected, the endogenous network effects included in the model significantly predicted friendship formation ($p < .001$). Specifically, adolescents were likely to form reciprocated friendships, become friends with adolescents their friends are already connected to (transitive triplets, i.e., friends of my friends become my friends), and form ties with a friendship nominator's nominator (3 cycles). In addition, both effects representing social status were significant ($p < 0.001$), demonstrating that adolescents tended to nominate popular peers as friends (indegree popularity squared), as well as adolescents with many outgoing friendship nominations (outdegree popularity squared). In terms of effects related to cigarette smoking, adolescents with higher levels of smoking received marginally more friendship nominations ($X^2 = 16.63$, $p = 0.08$) than adolescents with lower levels of smoking. Smoking did not significantly predict outgoing friendships, nor was similarity in smoking predictive of friendship formation.

Effects Predicting Cigarette Smoking

Longitudinal trends in cigarette smoking were explained by multiple parameters, including both distributional shape effects (e.g., linear, quadratic). The significant and negative linear shape parameter indicates that adolescents reported low levels of smoking overall. The positive quadratic shape parameter demonstrates that changes in smoking differed as a function of initial levels, with higher levels predicting further increases. The focal parameter of perceived social acceptability significantly predicted adolescent smoking ($X^2 = 29.11$, $p < .001$), while peer influence did not emerge as significant ($X^2 = 15.36$, $p < 0.12$). In addition, gender predicted an increase in smoking ($X^2 = 20.52$, $p < .03$), with males displaying a higher tendency to smoke. Of the additional control variables tested, adolescent drinking predicted cigarette smoking ($X^2 = 29.99$, $p < .001$), while academic grades and parental smoking did not.

Discussion

Cigarette smoking among adolescents remains a critical health concern, and developmental theories (Bronfenbrenner and Morris 2006) suggest that the socio-contextual environment shapes adolescent development. Given the increased priority of peer relationships during adolescence (Parker et al. 2006), a clear representation of the mechanisms through which peers impact smoking habits is crucial for prevention design. Further, schools are frequently used as intervention settings for programs addressing health behaviors (Stigler et al. 2011; Valente et al. 2003), and growing evidence indicates that peers can be effectively engaged in behavioral interventions (Osgood et al. 2013; Valente 2012). Although previous research suggests that perceived social acceptability of smoking impacts adolescent smoking habits (Bricker et al. 2010; Brown et al. 2010), social network research has exclusively focused on the impact of the level of smoking among an adolescent's friendship group on individual smoking (e.g., peer influence; Simons-Morton and Farhat 2010). Consequently, the main goal of the present study was to simultaneously investigate the extent to which perceived social acceptability and peer influence predict longitudinal patterns in cigarette smoking among a network of school-based adolescent friends. The study uses rigorous SAB models to concurrently investigate these processes, and therefore offers new insight into the mechanisms through which peers impact cigarette use.

Table 3 Friendship and smoking evolution

Parameter	Snijders-Baerveldt method		Fisher's combination method			
	β (SE)	Between school difference	X^2 (left side)	p value	X^2 (right side)	p value
Network dynamics						
Outdegree	− 2.55 (0.11)***	0.24	1417.50	< .001	0	> .999
Reciprocity	2.39 (0.13)***	0.28***	0	> .999	2652.93	< .001
Transitive triplets	0.77 (0.05)**	0.11***	0	> .999	1234.89	< .001
3-cycles	− 0.35(0.07)**	0.16	83.70	< .001	0.12	> .999
Indegree popularity sq	0.32(0.03)***	0.07	0	> .999	231.37	< .001
Outdegree popularity sq	− 0.54(0.02)***	0.04	226.95	< .001	0	> .999
Gender similarity	0.03(0.02)	0.04	4.98	0.89	12.84	0.23
Hispanic similarity	0.01(0.03)	0.07	7.69	0.66	7.95	0.63
Smoke alter	0.04(0.01)**	0.02	2.24	0.99	16.63	0.08
Smoke ego	0.04(0.01)*	0.02	3.15	0.98	14.76	0.14
Smoke similarity	0.13(0.05)	0.10	4.20	0.94	12.11	0.28
Behavior A.dynamics						
Smoking linear	− 1.12 (0.07)***	0.16	330.07	< .001	0	> .999
Smoking quadratic	0.14(0.04)*	0.08	1.17	> .999	39.01	< .001
Smoking influence	0.17 (0.17)	0.39	5.10	0.89	15.36	0.12
Effect from gender	0.21 (0.08)	0.19	2.29	0.99	20.52	0.03
Effect from grades	− 0.14 (0.10)	0.22	22.04	0.02	5.55	0.85
Effect from perceived acceptability	0.24(0.05)**	0.14	2.02	>.999 > .999	37.36 29.11	<.001 < .001
Effect from parental smoking	0.09(0.08)	0.20	5.31	0.90 0.87	13.85 13.30	0.18 0.21
Effect from alcohol	0.14(0.05)*	0.11	2.38	.99	29.99	< .001

