Longitudinal effects of psychological attributes on adolescent smoking initiation

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Abstract

Associations between smoking initiation and psychological attributes, hostility, depressive symptoms, and aggression were examined among a predominantly Latino and Asian sample of 1771 adolescents who reported never having smoked at baseline. Using a 3-wave longitudinal dataset, we found that psychological attributes were significantly associated with smoking initiation. Specifically, sixth grade depression and being an aggressive victim were significant predictors of smoking initiation by the 8th graders. The findings suggest that tobacco prevention programs should include strategies of managing hostile feelings and negative affect as part of the curriculum.

Keywords: adolescents, smoking initiation, hostility, depressive symptoms and aggression

Introduction

Smoking kills more than 430,000 Americans each year. Adolescent smoking and tobacco use are the first steps in this preventable public health tragedy (USDHHS, 1994, 2001; Johnson, O'Malley, & Bachman, 2003). Numerous studies have been conducted to identify risk factors associated with youth smoking onset in order to develop effective tobacco control programs. Much has been documented on the etiology of tobacco use among adolescents, including intrapersonal factors (including genetic makeup) (Ginzel et al., 2007; Lerman & Berrettini, 2003; Maes et al., 2004; Malaiyandi et al., 2005) as well as psychosocial and behavioral factors (Chen et al., 1999; Chen & Weiss, 2007; Hsia, Spruijt-Metz, 2008; Simons-Morton et al., 2004; Unger, et al., 2004; Weiss, Garbanati, Tanjasiri, Xie, & Palmer, 2006). Among these studies, increasing evidence has suggested that smoking is not randomly distributed across the population (Johnson et al., 2007; Piko, Luszczynska, Gibbons, & Teközel, 2005; Schofield, Pattison, Hill, & Borland, 2003). Adolescents with certain psychological attributes such as hostility and depressive symptoms as well as those who behave aggressively are especially vulnerable to smoking (Gilbert, 1995; Helstrom, Bryan, Hutchison, Riggs, & Blechman, 2004; Jamner, Shapiro, & Murray, 1999; Weiss et al., 2005). However, there is limited research that examines how these factors correlate with smoking initiation among culturally diverse early adolescents, particularly among Asian American and Latino youth. To fill this gap, we amassed a sample that consisted mainly of those ethnic groups, and assessed psychological attributes during sixth grade, when smoking prevalence was low, and again during the seventh and the eighth grades, as successively more of the adolescent took up smoking. The longitudinal design allows us to examine the role of psychological attributes in smoking initiation. We hope the findings of this study will provide useful information for developing more tailored prevention programs for culturally diverse youth populations.

Hostility, depressive symptoms, and aggression

Hostility is characterized by negative affect toward others (Robinson, Brower, & Gomberg, 2001; Spielberger, 1988). Hostility is one of the components of the "AHA Syndrome": anger, hostility, and aggression (Johnson, 1990), which manifests itself in characteristic thoughts, affect, and behavior. Anger, the affective component of the syndrome, can range from

irritation to rage. Hostility, the cognitive component, includes negative beliefs and suspicion about others, such as cynicism and mistrust. Aggression, the behavioral component resulting from the attitudinal and affective aspects, is an action intended to harm others, either verbally or physically (Fite, Colder, Lochman, & Wells, 2008; Miller, Smith, Turner, Guijarro, & Hallet, 1996). The experience of anger is identified as neurotic hostility, which is characterized by frequent feelings of anger associated with resentment and beliefs that one is often mistreated. The expression of anger is identified as expressive hostility, which is characterized by verbal or physical aggression (Bushman, Cooper, & Lemke, 1991; Morris, Zhang, & Bondy, 2006; Simourd & Mamuza, 2000). Psychodynamic theory suggests that expressive hostility is correlated with externalizing behaviors such as bullying, arguing, and aggression, whereas neurotic hostility is related to internalizing behaviors such as withdrawal, anxiety, and depression (Albayrak-Kaymak, 1999; Krueger, McGue, & Iacono, 2001). There is evidence that depressed adolescents are at heightened risk for hostility and aggressive behavior because depressed adolescents tend to attend selectively to the most negative features of events. Thus, they tend to feel intense, irritated, and hostile (Felsten, 1996; Knox, King, & Hanna, 2000; Griffin, Botvin, Scheier, Doyle, & Williams, 2003). There is also evidence to support a physiological substrate, dysregulation of serotonin, for hostility, aggression and depression (Birmaher, Kaufman, & Brent, 1997; Kaufman, Birmaher, & Perel, 1998; Whalen, Jamner, Henker, & Delfino, 2001). Hostility, depression, and aggression are often correlated; however, they reflect different constructs and may be independently associated with unhealthy behaviors, including smoking (Calhoun, Bosworth, Siegler, & Bastian, 2001; Whiteman, Fowkes & Deary, 1997).

Psychological attributes and adolescent smoking

Hostility and smoking. Hostility has been defined as either a mood state or personality trait. Hostility has been linked to a variety of negative health outcomes, including hypertension, cardiovascular disease, and cancer (Calhoun, 2001; Shapiro et al., 1995; van Loon, Marja, Surtees, & Ormel, 2001). Trait hostility has been associated with higher smoking rates in several large scale cross-sectional and longitudinal studies (Hampson, Andrews, & Barckley, 2007; Scherwitz et al., 1992; Weiss et al., 2005). In a longitudinal study of more than 4,700 individuals (Lipkus, Barefoot, Williams, & Siegler, 1994), high-hostility college students were more likely than low-hostility college students to take up smoking and to still be smokers 20 years later. Some studies have suggested a positive correlation between hostility and negative affect, which may inspire the use of tobacco as a means to reduce tension, irritation, and distress (Lee, Mendes de Leon, & Markides, 1988; Whalen, Jamner, Henker, & Delfino, 2001; White, Johnson, & Buyske, 2000). The frequent experience of intense anger reactions--particularly in situations involving criticism and evaluation--has been associated with adolescent smoking, in that adolescents who have difficulty controlling anger and regulating mood tend to use smoking as a coping mechanism (Johnson, 1990; Whiteman, Fowkes, & Deary, 1997).

