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Counteracting the Influence of Peer Smoking on YouTube

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Abstract

YouTube, a popular online site for user-generated content, is emerging as a powerful source of peer modeling of smoking. Previous research suggests that in counteracting such influence, health messages may inadvertently increase the perceived prevalence of drug use (a descriptive norm) without reducing its acceptability (injunctive norm). This research tested the ability of health messages to reduce the social acceptability of peer smoking on YouTube despite enhancing its perceived prevalence. In an online experiment with 999 adolescents, participants were randomly assigned to view one of two videos: (a) a mosaic displaying a variety of YouTube videos of adolescents smoking followed by a message about the mortality risk to those smokers, or (b) a control video on a health topic unrelated to smoking. Although exposure to the adolescent YouTube smokers increased perceived prevalence among some participants, it simultaneously increased beliefs about smoking's adverse health outcomes and negative attitudes toward smoking, effects that were associated with reductions in injunctive norms of social acceptability. Interventions that communicate the severity and scope of health risks associated with smoking may undercut the descriptive normative effects of peer modeling of smoking on social media sites such as YouTube.

Keywords

peer modeling; social media; social norms; youth smoking; YouTube

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Conflict of Interest Statement
The authors have no conflicts to disclose.

Introduction

Efforts to restrict cigarette advertising, including regulation of media, have reduced depictions of youth smoking in traditional U.S. mass media (Duke et al., 2009; Pechmann & Shih, 1999). In 1964, the tobacco industry adopted the Cigarette Advertising Code, which was the first attempt to curtail marketing of tobacco to youth (Richards, Tye, & Fisher, 1996). Legislation such as the Federal Cigarette Labeling and Advertising Act, the Tobacco Master Settlement, and the Family Smoking Prevention and Tobacco Control Act placed further constraints on advertising and marketing of cigarettes (Cummings, 1997; Husten & Deyton, 2013; Jones & Silvestri, 2001). Currently, some media corporations (e.g., Universal Studios) and trade organizations (e.g., the Motion Picture Association of America) impose their own standards for depicting tobacco consumption that go beyond legal requirements (Centers for Disease Control, 2016a). However, recent changes in media consumption, particularly among youth, have led some to ask whether these advances are being undercut by the promotion of tobacco products on largely unregulated and socially popular internet sites such as YouTube (Elkin, Thomson, & Wilson, 2010; Freeman, 2012; Ribisl & Jo, 2012).

The popular, interactive social media site, YouTube, hosts user-posted videos and commentary. In a recent survey of teenagers, approximately 85% named YouTube their favorite source for video content (Defy Media, 2016). Content analyses of YouTube demonstrate that tobacco-related material is not only plentiful, but also predominately positive in its portrayal of tobacco use (Bromberg, Auguston, Backinger, 2012; Carroll, Shensa, & Primack, 2011; Davis et al., 2009; Elkin et al., 2010; Forsyth & Malone, 2010; Kim, Paek, & Lynn, 2010; Luo et al, 2014; Paek et al., 2014; Richardson & Vallone, 2014; Seidenberg et al., 2012). Included in this content are videos featuring young people smoking, a problematic behavior because modeling of smoking in popular media has been shown to increase tobacco consumption (Jamieson & Romer, 2014; Sargent et al., 2005; Villanti, Boulay, & Juon, 2011). A potential response to such problematic content is to place anti-smoking messages in the same medium. However, linking anti-smoking messages on YouTube to videos modeling smoking may have the undesirable effect of highlighting rather than downplaying the problematic behavior.

Experience in media campaigns designed to reduce adolescent drug use has shown that showing the behavior can backfire by making the drug seem more alluring and commonplace among peers (Fishbein et al., 2002; Hornik et al., 2008; Leshner, 2002). This possibility is especially worrisome because peer norms are among the determinants of substance use (e.g. Bentler & Speckart, 1979; Borsari & Carey, 2001; Hansen & Graham, 1991; Kobus, 2003; Prentice & Miller, 1993). Compounding the concern is the finding that peer norms about substance use can be influenced by exposure to online content (Litt & Stock, 2011; Moreno et al., 2011). In other words, an intervention that communicates the harms of smoking while simultaneously highlighting adolescents engaged in the behavior may inadvertently increase the perceived normativity of smoking. This is especially plausible in the case of online sites such as YouTube, where messages intended to serve as correctives might draw attention to rather than discourage the behavior.

