Original Investigation

Evaluating Depressive Symptom Interactions on Adolescent Smoking Prevention Program Mediators: A Mediated Moderation Analysis

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Abstract

Introduction: Smoking prevention interventions have been shown to be effective in reducing smoking prevalence in the United States. Further work is needed to address smoking in China, where over one third of the world's current smokers reside. China, with more than 60% of the male population being smokers, also presents a unique opportunity to test cognitive processes involved in depression, social influences, and smoking. Adolescents at-risk for developing depression may process social information differently from low-risk counterparts.

Methods: The Wuhan Smoking Prevention Trial was a school-based longitudinal randomized controlled trial aimed at preventing initiation and escalation of adolescent smoking behaviors. Thousand three hundred and ninety-one male seventh-grade students were assessed with a 200-item paper-and-pencil baseline survey, and it was readministered 1 year later following program implementation.

Results: Friend prevalence estimates were significantly higher among 30-day smokers and among those at highest risk for depression symptoms. The program appeared to be successful in changing the perception of friend smoking prevalence only among adolescents with a comorbidity of high scores of depression symptoms and who have experimented previously with smoking. This Program × Comorbidity interaction on perceived friend smoking prevalence was significant in predicting 30-day smoking 1 year after program implementation.

Conclusions: This study provides evidence that those adolescents with high levels of depressive symptoms may be more sensitive to social influences associated with smoking prevalence. Individual Disposition \times Social Environmental Influences may be important when developing future effective prevention programming.

Introduction

Adolescents learn the rules of social engagement and choose behaviors based on their assessments of their social or peer environments (Bos, Sandfort, de Bruyn, & Hakvoort, 2008; Deb, Mitra, & Mukherjee, 2001; Makri-Botsari, 2005; Nelson, Leibenluft, McClure, & Pine, 2005). Smoking during adolescence is a prime example of how peers influence behavior (Kobus, 2003). Evidence-based smoking prevention programs target these social influences by changing perceptions of smoking prevalence, changing prosmoking norms and beliefs, and increasing the perception that smoking is not positively viewed by their peers (Chou et al., 2006; Graham, Marks, & Hansen, 1991; Hansen & Graham, 1991).

There has been some debate as to whether social influences prevention programs are generally effective (Botvin, Sussman, & Biglan, 2001; Peterson, Kealey, Mann, Marek, & Sarason, 2000; Sussman, Hansen, Flay, & Botvin, 2001; Thomas, 2002). The literature has shown long-term effects in the prevention of substance use (Skara & Sussman, 2003; Thomas & Perera, 2006; Tobler et al., 2000), but more importantly, there has been great advancement in the understanding of how these programs work and for whom (Graham et al., 1991; Hansen & Graham, 1991; Johnson et al., 2007; MacKinnon & Luecken, 2008; Sun et al., 2007; Unger et al., 2004). Yet, while these studies show that programs' main effects differed across subgroups, they do not account for the mechanisms that produce program differences between at-risk subgroups, such as those who score high or low on depression risk.

Depression appears to be a particularly robust risk factor for adolescent smoking (Audrain-McGovern, Lerman, Wileyto, Rodriguez, & Shields, 2004; Fergusson, Goodwin, & Horwood, 2003; Goodman & Capitman, 2000; Munafo, Hitsman, Rende, Metcalfe, & Niaura, 2008; Waller et al., 2006; Wang et al., 1996). Prevention programs may be particularly powerful among this high-risk group, and understanding the mechanisms behind this

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relationship might provide valuable insight for future prevention program development. In a randomized control trial conducted in the United States, a culturally tailored social influences-based smoking prevention program was delivered to seventh-grade adolescents and was found to be successful at one-year follow-up. Program effects were found to vary by cultural context (Unger et al., 2004). There was also evidence that the effects of the program were strongest among those with high scores on depression symptoms (Johnson et al., 2005). Another randomized controlled trial that implemented a social influences-based program found the program to be most effective among males who had higher scores of depression symptoms and who had previously experimented with cigarette use (Sun et al., 2007). The program effect for these high-risk males was 4.2 times (95% CI: 1.45-11.76) larger than that among their low-risk counterparts. However, it was not clear why the program worked especially well in the high-risk subsample or why depression risk and smoking might render one especially receptive to social influence messages.

The current study examined the relationships between depression symptoms, social influences, and smoking in the context of a social influences–based prevention program designed to manipulate smoking-related cognitions. This analysis tested hypothesized mechanisms responsible for the stronger program effects observed for those with higher depression scores and who may have previously experimented with cigarettes (Sun et al., 2007).