Depressive symptoms and adolescent smoking. Depression and depressive symptoms have been identified as important determinants of adolescent smoking in numerous studies (Fergusson, Lynskey, & Horwood, 1996; Koval, Pederson, Mills, McGrtady, & Carvajal, 2000; Patton et al., 1998; USDHHS, 2001). Depressed adolescents are more likely to take up smoking than their less depressed counterparts, but there is still controversy about the causal link in the depression-smoking relationship (Brown, Lewinsohn, Seeley, & Wagner, 1996; Nezami et al., 2005; Windle & Windle, 2001; Wu & Anthony, 1999). Previous studies suggested that smoking may develop in an attempt to cope with psychological distress and feelings of depression, and that depressive symptoms can leave adolescents more vulnerable to peer smoking influences (Cooper, 1994; Glass, 1990; Munafò, Hitsman, Rende, Metcalfe, & Niaura, 2008). The anticipated improvement in mood and psychosocial functioning is a motivating factor for taking up smoking among adolescents

(Goodman & Capitman, 2000; Patton et al., 1998; Rodriguez, Moss, & Audrain-McGovern, 2005).

Aggression, victimization, and adolescent smoking. Smoking among adolescents has been associated with both aggressive behaviors (Epstein, Botvin, Diaz, Williams, & Griffin, 2000) and victimization (Sussman & Dent, 2000; Timmermans, van Lier, & Koot, 2008). High levels of aggression at baseline, as well as hyperactivity and somatic complaints, have been associated with smoking initiation among adolescents fifteen months later (Leff et al., 2003). Furthermore, it has been suggested that aggressive victims (those who have been victimized and who are also aggressive), but not those who are victims only, have higher rates of smoking than other students (Helstrom, Bryan, Hutchison, Riggs, & Blechman, 2004; Mouttapa, Gallaher, Unger, & Valente, 2002). Aggressive victims may be particularly at risk for smoking initiation because of their high rates of emotional reactivity, academic difficulties, peer rejection (Schwartz, 2000), learning difficulties (Kaukiainen et al., 2002), and negative mood (Hess & Atkins, 1998). Such adolescents may initiate smoking in an attempt to gain peer acceptance and/or to alleviate stress and depression (Unger, Sussman, & Dent, 2003).

The goal of this study is to examine the longitudinal effects of hostility, depressive symptoms, aggression, and aggressive victimization on smoking initiation. We hypothesized that these psychological attributes in the 6th graders would be associated with smoking initiation when they reached the 8th grade. We also expected that being an aggressive victim and being depressed would strongly predict individual smoking initiation.

Methods

Sample

The participants were students who participated in a longitudinal school-based experimental trial of smoking prevention programs in a multicultural, urban population of adolescents in Southern California (Unger et al., 2004). Students were surveyed annually while in the 6th, 7th, and 8th grades. All 6th grade students in the 24 participating schools were invited to participate in the study. Of the 4,427 students invited to participate, 3,358 (75.85%) provided active parental consent. Of those who consented, a total of 3,190 students completed the 6th grade survey, 2,822 students completed the 7th grade survey, and 2,561 students completed the 8th grade survey. A total of 2,292 students completed surveys in all three waves. Attrition rates were lower among Asian Americans compared to other ethnic groups ($p< 0.001$).

Since the primary outcome of this study was smoking initiation, we eliminated from the analyses any students who reported smoking at baseline (n = 205; 8.9% of adolescents who completed all three assessments). Furthermore, there were 351 (15.31%) students with missing data on at least one of the variables in the final model. Hence, the sample size utilized in this study was 1771. The proportion of who initiated smoking during the observation period among those excluded was not significantly different from that of the analytic sample ($p=0.63$).

Procedure

Students completed a 160-item paper-and-pencil survey in their classrooms during a single class period (45-50 minutes). Trained data collectors, who were not previously acquainted with the students, distributed the surveys. The surveys were identified only by code numbers, not with the students' names or any other identifying information. Because the students were attending schools in which classes were conducted only in English, a basic level of English-language proficiency was assumed and the surveys were provided only in English. However, students were encouraged to ask the data collectors to clarify the meanings of any unfamiliar words. The study was conducted in accord with APA policy, under ethical guidelines overseen by the University of Southern California Institutional Review Board.

Measures

Lifetime smoking. Each year respondents were asked, "Have you ever tried cigarette smoking, even a few puffs?" Response options were "yes" and "no." Since the present study examined

smoking initiation, those students who reported smoking in the 6th grade (n= 141; 8.2%) were excluded from the analyses. Those students who reported not smoking in the 6th grade, but reported smoking in either the 7th or 8th grade were classified as "smoking initiators." Those students who reported not smoking in the 6th, 7th, and 8th grades were classified as "never smokers."

Hostility. In this study, we chose items that measure hostility as a relatively stable trait as opposed to a changing mood. To assess self-reported hostility, the following 4 questions adapted from the Buss-Durkee Hostility Inventory (Buss & Durkee, 1957) were asked: "I lose my temper easily;" "Sometimes people bother me just by being around;" "I can't help being a little rude to people I don't like;" and "Lately, I have been kind of grouchy." Responses were rated on a 4-point scale: 0= "definitely no," to 3= "definitely yes". Scores on these items were summed, for a possible range of 0-12. Cronbach's alpha for this scale was .69. A dichotomous variable was created such that those students with a score of 2.5 (the median for this sample) or greater were categorized as "high-hostility." Those with a score of less than 2.5 were categorized as "low-hostility."

