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How social media influence college students' smoking attitudes and intentions

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Abstract

Building on the influence of presumed influence (IPI) model, this study examines how smoking-related messages on social media influence college students' smoking. We surveyed 366 college students from three U.S. Midwestern universities in 2012 and examined the effects of expression and reception of smoking-related messages on smoking using path analysis. We found that the expression and reception of prosmoking messages not only directly affected smoking but also had indirect effects on smoking through (1) perceived peer expression of prosmoking messages and (2) perceived peer smoking norms. For antismoking messages, only reception had a significant indirect influence on smoking through (1) perceived peer reception of antismoking messages and (2) perceived peer smoking norms. In conclusion, social media function as an effective communication channel for generating, sharing, receiving, and commenting on smoking-related content and are thus influential on college students' smoking.

Keywords

Social media; Influence of presumed influence; Smoking attitude; Smoking intention; College students

1. Introduction

Recent data indicate that approximately 16% of U.S. college students report having smoked a cigarette at some point, 10.6% report having smoked within the past 30 days, and 2.5% report they smoke daily (American College Health Association, 2015). Of all age groups, college-aged adults (age 18 to 24 years) show the highest rate of current use of tobacco products (Substance Abuse and Mental Health Services Administration, 2013). To prevent smoking prevalence among college students, it is critical to understand how they develop

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attitudes toward cigarette smoking and what affects their smoking behaviors. According to the theory of reasoned action (Ajzen & Fishbein, 1980) and the theory of planned behavior (Ajzen, 1985), individuals' attitudes toward behavior determine their behavioral intentions. Based on these theories, some scholars have examined the effects of smoking attitudes on smoking intentions among college students. Mao et al. (2009) found that higher prosmoking attitudes were associated with higher likelihood to smoke in the next 6 months. Ling, Neilands, and Glantz (2009) also found that aggressive and critical attitudes against the tobacco industry were positively related to intentions to quit smoking.

Despite the considerable importance of smoking attitudes in predicting smoking intentions among college students, little is known about how social media usage affects students' attitudes toward smoking. The tobacco industry has been using social media as channels for the marketing and promotion of tobacco products (Freeman, 2012; Freeman & Chapman, 2007). During recent years, social media have been found to be the most significant predictor of college students' smoking. For example, disclosures of photos regarding smoking on social networking sites were indicative of their real-life smoking behaviors (van Hoof, Bekkers, van Vuuren, 2014). Zhu (2014) also found that prosmoking information scanning using social media influenced young adults' smoking behavior. Depue and colleagues (2015) found that exposure to tobacco use in social media predicted future smoking tendencies among young adults. Given that social smoking is one of the most prominent patterns of tobacco use among college students (Moran, Wechsler, & Rigotti, 2004; Levinson et al., 2007), social media can function as an effective channel through which college students easily share their thoughts on smoking, which in turn foster their perceived peer norms on smoking. Thus, research needs to examine the effectiveness of social media in determining smoking attitudes as well as smoking intentions among college students.

To fulfil the study needs, we explore the relationship between social media usage and cigarette smoking among college students within a theoretical foundation, drawing on the influence of presumed influence (IPI) model (Gunther & Storey, 2003). The IPI model has been widely employed to delineate how media messages about smoking influence a target audience's smoking via their effect on perceived peer norms (Gunther, Bolt, Borzekowski, Liebhart, & Dillard, 2006; Paek & Gunther, 2007; Paek, Gunther, McLeod, & Hove, 2011). According to the IPI model, individuals assume that mass media influence the attitudes and behaviors of their peers, and such assumption in turn affects their own attitudes and behaviors. From this perspective, college students may assume that smoking-related messages in social media will influence the attitudes and behaviors of their peers, and these perceptions about peers will influence their own smoking attitudes and behaviors.

Previous IPI studies have focused on looking at the effects of smoking-related content predominantly on traditional media (Gunther et al., 2006; Paek & Gunther, 2007; Paek et al., 2011); however, relatively few studies have examined the effect of smoking-related content on social media using the IPI model. Using the theoretical framework of the IPI model to explore how smoking-related messages in social media influence college students' smoking, this study adds to the currently small number of studies that apply the IPI model in social media settings (e.g., Bernhard, Dohle, & Vowe, 2015). In addition, the present study

assumes that the acts of receiving and expressing messages on social media have distinct effects on the person so engaged, and thus distinguishes message expression and reception effects. This approach is differentiated from previous studies focused on exploring only reception effects (Gunther et al., 2006; Paek & Gunther, 2007; Paek et al., 2011). Lastly, this study seeks to contribute to the growing literature on the role of social media in predicting college students' smoking attitudes and intentions.

2. Theoretical background

2.1. How social media affect attitudes and behavioral intentions

The IPI model provides a theoretical framework for understanding how social media affect public attitudes and behaviors with respect to a specific issue. The model predicts that a person may perceive influences of media on others and adapt their own attitudes and behaviors to correspond to that perception (Gunther & Storey, 2003). The IPI model identifies three causal relationships among the key components that explain the mechanism of media influence. The first relationship is the association between exposure to media messages and perceptions of other people's exposure to media messages. According to Gunther and Storey (2003), people estimate others' exposure to media messages based on their own exposure. Thus, the more individuals attend to social media messages, the more likely they are to assume that these messages have a wide reach and believe that their peers would likewise pay attention to such media messages.

The second association refers to presumed media influence suggesting that individuals' perceptions of peer exposure to media messages can shape the perceptions of their peers' attitudes and behaviors toward an issue. People tend to assume that the more others are exposed to media messages, the more likely these media messages will have an effect on others' attitudes and behaviors (Gunther et al., 2006). In support of this suggestion, previous research has found that perceived peer exposure to a media message was significantly related to perceived prevalence of particular behaviors among peers (Gunther et al., 2006; Ho, Poorisat, Neo, & Detenber, 2014).