The relationship found between depression and smoking may, in part, be attributable to social influence factors, such as perceived prevalence of friend smoking and prosmoking normative beliefs (e.g., peers think smoking is cool). Other studies also provide support for this hypothesis. One study demonstrated that among those adolescents who reported that most of their friends smoked, depression and anxiety increased the risk of becoming a smoker by almost three times (Patton et al., 1998). Another cross-sectional study found that adolescents who scored high on advertising receptivity and depressed moods were most vulnerable to experimenting with smoking (Tercyak, Goldman, Smith, & Audrain, 2002). Risk was even greater when exposed to peer smoking. The most interesting finding from the latter study was that the effects of advertising on smoking behavior were heightened among depressed adolescents but being exposed to other smokers (e.g., family, peers) by itself did not increase the risk for being a smoker. This suggests that simply being around others who smoke may not increase the risk of smoking onset for depressed adolescents. Rather, the increased risk may be due to how depressed adolescents perceive smoking, such as providing positive attention from peers or as providing more overall interaction with peers. Normative information from advertising, from social contexts, or from peer interactions may influence smoking behaviors, and among depressed adolescents, it may strengthen that influence.

Cognitive theories of depression (see Lakdawalla, Hankin, & Mermelstein, 2007) generally support the hypothesis that perceptions of social normative beliefs (e.g., what attributes smoking will bring to the individual or what attributes the individual believes others see in smokers) and perceptions of friend use prevalence (e.g., how many of their friends smoke or approve of smoking) may be heightened in a depressed individual because of the potential for rejection or acceptance by peers.

Depressed individuals may be sensitive to these cues in the environment and may be more motivated to act in a way that might bring them elevated standing among their peers.

The current study investigated the relationships between depression symptoms, social influence, and smoking in a longitudinal cohort and is the first, to our knowledge, that utilized a randomized trial to isolate and test whether changes in targeted social influence perceptions (via social influence smoking prevention program) will change smoking behavior among those with high scores of depression. If depressed adolescents are more aware of cues in their social environment, then a program aimed to change or correct perceptions would be more influential and result in greater changes in behavior for them than for their nondepressed counterparts. Cognitive theories of depression suggest that individuals with depression perceive or process social information differently than those who are not depressed. Therefore, we tested the hypothesis that the relationship between program and social influences (i.e., perceived friend prevalence) would be stronger among those who score high on depression symptoms and current experience with smoking compared with those with lower scores. The combination of depression symptoms and experience with smoking provide these high-risk individuals with a context to compare their perceptions with the normative corrections provided by the smoking prevention program. Without this context, there may not be enough information to motivate the high-risk individual to change their behavior in one direction or another.

Methods

Sample Selection

The Wuhan Smoking Prevention Trial (WSPT) was a school-based longitudinal randomized controlled trial aimed at preventing initiation and escalation of adolescent smoking behaviors (Chou et al., 2006). Wuhan is the capital of Hubei Providence in the People's Republic of China. Wuhan is the most populous city in central China with over 9 million residents. Middle schools were randomly selected from each of the seven urban districts within the city of Wuhan, and then, additional schools within each district were matched on school size, teacher/student ratio, and academic rankings to create pairs. One school from each pair was then randomly selected to program or control conditions (see Unger et al., 2001). Seventh-grade students were assessed with a 200-item paper-and-pencil baseline survey prior to program implementation in 1999 and were readministered one year later.

The current analytic sample was limited to males (mean age =12.6 years, SD=0.67) with complete Wave 1 (baseline) and Wave 2 (one-year follow-up) data. A social influences smoking prevention program was implemented after the administration of Wave 1 data collection but before Wave 2 data collection. All study protocols were approved by the Institutional Review Boards of the University of Southern California (USC) and the Wuhan Center for Disease Control and Prevention. All participants were actively consented.

Curriculum

The intervention condition of the WSPT received a 14-session 45-min classroom-based social influences program. The WSPT

curriculum was based on substance abuse prevention program named Project SMART, which was found to be effective in Southern California, Kansas/Missouri, and Indiana (Graham, Johnson, Hansen, Flay, & Gee, 1990; Hansen et al., 1988; MacKinnon et al., 1991; Pentz et al., 1989). Project SMART and the WSPT program aimed to foster an antismoking social norm among adolescents and present the serious social and physical consequences of smoking (Chou et al., 2006). Translation, tailoring, and piloting of curriculum components were done to enhance the relevance of the WSPT program to Chinese adolescents (see Sun et al., 2007). All sessions were delivered by trained health educators from the Wuhan City Center for Disease Prevention and Control, with support and guidance from the USC Institute for Health Promotion and Disease Prevention Research and Project SMART health educators. Program schools were compared with standard care control schools.

