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Association between Elementary School Personality and High School Smoking and Drinking

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Abstract

Background and aims—Among U.S. high school students, alcohol consumption and cigarette smoking are associated with numerous concurrent and future harms. We tested whether multiple elementary school personality dispositions to behave impulsively can predict these addictive behaviors invariably across gender and race.

Design and Setting—This longitudinal design involved testing whether individual differences on impulsigenic traits in elementary school predicted drinking and smoking four years later in high school in 23 public schools in Kentucky, USA.

Participants—1,897 youth ages 11 to 15, drawn from urban, rural, and suburban backgrounds.

Measurements—Drinking and smoking frequency were assessed by single item questions. The key predictors were impulsigenic traits measured with the UPPS-P Child Version impulsive behavior scale. Important covariates included were pubertal status, depression, negative affect, and positive affect; each was assessed by self-report.

Findings—Three personality traits measured in 5th grade, each representing different dispositions to engage in impulsive behavior, predicted drinking and smoking in 9th grade above and beyond other risk factors and 5th grade drinking and smoking. Specifically, urgency (b = .10, .13), sensation seeking (b = .13, .07), and low conscientiousness (b = .14, .11) each uniquely predicted both high school drinking and smoking, respectively. There was no evidence that any trait predicted either outcome more strongly than the other traits, nor was there evidence that predictive results varied by gender or race.

Conclusions—Three personality traits (urgency, sensation seeking, and low conscientiousness), when measured in 11-year-old children, individually predict those children's drinking and smoking behavior at age 15. The effects are invariant across gender and race.

Keywords

smoking; drinking; personality; impulsivity; adolescence; risk

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Internationally, adolescent engagement in drinking and tobacco smoking behavior are associated with numerous concurrent and future harms (1,2,3). Understanding risk for the emergence of these addictive behaviors is thus an important public health priority around the world. Particularly in the U.S., one set of risk factors for such behaviors receiving research attention is elevations in impulsigenic personality traits (4). This paper reports the results of

a study investigating the role of a set of impulsigenic traits to help explain the emergence of drinking and tobacco smoking across the four year period from elementary school to high school in the U.S.

The Problematic Nature of Adolescent Drinking and Tobacco Smoking

In the U.S., across the years from late elementary school through the first year of high school, alcohol consumption increases dramatically, from rate estimates of 7–10% in late elementary school (1,5,6) to approximately 40–50% by the end of the first year of high school (1). Youth engagement in drinking during these years is of considerable clinical importance. For both boys and girls ages 12–15, reports of having consumed alcohol one day (or more) during the preceding year, assessed by a single item, have sensitivity of 1.0 and specificity of .94 (boys) and .95 (girls) in the concurrent prediction of any DSM IV alcohol use disorder symptom over that year (1).

Drinking during these years concurrently relates to several other problem behaviors, including early onset marijuana use, early sexual intercourse, and low value on academic achievement (7). Prospectively, early consumption predicts diagnostic status and alcohol problems in later adolescence and adulthood (2,8,9). Alcohol consumption during these years is both a marker of current dysfunction and an indicator of risk for future dysfunction.

The rates of tobacco smoking also increase during these years. A small percentage of children have smoked cigarettes before age 12 (9,10,11,12,13,), and the number of teens who smoke increases across the adolescent years (14). Early tobacco use is clinically important because it means longer exposure to the health damaging effects of carcinogenic compounds in tobacco smoke (3), and it predicts (a) an increase in the quantity of cigarettes smoked per day during adolescence (15), (b) increased likelihood of tobacco addiction during adolescence and adulthood (10), and, (c) for girls, stunted physical growth (16).

Personality Risk for Addictive Behavior Involvement

There are many models describing the role of personality traits in addiction risk (17,18,19,3). For the purpose of this study, we emphasize a model that identifies three personality traits that increase risk for impulsive behavior (20,21,22). Both theoretically and empirically, the traits appear to reflect different personality pathways toward addictive behavior. One trait is called urgency (21,22). It has two facets: positive and negative urgency reflect the tendencies to act rashly when experiencing very positive and very negative emotion, respectively. The second trait is low conscientiousness. It also has two facets: lack of planning (the tendency to act without forethought) and lack of perseverance (difficulty maintaining a focus on tasks). The third trait is sensation seeking, which reflects a disposition to seek out novel, thrilling stimulation (20,21). Empirically, the three traits share from less than 1% to 13% of their variance (6,21).