The third causal relationship of the IPI model pertains to the path from perceived peer norms to one's own attitudes and behaviors. According to a review of the social psychology literature (Gunther, 1998), peer norms have the potential to exert a purposeful influence on individuals. Foremost among several types of social norms is a perception that a certain behavior is prevalent among one's peers, also known as perceived descriptive norms. Descriptive norms refer to perceptions of how much or how frequently others engage in a particular behavior (Cialdini, Reno, & Kallgren, 1990). Given that the most salient social referents in college are peers, college students' health risk behaviors may be largely influenced by their perceptions of those of their peers.

Taken together, the influence of social media on attitudes and behaviors can be explained by these three steps of the IPI model. Individuals with greater exposure to social media messages assume these messages reach a wider audience, causing them to develop a subjective sense that more of their friends, acquaintances, and peers are exposed to and

influenced by those messages. Thus, the perceived social media influence on peers will form, develop, or change individuals' attitudes and behavioral intentions.

2.2 IPI model for testing the effects of smoking-related messages in social media

2.2.1. Distinguishing the effects of message expression and reception—Social media have transformed the role of the message receiver from that of the audience to that of the user (Sundar, 2004). Social media users not only receive messages but also express their thoughts and ideas in their social networks. In this sense, the IPI model for testing the effects of social media messages should distinguish the effects of expressing and receiving messages.

Message construction requires cognitive elaboration, as one considers not only what one wishes to express but also the way in which that expression is likely to be received (Eveland, 2001, 2004). Indeed, after one has expressed a message, the perception of its meaning can change through the awareness that others will read it. This process, also called reasoning, refers to mental elaboration or collective consideration, and it encompasses both intrapersonal and interpersonal ways of thinking (Shah et al., 2007). After a message has been posted, an individual's perception of its meaning may change after he or she is aware that others have read it; this change in perception is one of commitment and consistency. Message writers can be influenced by their own message in a variety of ways, for instance, by mentally elaborating on what they expect that the message will mean to others, how they expect readers to react and respond to it, and by preemptively preparing their own responses (McLaughlin et al., 2016). Supporting this suggestion, van Hoof et al. (2014) found that college students' self-disclosure of photos related to tobacco on social media was directly associated with their real-life smoking behaviors. In the same vein, we argue that expressing smoking-related messages is significantly related to the message writers' future smoking behavior.

Additionally, people learn not only through their own experiences but also by observing the behavior of others and the results of those behaviors (Bandura, 2001). Health communication research has traditionally been dominated by a reception-effects paradigm in which most effects of communication are conceived as a consequence of informational or persuasive message reception (Fishbein & Cappella, 2006). Therefore, message reception has a substantial effect on the message recipients' thoughts, attitudes, or behaviors. Applying this message reception-effects paradigm to social media messages relevant to health risk behaviors suggests that exposure to risky content posted by friends can cultivate specific norms that are then rapidly spread through online networks and contribute to the adoption or rejection of risky beliefs and behaviors (Huang et al., 2014). In the context of college students' smoking, we expect that college students who observe smoking-related messages on social media are likely to adopt the referenced attitudes and behaviors.

2.2.2. Distinguishing the effects of antismoking and prosmoking messages—

Ample evidence suggests that smoking-related messages are prevalent on social media. Social media contain a large number of antismoking messages (Backinger et al., 2011; Chung, 2015; de Viron, Suggs, Brand, & Van Oyen, 2013). By facilitating the exchange of

antismoking information among users, social networking sites for smoking cessation influence social factors, which in turn result in great smoking cessation self-efficacy (Phua, 2013). Likewise, there is convincing evidence of a prevalence of and accessibility to prosmoking messages on social media. Forsyth and Malone (2010) found that videos positively portraying smoking predominated on YouTube. Similarly, Kim, Paek, and Lynn (2010) found that smoking fetish videos were highly prevalent on YouTube and featured sexually explicit smoking behavior by young women.

It is now evident that smoking-related messages influence college students' attitudes and perceptions about smoking. With respect to antismoking messages, studies have well-documented the efficacy of antismoking messages for young adults, including college students (Terry-McElrath et al., 2013). For example, antismoking messages that underline the negative health consequences of smoking were most persuasive and most effective in changing college students' knowledge, negative attitudes, and beliefs about tobacco use (Murphy-Hoefer, Hyland, & Rivard, 2010; Yoo, 2016).

On the other hand, prosmoking messages have been recognized as one of the risk factors associated with increased smoking in college students. Prior research has found significant effects of prosmoking messages (e.g., tobacco industry-sponsored promotion and portrayals of smoking in movies, magazine advertising) on tobacco use, attitudes, and beliefs among college students (Rigotti, Moran, & Wechsler, 2005; Shadel, Martino, Setodji, & Scharf, 2012).

As discussed above, both antismoking and prosmoking messages have unique effects on college students' smoking. Given the difference in natures and effects of the two messages, research on the effects of smoking-related messages needs to distinguish the effects of antismoking messages and those of prosmoking messages.

3. Hypothesized Model

Guided by the theoretical rationale of the IPI model, this study examines the direct and indirect effects of smoking-related messages on social media on smoking attitudes and intentions among college students. To investigate these effects more thoroughly, the present research incorporates two communicative behaviors (i.e., message expression and reception) of social media and two main types (i.e., antismoking and prosmoking) of smoking-related messages into the hypothesized model (see Fig. 1).