Concerns about the potential adverse effects of online anti-smoking messages highlight the importance of distinguishing between descriptive and injunctive norms. According to the focus theory of normative influence (Cialdini, Kallgren, & Reno, 1991), descriptive norms are judgments about the extent to which a reference group (typically of peers) is commonly engaging in a behavior (e.g., smoking); whereas, injunctive norms are judgments about the extent to which the behavior is socially acceptable, either broadly or within a particular group. Although one might draw inferences about one from the other, descriptive and injunctive norms are potentially dissociable. For example, many behaviors discouraged by injunctive norms are nonetheless perceived as common, such as cheating amongst college students (Jordan, 2001). Because injunctive norms appeal to values that promote particular standards of behavior, they can stand in tension with descriptive conceptions of what people actually do.

According to the theory of presumed media influence (Gunther & Storey, 2003), persuasive media messages influence attitudes indirectly by changing perceptions of descriptive norms among peers. In one survey, the more adolescents reported exposure to anti-smoking messages, the more they inferred that their peers were influenced by those messages (Paek & Gunther, 2007). In another, the more adolescents reported exposure to pro-tobacco media, the greater their perceptions of peer smoking and the more positive their own attitudes toward the behavior (Gunther et al., 2006). In addition, although exposure to anti-tobacco content predicted perceived effects on peers, it was not sufficient to outweigh the effects of positive tobacco messages. Indeed, adolescents often over-estimate the prevalence of peer use of drugs, including cigarettes (Gibbons et al., 1995). These findings suggest that information about the hazards of smoking may not be able to overcome the stronger effects of favorable modeling of tobacco use.

Informational smoking prevention interventions often communicate smoking's negative health consequences (Davis, et al., 2008). However, a recent Cochrane review found only two studies that examined the effects of smoking prevention interventions on perceptions of descriptive norms (Carson et al., 2011). In that review, one study showed a decrease in perceptions of descriptive norms in the intervention condition and the other exhibited a nonsignificant increase. Nan and Zhao (2016) found that reported exposure to both cigarette ads and smoking in entertainment media were positively related to perceived prevalence among peers. However, even exposure to anti-smoking ads was *positively* related to perceived approval among peers, suggesting that those ads might have inadvertently conveyed this message. This body of work raises the possibility that YouTube videos showing adolescents smoking may adversely affect either descriptive or injunctive norms even if accompanied by a prevention message.

Research on social norms has led to the development of interventions to curb binge drinking in college students. The strategy behind these interventions corrects misperceptions about the prevalence of drinking by providing more accurate information about this behavior among peers. This approach has been met with mixed success, however, with some studies raising concerns about backfire effects (e.g. Perkins, Haines, & Rice, 2005). One reason these might occur is that for those who initially underestimated peer prevalence, the normative message could make the standard of behavior riskier. However, the same

descriptive information is less likely to be construed in that fashion if combined with a message supporting the injunctive norm that the behavior is socially disapproved. In the domain of energy conservation, Schultz and colleagues (2007) demonstrated that communicating injunctive norms can over-ride unwanted normalizing effects of purely descriptive information.

In this research, we examined the impact of pairing YouTube video clips modeling adolescent smoking with a strong corrective message emphasizing and visually reinforcing the severity of the health consequences of smoking to those individuals (i.e., their increased risk of mortality). Although this strategy presented the strong possibility of increasing the perceived prevalence of smoking, it also sent a message about smoking's health hazards, which should change beliefs about the harms of smoking and in turn, attitudes toward smoking and the social acceptability of the behavior. We hypothesized that (H1) adolescents exposed to the corrective video would perceive smoking as more common than when exposed to a video unrelated to tobacco, but that (H2) the corrective health message would counteract the negative aspects otherwise associated with changes in descriptive norms by enhancing injunctive norms against the behavior. Furthermore, we expected that (H3) the intervention would induce changes in mortality beliefs about smoking that would be associated with changes in attitudes toward smoking and injunctive norms.

Methods

Sample

The sample consisted of 999 adolescents aged 15–19 (m = 17.2, 44.2% male) who completed the study over the internet under the supervision of the survey firm SSRS (http://ssrs.com/). Participants were recruited from October to November, 2015 through two internet panel companies (Critical Mix and Federated Sample) that drew random samples from their respondent pools of English speaking US households with oversampling of respondent demographics that are underrepresented in online panels or have a higher likelihood of nonresponse. Both panels verify the name and address of panel members and provide incentives with a value of about $3 for participation. Of those invited to participate, 9.7% completed the study, a rate that is comparable to recent responses to telephone surveys of adults (Pew Research Center, 2012). Parental consent was obtained for all participants under the age of 18. The university Institutional Review Board approved the study.