Depressive symptoms. Five items were adapted from the Center for Epidemiological Studies Depression Scale (CES-D; Radloff, 1991), a 20-item self-report scale that assesses depression during the past week. The CES-D is a valid and reliable measure of depressive symptoms, but not of the broader construct of negative affect among adolescents (Galaif, Chou, Sussman, et al., 1998; Schoenbach, Kaplan, Grimson, et al., 1982). In a pilot study we factor analyzed the 20 CES-D items using the principal components method to determine five items to use in the main trial of the longitudinal study. Consistent with suggestions from previous research, we chose the five items that loaded the highest on the factor labeled "depression." The factor loadings for these items ranged from 0.72 to 0.81, and Cronbach's alpha for this short scale was 0.87. The items were the following: "Think about how you felt during the past 7 days. On how many of these days did you…" (1) "Have trouble shaking off sad feelings?" (2) "Feel depressed?" (3) "Think your life had been a failure?" (4) "Feel lonely?" and (5) "Feel sad?" Response options were: 1="0-1 day", 2= "2-3 days", 3= "4-5 days", and 4= "6-7 days". Scores on these items were summed, for a possible range of 0-20. Students with a score of 1.2 (the median for this sample) or greater were categorized as "depressed" and students with a score less than 1.2 were categorized as "non-depressed."

Aggression and victimization. Four items were adopted from Olweus (1991) to assess self-reported physical and verbal forms of aggression and victimization during the past three months. The aggression items were the following: "Did you push or hurt another kid?" "Did you threaten another kid or say something mean to him or her?" The victimization items were the following: "Did another kid hit you, push you, or hurt you in any way?" "Did another kid threaten you or say something mean to you?" The response options for all items were: 3 = A lot, 2 = Sometimes, 1 = Once in a while, and 0 = Never. A total aggression score and a total victimization score were calculated by summing responses on their two respective items. Hence, aggression and victimization scores ranged from 0 to 6. To simplify the interpretation and to define the patterns of findings, three dichotomous variables, "aggressor" (yes/no), "victim" (yes/no), and "aggressive victim" (yes/no) were created. Students were classified as "aggressors" if they scored 4 or higher on aggression, and less than 4 on victimization, "victims" if they scored 4 or higher on victimization and less than 4 on aggression, "aggressive victims" if they scored 4 or higher on both aggression and victimization, and "the neither group" if they scored lower than 4 on both aggression and victimization (we used this category as a reference group). We used the cutoff of 4 so that students who were moderately to frequently involved in aggression and victimization were identified.

Covariates

Demographic covariates in the analyses were age, gender, socioeconomic status, ethnicity, and immigration status. Other covariates included program exposure and acculturation status. All

demographic covariates were assessed in the 6th grade.

Immigration status was dichotomized as immigrants vs. non-immigrants. Students were designated as non-immigrants if they reported that they, as well as both of their parents, were born in the United States. Students were designated as immigrants if they and/or at least one of their parents were born outside of the United States.

Program exposure. As part of this longitudinal study, the schools were randomly assigned to participate in a program evaluation of two newly developed smoking prevention curricula. Schools received either their school's standard smoking prevention curriculum or one of the two new curricula. The exposure to smoking prevention programs might have confounded the results of this study; therefore, we included it in the analysis as a covariate. The effects of our prevention programs are reported elsewhere (Unger, Chou, Palmer, Ritt-Olson, Gallaher, & Cen, 2004).

*Acculturation status***.** The eight-item Acculturation, Habits, and Interests Multicultural Scale for Adolescents (AHIMSA) (Unger et al., 2002) was used to assess acculturation. The questions, such as "I am most comfortable being with people from…" and "The holidays I celebrate are from…" all offered the same four response options which are labeled four orientation categories: a = "The United States" (Assimilation orientation), b= "The country my family is from" (Separation orientation), c = "Both" (Integration orientation), and d = "Neither" (Marginalization orientation). Each student was assigned to one of four orientation categories based on his or her most commonly selected response.

Data analysis

Characteristics of baseline ever smokers and never smokers. Chi-square analyses were conducted to determine whether ever smokers and never smokers varied by personality traits, aggressive behavior, and demographic characteristics in the 6th grade. Bivariate correlations for all independent variables revealed no multicollinearity problems.

In a multi-school-based intervention, longitudinal measurement is not the only methodological concern. The hierarchical data structure (i.e., students clustering within schools) is also a major concern. In these situations, a hierarchical model (i.e., random effect modeling, multi-level modeling or mixed effect modeling) is commonly used. The Generalized Linear Mixed Model (GLM) is a very robust model which can handle binary outcomes such as smoking initiation (Singer & Willett, 2002; Raudenbush, Bryk, Cheong, & Congdon, 2008).

Generalized Linear Mixed Models (Hierarchical Generalized Linear Models) using the SAS macro "glimmix" were computed to predict 8th grade smoking initiation from 6th grade (baseline) psychological attributes. We specifically examined (1) the unadjusted effects of psychological variables (controlling only for experimental condition and clustering of students within schools and classrooms), and (2) the statistical significance of those associations after controlling for the effects mentioned in (1) plus the other independent variables and demographic covariates. To test whether the presence of multiple psychological attributes placed individuals at higher risk of smoking initiation, all possible two-way interaction terms (hostility x depression, hostility x aggression, and depression x aggression) were tested.

Results

Characteristics of sample

Table 1 compares baseline never smokers and ever smokers on predictor variables and demographic covariates. Compared to never smokers, ever smokers scored higher on psychological risk factors (hostility, depressive symptom, and aggression). Ever smokers and never smokers also differed on demographic variables such as age, socioeconomic status, ethnicity, and immigration status. On the other hand, ever smokers and never smokers did not

differ on gender, program exposure, and immigration status.