First, the expression and reception of antismoking messages are expected to be significantly negatively associated with smoking attitudes and intentions (H1a and H1b). In contrast, the expression and reception of prosmoking messages are expected to be significantly positively associated with smoking attitudes and intentions (H1c and H1d). Second, college students who express and receive more messages on social media assume that their peers also have higher rates of expression and reception of these messages. Thus, the expression and reception of smoking-related messages are expected to be positively associated with perceived peer expression and reception of smoking-related messages (H2a–H2d). Third, those with higher perceptions of peer expression and reception of smoking-related messages

are likely to assume that smoking-related messages exert a greater influence on others than on themselves. For antismoking messages, college students with higher perceptions of peer expression and reception are expected to report low levels of perceived smoking prevalence among peers (H3a and H3b). On the contrary, those with higher perceptions of peer expression and reception of prosmoking messages are expected to show high levels of perceived peer smoking norms (H3c and H3d). Lastly, we expect that perceived peer smoking norms will be positively associated with smoking attitudes and intentions (H4).

The pivotal mechanism of the IPI model—the influence of presumed media influence—holds that individuals' attitudes and behavioral intentions are altered by perceived media influence. Based on this process, some scholars have examined presumed media influence in research pertinent to adolescents' smoking (Gunther et al., 2006; Paek & Gunther, 2007; Paek et al., 2011). In a similar vein, the expression and reception of smoking-related messages in social media may have significant indirect influences on college students' smoking outcomes via their effects on perceived peer smoking norms. More specifically, the expression and reception of smoking-related messages are expected to exert significant indirect effects on smoking attitudes and intentions via (1) perceived peer expression and reception and (2) perceived peer smoking norms (H5).

Additionally, four exogenous variables that are likely to be relevant to smoking attitudes and intentions are entered as control variables in the hypothesized model: gender, ethnicity, family smoking, and family or friends with smoking-related illnesses. They all may, in certain ways, influence smoking attitudes and intentions, but we do not elaborate on them separately in the model, as this study primarily focuses on the relationships among the expression and reception of smoking-related messages, perceived peer expression and reception of smoking related messages, perceived smoking norms, and smoking outcomes.

4. Method

4.1. Data Collection

Data were collected via a web-based survey of undergraduate students at three Midwestern universities in the spring semester of 2012. We recruited potential participants through bulletin board notices, flyers, and announcements in classes. The survey was accessible from any computer with Internet access. Participants were given the option of taking the survey using their own computers or desktops in our research lab. They took approximately 15 minutes to complete the survey and received extra credit or \$15 for their participation.

A total of 366 participants completed the survey over a two-week study period. The mean age of the sample was 19.74 ($SD = 1.88$); 62.3% were females, and 37.7% were males. Nearly 40% of participants were freshmen, 27.3% were sophomores, 17.8% were juniors, 13.9% were seniors, and 1.1% were other. The sample was predominately Caucasian (88%), with 5.7% Asian, 1.6% Hispanic, 1.1% African American, and 3.6% other. Almost 42% of participants had family smokers, and 41.5% of participants had family members or close friends with smoking-related illnesses.

4.2. Measures

Expression of antismoking messages was measured using six questions asking how often participants posted antismoking messages on social media in the past 6 months. Responses ranged along a 7-point scale (1 = *never* to 7 = *all the time*) ($\alpha = .89$, $M = 1.15$, $SD = .51$). Reception of antismoking messages was created using six questions asking how often participants saw or heard antismoking messages on social media in the past 6 months. Responses were based on a 7-point scale (1 = *never* to 7 = *all the time*) ($\alpha = .91$, $M = 2.18$, $SD = 1.23$).

Expression of prosmoking messages was measured using six items asking how often participants posted prosmoking messages on social media in the past 6 months. Responses ranged along on a 7-point scale (1 = *never* to 7 = *all the time*) ($\alpha = .86$, $M = 1.16$, $SD = .52$). Reception of prosmoking messages was constructed using six items asking how often participants saw or heard prosmoking messages on social media in the past 6 months. Responses were given on a 7-point scale (1 = *never* to 7 = *all the time*) ($\alpha = .87$, $M = 1.76$, $SD = 1.02$).

Perceived peer expression of antismoking messages was measured using six questions on participants' beliefs concerning the frequency at which their close friends posted antismoking messages on social media in the past 6 months. Responses were given on a 7-point scale (1 = *never* to 7 = *all the time*) ($\alpha = .93$, $M = 1.52$, $SD = .79$). Perceived peer reception of antismoking messages was measured using six questions on participants' beliefs concerning the frequency at which their close friends saw or heard antismoking messages on social media. Responses were based on a 7-point scale (1 = *never* to 7 = *all the time*) ($\alpha = .94$, $M = 2.39$, $SD = 1.16$).

Perceived peer expression of prosmoking messages was measured using six items on participants' beliefs concerning the frequency at which their close friends posted prosmoking messages on social media in the past 6 months. Responses ranged along a 7-point scale (1 = *never* to 7 = *all the time*) ($\alpha = .89$, $M = 1.46$, $SD = .80$). Perceived peer reception of prosmoking messages was measured using six items on participants' beliefs concerning the frequency at which their close friends saw or heard prosmoking messages on social media in the past 6 months. Responses were based on a 7-point scale (1 = *never* to 7 = *all the time*) ($\alpha = .91$, $M = 2.00$, $SD = 1.07$).

To measure perceived peer smoking norms, participants were asked to indicate what percentage of their close friends smoke cigarettes at least once a week. Responses were given on a 10-point scale ranging from 1 (0~10%) to 10 (91~100%) ($M = 2.37$, $SD = 2.12$).