Design

Participants were randomly assigned to one of two conditions differing only in the video that was presented. One condition included the treatment intervention of exposure to adolescents smoking followed by the corrective health message (video can be viewed here: https://youtu.be/juaTwcPoCUU). The other was a control video concerning the convenient aspects of preparing salmon but no tobacco message (https://youtu.be/xtjpYKHeLU4). Before exposure to these videos, participants completed items about their consumption of tobacco products. Following the video, participants completed the dependent measures and items concerning gender and racial-ethnic background.

Video Stimuli

The treatment video began with a 4-second mosaic of YouTube video segments showing sixteen instances of one to two young people smoking cigarettes. The segments were selected based on a search that found over 8,000 YouTube videos with tobacco related content that had at least 20,000 views. We randomly selected 200 of these videos for further analysis and located others that were developed by the same creators. After viewing the mosaic, the camera zoomed to a sequence of five of the videos showing each smoker for approximately five seconds. The YouTube username of each individual was displayed below their image. After this exposure to a concentrated round of peer modeling of smoking on YouTube, the health information intervention began. In it, spoken narration and corresponding text appeared over a dynamic background displaying a human figure's respiratory system that then zoomed into an animation of a metastasizing cancer cell. The message spoken as it appeared in print on the screen over the image said: *Every day, almost 3,900 people under 18 years of age try their first cigarette, and more than 950 of them will become new, regular daily smokers. Half of them will ultimately die from their habit (CDC, 2016b)*.

The control video, which was of comparable length, showed a man discussing the preparation and healthfulness of consuming salmon. This YouTube video was chosen because of its non-controversial message about health unrelated to tobacco consumption. Pretesting with a different sample of young people confirmed that participants' reactions to the presenter and his message in the video were unrelated to tobacco use attitudes.

Measures

Tobacco consumption—Because our corrective health message may have been less effective among users of tobacco, we assessed tobacco use prior to viewing the video with a series of items concerning consumption of cigarettes, chewing tobacco, hookah tobacco, pipe tobacco, cigars/cigarillos, and electronic cigarettes. For each, participants reported whether they had ever tried that product and, if so, whether they had used it in the past 30 days. When participants reported never having tried a particular tobacco product, we assessed susceptibility to doing so with three items shown in previous research to predict future tobacco use: how curious they were about the product, their likelihood of trying the product if a friend offered it to them, and how much, if at all, their closest friends used the product (Nordoro et al., 2014; Unger et al, 1997). If participants reported any evidence of current use of a tobacco product, they were asked if they had ever tried to quit using the product. Based on these responses, participants were assigned to a 5-point ordinal scale of tobacco consumption comprised of (1) never-users who reported no susceptibility, $n = 293$; (2) never-users who reported some level of susceptibility, $n = 347$; (3) ever-users who had not used a tobacco product in the past 30 days, $n = 113$; (4) current 30-day users who had tried to quit, $n = 123$; and (5) current 30-day users who had never tried to quit, $n = 123$. Cigarette users represented approximately 80% of the current tobacco users.

Smoking norms—Following exposure to either video, an item that assessed perception of the prevalence of tobacco consumption (descriptive norm) was asked: *Out of every 100 people your age, how many do you think use a tobacco product?* They responded on a 20-

point scale, ranging from 1 to 100 (cf. Gunther et al., 2006). To assess the social acceptance of smoking (injunctive norm), we asked the following items, each of which was answered on a four-point scale from (1) definitely yes to (4) definitely not: *Do you think smoking cigarettes makes young people look cool or fit in?* and *Do you think young people who smoke cigarettes have more friends than those who don't smoke cigarettes?* ($r = .66$, $p < .001$) (cf. Paek & Gunther, 2007). We averaged these z-transformed scores to create the measure of injunctive norms.

Mortality beliefs—The intervention specifically claimed that half of those who became regular, daily smokers would eventually die of smoking-related illness. Following exposure to the video, we assessed the influence of this information on tobacco-related mortality beliefs with two items: *What is the likelihood of dying if you have smoked cigarettes over an extended time? How many daily smokers ultimately die of a smoking-related illness*? The former included the response options ranging from (1) *not at all likely to* (5) *extremely likely* and the latter was assessed on a four-point scale with response options ranging from *none* to *75% or more*. The items were significantly related, $r = .22$, $p < .001$, and we averaged the z-transformed scores to provide a measure of mortality beliefs.

