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A parallel process model of the development of positive smoking expectancies and smoking behavior during early adolescence in Caucasian and African American girls

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Abstract

This study examined the development of positive smoking expectancies and smoking behavior in an urban cohort of girls followed annually over ages 11-14. Longitudinal data from the oldest cohort of the Pittsburgh Girls Study ($N=566$, 56% African American, 44% Caucasian) were used to estimate a parallel process growth model of positive smoking expectancies and smoking behavior. Average level of positive smoking expectancies was relatively stable over ages 11-14, although there was significant variability in initial level and rate of change in positive smoking expectancies. Ethnicity was associated with expectancy intercept and slope, such that African American, relative to Caucasian, girls initially had more positive expectancies, and less rapid change in positive expectancies. Ethnic differences in past year smoking prevalence emerged at age 14, with greater smoking prevalence among Caucasian (17%), compared to African American (8%), girls. Initial level of positive smoking expectancies and initial smoking behavior were positively associated, but positive expectancies did not predict growth in smoking behavior. Depression at age 11 was concurrently and positively associated with both positive expectancies and smoking. Study results suggest the potential utility of culturally tailored smoking prevention efforts, and the potential secondary benefit of depression treatment to prevent smoking among at-risk girls.

Keywords

cigarette smoking; positive smoking expectancies; adolescent girls; ethnicity

1. Introduction

The narrowing of the gender gap in rates of adolescent tobacco use (Substance Abuse and Mental Health Services Administration [SAMHSA], 2008), and the more rapid rate of progression to tobacco use disorders among females (e.g., DiFranza et al., 2002), relative to

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males, compels research on the factors associated with the early initiation and escalation of tobacco use in girls. In addition, little is known regarding factors that begin to explain the lower prevalence of tobacco use found in a recent national survey among African American (6.1%), compared to Caucasian (12.2%), adolescents ages 12-17 (SAMHSA, 2008). This study examined the development of positive tobacco expectancies in relation to tobacco use during early adolescence, and possible ethnic differences in the development of tobacco use.

Among the factors that have been examined as predictors of tobacco use, smoking outcome expectancies, which are beliefs about the possible effects of cigarette use (e.g., feel relaxed), consistently emerge as predictors of smoking behavior (e.g., Hine, Honan, Marks, & Brettschneider, 2007). Importantly, positive, but not negative, smoking expectancies predict smoking behavior in early adolescence (Copeland et al., 2007). Thus, we focused on positive expectancies, and examined selected covariates: in the biological domain, pubertal maturation (e.g., Westerling, Andrews, Hampson & Peterson, 2008); in the psychological domain, conduct problems (e.g., Otten, Wanner, Vitaro & Engels, 2009) and depression (e.g., Fleming, Mason, Mazza, Abbott & Catalano, 2008); and in the social domain, parental smoking (e.g., Milton et al., 2004) and supervision (e.g., Westerling et al., 2008).

We used a parallel process model to study the development of positive tobacco-related expectancies and tobacco use in a cohort of early adolescent girls. We predicted that initial level and change in positive expectancies would be positively associated with initial level and change in tobacco use. We further predicted that African American, compared to Caucasian, girls would report less positive tobacco expectancies; and that greater conduct problems and depression, greater pubertal maturation, greater caretaker smoking, and less parental supervision would be associated with more positive expectancies and smoking.

2. Method

2.1 Sample characteristics and data collection

Analyses used annual data collected at ages 11 to 14 from the oldest cohort in the Pittsburgh Girls Study, a community sample followed since ages 5-8 (for details, see Hipwell et al., 2005). The sample (n=566) included girls who participated in at least one assessment (56% African American, 44% Caucasian), and their primary caretaker (92% female, 45% single parent household). Annual in-home structured interviews were conducted separately with the girl, and with the girl's primary caretaker, by a trained interviewer. Study procedures were approved by the university's Institutional Review Board. Retention averaged 91%; there was no attrition bias.