Smoking Initiation	7th and 8th Grade Combined		7th Grade		8th Grade	
	n	%	n	%	n	%
Yes	316	17.8	160	9%	156	8.8%
No	1455	82.2	1611	91%	1615	91.2%

Note. The analytic sample consisted of those students who reported that they did not initiate smoking in the 6th grade

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Table 2. Smoking Initiation in Grades 7 through 8

Smoking initiation in the 7th and 8th grades.

Table 2 presents self-reported smoking initiation by the 7th and 8th grades. A total of 160 participants (9% of the analytic sample) who reported never smoking in the 6th grade initiated smoking by the 7th grade. By the 8th grade, an additional 156 participants reported ever smoking, bringing the total to 316 (17.8%) participants who reported that they initiated smoking within the study period.

Differences between aggressors, victims, aggressive victims, and the neither group.

Aggressors, victims, aggressive victims, and the control group were compared to each other on mean scores on psychological attributes and mean age. Group differences were found on the psychological attributes. Specifically, adolescents who were non-aggressive and non-victimized were lowest on hostility (M = 2.25, SD = 0.76) and depressive symptoms (M = 1.32, SD = 0.53). On the other hand aggressive victims were highest on hostility (M = 2.93, SD = 0.80) and depressive symptoms (M = 1.83, SD = 0.85). Using G*Power (Faul & Erdfelder, 1992), we found that the effect sizes of the group differences in hostility, depressive symptoms were 0.29 and 0.21, respectively, which corresponds to "medium" effect sizes according to Cohen (1992). Such findings suggest that higher levels of psychosocial problems are associated with involvement in aggression and victimization.

Association between psychological attribute and smoking initiation

Table 3 presents the odds ratios and 95% confidence intervals for smoking initiation by the 8th grade. The findings suggest that psychological attributes have longitudinal associations with smoking initiation. Specifically, in the full model that adjusted for all other predictor variables and covariates, sixth grade depression (AOR = 1.61, $p < 0.01$) and being an aggressive victim (AOR = 1.74, $p < 0.01$) were significant predictors of smoking initiation by the 8th grade. In the model that adjusted for clustering of students within schools/classrooms and experimental condition only, sixth grade hostility was associated with smoking initiation by the 8th grade (AOR = 1.48, $p < .01$). However this association did not reach statistical significance in the full model. Furthermore, none of the two way interaction terms (hostility x depression, hostility x aggression, and depression x aggression) were significantly associated with smoking initiation by the 8th grade.

Discussion

In this study, we examined the direct and interactive effects of psychological attributes, hostility, depressive symptom and aggressive behavior on smoking initiation among culturally diverse adolescents. Each of the psychological factors was independently and significantly associated with risk for smoking initiation. Adolescents who scored relatively high on depressive symptoms and aggression in 6th grade were especially at increased risk for smoking initiation by the 8th grade.

As hypothesized, the finding indicated that hostility increased adolescents' risk to take up smoking. Although research on a causal link between hostility and adolescent smoking is virtually non-existent, the temporal precedence of hostility in smoking initiation is in agreement with the stress-reduction theory of addictive behaviors, in that smoking may be perceived as an effective tension reducer. There is evidence suggesting that hostile or irritable individuals are more vulnerable to stress, negative affect and mistrust. Thus, smoking initiation may occur as a means of reducing frustration, irritation, and anger at a time of substantial stress (Delfino, Jamner, & Whalen, 2001; Shapiro, Jamner, Davydov, & James, 2002; Timmermans, van Lier, & Koot, 2008). It seems that smoking may

be seen as a way of reducing hostile feelings in the eyes of our sample of adolescents.

The sequential connection between depressive symptoms and smoking initiation found in the present study is consistent with previous studies. It may be true that one of the motives for adolescents to take up smoking is to cope with depression and improvement in psychosocial functioning (Cooper, 1994; Munafò, Hitsman, Rende, Metcalfe, & Niaura, 2008; Patton et al., 1998). As stated earlier, there is still controversy about the causal link in the depression-smoking relationship. Adolescent smoking is a dynamic process, and smoking acquisition may vary by stages of life or by stages of smoking involvement (Patton et al., 1996; Wu & Anthony, 1999). With a sample of early adolescents starting from the 6th grade in the present study, we were able to assess their psychological attributes prior to their smoking careers with the hopes of obtaining evidence that is consistent with a causal link between depression and smoking behavior. A study with late adolescents and adults would be less informative, because the connection between tobacco and depressed mood might have alternative explanations, in that the causal link could be much complex. In fact, our results showed a strong link between depressive symptoms and smoking initiation because after controlling for all other variables, the scores of depressive symptoms in 6th grade were still significantly associated with smoking initiation when the students reached 8th grade. This may suggest that depressive symptoms may carry a larger risk for smoking initiation compared to other psychological attributes.

One of the important findings of this study was the relationship between psychological attributes and their impact on smoking onset. Our longitudinal data demonstrated that those students who were aggressive victims at baseline were more likely to have higher rates of hostility and depressive symptoms compared to others who were not. In addition, the aggressive victims were more likely to initiate smoking than others by the 8th grade. This finding is consistent with the frustration-aggression hypothesis (Berkowitz, 1989). Individuals who experience excessive negative affect tend to view others as distrustful, the world as threatening, and to feel depressed and hostile (Felsten, 1996; Kashani, Dahlmaier, Burduin, Soltys, & Reid, 1995; Knox, King, & Hanna, 2000). The links among the psychological attributes demonstrated in the present study further suggest hostility and depressive symptoms may carry a larger risk for smoking initiation. Furthermore, that risk is amplified when hostility and aggression co-occur.

Limitations

One limitation of this study is that our results are based on adolescents' self-reports of their smoking behavior and psychosocial status. Although previous research has demonstrated the accuracy of self-reports of smoking by adolescents (Wills & Cleary, 1997), self-reports of depressive symptoms, hostility, and aggression may be affected by different understandings and interpretations of those concepts, depending on the cultural values, beliefs, and acculturation experiences of immigrant children.