Measures

Smoking

Thirty-day prevalence was assessed by asking "Think about the last 30-days. On how many of those days did you smoke cigarettes?" ($0 = smoked < 1 \ day$ in the past month and $1 = smoked \ at$ least $1 \ day$). The reference group for thirty-day smokers may include those individuals who have never smoked, quit smoking (smoked but quit smoking prior to the last thirty days), or tried smoking (experimented or puffed a few times but not within the past thirty days).

Depression

Depression was assessed at Wave 1 with four items that asked students "Have you felt depressed in the last week?", "Have you felt alone in the last week?", "Have you felt sad in the last week?", and "Have you felt like crying out in the last week?". Response choices ranged from (1) *never* to (4) *often*, with higher scores indicating higher symptoms of depression. The depression score was the mean of the four items with the standardized Cronbach's alpha = .76, indicating satisfactory internal consistency. A pilot study conducted with Chengdu, Wuhan, and Qingdao 10th-grade adolescents (n = 1,388) showed a correlation of .74 between this 4-item scale with the 20-item Center for Epidemiological Studies Depression Scale (CES-D; Radloff, 1977, 1991). Depression was dichotomized, with those who scored at the top 20% of symptoms (score \geq 2.5) coded as being high risk for depression (1) versus low risk (0).

Comorbidity

Comorbidity of depression risk and smoking was assessed by taking the product of high depression score (high risk = 1) and Wave 1 thirty-day smoking (smoke = 1). If an individual had high risk of depression and had smoked in the past thirty days, then they were coded as having a comorbidity (CoM = 1) versus all others (CoM = 0).

Perceived Friend Prevalence

Friend prevalence was assessed by first priming students by asking them how many male/female friends they have and then, of those friends, the number of friends they think have smoked in the past. The mean number of male and female friends who smoke was used for the perceived friend prevalence variable. Friend prevalence estimates were significantly higher among thirty-day smokers (t value = -10.38, p < .0001) and among those at highest risk for depression symptoms (t value = -3.60, p < .0004).

Demographic Measures

General measures such as age, weekly allowance, academic performance, grade, and class/school attended were also collected.

Data Analysis

Linear and logistic models were used to test the study hypotheses. Statistical package and procedures, SAS 9.1 Proc GLM and Proc Logistic, were used for analyses.

Attrition Analyses

The propensity score analysis technique (Austin, Grootendorst, & Anderson, 2007; Grunkemeier, Payne, Jin, & Handy, 2002) was used in prior reports on this cohort (Sun et al., 2007) and duplicated in this study in order to statistically control for possible bias due to unbalanced attrition between the intervention conditions. Propensity for attrition scores was estimated for each participant from logistic regression on boys who participated in the Wave 1 survey. Age, number of days smoked in the last thirty days, academic performance, weekly allowance, hostility, depression, and program condition were used to predict attrition status (whether participants were reassessed one year later). Only academic performance and weekly allowance were found to be significant predictors of one-year attrition. The propensity for attrition score was calculated by regressing attrition on program, gender, Program × Gender, age, depression, thirtyday smoking status, education, academic grade, and weekly allowance. The scores from this model ($\hat{y} = attrition$) were output to create the propensity for attrition score. This propensity for attrition score was treated as a confounder in the analyses so that the estimated program effect could be interpreted as if there were balanced attrition rates between the program and control conditions (Graham & Donaldson, 1993; Hansen, Tobler, & Graham, 1990).

Mediated Moderation Analysis

Understanding mediation in the presence of a moderator is complex. A mediated moderation effect is present when the effect of an interaction on a dependent variable is mediated. For example, the effect of a program (X) depends on the presence of the comorbidity (Z), which changes perceived prevalence (M) and, in turn, affects smoking behavior (Y). The current study utilized the framework proposed by Muller, Judd, and Yzerbyt's (2005) to assess the presence of a mediated moderator pathway. Three conditions must be met for mediated moderation to be established as a pathway. First, the interaction between the independent variable (X: program) and moderator variable (Z: comorbidity) on the dependant variable (Y: smoking) must be significant, indicating an overall moderated treatment effect. Second, one of two patterns or both patterns should be present: (a) the interaction between the independent variable and moderator variable $(X \times Z)$ on the mediator variable (M: perceived prevalence) and the path between the mediator variable on the outcome variable (Y) must both be significant or (b) the independent variable (X)on the mediator variable (M) and the interaction between the mediator variable and moderator variable $(X \times Z)$ on the outcome variable (Y) must both be significant. Third, the interaction between the independent variable and moderator variable $(X \times Z)$ on the dependent variable (Y) should lose significance (compared with the first condition) when the mediator (M) and the interaction between the mediator and moderator $(M \times Z)$ are included in the regression model. Figure 1 graphically represents the model that was tested.