To measure smoking attitudes, participants were asked to indicate their thoughts on five items related to smoking attitudes, followed by a 7-point scale ranging from 1 (*completely no*) to 7 (*completely yes*). All responses were averaged to create a scale of smoking attitudes ($\alpha = .91$, $M = 2.64$, $SD = 1.28$). Higher values indicated more favorable attitudes toward smoking.

A measure to gauge smoking intentions was created using four items developed by Pierce, Farkas, Evans, and Gilpin (1995). Participants were asked to indicate their level of intention on a 7-point scale ranging from 1 (*definitely not*) to 7 (*definitely yes*) ($\alpha = .92$, $M = 2.54$, $SD = 1.96$). Finally, this research included gender, ethnicity, family smoking, and family or friends with smoking-related illnesses as exogenous variables to control their potentially confounding effects on endogenous variables. Table 1 shows descriptive statistics for all variables.

4.3. Analytical approach

To test the hypothesized model described in Fig. 1, this study performed a path analysis in Mplus 6.1. A path analysis allows researchers to test a set of simultaneous regression equations that theoretically establish the relations among the observed variables in the hypothesized model (Schumacker & Lomax, 2010). Using this analytical approach, we examined not only the direct influence of smoking-related messages on smoking attitudes and intentions but also the indirect effects on smoking attitudes and intentions through perceived peer expression and reception of smoking-related messages and perceived peer smoking norms. The maximum likelihood mean-adjusted (MLM) estimator was used to address non-normally distributed data. The MLM estimator is appropriate for continuous but non-normal data, as it implements robust corrections to the test statistic and standard errors (Chou, Bentler, & Satorra, 1991).

5. Results

This study first assessed the hypothesized model with five goodness-of-fit indices, including the chi-squared statistic, the root mean square error of approximation (RMSEA), the comparative fit index (CFI), the Tucker–Lewis index (TLI), and the standardized root mean square residual (SRMR). All fit measures gave evidence of a poor model with the data, $\chi^2 = 496.42$, $df = 36$, $p < .001$, $RMSEA = .19$ (90% CI = .17 to .20), $CFI = .75$, $TLI = .24$, and $SRMR = .13$. According to the modification indices and theoretical backgrounds, the originally theorized model was refined. Based on the cutoff criteria (Hu & Bentler, 1999), the modified model presented a reasonably good fit to the data: $\chi^2 = 75.80$, $df = 28$, $p < .001$, $RMSEA = .07$ (90% CI = .05 to .09), $CFI = .97$, $TLI = .90$, $SRMR = .04$.

Fig. 2 indicates the results of all hypothesized paths in the final model. Contrary to H1a and H1b, neither the expression nor the reception of antismoking messages was significantly related to smoking outcomes. However, the expression of prosmoking messages was positively related to smoking intentions (H1c: $\beta = .14$, $p < .001$), and the reception of prosmoking messages was positively associated with smoking attitudes (H1d: $\beta = .11$, $p < .05$).

As proposed in H2a–d, we found that the expression and reception of smoking-related messages were positively associated with perceived peer expression and reception of smoking-related messages (H2a: $\beta = .32$, $p < .001$; H2b: $\beta = .78$, $p < .001$; H2c: $\beta = .28$, $p < .01$; H2d: $\beta = .76$, $p < .001$). In addition, there were unexpected relationships between the reception of smoking-related messages and perceived peer expression of smoking-related messages. Higher levels of reception of antismoking messages turned out to be positively

related to higher levels of perceived peer expression of antismoking messages ($\beta = .37, p < .001$). Higher levels of reception of prosmoking messages were also positively associated with higher levels of perceived peer expression of prosmoking messages ($\beta = .44, p < .001$).

Contrary to H3a, there was no significant relationship between perceived peer expression of antismoking messages and perceived peer smoking norms. Unlike H3b, perceived peer reception of antismoking messages was positively related to perceived peer smoking norms ($\beta = .13, p < .05$). Supporting H3c, perceived peer expression of prosmoking messages was positively associated with perceived peer smoking norms ($\beta = .21, p < .001$). Contrary to H3d, perceived peer reception of prosmoking content had no significant association with perceived peer smoking norms.

Consistent with H4, perceived peer smoking norms were positively related to smoking attitudes ($\beta = .20, p < .001$) and intentions ($\beta = .39, p < .001$).

H5 predicted the indirect effects of expressing and receiving smoking-related messages on smoking attitudes and intentions via (1) perceived peer expression and reception and (2) perceived peer smoking norms. As shown in Table 2, higher levels of expression of prosmoking messages led to higher levels of perceived peer expression of prosmoking messages. This in turn predicted higher levels of perceived peer smoking norms, which ultimately resulted in greater favorable attitudes toward smoking and smoking intentions (indirect effect on smoking attitudes = .01, $p < .05$; indirect effect on smoking intentions = .03, $p < .05$).

Table 3 presents the indirect impacts of the reception of smoking-related messages on smoking attitudes and intentions. Higher levels of reception of antismoking messages led to higher levels of perceived peer reception of antismoking messages. This in turn predicted higher levels of peer smoking norms, resulting ultimately in greater positive attitudes toward smoking and smoking intentions (indirect effect on smoking attitudes = .02, $p < .05$; indirect effect on smoking intentions = .04, $p < .05$). Additionally, higher levels of reception of prosmoking messages led to higher levels of perceived peer expression of prosmoking messages. This in turn predicted greater perceived peer smoking norms, resulting ultimately in greater positive attitudes toward smoking and smoking intentions (indirect effect on smoking attitudes = .02, $p < .05$; indirect effect on smoking intentions = .04, $p < .01$).