Each of these traits relates both concurrently and prospectively to multiple forms of addictive behavior. Prospectively, urgency or its facets predict subsequent drinking in both adolescents and adults (23,24); bulimic symptoms in both adolescents and adults (25,26); and drug use (27), risky sex (27), gambling (28), and non-suicidal self-injury (29) in adults.

Sensation seeking predicts subsequent risky behavior involvement, risky sexual behavior, increases in drinking frequency, and increases in smoking in adults (23,30,27). Low conscientiousness predicts increased drinking, smoking, and risky sexual behavior in youth (31). For prior studies of youth, the prospective prediction interval has been one year spanning the transition from elementary school to middle school.

To date, there have been no tests of whether specific impulsigenic traits in elementary school predict problematic addictive behavior involvement over longer intervals and multiple developmental transitions. Prior longer-term prospective studies were typically conducted before distinctions among impulsigenic traits were identified, and thus focused on broad constructs such as “undercontrolled” personality (32). Therefore, researchers have no information on whether different impulsigenic trait pathways play differing roles in increasing risk for the development of addictive behaviors. In addition, no studies have tested personality prediction of addictive behavior across the transitions from elementary to high school.

Other Possible Predictors of High School Addictive Behavior

We tested the predictive role of these impulsigenic traits beyond prediction from other, existing risk factors. Early pubertal onset, defined as occurring before 75% of one’s peers (33), predicts early onset addictive behaviors (34,35,36,37). The experience of negative affect and/or depressive symptomatology does as well (38,39,40,41). We also tested the predictive role of positive affect, based on the consideration that much youth substance use is likely to occur at parties in the context of positive mood.

Aims of the Current Study

Our aims were (1) to test the hypothesis that multiple impulsigenic traits, measured in elementary school, would predict both drinking and smoking behavior four years later, in high school and (2) to test whether prediction was invariant across gender and race (European American and African American). We tested the predictive role of each impulsigenic trait beyond prediction from (a) the other traits, (b) prior engagement in the addictive behaviors, and (c) other, established risk factors.

Method

Sample

Participants were 1897 youth in 5th grade at the start of the study. We selected 23 public elementary schools for inclusion because they represented urban, rural, and suburban backgrounds. All 5th graders at each school were approached to participate. The sample was equally divided between girls and boys; mean age 10.33 at wave 1. The ethnic breakdown of the sample was as follows: 60.9%, European American, 18.7% African American, 8.2 % Hispanic, 3% Asian American, and 8.8% other racial/ethnic groups.

Participant Retention

Table 1 of the on-line supplement presents retention data for each wave of the larger longitudinal project from which the current study was developed. As the table shows, in the larger study retention at each wave ranged between 92.4% and 98.3% of prior wave participants. Considering only the 2 waves used in the current study, n = 1,843 (97.2% of the overall sample) participated in wave 1 (54 participants consented to participate but were unavailable at wave 1 and began participation the next wave) and n = 1,428 (75.3% of the overall sample) participated in wave 2. As described below, we were able to use expectation maximization and maximum likelihood methods to make use of the full sample of 1,897.

Procedure

Data for the current study were drawn from a larger longitudinal study that included assessments at six month intervals from spring, 5th grade through spring, 8th grade and 12 months later in the spring of 9th grade. We report results on the first and final waves to test the hypothesis that elementary school impulsigenic traits predict high school addictive behavior across multiple developmental transitions. The questionnaires were administered in 23 public elementary schools at wave 1 and 7 high schools at wave 2. A passive-consent procedure was used. Each family was sent a letter, through the U.S. Mail, introducing the study. Families were asked to return an enclosed, stamped letter or call a phone number if they did not want their child to participate. Out of 1,988 5th graders in the participating schools, 1,897 participated in the study (95.4%). Reasons for non-participation included declination of consent from parents, declination of assent from children, and language or cognitive difficulties.