***$p < 0.001$; **$p < 0.01$; *$p < 0.05$

Friendship Evolution

Consistent with previous social network research, adolescent friendship formation followed basic network properties, such that adolescents formed reciprocated and triadic friendships (Burk et al. 2007; Snijders et al. 2007). In addition, social status was predictive of friendships, in that adolescents tended to nominate popular peers as friends, and also preferred adolescents who were active in the network (e.g., sending many outgoing friendship nominations) as friends. In terms of the impact of cigarette smoking on friendship, adolescents with higher levels of smoking showed marginal increases in popularity. Popularity of adolescent smokers has been documented elsewhere (Lakon et al. 2010; Schaefer et al. 2012; Valente et al. 2005) and suggests that although cigarette use continues to decline nationally (CDC 2017), social benefits within the adolescent context remain. In contrast to several previous studies (DeLay et al. 2013; Green et al. 2013; Mercken et al. 2010), support for friendship formation based on similarity in smoking was not found in the present study. This difference could be attributed to the restriction of friendship to seven "close friends" versus more loosely defined friendship. Shared smoking habits may promote friendship in less intimate, more casual relationships, while this similarity is less relevant in the context of close friendships.

Smoking Evolution

Of prominent interest to the goals of the study, evidence was found for the effect of perceived social acceptability of smoking on future adolescent smoking, while support for peer influence was insignificant. This suggests that adolescents were more likely to change their smoking behaviors in response to how they perceived their friends to feel about smoking versus the smoking behavior of their friends. For example, for every one-unit increase in the social acceptability scale, an adolescent had odds 1.27 times higher (i.e., $e^{0.24} = 1.27$) to increase his or her smoking by Wave II. This finding is further strengthened by the preliminary correlational analyses used to investigate the relationship between perceived social acceptability and smoking. Specifically, the strength of the relationship between an individual adolescent's perceived

social acceptability of smoking and their individual smoking behavior was twice as strong as the relationship between individual perceived social acceptability and the level of smoking among the adolescent's friends.

Taken together, the findings indicate that adolescent smoking behavior is largely impacted by individual perceptions of peer approval of smoking. At the same time, there may be a disconnect between how an adolescent believes their friends feel about smoking and the actual smoking behavior of their friends. While previous research has found mixed support for peer influence, measured as the level of smoking among an adolescent's friends, on individual smoking behavior (Simons-Morton and Farhat 2010), findings from the current study suggest that this relationship is tempered by accounting for perceived social acceptability of smoking. As a result, prevention programs that aim to reduce adolescent cigarette use should address perceptions of adolescent smoking and beliefs that peers approve of this behavior. Although perceived social acceptability of smoking and peer smoking are certainly related influences on an adolescent's decision to smoke, prevention programs may have particular success with strategies that highlight peer disapproval of smoking.

In addition to the theoretical variables of interest, the study also found that adolescents engaged in comorbid alcohol use and smoking, such that adolescents who ranked higher on the alcohol use scale also had an increased likelihood of smoking. Further, males were more likely than females to smoke, suggesting important gender differences to consider when designing prevention efforts. Lastly, the significant quadratic shape effect demonstrates that smoking was self-reinforcing, in that adolescents with high smoking levels at Wave I were likely to continue their use at Wave II, indicating the addictive nature of cigarettes. Overall, the current study demonstrates that peers play an important role in shaping adolescent smoking behaviors, but this impact stems from perceptions of peer approval rather than the level of smoking among an adolescent's friendship group. Thus, findings from the current study highlight the need for prevention efforts to take into account the multifaceted dynamics between adolescent smoking and friendships.

Although the present study offers considerable strengths, several limitations need to be mentioned. First, the sample represents one high school district in Southern California. Results of the study may not generalize to adolescent populations in different geographic locations or composed of varying demographics. Second, the current study focused on grade level school friendships, and therefore did not account for mechanisms of peer influence occurring outside of the school context. Larger friendship networks, particularly those composed of students within all grades and outside of school, may display different social processes. Nevertheless, measures of friendship, friend influence, and perceived social acceptability in the current study all represent close adolescent friendships and are thus most relevant to the research questions at hand. Lastly, although the study is longitudinal in nature, the results are limited to two waves of data collection and therefore capture behavioral change over the course of one academic year. Future research is needed to investigate these processes across larger measurement occasions. Despite these limitations, findings from the current study offer valuable insight into the dynamic between adolescent friendships and cigarette smoking, and consequently, the appropriate design of prevention efforts.

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Compliance with Ethical Standards

All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. This article does not contain any studies with animals performed by any of the authors. Informed consent was obtained from all individual participants included in the study.

Conflict of Interest The authors declare that they have no conflict of interest.

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