6. Discussion

This research uses the IPI model as a theoretical model to examine how the expression and reception of smoking-related messages on social media affect college students' smoking attitudes and intentions. Consistent with previous IPI research on smoking (Gunther et al., 2006; Paek & Gunther, 2007; Paek et al., 2011), the findings provide substantial evidence for most of the theoretical pathways of the proposed model. However, this is not a mere extension of past work. Indeed, the present study contributes to the theoretical development of the IPI model in two ways by (1) distinguishing the effects of antismoking messages and the effects of prosmoking messages and (2) testing message expression and reception effects separately within the theoretical framework of the IPI model. Our findings also have

important practical contributions to developing effective strategies for both health policy-makers and health campaign planners.

Specifically, this study shows the differential effects of expression and reception behaviors on college students' smoking in terms of two message frameworks (i.e., antismoking versus prosmoking). We found that expressing and receiving prosmoking messages had significant associations with smoking attitudes and intentions. However, the expression and reception of antismoking messages exhibited no significant relationships with the same outcomes. These results are in concert with previous research suggesting that prosmoking messages are more influential than antismoking messages in predicting college students' smoking behaviors. Antismoking messages have only a limited effect on changing intentions and behaviors in smoking prevention and cessation (Murphy-Hoefer et al., 2010). Prosmoking media and advertising, on the other hand, increase smoking susceptibility and initiation (Shmueli, Prochaska, & Glantz, 2010). It may be the case that antismoking messages trigger boomerang responses including defiance and desire for retaliation, especially for college student smokers (Freeman, Hennessy, & Marzullo, 2001; Wolburg, 2006).

In addition, our findings show a noticeable difference in indirect effects between prosmoking messages and antismoking messages. College students who expressed and received more prosmoking messages on social media tended to perceive their peers to also be expressing such messages on social media. The perception overestimated perceived peer smoking norms, which accordingly increased favorable attitudes toward smoking and smoking intentions. With regard to antismoking messages, college students who received antismoking messages via social media were likely to perceive that their peers received the same messages. However, contrary to our expectations, the perceived peer reception of antismoking messages increased perceived peer smoking norms, resulting in more favorable attitudes toward smoking and higher smoking intentions. This pathway is an extension of the unexpected or boomerang effects of antismoking messages, in other words, an increased desire to smoke in defiance of antismoking campaigns (Wolburg, 2004, 2006). Reactance theory suggests that when people are forced to do something they tend to feel threatened, become argumentative, deny the accuracy of a charge, and assert their personal freedom (Miller & Rollnick, 2002). Given that college-aged people have higher levels of psychological reactance than any other age group (Dowd, Pepper, & Seibel, 2001), they may believe that their peers would be likely to resist antismoking persuasion tactics, going so far as to smoke cigarettes in reaction to them.

Another interesting finding is that the reception of prosmoking messages increased not only the perceived peer reception of prosmoking messages but also the perceived peer expression of prosmoking messages. Consequently, the increased perceived peer expression led to greater perceived peer smoking norms, resulting in more favorable smoking attitudes and higher smoking intentions. Given that social media allow the spread of desired messages and the creation of user-generated content, social media users sometimes encounter the prosmoking messages disseminated by their peers. College students typically perceive a higher prevalence of tobacco use among their peers than what in fact exists (Cunningham & Selby, 2007; Page, 1998). Such overestimation might lead to exaggerated estimates of their peers' prosmoking behaviors, including posting of prosmoking messages online. In

particular, the more college students received prosmoking messages on social media, the more likely they were to believe that their peers expressed prosmoking messages on social media.

Taken together, these results provide practical implications for social media antismoking policies and campaigns targeting college students. In social media environments, weakening prosmoking messages can be effective in preventing or reducing smoking among college students. Thus, public health policy-makers need to develop regulations on prosmoking content in social media, regardless of whether it is commercial or personal in origin. In addition, strengthening antismoking messages can result in unintended consequences. For this reason, health campaign planners should control content levels of social media antismoking messages targeted at college students.

Furthermore, this research elucidates the differential effects between the expression and reception of smoking-related messages in the IPI model. More specifically, the expression effect could be explained for only prosmoking messages through the presumed influence mechanisms such that higher expression of prosmoking messages led to higher perceived peer expression of similar messages. Such perception in turn predicted greater perceived peer smoking norms, resulting in more positive attitudes toward smoking and greater smoking intentions. In an online communication environment, the expression of messages is a self-involved and goal-directed behavior (Namkoong et al., 2013; Yoo, Choi, & Park, 2016). Thus, social media users who talk about smoking might already have preexisting attitudes toward smoking. As cigarette smoking has long been regarded a danger to public health, it is often frowned upon for people to express prosmoking messages actively to others. For this reason, a majority of college students who expressed prosmoking messages in social media might be smokers with positive attitudes toward smoking along with smoking inclinations. In terms of the IPI model, they perceived that their peer smokers expressed prosmoking messages via social media to an extent equal to their own expressions. Such perception strengthened perceived peer smoking norms, resulting in their having even more positive attitudes toward smoking and stronger smoking inclinations. Compared to their expression of prosmoking messages, college students might be less inclined to express antismoking messages via social media because antismoking messages could come from a variety of sources (e.g., family, peers, school, neighborhood, and mass media) besides social media. Therefore, college students might feel less need or motivation to express antismoking messages via social media. Understanding college students' intentions to express antismoking messages is critical to designing effective social media antismoking interventions targeting college students. These results suggest that focusing more on the reception of antismoking messages than the expression of antismoking messages would probably result in successful smoking prevention and cessation among college students.