Questionnaires were administered in the children's classrooms or in a central location during school hours. Confidentiality was emphasized; the research team introduced the federal certificate of confidentiality for the project and emphasized that they were legally bound to keep all responses confidential. All participants signed assented to participate. The questionnaires took 60 minutes or less to complete. This procedure was approved by the University's IRB and by the participating school systems. Children who left the school system and consented to continue participation did so through a secure website or using hard copies of study questionnaires. They were paid $30 for doing so.

Measures

Outcomes—Using the Drinking Styles Questionnaire (42), we measured self-reported drinking frequency because it is the best marker of concurrent alcohol-related problems, as noted above (1). Drinking frequency was measured using a single item asking how often one drinks alcohol, where a drink refers to more than a sip, a taste, or a swallow or two. This single item assessment has proven stable over time and there is good evidence for its construct validity (34,6,27). Response options were "I have never had a drink of alcohol," "I have only had 1,2,3, or 4 drinks of alcohol in my life," "I only drink alcohol 3 or 4 times a year," "I drink alcohol about once a month," "I drink alcohol once or twice a week," and "I drink alcohol almost daily." We measured wave 1 drinking dichotomously and wave 2 drinking as an ordered categorical variable. We measured the frequency of smoking using the following response options: "I have never smoked," "I have smoked cigarettes 1,2,3, or 4

times in my life," "I smoke cigarettes 3 or 4 times a year" "I smoke about once a month," "I smoke about once or twice a week," and "I smoke almost daily or every day." We measured wave 1 smoking dichotomously and wave 2 smoking as an ordered categorical variable.

Key Predictors—Impulsigenic traits were measured with The UPPS-P Child Version (43-Table S2). Positive urgency, negative urgency, lack of planning, lack of perseverance, and sensation seeking were each measured with 8 items. Item responses are on a four-point Likert-type scale, ranging from "not at all like me" to "very much like me." Scale scores were calculated as the mean item response. At wave 1, the spring of 5th grade, coefficient alpha estimates of internal consistency for the five scales were: positive urgency, .89; negative urgency, .85; lack of planning, .77; lack of perseverance, .65; sensation seeking, .79; all values were greater in spring of 9th grade. Factor analyses of the UPPS-P confirm the three-trait structure with underlying facets, such that positive and negative urgency are facets of overall urgency and lack of planning and lack of perseverance are facets of overall low conscientiousness (21).

Because of the hierarchical structure of the UPPS-P, we engaged in preliminary analyses to determine if (a) positive and negative urgency performed differently from each other or (b) lack of planning and lack of perseverance performed differently from each other. At wave 1, positive and negative urgency correlated $r = .63$, $p < .001$; the two low conscientiousness traits correlated $r = .44$, $p < .001$. As we describe below, preliminary model tests indicated that, for both urgency and low conscientiousness, the facets performed in the same way. In the absence of differentiation at the facet level, the key model tests were conducted using the three traits of urgency, low conscientiousness, and sensation seeking.

Covariates—To assess early pubertal onset, we used the Pubertal Development Scale (*PDS*; 44), which consists of five questions each for boys and girls. Scores correlate highly with physician ratings ($r = .61$ to .67: 45,46). We dichotomized responses at a mean score of 2.5 to reflect pubertal onset (47). To assess depressive symptomatology, we used the Center for Epidemiologic Studies- Depression scale (*CES-D*; 48). This scale has proven reliable ($\alpha = .85$ in spring, 5th grade) and valid for use with children, adolescents, and adults (48). To assess positive and negative affect, we used the Positive Affect, Negative Affect Scale-Child Version (PANAS-C; 49). The PANAS-C measures dimensions of positive and negative affectivity. There is impressive evidence for both scales' reliability and validity (49). In the current sample, $\alpha = .90$ or higher in spring, 5th grade for the two scales.

Demographic and background questionnaire—Participants were asked to circle their sex, write in their current age (in years), and indicate which of the following best described their ethnicity; White/Caucasian, Black/African American, Hispanic/Latino, Asian, Arabic, Other.