Smoking attitudes—In the post-test, as a measure of affective evaluations of cigarette smoking, participants responded to five 7-point semantic differential items with the anchors *bad/good*, un*enjoyable/enjoyable*, *unpleasant/pleasant*, *foolish/wise*, and *harmful/beneficial*. Factor analysis revealed that the items varied along a single factor, and we averaged the scores to create a composite of these items ($\alpha = .82$). Approximately 58% of participants uniformly rated cigarette smoking at the highest level of unfavorability. We therefore created a dichotomous score of 1 for those who rated cigarette use as completely unfavorable and 0 for those who rated it as less unfavorable.

Analysis

We first tested the effect of the intervention on our dependent variables using regression models including age, gender, racial-ethnic background, and current tobacco use. Interactions between these characteristics and outcomes were also examined. In addition to testing for effects of the manipulation on dependent variables, we tested a structural equation model (SEM) that examined whether the hypothesized effect of condition on injunctive norms was related to changes in descriptive norms, health beliefs, or attitudes. This analysis was implemented using the program MPlus (Muthen & Muthen, 2012), which allowed a test of the direct as well as indirect relations between experimental condition and outcomes using robust variance estimation procedures to compensate for non-normality in response distributions. We also included covariates if they were found to be related to outcomes in the initial analysis.

Results

Demographic and tobacco-use characteristics presented in Table 1 indicate that randomization was successful in that there were no significant differences between

conditions. Furthermore, the sample was balanced in gender and included a wide range of youth from different racial-ethnic backgrounds as well as tobacco use experience.

Table 2 presents the correlation matrix of predictors and dependent variables that were ultimately included in the SEM. Our first hypothesis (H1) concerned whether exposure to images of young smokers would increase perceived descriptive smoking norms. Although the overall relation was not significant, $r = .055$, $p = .08$ (see Figure 1A), subsequent analysis revealed an interaction indicating that Hispanic participants in particular perceived greater prevalence of peer smoking in the treatment condition, an effect that was significant (b = 10.07, $p = .02$). The analysis also revealed that female gender (b = 2.67, $p = .07$), age (b = 1.55, $p = .003$) and current tobacco use (b = 3.16, $p < .001$) were positively related to perceived smoking prevalence.

Exposure to the intervention produced stronger beliefs regarding the mortality effects of smoking, $r = .12$, $p < .001$. Here again, Hispanic participants in the intervention condition also reported stronger effects regarding these beliefs, b = .40, $p = .008$. In addition, current tobacco use (b = −.10, $p < .001$) was negatively related to these beliefs (see Figure 1B). Negative attitudes toward smoking were directly influenced by condition ($r = .07$, $p = .02$; see Figure 1C). In addition, a logistic regression revealed that both tobacco use (b = −.88, $p < .001$) and female gender (b = .59, $p < .001$) were related to these attitudes. Finally, as predicted by H2, the intervention produced less favorable injunctive norms regarding smoking ($r = −.12$, $p < .001$; see Figure 1D). However, the effect grew progressively stronger as current tobacco use increased (b = −.10, $p = .009$), indicating that youth currently using tobacco were more influenced by the intervention on this critical outcome. Female gender was also inversely related to injunctive norms, $r = −.11$, $p = .001$.

Our final hypothesis (H3) predicted that the message's effect on injunctive norms would be related to changes in beliefs about the harms of smoking and attitudes toward the behavior. Consistent with this hypothesis, both beliefs and attitudes toward smoking were inversely related to injunctive norms, r's = −.17, −.46, p's <.001, respectively. Following a preliminary analysis to identify nonsignificant paths, we tested the model in Figure 2, which provided a good fit to the covariance matrix ($X^2(14) = 19.6$, $p = .14$, $RMSEA = .020$, $CFI = .99$, $TLI = .98$) as well as accounting for a significant proportion of variability in beliefs ($r^2 = .04$), attitudes ($r^2 = .30$) and injunctive norms ($r^2 = .25$), all p's < .01.

As already noted, the intervention increased perceived descriptive norms among Hispanic youth, an effect that just missed statistical significance in the SEM (b = 6.18, $p = .068$). The intervention significantly enhanced mortality beliefs (b=.12, $p = .017$), and did so especially among Hispanic youth, b = .39, $p = .017$. Mortality beliefs were directly related to unfavorable attitudes toward smoking (b = .11, $p < .001$), and attitudes in turn were inversely related to the injunctive norm of perceived social acceptance (b = −.68, $p < .001$). There was also a direct relation between the intervention and injunctive norms (b = −.16, $p = .002$), indicating that mortality beliefs and attitudes did not fully account for the effect of the intervention. Nevertheless, in addition to the direct effect, the indirect relation between the intervention and injunctive norms that was associated with changes in beliefs and attitudes was significant (b = −.01, $p = .03$).