Although not theoretically hypothesized, gender, ethnicity, family smoking, and family or friends with smoking-related illnesses were examined as exogenous factors affecting smoking attitudes and intentions. Among such factors, male gender was found to be a significant predictor of smoking attitudes and intentions among college students. Specifically, male students showed more favorable attitudes toward smoking and higher

levels of smoking intentions than female students. Since approximately 2001, there has been little consistent gender difference in smoking among college students (Johnston, O'Malley, Bachman, & Schulenberg, 2010). However, in light of our findings, health educators should channel their efforts toward male college students.

6.1. Limitations

Notwithstanding the implications laid out above, this research should acknowledge some limitations and offer suggestions for future research. The present study used the rather simplistic measure of social media usage for smoking-related messages. Because expression and reception measures may not represent a variety of usage patterns in social media, future studies should consider a number of relevant measures of social media use. In addition, this research used cross-sectional survey data to examine the multiple pathways of the IPI model. This could not rule out the potential of reversed paths in the model, and thus, future research should conduct analyses of longitudinal data to establish a rigorous causal model. Finally, social media can be classified in a number of ways to reflect the diverse range of social media platforms. The different types of social media may lead to different results in examining the influence of social media messages on smoking. Therefore, further research is needed to examine the relative effectiveness of expression and reception of smoking-related messages in different social media applications at deterring college students' smoking.

6.2. Conclusions

Social media have become major channels of communication and commentary on public health issues, including conversations on tobacco use (Sanders-Jackson, Brown, & Prochaska, 2015). This study supports the notion that social media play a role as communication channels for college students to generate, share, receive, and comment on smoking-related content. More importantly, social media can enrich traditional one-to-one communication by enabling communication from one to many or from many to many (Hawn, 2009). Using social media, college students are able to communicate with each other about smoking issues related to smoking habits, behaviors, and attitudes 24 hours a day, 7 days a week, regardless of accommodations or geographic location. Given that social media attract a large number of college students, public health practitioners should consider adopting social media as an intervention platform for smoking prevention and cessation in college populations.

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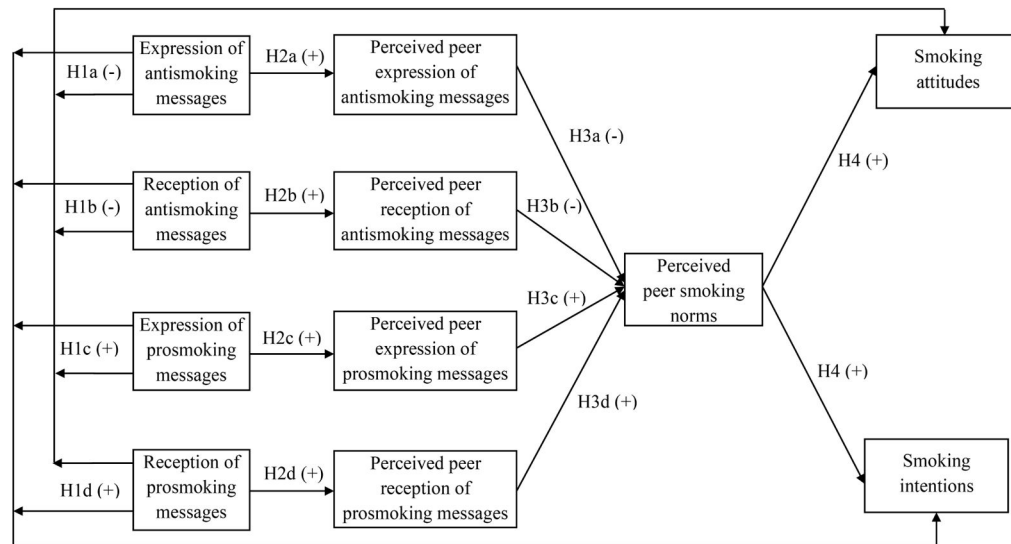
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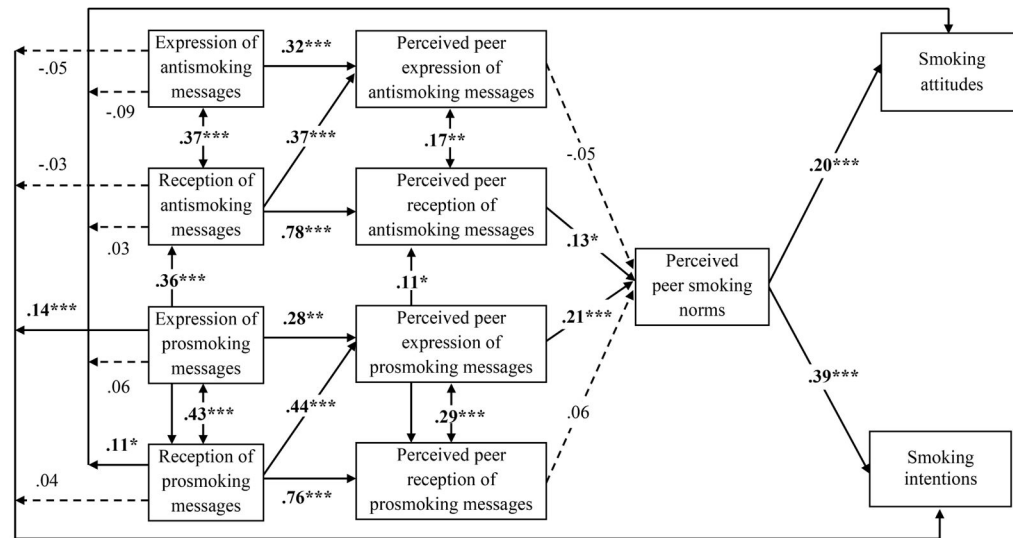
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- Expressing prosmoking messages is directly related to smoking intentions.
- Receiving prosmoking messages is directly related to smoking attitudes.
- Expressing prosmoking messages is indirectly related to attitudes and intentions.
- Receiving prosmoking messages is indirectly related to attitudes and intentions.
- Receiving antismoking messages is indirectly related to attitudes and intentions.