2.2 Measures

2.2.1 Girls' tobacco use and positive smoking outcome expectancies—At ages 11-14, girls reported on any tobacco use in the past year (coded 0=*no*, 1=*yes*). The Drug, Alcohol, and Tobacco Expectancy Questionnaire (adapted from Hornik et al., 2002) assessed four positive tobacco expectancies on a 5-point scale (0=*very unlikely* to 4=*very likely*): be more relaxed, have a good time with friends, feel better, and be like the coolest kids. Measurement invariance analyses were conducted by ethnicity, and across ages 11 to 14. Confirmatory factor analyses at each age, separately by ethnicity, indicated satisfactory fit of a single-factor for the four expectancies. Results of multiple group analyses (by ethnicity), at each wave suggested omitting the “relax” expectancy to improve fit. Full measurement invariance for the three remaining expectancies over ages 11-14 was observed. Internal consistency reliability of the three items ranged from $\alpha=.83$ (age 11) to $\alpha=.89$ (age 12).

2.2.2 Conduct problems, depression, and pubertal maturation—Conduct problems and depression symptoms in the past year were assessed at age 11 using the Child Symptom Inventory, 4th edition (CSI-4; Gadow & Sprafkin, 1994). Items were rated on a four-point scale (0=*never* to 3=*very often*), and summed for conduct problems ($\alpha=.64$) and depression ($\alpha=.74$). At age 11, girls reported on four signs of pubertal maturation (1=*have not begun* to 4=*development completed*) and the onset of menarche (yes/no) using the *Peterson Pubertal Developmental Scale*; Peterson, Crockett, Richards & Boxer, 1988). Responses were summed ($\alpha=.68$); higher scores indicate greater maturation.

2.2.3 Primary caretaker cigarette use and report of parental supervision—The caretaker self-reported past year tobacco use when the girl was age 11 (0=*never tried cigarettes* to 7=*used more than once a day*). The *Supervision-Involvement Scale* (Loeber, Farrington, Stouthamer-Loeber & Van Kammen, 1998) includes four items that the caretaker rated on a 3-point scale (i.e., 3=*almost never*, 2=*sometimes*, 1=*almost always*). Items were summed ($\alpha=.60$); a higher score indicates poor supervision.

2.3 Data analysis

Unconditional latent growth curve models for positive tobacco expectancies and tobacco use over ages 11-14 were estimated using Mplus 5.12 (Muthen & Muthen, 2008), followed by estimation of a parallel process model, which included ethnicity (coded 1=Caucasian, 2=African American) as a covariate.

3. Results

3.1 Sample descriptive statistics

At age 11, more African American, compared to Caucasian, families received public assistance (36.9% versus 12.3%, respectively; $\chi^2(1)=41.44, p<.000$). African American caretakers reported, on average, poorer parental supervision compared to Caucasian caretakers (*Mean [Standard Deviation]*=4.36 [0.83] versus 4.16 [0.53]; $t(522)=3.34, p=.001$). African American and Caucasian caretakers did not differ in past year cigarette use (52% and 60% reported no past year use, respectively). African American girls reported more conduct problems (0.31 [0.78] versus 0.05 [0.25]; $t(390)=5.47, p=.001$), greater depressed mood (6.28 [2.99] versus 5.20 [3.09]; $t(543)=4.14, p=.001$), and greater pubertal maturation (11.60 [3.20] versus 10.96 [3.13]; $t(540)=2.31, p=.02$) compared to Caucasian girls.