Another limitation of this study is that our sample consisted of adolescents in a school-based setting rather than a clinical population. Therefore, we employed brief measures that serve as indicators of psychological attributes of our interest, rather than more complex diagnostic instruments that might be used with a clinical sample in accord with DSM-IV criteria. While the results do reflect associations between smoking and the psychological attributes tapped by our items, we are necessarily cautious in asserting that these variables correspond to the same terms as used by clinicians.

In addition, the findings of this study may not generalize to adolescents who are non-Asians and non-Hispanics. We selected our schools because they had large percentages of Hispanics and Asians. The patterns we observed might not appear in schools where the majority of students are White.

Conclusion

In summary, our results provide evidence for a longitudinal association between smoking initiation and psychological attributes (hostility,

depressive symptoms, and aggression) among culturally diverse and early adolescents. We find that the risk of smoking initiation is significantly increased among students who score higher on hostility, depressive symptoms, and aggression. In addition, it may be helpful to identify youth who score high on these psychological attributes and teach them skills to handle interpersonal conflict and negative feelings, so as to prevent their involvement in aggressive behaviors and substance use.

References

Albayrak-Kaymak, D. (1999). Internalizing or externalizing: Screening for both problem youth. *International Journal of Advances in Counseling, 21*, 125-137.

Berkowitz, L. (1989). Frustration-aggression hypothesis: examination and reformation. *Psychological Bulletin, 106,* 59-73.

Birmaher, B. R., Kaufman, J., & Brent . D. A. (1997). Neuroendrocrine response to 5-hydroxy-L-tryptophan in prepubertal children at high risk of major depressive disorder. *Archives of General Psychiatry, 54*, 1113-1119.

Brown, R. A., Lewinsohn, P. M., Seeley, J. R., & Wagner, E. F. (1996). Cigarette smoking, major depression, and other psychiatric disorders among adolescents. *Journal of the American Academy of Child and Adolescent Psychiatry, 35,* 1602-1610.

Bushman, B. J., Cooper, H. M., & Lemke, K. M. (1991). Meta-analysis of factor analyses: An illustration using the Buss-Durkee Hostility Inventory. *Personality and Social Psychology Bulletin, 17,* 344-349.

Buss, A. H., & Durkee, A. (1957). An inventory for assessment different kinds of hostility. *Journal of Counseling Psychology, 21,* 343-349.

Calhoun, P. S., Bosworth, H. B., Siegler, I. C., & Bastian, L. A. (2001). The relationship between hostility and behavioral risk factors for poor health in women veterans. *Preventive Medicine, 33,* 552-557.

Chen, X., Unger, J. B., & Johnson, C. A. (1999). Is acculturation a risk factor for early smoking initiation among Chinese American minors? A comparative perspective. *Tobacco Control, 8,* 402-410.

Chen, X., & Weiss, J. W. (2007). Enrichment in Pre-Kindergarten Life Predicts Initiation of Cigarette Smoking in Asian American and Hispanic/Latino Adolescents. *Journal of Child and Family Studies*, *16,* 498-507.

Cohen, J. (1992). A power primer. *Psychological Bulletin, 112*, 155-159.

Cooper, M. L. (1994). Motivations for alcohol use among adolescents: development and validation of a four-factor model. *Psychological Assessment, 6,* 117-128.

Delfino, R. J., Jamner, L. D., & Whalen, C. K. (2001). Temporal analysis of the relationship of smoking behavior and urges to mood states in men versus women. *Nicotine & Tobacco Research, 3,* 235-248.

Epstein, J. A., Botvin, G. J., Diaz, T., Williams, C., & Griffin, K. (2000). Aggression, victimization and problem behavior among inner-city minority adolescents. *Journal of Child & Adolescent Substance Abuse, 9,* 51-66.

Faul, F., & Erdfelder, E. (1992). *GPOWER: A priori, post-hoc, and compromise power analyses for MS-DOS* (Computer Program). Bonn, FRG: Bonn University, Department of Psychology.

Felsten, G. (1996). Hostility, stress, and symptoms of depression. *Personality and Individual Differences, 21,* 461-467.

Fergusson, D. M., Lynskey, M. T., & Horwood, L. J. (1996). Co-morbidity between depressive disorders and nicotine dependence in a cohort of 16-year-olds. *Archives of General Psychiatry, 53,* 1043-1047.

Fite, P. J., Colder, C. R., Lochman, J. E., & Wells, K. C. (2008). The relation between childhood proactive and reactive aggression and substance use initiation. *Journal of Abnormal Child Psychology, 36,* 261-271.

Galaif, E. R., Chou, C.-P., Sussman, S., & Dent, C. (1998). Depression, suicidal ideation, and substance use among continuation high school students. *Journal of Youth and Adolescence, 27,* 275-299.

Gilbert, D. G. (1995). *Smoking: Individual differences, psychopathology, and emotion.* Washington, DC: Taylor & Francis.

Ginzel, K. H., Maritz, G. S., Marks, D. F., Neuberger, M., Pauly, J. R., Polito, J. R., Schulte-Hermann, R., and Slotkin, T. A. (2007). Critical Review: Nicotine for the Fetus, the Infant and the Adolescent? *Journal of Health Psychology, 12*, 215-224.

Griffin, K. W., Botvin, G. J., Scheier, L. M., Doyle, M. M., & Williams, C. (2003). Common predictors of cigarette smoking, alcohol use, aggression, and delinquency among inner-city minority youth. *Addictive Behaviors, 28,* 1141-1148.

Glass, R. M. (1990). Blue mood, blackened lungs, depression and smoking. *Journal of the American Medical Association, 264,* 1583-1584.

Goodman, E., & Capitman, J. (2000). Depressive Symptoms and Cigarette Smoking Among Teens. *Pediatrics, 106*, 748-755.