In building the mediated moderation models, Wave 1 thirty-day smoking and Wave 1 perceived friend smoking prevalence were included in the model to adjust estimates, so it would account for baseline levels of these measures and attribute changes to program effect. School and propensity for attrition scores were also added as control variables in all models.

Results

The sample characteristics and attrition analyses are presented in Table 1. There were 1,391 males surveyed at Wave 1 and 1,248 were successfully retained for Wave 2 assessment (90% retention rate). Attrition was significantly higher in the program group (13.1% vs. 7.5%; $\chi^2 = 11.58$, p < .0007). There was also greater dropout between Waves 1 and 2 for ever-smokers, thirty-day smokers, those with comorbidity status, and those who had perceived higher friend use (see Table 1). In a logistic regression model predicting attrition, the Treatment Condition × Thirty-Day Smoke interaction was not statistically significant ($\beta = .89$, SE = .48 p = .07), suggesting that there was no differential attrition of smokers between conditions.

Mediated Moderation Analyses

The overall program effect on thirty-day smoking at Wave 2, after controlling for Wave 1 smoking, propensity for attrition, and school, was statistically significant ($\beta = 1.63$, SE = .75, p = .03). The interaction between program and CoM risk was also significant ($\beta = -1.39$, SE = .66, p = .04) and fulfilled the first condition of mediated moderation analysis.

The interaction between program and CoM risk was significant (β = -1.20, SE = .49, p = .01) in predicting Wave 2 perceived friend use prevalence, after controlling for Wave 1 perceptions, propensity for attrition, and school. Interpretation of the beta suggests that the treatment effect reduces perceived friend use as CoM risk increases. The Wave 2 perceived friend use prevalence on Wave 2 thirty-day smoking (β = .293, SE = .04, p < .0001) was also significant, fulfilling the second condition of mediated moderation analysis (see Table 2).

Finally, the third condition of mediated moderation analysis is for the interaction between program and CoM $(X \times Z)$ to be smaller in magnitude in Model 3 compared with Model 1 (see Table 2).

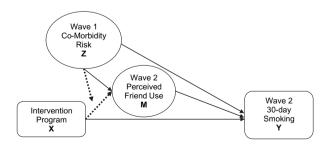


Figure 1. Mediated moderation model. Notes: X = independent variable; Y = dependent variable; M = mediator; and Z = moderator. Dotted lines indicate $X \times Z$ pathway or mediated moderation pathway as hypothesized.

Table 1. Sample Characteristics and Attrition Analyses

	Wave 1 males, $(n = 1,391)^a$	Wave 2 males, $(n = 1,248)$	$\frac{\text{Attrition}^{\text{b}}}{p \text{ value}}$	
	n° (%)	n (%)		
Treatment condition				
Program	688 (50.5)	598 (86.9)	.0007	
Control	703 (49.5)	650 (92.5)		
Wave 1 lifetime smoker				
Yes	604 (43.4)	532 (42.6)	.08	
No	787 (56.6)	716 (57.4)		
Wave 1 thirty-day smoker				
Yes	282 (20.3)	243 (19.5)	.03	
No	1,108 (79.7)	1,004 (80.5)		
Wave 1 depression scored				
High risk (score ≥ 2.5)	253 (18.2)	223 (17.9)	.37	
Low risk (score < 2.5)	1,136 (81.7)	1,023 (82.0)		
Wave 1 comorbidity ^e				
Yes	74 (5.3)	60 (4.8)	.01	
No	1,314 (94.5)	1,185 (95.0)		
	Mean (SD)	Mean (SD)	p value	
Wave 1 perceived friend use ^f	.78 (1.8)	.74 (1.7)	.03	

Note. ^aThe n's above each column denotes the number of males within each wave.

^bAttrition refers to the chi-square or *t* test significance test for group differences between males with complete data (W1 and W2) and males with W1 only data due to loss across each variable of interest.