Descriptive norms were also positively related to mortality beliefs ($r = .11$, $p = .001$), suggesting that these judgments were related apart from the effects of the intervention. We tested alternative structures to determine whether the model would fit better if the relation between the two judgments were driven by one or the other, but the correlated model fit the best. In addition, we tested a model in which attitudes and injunctive norms were merely correlated rather than injunctive norms being dependent on attitudes, but this model did not fit better either.

Discussion

Because they are both prevalent and unregulated, depictions of young people smoking in popular social media such as YouTube pose challenges for tobacco control. Placing corrective messages in these media has the potential to mitigate the effects of such peer modeling. In this experiment featuring a large sample of adolescents ages 15 to 19, we paired examples of peer modeling of smoking taken from YouTube with a visually reinforced informational intervention that emphasized the mortality rates for smokers. Relative to a control condition, after exposure to the intervention, participants held stronger beliefs about smoking's negative health consequences, less favorable attitudes toward the behavior, and less favorable perceptions of its social acceptability (a change in an injunctive norm). This experiment asked whether such outcomes could be obtained despite the likelihood that showing the behavior would increase the perceived prevalence of smoking among youth. We observed a trend in the expected prevalence increase (i.e., stronger descriptive norm) in the sample as a whole, and a significant effect for Hispanic youth. Importantly, however, this change in perception of youth smoking prevalence was not accompanied by tendencies to view smoking as more socially acceptable—instead smoking was viewed as *less* so. An SEM analysis suggested that the intervention's effect on perceived injunctive norms was accompanied in part by changes in health beliefs and attitudes regarding cigarette use. Thus, our findings support the hypothesis that highlighting smoking behavior, which could invite the perception of increased prevalence of use, need not lead to greater perceptions of peer acceptance if health messages effectively communicate the danger to peers who engage in the harmful behavior.

The effect of the intervention on descriptive norms and health beliefs was most evident among Hispanic youth. One explanation for this outcome is that although the young people shown smoking in the intervention video were diverse in race and ethnicity, we inadvertently featured two youth (out of five) with Hispanic-appearing YouTube names (Elsealio, Israel Velasco). Research has suggested that non-white young people attribute greater effects of media representations of their own racial-ethnic identity to members of their own group than of representations of other identities (David, Morrison, Johnson, & Ross, 2002). This may well have accentuated both the risk and prevalence of smoking to Hispanic viewers. Future research might explore whether peer modeling of smoking is especially influential on perceptions of descriptive norms when the smokers' salient demographic characteristics match those of YouTube viewers.

One encouraging result is that prior tobacco consumption did not reduce the effects we observed on our outcomes. In the one case where we observed an interaction with tobacco

consumption, the effect of the intervention on injunctive norms was attenuated for youth who had not used any tobacco product. Nevertheless, those youth reported strongly unfavorable injunctive norms, while among those who had used tobacco, the intervention remained robust. One might anticipate that, because motivated reasoning could lead individuals to reject information inconsistent with their behavior (Kunda, 1990; Lord, Ross, & Lepper, 1979), those who used tobacco products might have exhibited a weaker effect of the intervention, as has sometimes been observed among smokers (Fotuhi et al., 2013; Halpern, 1994; Litz, Payne & Colletti, 1987). However, we found that the intervention affected tobacco users as well as nonusers. Indeed, the intervention enhanced beliefs and attitudes regarding the harms of cigarette smoking in ways noteworthy for their generality.

The adverse effects of enhancing peer perceptions of drug use in messages directed to youth has mainly been observed in campaigns against illicit drugs such as marijuana (Fishbein et al., 2002; Hornik et al., 2008; Leshner, 2002). We were only able to identify two interventions that examined changes in peer prevalence perceptions following interventions to prevent youth tobacco use (Carson et al., 2011). However, a large survey of adolescents regarding their exposure to both pro- and anti-smoking media found that anti-smoking ads might actually increase perceptions of peer acceptance of smoking (Nan & Zhou, 2016). It is also reassuring that current media campaigns funded by FDA (2016) and the American Legacy Foundation (Beer, 2015) do not feature images of youth smoking (but see this ad: https://www.fastcocreate.com/3049629/behind-the-brand/how-the-truth-campaign-plans-to-end-youth-smoking-once-and-for-all). Nevertheless, campaigns should assess both descriptive and injunctive norms as part of their evaluations to ensure that they do not produce inadvertent and counterproductive effects on these important outcomes.