Hampson, S. E., Andrews, J. A., & Barckley, M. (2007). Predictors of the development of elementary-school children's intention to smoke cigarettes: hostility, prototypes, and subjective norms. *Nicotine and Tobacco Research, 9,* 751-760.

Helstrom, A., Bryan, A., Hutchison, K. E., Riggs, P. D., & Blechman, E. A. (2004). Tobacco and alcohol use as an explanation for the association between externalizing behavior and illicit drug use among delinquent adolescents. *Preventive Science, 5,* 267-277.

Hess**,** L. E., & Atkins, M. S. (1998). Victims and aggressors at school: Teacher, self, and peer perceptions of psychosocial functioning. *Applied Developmental Science, 2*, 75-89.

Hsia, F. N., Spruijt-Metz, D. (2008). Gender Differences in Smoking and Meanings of Smoking in Asian-American College Students. *Journal of Health Psychology, 13,* 459-463.

Jamner, Shapiro, D., & Murray, J. (1999). Nicotine reduces the frequency of anger reports in smokers and non-smokers with high but not low hostility: An ambulatory study. *Experimental and Clinical Psychopharmacology, 7,* 454-463.

Johnson, C. A., Cedn, S., Gallaher, P. Palmer, P. H., Xiao, L., Ritt-olson., & Unger, J. B. (2007). Why smoking prevention programs sometimes fail. Does effectiveness depend on socio-cultural context and individual characteristics? *Cancer Epidemiological Biomarkers Prevention, 16*, 1043-1049.

Johnson, E. H. (1990). *The deadly emotions: The role of anger, hostility, and aggression in health and emotional well-being.* New York: Praeger Publishers.

Johnston, L. D., O'Malley, P. M., & Bachman, J. G. (2003). *Monitoring the Future national results on adolescent drug use: Overview of key findings, 2002*. (NIH Publication No. 03-5374). Bethesda, MD7 National Institute on Drug Abuse.

Kashani, L., Dahlmaier, J., Burduin, C., Soltys, M. & Reid, J. (1995). Characteristics of anger expression in depressed children. *Journal of the American Academy of Child and Adolescent Psychiatry, 34,* 322-326.

Kaufman, A. E., Birmaher, B., & Perel, J. (1998). Serotonergic functioning in depressed abused children: clinical and familial correlates. *Biological Psychiatry, 44*, 973-981.

Kaukiainen**,** A., Salmivalli, C., Lagerspetz, K., Tamminen, M., Vauras, M., Mäki, H., & Poskiparta, E. (2002). Learning difficulties, social intelligence and self-concept: Connections to bully-victim problems. *Scandinavian Journal of Psychology, 43*, 269-278.

Knox, M., King, C., & Hanna, G. L. (2000). Aggressive behavior in clinical depressed adolescents. *Journal of the American Academy of Child and Adolescent Psychiatry, 39*, 611-618.

Koval, J. J., Pederson, L. L., Mills, C. A., McGrtady, G. A., & Carvajal, S. C. (2000). Models of the relationship of stress, depression, and other psychosocial factors to smoking behavior: A comparison of a cohort of students in grades 6 and 8. *Preventive Medicine, 30,* 463-477.

Krueger, R. F., McGue, M., & Iacono, W. G. (2001). The higher-order structure of common DSM mental disorders: internalization, externalization, and their connections to personality. *Personality and Individual Differences, 30,* 1245-1259.

Lee, D. J., Mendes de Leon, C. F., & Markides, K. S. (1988). The relationship between hostility, smoking, and alcohol consumption in Mexican Americans. *International Journal of the Addictions, 23,* 887-896.

Leff, M. K., Moolchan, E. T., Cookus, B. A., Spurgeon, L., Evans, L. A., & London, E. D. (2003). Predictors of smoking initiation among at risk youth: A controlled study. *Journal of Child and Adolescent Substance Abuse, 13,* 59-76.

Lerman, C., & Berrettini, W. (2003). Elucidating the role of genetic factors in smoking behavior and nicotine dependence. *American Journal of Medicine and Genetic Behavior, 118*, 48-54.

Lipkus, I. M., Barefoot, J. C., Williams, R. B., & Siegler, I. C. (1994). Personality measures as predictors of smoking initiation and cessation in the UNC Alumni Heart Study. *Health Psychology, 13,* 149-155.

Maes, H. H., Sullivan, P. F., Bulik, C. M., et al. (2004). A twin study of genetic and environmental influences n tobacco initiation, regular tobacco use and nicotine dependence. *Psychological Medicine, 34,* 1251-1261.

Malaiyandi, V., Sellers, E. M., & Tyndale, R. F. (2005). Implications of CYP2A6 genetic variation for smoking behaviors and nicotine dependence. *Clinical Pharmacological Therapy, 77,* 145-158.

Miller, T. Q., Smith, T. W., Turner, C. W., Guijarro, M. L., & Hallet, A. J. (1996). A meta-analytic review of research on hostility and physical health. *Psychological Bulletin, 119,* 322-348.

Morris, E. B., Zhang, B., & Bondy, S. J. (2006). Bullying and Smoking: Examining the Relationships in Ontario Adolescents. *Journal of School Health, 76*, 465–470.

Mouttapa, M., Gallaher, P., Unger, J. B., & Valente, T. (2002). *Adolescent smoking: A unique correlate to aggressive behavior among classmates* (poster). Paper presented at the California Tobacco-Related Disease Research Program (TRDRP) Annual Investigators' Meeting, San Jose, California.

Munafò, M. R., Hitsman, B., Rende, R., Metcalfe, C., & Niaura, R. (2008). Effects of progression to cigarette smoking on depressed mood in adolescents: evidence from the National Longitudinal Study of Adolescent Health. *Addiction, 103*, 162–171.