'The *n*'s and percentages listed under each column refer to the sample for each variable within each wave.

^dDepression score: mean of four items with response choices ranging from 1 = never to 4 = often and dichotomized into high risk = top 20% of scores versus low risk = all others.

 $^{\circ}$ Comorbidity status represents individuals who were at high risk for depression (depression score = 1) and were smokers at Wave 1 (thirty-day smoker = 1).

^fPerceived friend use: number of friends they think have smoked in the past (0 = none and 1 = one friend to 12 = 12 or more).

The results indicate that this is indeed the case ($\beta = -1.29$, SE = .70, p = .07 vs. $\beta = -1.39$, SE = .66, p = .04), and although the estimate loses significance, the magnitude changed by 8%, indicating a modest mediated moderation effect. The absence of a significant interaction of CoM on the path between perceived friend prevalence ($M \times Z$) and smoking ($\beta = -.06$, SE = .14, p = .64) suggested that the effect of perceived prevalence on smoking was similar across CoM groups. The program still appears to have a residual direct effect on smoking ($\beta = 1.98$, SE = .79, p = .01).

Discussion

This study examined the mechanisms between personal dispositions and smoking prevention program effects with specific regard to social influence processes. A comorbidity between smoking and depression symptoms may place an individual at increased risk for further disease development above and beyond any single morbidity (Sun et al., 2007). The overall moderated program effect was reported previously (Sun et al., 2007);

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	Model 1ª			Model 2			Model 3		
	DV: Wave 2 thirty-day smoking ^b		DV: Wave 2 perceived friend prevalence ^c		DV: Wave 2 thirty-day smoking				
Independent variable	β	SE	P	β	SE	p	β	SE	p
Intercept	-2.91	0.40	<.0001	.001	0.26	.99	-3.08	0.42	<.0001
C: Wave 1 thirty-day smoking	1.68	0.21	<.0001				1.46	0.23	<.0001
C: Wave 1 perceived friend smoking				0.25	0.03	<.0001	0.08	0.05	.11
X: Program ($Tx = 1$ and control = 0)	1.63	0.75	.03	0.09	0.31	.77	1.98	0.79	.01
Z: Comorbidity (CoM)	0.96	0.53	.07	1.33	0.39	.0007	0.85	0.57	.14
XZ : Program \times CoM	-1.39	0.66	.04	-1.20	0.49	.01	-1.29	0.70	.07
M: Wave 2 perceived friend smoking prevalence							0.29	0.04	<.0001
MZ: Wave 2 perceived friend smoking prevalence × CoM							-0.06	0.14	.64

Note. C = control variable; DV = dependent variable; M = mediator variable; X = independent variable; Z = moderator variable; MZ = interaction between independent and moderator variable.

however, in this context, it may provide further information as to how an individual might perceive information regarding pro smoking norms. We may speculate that the program, which aims to change prosmoking cognitions, provided an alternative source of social information about smoking to students. Those students who are sensitive to how they might fit in with their peers and, as we hypothesized this group to be, those with high levels of depression symptoms may more readily adopt the social information provided to them by the program. Students with depression and smoking comorbidity may be more attuned to the corrections presented by the curriculum. Unlike their depressed counterparts who have never experimented with smoking, they may have the experience to know that smoking does not necessarily make one popular or cool or bring more positive attention from peers; thus, they would be able to confirm the messages presented in the curriculum and change their behavior accordingly to avoid further possible peer rejection.

The most important and novel contribution to prevention literature is the mediated moderated findings. Evidence suggests that the program changed perceptions of perceived friend use prevalence as intended but only for those with a comorbidity of high depression symptoms and prior smoking. The magnitude of the overall treatment effect on smoking behaviors depends on the presence of the CoM, and the mediating process that is responsible for that moderation lies in the social influence variable being manipulated by the program. To simplify, the program was able to change perceptions among those with CoM, and those changes were responsible for changes in smoking behavior. This finding is especially important in future curriculum development in which smoking or other socially driven behaviors are the main outcomes of interest. Gene × Environment (social, physical, etc.) interactions need to be considered when developing future hypotheses to test and in designing interventions since those interactions may drive the success or

failure of the program if the mediators and pathways are not specified well (Johnson et al., 2007).