3.2 Unconditional latent growth curve models (LGCMs)

The unconditional linear LGCM for positive tobacco expectancies across ages 11-14, with full measurement invariance, had adequate fit: $\chi^2[25, N = 564] = 45.51, p = .007$; Confirmatory Fit Index (CFI) = .99; Root Mean Square Error of Approximation (RMSEA) = .04; Weighted Root Mean Residual (WRMR) = .98. Ethnic differences in positive expectancies were examined using a 2 (ethnicity) $\times$ 4 (time) repeated measures ANOVA, which indicated a significant main effect of ethnicity ($F[1, 562]=6.54, p=.01$), but no significant main effect of time ($F[3, 560] = 0.66, p=.58$), and no significant ethnicity $\times$ time interaction ($F[3, 560]=1.90, p=.13$). Mean factor scores for the positive expectancy items (see Table) suggested a declining trend among African American girls, whereas expectancies tended to increase among Caucasian girls. Post-hoc comparisons at each age indicated that African American, compared to Caucasian, girls had higher positive tobacco expectancies at age 11, but not at ages 12-14.

The unconditional linear LGCM for tobacco use in the total sample across ages 11-14 had good fit: $\chi^2[5, N = 564] = 3.70, p = .59$; CFI = 1.00; TLI = 1.00; RMSEA = .00; WRMR = .51. A significant difference in tobacco use by ethnicity emerged at age 14 (see Table), with greater use among Caucasian, compared to African American, girls (17% versus 8%, respectively).

3.3 Parallel process model of positive tobacco expectancies and tobacco use

The parallel process model had good fit to the data: $\chi^2 [50, N = 566] = 83.90, p = .002$; CFI = .99; TLI = .99; RMSEA = .04; WRMR = .88. The covariance between expectancy intercept and slope was significant (see Figure: $r = -.48, p = .03$), suggesting that higher initial positive expectancy was associated with slower rate of change in expectancies over time. The covariance between tobacco use intercept and slope was not significant ($r = -.35, p = .43$). Initial level of positive expectancies was associated with initial tobacco use ($r = .34, p = .047$). Expectancy intercept did not predict growth in tobacco use over ages 11-14 ($B = -.12, SE = 0.11, \beta = -.27, p = .28$), and tobacco intercept did not predict growth in positive expectancies ($B = .04, SE = 0.07, \beta = .16, p = .51$).

Ethnicity was associated with expectancy intercept, such that African American girls initially had, on average, greater positive expectancies than Caucasian girls ($B = .31, SE = .09, \beta = .26, p = .001$). Contrary to prediction, girls who did not receive public assistance had, on average, more positive initial expectancies than girls who did receive public assistance ($B = -.25, SE = .09, \beta = -.18, p = .01$). Expectancy intercept also was positively associated with both depression symptom severity ($B = .03, SE = .01, \beta = .14, p = .04$), and parental tobacco use ($B = .03, SE = .01, \beta = .16, p = .02$).

Expectancy slope was associated with ethnicity, such that African American girls had a lower rate of change, on average, in positive expectancies than Caucasian girls ($B = -.11, SE = .04, \beta = -.20, p = .01$). In addition, expectancy slope was negatively associated with poor parental supervision ($B = -.07, SE = .03, \beta = -.20, p = .03$), suggesting that poorer parental supervision was associated with slower growth in positive tobacco expectancies.

As predicted, tobacco use intercept was positively associated with conduct problems ($B = .25, SE = .06, \beta = .16, p = .001$), depression ($B = .08, SE = .03, \beta = .26, p = .01$), and pubertal maturation ($B = .07, SE = .02, \beta = .24, p = .005$). Ethnicity was the only significant predictor of tobacco use slope ($B = -.19, SE = .09, \beta = -.36, p = .03$), indicating that Caucasian, compared to African American, girls had, on average, more rapid growth in tobacco use.

4. Discussion

The parallel process model provided support for a positive association between initial level of positive smoking expectancies and early smoking behavior, but not for an association between rate of change in positive expectancies and smoking behavior at ages 11-14. Contrary to prediction, there was no statistically significant change in positive tobacco expectancies with age, despite an overall increase in the prevalence of past year smoking. Among the risk factors examined, depression warrants attention in prevention efforts with girls, as it appeared to be a risk factor for both positive tobacco expectancies and early smoking behavior.