**Fig. 1.**

Hypothesized IPI model for examining the expression and reception effects of smoking-related social media messages on college students' smoking. Note: Gender, ethnicity, family smoking, and family or friends with smoking-related illnesses are included as exogenous variables, but not shown here.

**Fig. 2.**

Expression and reception effects of smoking-related social media messages on college students' smoking.

Note: All the coefficients are completely standardized. Gender, ethnicity, family smoking, and family or friends with smoking-related illnesses are included as exogenous variables, but not shown here. $\chi^2 = 75.80$, $df = 28$, $p < .001$, RMSEA = .07 (90% CI = .05 to .09), CFI = .97, TLI = .90, SRMR = .04; * $p < .05$, ** $p < .01$, *** $p < .001$.

Table 1

Descriptive data for key variables

Concept and measure	
Expression of antismoking messages (1–7 scale: $\alpha = .89$, $M = 1.15$, $SD = .51$)	
1	In the past 6 months, how often have you posted comments, questions, pictures, videos, or other information about antismoking (e.g., quit smoking, smoking ban, negative attitudes toward smoking, or disadvantages of smoking) on a blog?
2	In the past 6 months, how often have you posted comments, questions, pictures, videos, or other information about antismoking on a social networking site such as Facebook, MySpace, or Google+?
3	In the past 6 months, how often have you posted comments, questions, pictures, videos, or other information about antismoking on Flickr or Tumblr?
4	In the past 6 months, how often have you posted comments, questions, pictures, videos, or other information about antismoking on Twitter?
5	In the past 6 months, how often have you posted comments, questions, pictures, videos, or other information about antismoking on YouTube?
6	In the past 6 months, how often have you posted comments, questions, pictures, videos, or other information about antismoking on other social networking sites?
Reception of antismoking messages (1–7 scale: $\alpha = .91$, $M = 2.18$, $SD = 1.23$)	
1	In the past 6 months, how often have you seen or heard comments, questions, pictures, videos, or other information about antismoking (e.g., quit smoking, smoking ban, negative attitudes toward smoking, or disadvantages of smoking) on a blog?
2	In the past 6 months, how often have you seen or heard comments, questions, pictures, videos, or other information about antismoking on a social networking site such as Facebook, MySpace, or Google+?
3	In the past 6 months, how often have you seen or heard comments, questions, pictures, videos, or other information about antismoking on Flickr or Tumblr?
4	In the past 6 months, how often have you seen or heard comments, questions, pictures, videos, or other information about antismoking on Twitter?
5	In the past 6 months, how often have you seen or heard comments, questions, pictures, videos, or other information about antismoking on YouTube?
6	In the past 6 months, how often have you seen or heard comments, questions, pictures, videos, or other information about antismoking on other social networking sites?
Expression of prosmoking messages (1–7 scale: $\alpha = .86$, $M = 1.16$, $SD = .52$)	
1	In the past 6 months, how often have you posted comments, questions, pictures, videos, or other information about prosmoking (e.g., tobacco advertisement, cool images of smoker, benefits of smoking, or celebrity smoking) on a blog?
2	In the past 6 months, how often have you posted comments, questions, pictures, videos, or other information about prosmoking on a social networking site such as Facebook, MySpace, or Google+?
3	In the past 6 months, how often have you posted comments, questions, pictures, videos, or other information about prosmoking on Flickr or Tumblr?
4	In the past 6 months, how often have you posted comments, questions, pictures, videos, or other information about prosmoking on Twitter?
5	In the past 6 months, how often have you posted comments, questions, pictures, videos, or other information about prosmoking on YouTube?
6	In the past 6 months, how often have you posted comments, questions, pictures, videos, or other information about prosmoking on other social networking sites?
Reception of prosmoking messages (1–7 scale: $\alpha = .87$, $M = 1.76$, $SD = 1.02$)	
1	In the past 6 months, how often have you seen or heard comments, questions, pictures, videos, or other information about prosmoking (e.g., tobacco advertisement, cool images of smoker, benefits of smoking, or celebrity smoking) on a blog?
2	In the past 6 months, how often have you seen or heard comments, questions, pictures, videos, or other information about prosmoking on a social networking site such as Facebook, MySpace, or Google+?