Depressed adolescents may be easily influenced and conform to the values and beliefs of those they identify as friends or closest peers (Katkin, Blum Sasmor, & Tan, 1966). If their referent group endorses deviant behaviors, then depressed adolescents may be more likely to engage in those behaviors for the added benefit of (perceived) acceptance (Besic & Kerr, 2009). These analyses suggest that depressed individuals can also be influenced by prevention program messages that manipulate perceptions of smoking prevalence. Studies that assess conformity and decision making under peer influence among depressed adolescents will contribute greatly to understanding the social and cognitive mechanisms involved in behavior choice.

Limitations and future directions

There are several limitations to the findings of this study that warrant discussion. Despite randomized assignment at the school level, the conditions were unbalanced. Initial analyses controlled for the unbalanced conditions by using a mixed model and indicated school intercepts as a random effect. However, models would not converge. Thus, we reverted to logistic and linear regression models and controlled school as a covariate. By doing so, we run the risk of a Type I error, so the results presented here should be interpreted with great caution. Future studies may need to oversample for high-risk adolescence to test specific hypothesized pathways and great care should be taken to confirm balanced randomization to treatment conditions.

Differential attrition was also present in this study. Although we controlled for attrition by producing a propensity score and treating it as covariate in all our modeling, we made assumptions based on literature and exploratory analyses as to which

^aAll models controlled for attrition propensity score and school.

^bThirty-day smoking represents the number of smokers who indicated they smoked in the past thirty days within the indicated wave (1 = yes and 0 = no).

Perceived friend prevalence represents the number of friends they believe smoked in the past thirty days (0 = none to 12 = 12 friends or more).

variables may have contributed to dropout. There may be another unmeasured factor that would bias dropout rate and thereby bias our study results. Thus, caution is necessary in interpreting and generalizing these study findings. Future studies will need to focus on reducing dropout or where warranted, appropriate imputation should be conducted.

These analyses were conducted only among males in mainland China; thus, these results may not be generalizable to any other population. Future studies will need to test the cross-cultural validity of the pathways being tested here. It may be that Chinese adolescents are more adept at recognizing social cues since their collectivistic culture encourages social harmony (Bond & Smith, 1996; Triandis, 1995). Furthermore, depression in China may manifest differently or may have a different meaning from other western populations (Parker, Gladstone, & Tsee Chee, 2001; Ryder et al., 2008; Song et al., 2008). Future cross-cultural studies will need to assess differences in depressive symptomatology and social influences.

These results indicated that perceptions surrounding friend use prevalence were changed among the high-risk comorbid group. What we could not test in this study was whether their perceptions of their friends' use changed or whether they changed who they selected as friends. Overestimations of peer smoking behaviors have been shown to be a significant predictor of adolescent smoking and contributed to the overall norm that smoking was acceptable by peers (Graham et al., 1991; Gunther, Bolt, Borzekowski, Liebhart, & Dillard, 2006; Lai, Ho, & Lam, 2004; Reid, Manske, & Leatherdale, 2008). Social influences smoking prevention programs aim to change these overestimations and perceptions surrounding peer acceptance of smoking. Whether the WSPT program changed the depressed students' estimations or if it worked in a way to encourage CoM students to choose friends who do not smoke is left to be determined by future studies. Given the support in the literature, which suggests that depressed adolescents have a difficult time making friends and are often at the periphery of the social group, we are confident that the WSPT program changed cognitions rather than being able to affect change in friendships within a year (Aseltine, Gore, & Colten, 1994; Bosacki, Dane, & Marini, 2007; Henrich, Blatt, Kuperminc, Zohar, & Leadbeater, 2001; Oldehinkel, Rosmalen, Veenstra, Dijkstra, & Ormel, 2007; Pedersen, Vitaro, Barker, & Borge, 2007). Furthermore, both interpersonal and cognitive theories of depression suggest that difficulty with peer interactions, whether they are accurate with their perceptions or if they are biased in their perceptions, would agree that changing friendship groups would be unlikely (Joiner & Coyne, 1999; Lakdawalla et al., 2007; Marcus & Nardone, 1992). Future studies need to examine further whether adolescents at risk for depression perceive their social environment differently or if they interpret their environment differently. Using smoking as an example, future studies should look at whether a depressed adolescent overestimates their friends' smoking behaviors or if they simply have more friends who smoke. Studies should also assess whether overestimation (i.e., cognition) or direct peer influence (i.e., actual social environment providing opportunities to smoke) is responsible for heightened risk for smoking often found among depressed adolescents. These are all interesting hypotheses that will give great insight to the specific mechanisms to target when developing future prevention programs.

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Declaration of Interests

None declared.

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