Study findings highlight ethnicity as a predictor of positive tobacco expectancies and smoking behavior in girls. Although African American, relative to Caucasian, girls initially had higher positive expectancies, African American girls tended to show slower change in positive tobacco expectancies, and lower prevalence of smoking at age 14, compared to Caucasian girls. The apparent resistance of African American girls to smoking in the context of greater likelihood of experiencing certain risk factors (e.g., greater pubertal maturation) points to the importance of identifying protective factors that are associated with lower smoking prevalence among African American girls.

The unexpected finding that poor parental supervision predicted slower growth in positive expectancies also may reflect ethnic subgroup differences, and may have been observed here because African American, compared to Caucasian, caretakers reported, on average, poorer

parental supervision; and because African American girls tended to show slower growth in positive expectancies. Inconsistent findings regarding ethnic differences in the influence of parenting behaviors on adolescent smoking have emerged in the literature, suggesting that in some contexts, poor parental supervision is not necessarily associated with greater risk for smoking (Wallace & Muroff, 2002).

Among the risk factors examined, depression was associated with both concurrent positive smoking expectancies and tobacco use. Prior research has identified depression as a risk factor for early smoking behavior in girls (e.g., Fleming et al., 2008). However, this is one of the first studies involving early adolescents to associate depression with positive tobacco expectancies, as well as with actual smoking behavior.

Certain study limitations warrant comment. Results may not be generalizable to boys, or to other ethnic groups. Only positive, and not negative, smoking expectancies were examined. Other risk factors for smoking behavior (review: Andrews, 2005), such as perceptions of peer smoking, were not studied. Tobacco use was self-reported, with no biochemical verification.

Study results provide further support, in accord with expectancy theory, for positive smoking expectancies as predictors of tobacco use. The finding that despite greater apparent risk for early smoking, African American, relative to Caucasian, girls had slower growth in smoking highlights the importance of identifying protective factors that operate within ethnic subgroups. In addition, the finding that depression was associated with more positive expectancies and initial smoking behavior suggests that preventive interventions that aim to reduce depression may secondarily reduce risk for early smoking behavior.

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Figure.

Parallel process growth model of positive tobacco expectancies and growth in tobacco use over ages 11-14. Expect= Positive Tobacco Expectancies, Public Assist= Receipt of public assistance, Conduct Prob= Conduct Disorder symptom count, Parent Tob Use= Parent's tobacco use at girl age 11. Only significant paths are depicted (N=566).

Table
Descriptive statistics for girls' positive tobacco expectancies and past year tobacco use at ages 11-14

Positive Tobacco Expectancy Factor Score *	N	Total Sample		African American		Caucasian		Difference by ethnicity
		Mean	SD	Mean	SD	Mean	SD	
Age 11	564	0.08	0.71	0.17	0.76	-0.03	0.62	$t(560)=3.44, p=.001$
Age 12	564	0.11	0.72	0.16	0.76	.004	0.65	$t(555)=1.96, p=.055$
Age 13	564	0.09	0.69	0.12	0.72	0.04	0.66	$t(562)=1.43, ns$
Age 14	564	0.11	0.68	0.12	0.70	0.09	0.66	$t(562)=0.45, ns$
Any Past Year Tobacco Use	N	Total Sample		African American		Caucasian		Difference by ethnicity
		n	%	n	%	n	%	
Age 11	544	12	2.2	3	1.3	9	2.9	$\chi^2(1)=1.62, ns$
Age 12	539	24	4.5	11	3.6	13	5.6	$\chi^2(1)=1.18, ns$
Age 13	532	38	7.1	16	5.3	22	9.6	$\chi^2(1)=3.68, ns$
Age 14	515	59	11.5	22	7.5	37	16.8	$\chi^2(1)=10.88, p=.001$

* Multiple group growth model results indicated no significant differences by ethnicity in growth parameters for positive tobacco expectancies. The multiple group growth model for tobacco use did not converge, so chi-square tests were conducted at each age.