Statistical Analysis

Treatment of Missing Data—We first evaluated whether data appeared to be missing at random. Next, because data did appear to be missing at random and because traditional listwise and pairwise deletion strategies for missing data have been shown to produce biased

parameter estimates (50,51), we used an expectation maximization procedure to impute missing values (50,51). In monte carlo studies, this method has produced parameter estimates virtually identical to full information maximum likelihood and parameter estimates equal to population values to at least two decimals, even at much smaller sample sizes (51). To avoid the reduction in standard error for a single imputation approach, we used SPSS-22 which includes a correction to the standard error estimates.

Analysis at Facet Level—We began by constructing single, confirmatory structural models using measured variables that included analysis at the facet level: positive and negative urgency were both included, as were both lack of planning and lack of conscientiousness. Other aspects of the model are as follows. There were two outcome variables: time 2 drinking and time 2 smoking, measured as ordered categorical variables. Predictors of both outcome variables were wave 1 measures of smoking, drinking, the five impulsigenic traits (the four listed above plus sensation seeking), early pubertal onset, depressive symptomatology, and positive and negative affect. In addition to those two outcome variables, each trait and each covariate predicted itself over the four year interval (for example, wave 1 sensation seeking predicted wave 2 sensation seeking). All predictors at wave 1 were allowed to covary, as were the outcome variables at wave 2.

Model Test—As described below, the final, key model tests was the same except that urgency replaced positive and negative urgency, and low conscientiousness replaced lack of planning and lack of perseverance. We then tested whether the model was invariant across gender and race. Concerning race, we compared European Americans and African Americans; the sample sizes for other racial groups were too small to model. We measured model fit with the confirmatory fit index (CFI), the Tucker-Lewis index (TLI), and the root mean square error of approximation (RMSEA). We used Mplus (52).

Results

Retention

Those who participated at all waves of the larger longitudinal study did not differ from those who participated in fewer waves on any study variables. We therefore used the expectation maximization procedure described above to impute values for the missing data points; doing so enabled us to use the full sample of $n = 1{,}897$.

Possible Effects due to School Membership

Because participants came from 23 different elementary schools, we examined whether there was a lack of independence between predictor scores as a function of attending the same school. We first calculated intraclass correlations between predictors and school membership. Each of those intraclass correlations was .000, providing no evidence of dependence between school and predictor score. To determine the value of including school in a multilevel model, we calculated the design effect:

$$1+(\text{average cluster size}-1)*\text{intraclass correlation}$$

A guideline is to use multilevel modeling when the design effect exceeds 2 (52). In the current case, the design effect for each predictor is 1. We therefore did not model a school effect in our structural model.

Descriptive Statistics

Table 1 provides descriptive statistics of the three personality traits, time 1 pubertal status, and the frequencies of smoking and drinking at both waves. Table 2 provides a correlation matrix of all key study variables.

Model Test

Facet-level Tests—A structural model that includes the facets of urgency and low conscientiousness produced the following fit indices: χ^2 (90) = 306.06, CFI = .97, TLI = .94, RMSEA = .04. A model constraining positive and negative urgency to have equal weights produced no loss in fit, as indicated by a non-significant change in chi-square and no change in the other fit indices: χ2 (92) = 310.54, CFI = .97, TLI = .94, RMSEA = .03. Thus, there was no basis for treating the two traits separately and the overall urgency trait was modeled subsequently. A model constraining lack of planning and lack of perseverance to have equal weights also produced no loss in fit: χ^2 (92) = 310.31, CFI = .97, TLI = .94, RMSEA = .03. Again, because there was no basis for treating the two traits separately, we modeled overall low conscientiousness subsequently.

Model test—Figure 1 depicts those predictive effects, other than autoregressions (a variable predicting itself over time), that were statistically significant. Supplement Table S3 provides beta weights and confidence intervals for all tested effects, including autoregressions. The model fit the data well: χ^2 (56) = 151.97, CFI = .98, TLI = .96, RMSEA = .03. As the figure shows, early pubertal onset predicted increases in both behaviors, whereas depression, negative affect, and positive affect predicted neither behavior. All three impulsigenic traits, urgency, low conscientiousness and sensation seeking, predicted increases in both drinking and smoking behavior across the four year interval. Each of these predictive effects was present above and beyond prediction from prior behavior, the other traits, early pubertal onset, depression, and positive and negative affectivity.