The primary theoretical contribution of this research is to highlight the importance of distinguishing between descriptive and injunctive norms in the context of tobacco control. Not only are they conceptually and empirically distinct, but we found that the intervention exerted opposing effects on these two outcomes. Our findings extend the results of Schultz and colleagues (2007), in which information about a descriptive norm produced unintended effects (i.e. increasing energy consumption in those who initially consumed less) that were eliminated when descriptive information was combined with a message emphasizing the injunctive norm that energy conservation is socially desirable. Our results show that the problematic consequences of enhancing a descriptive norm about peer smoking can be counteracted by providing information that despite its prevalence, the behavior is hazardous to health.

It is also worth noting that prominent theories of health communication do not consider the effects of health beliefs and attitudes on injunctive norms. Gunther's model of health messages proposes that they exert their effects primarily by changing perceptions of peer prevalence and by implication their acceptance of those messages. However, the model does not consider the possibility that descriptive and injunctive norms can be differentially influenced by health messages. The theory of planned behavior (Fishbein & Ajzen, 2010) treats attitudes and norms as separate factors influencing behavior and does not consider how beliefs and attitudes might influence injunctive norms. The model we identified in Figure 2 fit our results but must still be regarded as preliminary and subject to further tests.

Given the importance of normative change in influencing behavior (Nyborg et al., 2016) and its success in reducing smoking among both youth and adults (Zhang, Cowling, & Tang, 2010), our findings suggest that it would be valuable to consider how changes in beliefs and attitudes can influence both types of norms.

Our research has some limitations. First, we exposed youth to a mosaic of peer modeling, which is potentially more impactful than what they might encounter on a single visit to YouTube. This mosaic also removed other content that appears on YouTube and that might compete with the video. Nevertheless, our findings suggest that even with such a concentrated exposure, the informational intervention was able to overcome pro-smoking effects associated with the perceived prevalence of peer smoking. Our design did not allow us to separate the effects of peer modeling absent a smoking prevention message. Because we felt a condition with only images of peer smoking would be ethically questionable given our adolescent audience, we did not test this in a separate condition. Furthermore, we believed that the condition presenting both peer models and health information would fulfill the aims of the study.

Our control video was selected to be unrelated to tobacco use but a potentially more sensitive control could have shown youth engaging in safe activities unrelated to tobacco use (e.g., exercise). We did not use such a video out of concern that it might inadvertently influence perceptions of youth prevalence of tobacco use.

Our internet sample may not generalize to all youth, and in particular the effects may differ by local jurisdictions depending on whether they restrict the purchase of cigarettes to those over age 20. Finally, our findings are only applicable to cigarette smoking, since the peer modeling and health message were directed toward this behavior. Thus, it is not possible to draw conclusions about how participants felt about other tobacco products, which are now gaining in popularity (Arrazola, et al., 2015). Future research should examine the ability to correct misinformed beliefs about the harm that may be associated with these products. Despite these shortcomings, our experimental design had the advantage of focusing specifically on the youth population, spanning both genders and including a wide range of both racial-ethnic backgrounds as well as tobacco use.

Although we did not directly test the use of corrective messages placed alongside actual problematic YouTube videos in a real world setting, our findings suggest that placing such health messages with YouTube videos of youth smoking could be an effective way to counteract peer modeling of smoking on this and other social media sites that feature user-generated content. Our findings suggest that this strategy would be worth pursuing. Notably, because the intervention was constructed to be compatible with the YouTube medium, it is possible to construct and position similar interventions such that exposure co-occurs *with specific smoking-related content identified as potentially problematic*. Thus, these results support the testing of similar informational interventions that communicate the negative health consequences of smoking to accompany peer modeling of smoking on the internet. The proliferation of problematic pro-tobacco content on YouTube and other unregulated social media popular with youth will require such efforts to reframe explicit and implicit

pro-tobacco messaging and to mitigate their effects. On the positive side, it is possible to do so at relatively little expense in comparison to placing interventions in traditional media.