Nezami, E., Unger, J., Tan, S., Mahaffey, C., Ritt-Olson, A., Sussman, S. Nguyen-Michel, S., Baezconde-Garbanati, L., Azen., S., & Johnson, C. A. (2005). The influence of depressive symptoms on experimental smoking and intention to smoke in a diverse youth sample. *Nicotine Tobacco Research, 7,* 243-8.

Olweus, W. (1991). Bully/victim problems among schoolchildren: basic facts and effects of a school based intervention program (pp. 411-448). In D. Pepler & K. Rubin (Eds.), *The development and treatment of childhood aggression.* Hillsdale New York: Lawrence Erlbaum and Associates.

Patton, G. C., Carlin, J. B., Coffey, C., Wolfe, R., Hibbert, M., & Bowes, G. (1998). Depression, anxiety, and smoking initiation: A prospective study over 3 years. *American Journal of Public Health, 88,* 1518-1522.

Patton, G. C., Hibbert, M., Rosier, M. J., Carlin, J. B., Caust, J., & Bowes, G. (1996). Is smoking associated with depression and anxiety in teenagers? *American Journal of Public Health, 86,* 225-230.

Piko, B. F., Luszczynska, A., Gibbons, F. X., & Teközel, M. (2005). A culture-based study of personal and social influences of adolescent smoking. *European Journal of Public Health, 15,* 393–398.

Radloff, L. S. (1991). The use of Center for Epidemiologic Studies Depression Scale in adolescents and young adults. *Journal of Youth and Adolescence, 20*, 149-166.

Raudenbush, S.W., Bryk, A.S., Cheong, Y.F., & Congdon, R.T. (2008). *HLM 6: Hierarchical Linear and Nonlinear Modeling*. Lincolnwood, IL: Scientific Software International, Inc.

Robinson, E. A. R., Brower, K. J., & Gomberg, E. S. L. (2001). Explaining unexpected gender differences in hostility among persons seeking treatment for substance use disorders. *Journal of Studies on Alcohol, 62,* 667-674.

Rodriguez, D., Moss, H. B., & Audrain-McGovern, J. (2005). Developmental heterogeneity in adolescent depressive symptoms: associations with smoking behavior. *Psychosomatic Medicine,* 67, 200-210.

Schoenbach, V. J., Kaplan, B. H., Grimson, R. C., & Wagner, E. H. (1982). Use of a symptom scale to study the prevalence of a depressive syndrome in young adolescents. *American Journal of Epidemiology, 116,* 791-800.

Schofield, P. E., Pattison, P. E., Hill, D. J., Borland, R. (2003). Youth Culture and Smoking: Integrating Social Group Processes and Individual Cognitive Processes in a Model of Health-related Behaviors. *Journal of Health Psychology, 8*, 291-306.

Simons-Morton, B., Chen, R., Abroms, L., & Haynie, D. L. (2004). Latent growth curve analyses of peer and parent influences on smoking progression among early adolescents. *Health Psychology, 23,* 612-621.

Scherwitz, L. W., Perkins, L. L., Chesney, M. A., Hughes, G. H., Sidney, S., & Manolio, T. A. (1992). Hostility and health behaviors in young adults: the CARDIA Study. Coronary Artery Risk Development in Young Adults Study. *American Journal of Epidemiology, 136*, 136-145.

Shapiro, D., Hui, K. K., Oakley, M. E., Pasic, J., & Jamner, L. D. (1995). Effectiveness of a combined behavioral-drug intervention for hypertension: Drug, personality, and quality of life effects. In J. E. Dimsdale & A. Baum (Eds.), *Quality of life in behavioral medicine research* (pp. 171-190; Hillsdale, NJ: Lawrence Erlbaum Associates,.

Shapiro, D., Jamner, L. D., Davydov, D. M., & James, P. (2002). Situations and moods associated with smoking in everyday life. *Psychology of Addictive Behaviors, 16,* 342-345.

Schoenbach, V. J., Kaplan, B. H., Grimson, R. C., & Wagner, E. H. (1982). Use of a symptom scale to study the prevalence of a depressive syndrome in young adolescents. *American Journal of Epidemiology, 116,* 791-800.

Schwartz, D. (2000). Subtypes of victims and aggressors in children's peer groups. *Journal of Abnormal Child Psychology, 28,* 181-192.

Singer, J., & Willett, J.B. (2002). *Applied Longitudinal Data Analysis: Modeling Change and Event Occurrence.* NY: Oxford University Press.

Simourd, D. J., & Mamuza, J. M. (2000). The hostility interpretations questionnaire: Psychometric properties and construct validity. *Criminal Justice and Behavior, 27,* 645-663.

Spielberger, C. D. (1988). *State-Trait anger expression inventory: Professional Manual.* Odessa, FL: Psychological Assessment Resources.

Sussman, S., & Dent, C. W. (2000). One-year prospective prediction of drug use from stress-related variables. *Substance Use & Misuse. Special Issue: Stress and substance use, 35*, 717-735.

Timmermans, M., van Lier, P. A., & Koot, H. M. (2008). Which forms of child/adolescent externalizing behaviors account for late adolescent risky sexual behavior and substance use? *Journal of Child Psychology and Psychiatry, 49,* 386–394.

Unger, J. B., Chou, C. P., Palmer, P. H., Ritt-Olson, A., Gallaher, P., & Cen, S. (2004). Project FLAVOR: One-year outcomes of a multicultural, school-based smoking prevention curriculum for adolescents. *American Journal of Public Health, 94*, 263-265.

Unger, J. B., Gallaher, P., Shakib, S., Ritt-Olson, A., Palmer, P. H., & Johnson, C. A. (2002). The AHIMSA Acculturation Scale: a new measure of acculturation for adolescents in a multicultural society. *Journal of Early Adolescence, 22*, 225-51.

Unger**,** J. B., Sussman**,** S., & Dent**,** C. W. (2003). Interpersonal conflict tactics and substance use among high-risk adolescents. *Addictive Behaviors, 28,* 979-987.