We next tested whether the magnitude of prediction differed across the three traits. We constructed a model in which we constrained the magnitude of prediction of each outcome variable to be equal across the three traits. This model resulted in no loss in model fit, as indicated by a non-significant change in chi-square and no change in other fit indices: χ^2 (60) = 157.03, CFI = .98, TLI = .96, RMSEA = .03.

We tested whether this predictive model was invariant across gender. In the first step of invariance testing, we specified the same model for boys and girls. This model fit the data well: χ^2 (96) = 270.87, CFI = .97, TLI = .93, RMSEA = .04. We next constrained each of the 24 predictive paths to be equal across gender (from each of the time 1 predictors to the two time 2 behaviors and all autoregressions). This more constrained model also fit the data well: χ^2 (120) = 332.46, CFI = .97, TLI = .93, RMSEA = .04. Although the chi-square

difference test was statistically greater than zero ($\Delta\chi^2$ (24) = 61.59, $p < .01$), there was no drop in any of the fit index values, providing no indication of effect variation by gender. We thus conclude that the model appears to operate in the same way for boys and girls.

We also tested whether the predictive model was invariant across race. We compared European American and African American youth. In the first step of invariance testing, we specified the same model for both groups. The model fit well: χ^2 (112) = 273.34, CFI = .97, TLI = .92, RMSEA = .04. We next constrained each of the 24 predictive paths to be equal across race, and this constrained model produced no drop in model fit: χ^2 (136) = 277.03, CFI = .97, TLI = .94, RMSEA = .04. Thus, the model appears to operate in the same way for European American and African American youth.

Discussion

The key findings of this study were that each of three personality traits, urgency, sensation seeking, and low conscientiousness, when measured in elementary school children, predicted those children's drinking and smoking behavior four years later, during the first year of high school. Strikingly, each impulsigenic trait predicted beyond prediction from prior addictive behavior, the other traits, early pubertal onset, 5th grade depression, negative affectivity and positive affectivity. This prediction occurred across the multiple developmental transitions associated with the progression from elementary school through middle school to high school. We found no evidence that any one of the three traits predicted more strongly than the other two. The observed effects did not appear to differ between boys and girls or between European American and African American youth.

Preventive interventions designed to address the broad, transdiagnostic risk associated with personality are just beginning but do show promise (53,54). Interventions appropriate to urgency, sensation seeking, and low conscientiousness are likely to differ from each other (54); it may prove necessary to assess the full range of impulsigenic traits to identify the most effective prevention strategies for a given adolescent.

Limitations of this research include the following. Although we documented temporal prediction from early personality to later addictive behavior beyond important controls, this study does not represent a rigorous test of causal processes. Although our self-report method facilitated the collection of information from such a large sample, there was no opportunity to clarify items for participants or address their questions. Retention over the course of the longitudinal period was good and there was no evidence of differential attrition, but we cannot know if the findings would have differed had there been no attrition. We did not include assessments of the context of either drinking or smoking; further understanding of the role of context is crucial (55,56,57). More broadly, it is important to integrate the current risk factors into more comprehensive risk models. Finally, some children had already begun smoking and drinking by the fifth grade. The current study could not predict onset for those youth.