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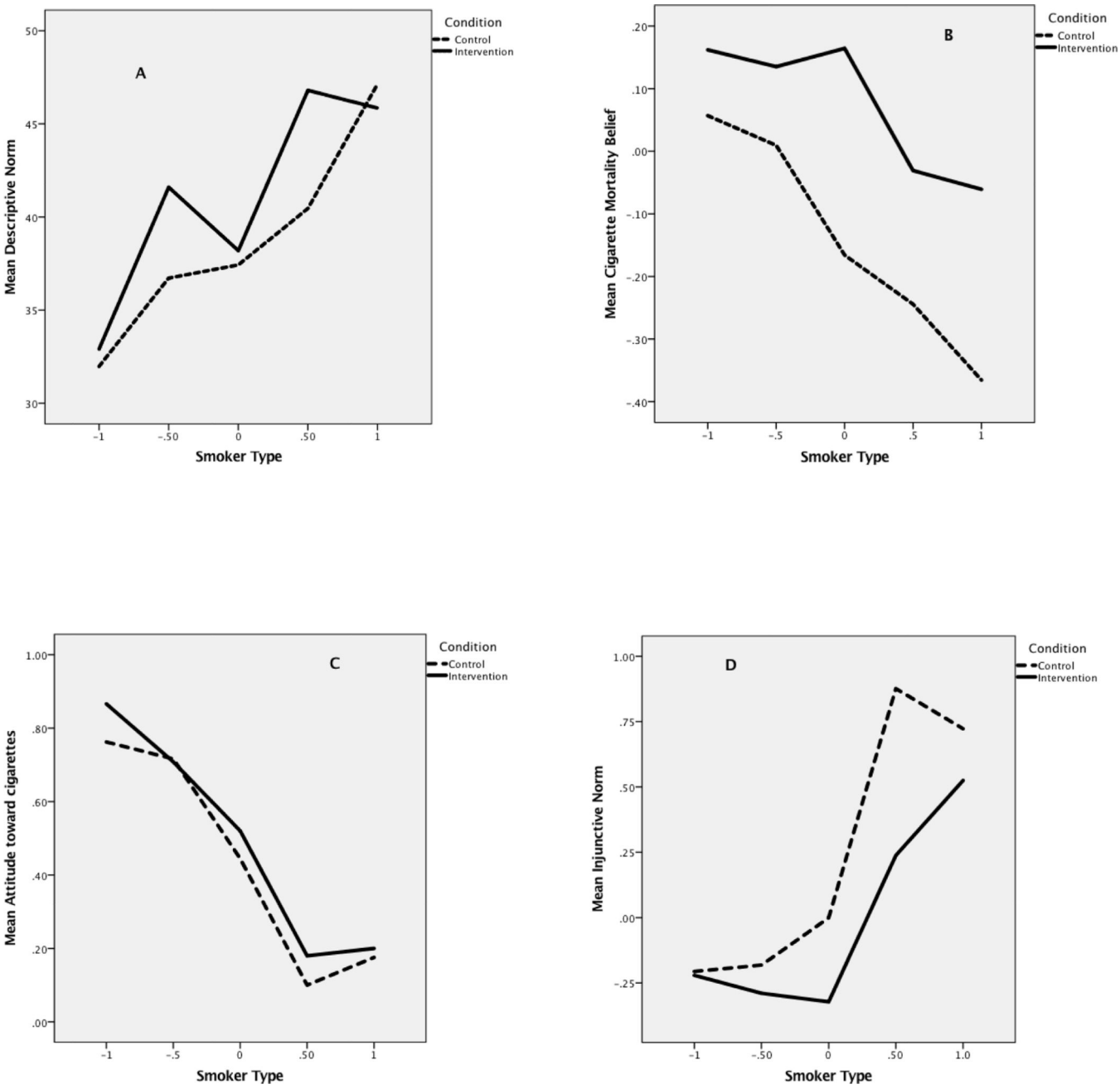

Figure 1.

Mean responses to intervention vs. control for (A) descriptive norms, (B) mortality beliefs, (C) attitudes against smoking, and (D) favorable injunctive norms.