United States Department of Health and Human Services. (1994). *Preventing tobacco use among young people: A report of the Surgeon General.* Atlanta: U.S. Department of Health and Human Services, Public Health Service, Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion, Office on Smoking and Health.

USDHHS. (2001). Cigarette smoking among adults - United States, 1999. *MMWR*, 50, 869-873.

van Loon, A. J., Marja, T., Surtees, P. G., & Ormel, J. (2001). Personality and coping: their relationship with lifestyle risk factors for cancer. *Personality and Individual Differences, 31,* 541-553.

Weiss, J. W., Mouttapa, M., Chou, C.-P., Nezami, E., Johnson, C. A., & Palmer, P. H. (2005). Hostility, depressive symptoms, and smoking in early adolescence. *Journal of Adolescence, 28*, 49-62.

Weiss, J. W., Garbanati, J. A., Tanjasiri, S. P., Xie, B., & Palmer, P. H. (2006). Effects of family functioning and self-image on adolescent smoking initiation among Asian-American subgroups. *Journal of Adolescent Health, 39*, 221-228.

Whalen, C. K., Jamner, L. D., Henker, B., & Delfino, R. J. (2001). Smoking and moods in adolescents with depressive and aggressive dispositions: Evidence from surveys and electronic diaries. *Health Psychology, 20,* 99-111.

Wills, T. A., & Cleary, S. D. (1997). The validity of self-reports of smoking: Analyses by race/ethnicity in a school sample of urban adolescents. *American Journal of Public Health, 87,* 56-61.

Windle, M., & Windle, R. C. (2001). Depressive symptoms and cigarette smoking among middle adolescents: Prospective associations, and intrapersonal and interpersonal Influences. *Journal of Consulting and Clinical Psychology, 69,* 215-226.

Wu, L. T., & Anthony, J. C. (1999). Tobacco smoking and depressed mood in late childhood and early adolescence. *American Journal of Public Health, 89*, 1837-1840.

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Appendix A

Table 1. Characteristics of non-smoking initiators and smoking initiators at baseline

		Never Smokers (n= 1455)		Smoking Initiators (n = 316)		P-value
		n	%	n	%	
Independent Variables						
Hostility	Low-Hostility	722	49.6	125	39.6	<0.01
	High-Hostility	733	50.4	191	60.4	
Depressive	Non-Depressed	706	48.5	117	37.0	<0.01
Symptoms	Depressed	749	51.5	199	63.0	
Aggression/	Neither Group	980	67.4	179	56.6	<0.01
Victimization	Aggressors	65	4.5	20	6.3	
Status	Victims	299	20.5	70	22.2	
	Aggressive Victims	111	7.6	47	14.9	
Covariates						
Gender	Girl	819	56.3	161	50.9	N/S
	Boy	636	43.7	155	49.1	
Ethnicity	Latino	512	35.2	163	51.2	<0.01
	Asian	432	29.7	42	13.3	
	Caucasian	170	11.7	29	9.2	
	African-American	21	1.4	6	1.9	
	Multiethnic	231	15.9	54	17.1	
	Other	89	6.1	22	7.0	
Immigration	Non-immigrant	204	14.0	46	14.6	N/S
Status	Immigrant	1251	86.0	270	85.4	
Acculturative	No	1002	68.9	197	62.3	< .01
Stress [a]	Yes	249	17.1	73	23.1	
Experimental	Control group	540	37.1	116	36.7	N/S
Condition	CHIPS program	422	29.0	100	31.6	
	FLAVOR program	493	33.9	100	31.6	
		Mean	SD	Mean	SD	p-value
Age (Years)		11.27	0.49	11.34	0.52	0.02
Socioeconomic status		0.19	0.72	-0.09	0.70	<0.001

[a] Immigrants only

Appendix B

Table 3. Generalized linear mixed models to test association between psychological attributes and smoking initiation

	Adjusted Model[a]		Full Model[b]	
	AOR[c]	95% CI	AOR	95% CI
Psychological Attributes				
Hostility (yes vs. no)	1.48**	1.15-1.89	1.24	0.95-1.61
Depression (yes vs. no)	1.58**	1.17-2.14	1.61**	1.20-2.15
Aggressors (vs. controls)	1.65	0.97-2.79	1.40	0.82-2.41
Victims (vs. controls)	1.28	0.87-1.87	1.16	0.77-1.73
Aggressive victims (vs. controls)	2.24***	1.53-3.27	1.74**	1.16-2.61
Covariates				
Gender (male vs. female)	1.24	0.97-1.58	1.29*	1.01-1.65
African American (vs. Caucasian)	1.48	0.56-3.93	1.52	0.57-4.05
Asian (vs. Caucasian)	0.73	0.35-1.52	0.69	0.33-1.46
Latino (vs. Caucasian)	1.46	0.91-2.34	1.39	0.85-2.28
Multiethnic (vs. Caucasian)	1.23	0.75-2.03	1.13	0.66-1.94
Other (vs. Caucasian)	1.35	0.74-2.47	1.26	0.67-2.35
Immigrant (yes vs. no)	0.77	0.54-1.10	0.87	0.59-1.28
Acculturative stress (yes vs. no)	1.44*	1.01-2.06	1.67**	1.18-2.37
Age	1.24	0.98-1.58	1.21	0.95-1.54
Socioeconomic status	0.68**	0.54-0.86	0.74**	0.60-0.92

Note. The analytic sample consisted of those students who reported that they did not initiate smoking in the 6th grade.

*p < 0.05; **p < 0.01; ***p < 0.001.

[a] Odds ratios adjusted for experimental condition and clustering of students within schools/classrooms only.

[b] Odds ratios adjusted for experimental condition, all covariates, and all other predictor variables in the model, and clustering of students within schools and within classrooms.

[c] AOR = adjusted odds ratio.