In summary, there appear to be multiple personality dispositions that, when present among elementary school children, each separately predict those children's addictive behavior

involvement four years later in high school. To understand increased risk for both drinking and smoking behavior among high school students, it may be necessary to assess several different impulsigenic traits and to do so at a young age. The same risk process appeared to operate for boys and girls and for members of at least two racial groups. These findings shed further light on risk for adolescent addictive behavior involvement and point to opportunities for both early identification of youth at high risk and for targeted prevention and intervention efforts.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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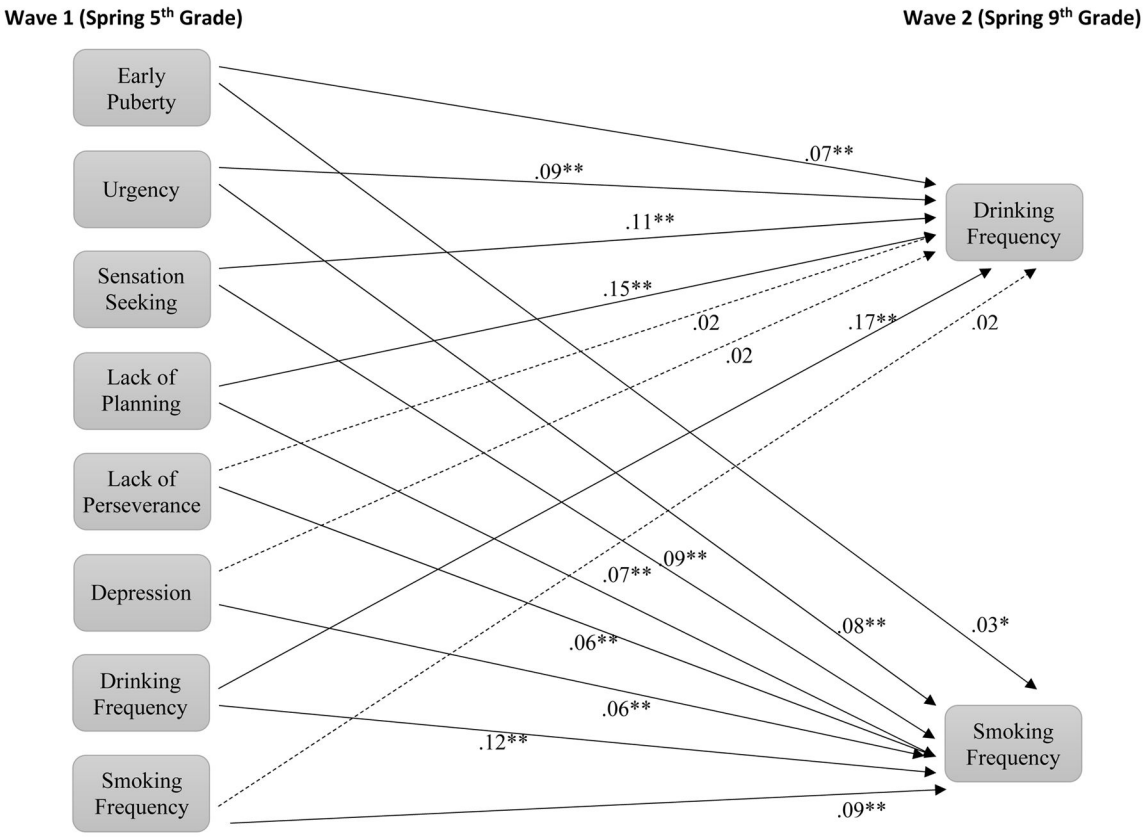

Figure 1. Elementary School Personality Predicts High School Behavior

Note. Autoregressions and cross-sectional correlations are not included for the sake of clarity. Values are standardized beta weights. *=p<.05, **=p<.01; Dashed lines indicate nonsignificant paths.

Table 1

Descriptive statistics of key variables measured at both waves, all participants (N = 1897)