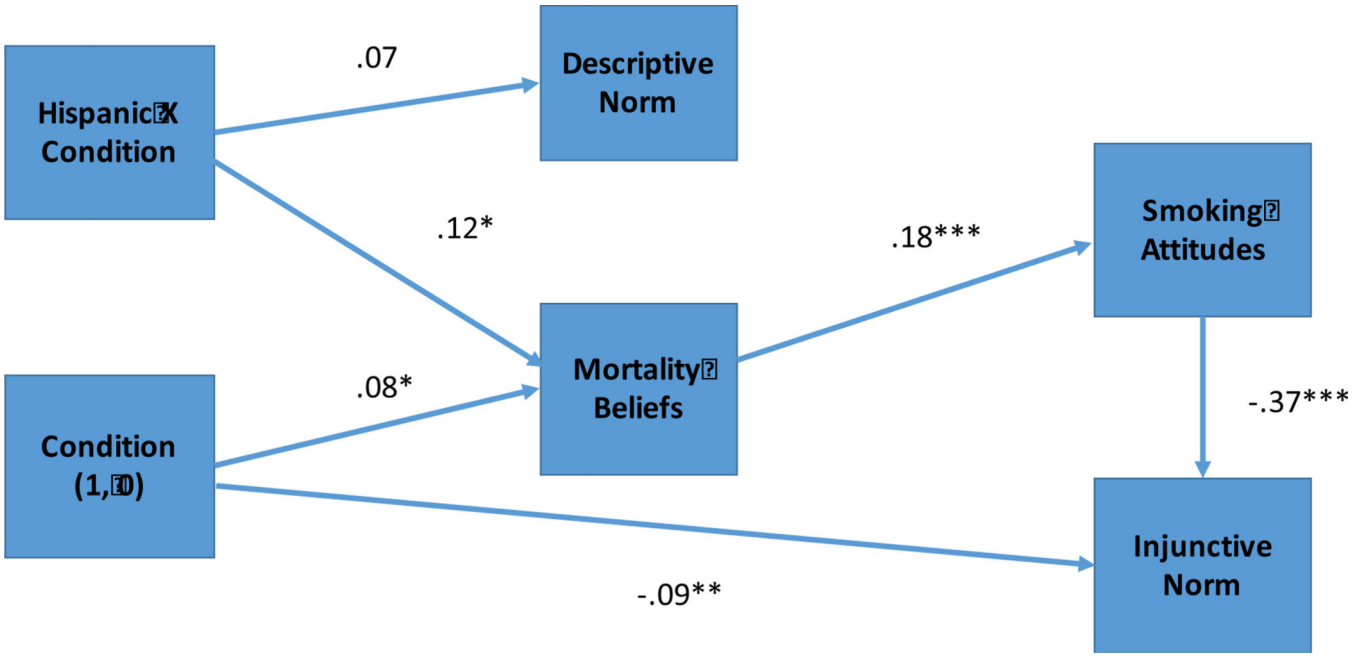

Figure 2.

Results of SEM with standardized path coefficients (Condition = 1 for intervention). Path coefficient significance levels: * $p < .05$, ** $p < .01$, *** $p < .001$. Path between Hispanic X Condition to Descriptive Norm, $p = .068$. Correlation between Descriptive Norm and Mortality Beliefs (not shown) was $r = .11$, $p = .001$. Gender and current smoking predictors not shown.

Table 1

Demographic and tobacco use characteristics by condition.

Characteristic	Intervention (N=500)	Control (N=499)	X^2 test *p*-value
Gender			
Male	42.2	47.1	.12
Female	57.8	52.9	
Age			
15	16.8	20.0	.30
16	17.0	15.8	
17	16.6	20.0	
18	25.4	22.4	
19	24.2	21.6	
Race-Ethnicity			
Non-Hispanic White	72.1	74.0	.72
Non-Hispanic Black	12.7	8.0	.10
Non-Hispanic Asian	5.3	7.4	.24
Hispanic	12.7	12.7	.99
Other	3.5	2.8	.66
Tobacco Use			
Never Used/Not Susceptible	30.0	28.7	.10
Never Used/Susceptible	37.0	32.5	
Tried by not Current User	10.0	12.6	
Current User/Tried to Quit	10.0	14.6	
Current User/No Quit Attempt	13.0	11.6	

Note: Because racial-ethnic classifications could overlap, tests were conducted separately for each category.

Table 2

Intercorrelations, means and standard deviations of main study variables.

Variable	1	2	3	4	5	6	7	8	9
1. Condition									
2. Mortality Beliefs	**.115**								
3. Descriptive Norm	.055	**.097**							
4. Attitude toward Cigarettes	*.073*	**.258**	*−.073*						
5. Injunctive Norm	**−.116**	**−.172**	.041	**−.457**					
6. Female Gender	.049	.062	.058	**.150**	**−.108**				
7. Tobacco User Type	−.034	**−.144**	**.187**	**−.502**	**.357**	**−.084**			
8. Hispanic Ethnicity	.000	−.020	.016	−.009	.003	.016	−.006		
9. Hispanic X Condition	**.260**	*.073*	*.075*	.002	−.005	.034	−.004	**.683**	
Mean	.50	.012	38.5	.58	−.01	1.55	−.06	.13	.06
Standard Deviation	.50	.797	22.9	.49	.90	.50	1.34	.33	.24

Notes: Condition = 1 for intervention and 0 for control. Correlations in bold represent $p < .01$, and in italics, $p < .05$.

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