Concept and measure	
3	In the past 6 months, how often have you seen or heard comments, questions, pictures, videos, or other information about prosmoking on Flickr or Tumblr?
4	In the past 6 months, how often have you seen or heard comments, questions, pictures, videos, or other information about prosmoking on Twitter?
5	In the past 6 months, how often have you seen or heard comments, questions, pictures, videos, or other information about prosmoking on YouTube?
6	In the past 6 months, how often have you seen or heard comments, questions, pictures, videos, or other information about prosmoking on other social networking sites?
Perceived peer expression of antismoking messages (1–7 scale: $\alpha = .93$, $M = 1.52$, $SD = .79$)	
1	In the past 6 months, how often do you think that your close friends have posted antismoking messages (e.g., quit smoking, smoking ban, negative attitudes toward smoking, or disadvantages of smoking) on a blog?
2	In the past 6 months, how often do you think that your close friends have posted antismoking messages on a social networking site such as Facebook, MySpace, or Google+?
3	In the past 6 months, how often do you think that your close friends have posted antismoking messages on Flickr or Tumblr?
4	In the past 6 months, how often do you think that your close friends have posted antismoking messages on Twitter?
5	In the past 6 months, how often do you think that your close friends have posted antismoking messages on YouTube?
6	In the past 6 months, how often do you think that your close friends have posted antismoking messages on other social networking sites?
Perceived peer reception of antismoking messages (1–7 scale: $\alpha = .94$, $M = 2.39$, $SD = 1.16$)	
1	In the past 6 months, how often do you think that your close friends have seen or heard antismoking messages (e.g., quit smoking, smoking ban, negative attitudes toward smoking, or disadvantages of smoking) on a blog?
2	In the past 6 months, how often do you think that your close friends have seen or heard antismoking messages on a social networking site such as Facebook, MySpace, or Google+?
3	In the past 6 months, how often do you think that your close friends have seen or heard antismoking messages on Flickr or Tumblr?
4	In the past 6 months, how often do you think that your close friends have seen or heard antismoking messages on Twitter?
5	In the past 6 months, how often do you think that your close friends have seen or heard antismoking messages on YouTube?
6	In the past 6 months, how often do you think that your close friends have seen or heard antismoking messages on other social networking sites?
Perceived peer expression of prosmoking messages (1–7 scale: $\alpha = .89$, $M = 1.46$, $SD = .80$)	
1	In the past 6 months, how often do you think that your close friends have posted prosmoking messages (e.g., tobacco advertisement, cool images of smoker, benefits of smoking, or celebrity smoking) on a blog?
2	In the past 6 months, how often do you think that your close friends have posted prosmoking messages on a social networking site such as Facebook, MySpace, or Google+?
3	In the past 6 months, how often do you think that your close friends have posted prosmoking messages on Flickr or Tumblr?
4	In the past 6 months, how often do you think that your close friends have posted prosmoking messages on Twitter?
5	In the past 6 months, how often do you think that your close friends have posted prosmoking messages on YouTube?
6	In the past 6 months, how often do you think that your close friends have posted prosmoking messages on other social networking sites?
Perceived peer reception of prosmoking messages (1–7 scale: $\alpha = .91$, $M = 2.00$, $SD = 1.07$)	
1	In the past 6 months, how often do you think that your close friends have seen or heard prosmoking messages (e.g., tobacco advertisement, cool images of smoker, benefits of smoking, or celebrity smoking) on a blog?
2	In the past 6 months, how often do you think that your close friends have seen or heard prosmoking messages on a social networking site such as Facebook, MySpace, or Google+?

Concept and measure	
3	In the past 6 months, how often do you think that your close friends have seen or heard prosmoking messages on Flickr or Tumblr?
4	In the past 6 months, how often do you think that your close friends have seen or heard prosmoking messages on Twitter?
5	In the past 6 months, how often do you think that your close friends have seen or heard prosmoking messages on YouTube?
6	In the past 6 months, how often do you think that your close friends have seen or heard prosmoking messages on other social networking sites?
Perceived peer smoking norms (1–10 scale: $M = 2.37$, $SD = 2.12$)	
1	What percentages of your close friends smoke cigarettes at least once a week?
Smoking attitudes (1–7 scale: $\alpha = .91$, $M = 2.64$, $SD = 1.28$)	
1	What do you feel about people who smoke cigarettes? – smart
2	What do you feel about people who smoke cigarettes? – adventurous
3	What do you feel about people who smoke cigarettes? – good-looking
4	What do you feel about people who smoke cigarettes? – cool
5	What do you feel about people who smoke cigarettes? – popular
Smoking intentions (1–7 scale: $\alpha = .92$, $M = 2.54$, $SD = 1.96$)	
1	Do you think that in the future you might experiment with cigarettes?
2	Do you think you will smoke a cigarette at any time during the next year?
3	Do you think you will be smoking cigarettes five years from now?
4	If one of your best friends offered you a cigarette, would you smoke it?
Exogenous variables	
1	Gender (62.3% female)
2	Ethnicity (88% Caucasian)
3	Family smoking (42% yes)
4	Family or friends with smoking-related illnesses (41.5% yes)

Table 2

Indirect effects of expression of smoking-related messages on smoking outcomes via the presumed influence mechanism

Significant indirect path					Path coefficient	SE	BC bootstrap 95% confidence interval		
Expression of prosmoking messages	→	Perceived peer expression of prosmoking messages	→	Perceived peer smoking norms	→	Smoking attitudes	.01 [*]	.01	(.00, .02)
Expression of prosmoking messages	→	Perceived peer expression of prosmoking messages	→	Perceived peer smoking norms	→	Smoking intentions	.03 [*]	.01	(.01, .04)

Note: All the coefficients are standardized; BC = bias corrected; 5,000 bootstrap samples;

* $p < .05$.

Table 3

Indirect effects of reception of smoking-related messages on smoking outcomes via the presumed influence mechanism

Significant indirect path					Path coefficient	SE	BC bootstrap 95% confidence interval		
Reception of antismoking messages	→	Perceived peer reception of antismoking messages	→	Perceived peer smoking norms	→	Smoking attitudes	.02 *	.01	(.00, .04)
Reception of antismoking messages	→	Perceived peer reception of antismoking messages	→	Perceived peer smoking norms	→	Smoking intentions	.04 *	.02	(.01, .07)
Reception of prosmoking messages	→	Perceived peer expression of prosmoking messages	→	Perceived peer smoking norms	→	Smoking attitudes	.02 *	.01	(.00, .03)
Reception of prosmoking messages	→	Perceived peer expression of prosmoking messages	→	Perceived peer smoking norms	→	Smoking intentions	.04 **	.01	(.01, .06)

Note: All the coefficients are standardized; BC = bias corrected; 5,000 bootstrap samples;

* $p < .05$,
** $p < .01$.