	Wave 1		Wave 2	
	Females	**Males**	**Females**	**Males**
Mean (SD)				
Urgency	4.35 (1.26)	4.35 (1.34)	4.33 (1.25)	4.35 (1.27)
Sensation Seeking	2.65 (.69)	2.61 (.70)	2.66 (.71)	2.68 (.69)
Low Conscientiousness	4.06 (.87)	4.04 (.88)	4.42 (.99)	4.36 (.98)
Depression	34.71 (8.17)	34.69 (8.71)	36.51 (9.64)	36.44 (9.53)
Negative Affect	2.10 (.74)	2.12 (.79)	1.84 (.78)	1.83 (.75)
Positive Affect	3.71 (.70)	3.76 (.71)	3.48 (.80)	3.41 (.75)
Percentages				
Pubertal Status	23.5%	23.2%	--	--
Frequencies				
Drinking = 0	86.5%	89.2%	52.5%	53.0%
Drinking = 1	13.5%[a]	10.8%[a]	32.4%	29.7%
Drinking = 2			7.8%	9.6%
Drinking = 3			4.6%	3.6%
Drinking = 4			1.5%	2.4%
Drinking = 5			1.3%	1.7%
Smoking = 0	94.6%	94.8%	70.2%	71.5%
Smoking = 1	5.4%[a]	5.2%[a]	21.4%	17.8%
Smoking = 2			5.4%	5.3%
Smoking = 3			1.4%	3.2%
Smoking = 4			1.6%	2.1%
Smoking = 5			.00%	.00%

Note.

[a]Wave 1 values are dichotomous reflecting drinker or smoker status. Levels of drinking and smoking behavior engagement are represented by percentages of individuals who engaged in drinking behavior or smoking behavior at different levels of the count variable. Drinking frequencies; 0 = I have never had a drink of alcohol, 1 = I have only had 1,2,3, or 4 drinks of alcohol in my life, 2= I only drink alcohol 3 or 4 times a year, 3 = I drink alcohol about once a month, 4 = I drink alcohol once or twice a week, 5 = I drink alcohol almost daily. Smoking frequencies; 0 = I have never smoked, 1 = I have smoked cigarettes 1,2,3, or 4 times in my life, 2 = I smoke cigarettes 3 or 4 times a year, 3 = I smoke about once a month, 4 = I smoke about once or twice a week, 5 = I smoke almost daily or every day. Pubertal status is represented by percentage of participants considered pubertal.

Table 2

Bivariate Correlations of Key Study Variables

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1. Sex	-																	
2. Pub	.00	-																
3. Urg W1	.00	.13**	-															
4. SS W1	.03	.08**	.33**	-														
5. LC W1	.00	.03	.21**	−.08**	-													
6. Dep W1	.00	.14**	.42**	.04	.20**	-												
7. NA W1	−.02	.03	.40**	.01	.08**	.49**	-											
8. PA W1	−.03	.02	−.07**	.20**	−.37**	−.25**	−.12**	-										
9. Drink W1	.04	.18**	.23**	.15**	.16**	.14**	.09**	−.07**	-									
10. Smoke W1	.00	.18**	.23**	.07**	.19**	.13**	.08**	−.07**	.42**	-								
11. Urg W2	−.01	.06**	.33**	.15**	.14**	.21**	.13**	−.02	.16**	.10**	-							
12. SS W2	−.02	−.02	.08**	.37**	−.01	.01	−.04	.10**	.08**	.02	.38**	-						
13. LC W2	.03	.05*	.14**	.01	.23**	.12**	.08**	−.13**	.05*	.07**	−.01	−.35**	-					
14. Dep W2	.00	.07**	.22**	.00	.09**	.28**	.18**	−.10**	.08**	.08**	.42**	.05*	.11**	-				
15. NA W2	−.02	.08**	.18**	.01	.10**	.22**	.20**	−.07**	.07**	.06**	.43**	.05*	.08**	.68**	-			
16. PA W2	.01	.01	−.08**	.11**	−.13**	−.17**	−.12**	.22**	−.04	−.04	−.02	.23**	−.22**	−.33**	−.29**	-		
17. Drink W2	−.02	.12**	.19**	.16**	.15**	.08**	.04	−.03	.26**	.18**	.33**	.20**	.09**	.29**	.30**	−.07**	-	
18. Smoke W2	−.02	.11**	.20**	.12**	.16**	.15**	.07**	−.08**	.24**	.21**	.30**	.15**	.11**	.32**	.32**	−.14**	.55**	-

Note.

*=p<.05,

**=p<.01.

W1= Wave 1, spring of 5th grade; W2 = Wave 2, spring of 9th grade; Pub = Early Pubertal Onset; Urg = Urgency, SS = Sensation Seeking, LC = Low Conscientiousness, Dep = Depression, NA = Negative Affect, PA = Positive Affect