The Association of Low Parental Monitoring With Early Substance Use in European American and African American Adolescent Girls

ERICA C. BLUSTEIN, B.S.,[a,b] MELISSA A. MUNN-CHERNOFF, PH.D.,[c,d,e,*] JULIA D. GRANT, PH.D.,[c,d] CAROLYN E. SARTOR, PH.D.,[c,d,f] MARY WALDRON, PH.D.,[c,g] KATHLEEN K. BUCHOLZ, PH.D.,[c,d] PAMELA A. F. MADDEN, PH.D.,[c,d] & ANDREW C. HEATH, D.PHIL.[c,d]

[a]*Department of Biology, Rhodes College, Memphis, Tennessee*
[b]*College of Medicine, University of Arkansas for Medical Sciences, Little Rock, Arkansas*
[c]*Department of Psychiatry, Washington University School of Medicine, St. Louis, Missouri*
[d]*Alcoholism Research Center, Washington University School of Medicine, St. Louis, Missouri*
[e]*Department of Psychiatry, University of North Carolina at Chapel Hill, Chapel Hill, North Carolina*
[f]*Department of Psychiatry, Yale University School of Medicine, New Haven, Connecticut*
[g]*Department of Counseling and Educational Psychology, Indiana University School of Education, Bloomington, Indiana*

ABSTRACT. Objective: Research indicates that low parental monitoring increases the risk for early substance use. Because low parental monitoring tends to co-occur with other familial and neighborhood factors, the specificity of the association is challenging to establish. Using logistic regression and propensity score analyses, we examined associations between low parental monitoring and early substance use in European American (EA) and African American (AA) girls, controlling for risk factors associated with low parental monitoring. **Method:** Participants were 3,133 EA and 523 AA girls from the Missouri Adolescent Female Twin Study with data on parental monitoring assessed via self-report questionnaire, and with ages at first use of alcohol, tobacco, and cannabis queried in at least one of three diagnostic interviews (median ages = 15, 22, and 24 years). **Results:** The rate of early alcohol use was greater in EA than AA girls, whereas the proportion of AA girls reporting low parental monitoring was higher than in EA girls. EA girls who experienced low parental monitoring were at elevated risk for early alcohol, tobacco, and cannabis use, findings supported in both logistic regression and propensity score analyses. Evidence regarding associations between low parental monitoring and risk for early substance use was less definitive for AA girls. **Conclusions:** Findings highlight the role of parental monitoring in modifying risk for early substance use in EA girls. However, we know little regarding the unique effects, if any, of low parental monitoring on the timing of first substance use in AA girls. (*J. Stud. Alcohol Drugs, 76,* 852–861, 2015)

PARENTAL MONITORING—knowing a child's whereabouts, friends, and activities, and supervising or exerting control over their activities (e.g., setting curfews)—plays an important role in healthy adolescent development. Parental monitoring during adolescence, which has shown stability across early, middle, and late stages (Li et al., 2000b; Van Ryzin et al., 2012), is consistently linked to alcohol and tobacco use (Habib et al., 2010; Hemovich et al., 2011; Jackson & Schulenberg, 2013; Latendresse et al., 2008; Steinberg et al., 1994; Van Ryzin et al., 2012; Wang et al., 2009; White et al., 2006; Wright & Fitzpatrick, 2004), with higher levels of monitoring protecting against, and lower levels of monitoring elevating, the risk for early use. Elevated rates of illicit substance use (primarily cannabis use) are also observed in adolescents reporting lower levels of parental monitoring (Hemovich et al., 2011; Ramirez et al., 2004; Stanton et al., 2002; Steinberg et al., 1994; Van Ryzin et al., 2012; Wang et al., 2009; White et al., 2006; Wright & Fitzpatrick, 2004). The association between substance use and parental monitoring during adolescence appears robust and remains significant into the young adult years for alcohol (Abar et al., 2014; Arria et al., 2008; Walls et al., 2009) and cannabis (Pinchevsky et al., 2012; White et al., 2006).

Although parental monitoring is a well-established correlate of adolescent substance use, whether its observed association with alcohol and other drug use can be attributed specifically to monitoring, rather than related protective and risk factors, is unclear. Deviant peer affiliation is a well-known risk factor for adolescent substance use (D'Amico & McCarthy, 2006; Korhonen et al., 2008; van den Bree & Pickworth, 2005; Wang et al., 2009) that is also associated with lower levels of parental monitoring (Ary et al., 1999;

Received: January 22, 2015. Revision: July 16, 2015.

This work was supported by National Institutes of Health (NIH) Grants AA09022, AA07728, AA11998, AA17915, AA17688, AA21492, and HD049024 (to Andrew C. Heath) and AA12640 and U10 AA008401 (to Kathleen K. Bucholz). Melissa A. Munn-Chernoff was supported by Grant T32 AA07580 (principal investigator: Andrew C. Heath), Carolyn E. Sartor was supported by Grant AA017921, and Mary Waldron was supported by Grant DA023696. The NIH had no further role in study design; in the collection, analysis, and interpretation of the data; in the writing of the report; or in the decision to submit the article for publication.

*Correspondence may be sent to Melissa A. Munn-Chernoff at the Department of Psychiatry, University of North Carolina at Chapel Hill, 101 Manning Drive, Campus Box 7160, Chapel Hill, NC 27599, or via email at: melissa_chernoff@med.unc.edu.

Flannery et al., 1999; Miranda, Jr. et al., 2013; Tornay et al., 2013). Similarly, parental substance use disorders, which confer both genetic and environmental risk for adolescent substance use, are associated with poor parenting (Chassin et al., 1993; Jacob & Johnson, 1997). Disentangling parental monitoring effects from correlated factors that are also associated with early substance use requires an analytic approach that can account for this clustering.

The strategy implemented in the current study, propensity score analysis (PSA; Green & Stuart, 2014; Rosenbaum, 2010; Rosenbaum & Rubin, 1983; West et al., 2014), achieves this aim by creating subsamples matched on a liability indicator (i.e., propensity) to initiate alcohol, tobacco, or cannabis at an early age, using as predictors familial and neighborhood factors (i.e., background characteristics) associated with low parental monitoring. PSA was developed to allow tests of causal hypotheses without dependence on strong linear statistical model assumptions, for situations where randomized experimentation was not possible. These methods have been successfully applied in prior research on early-onset substance use (e.g., Odgers et al., 2008; Waldron et al., 2014). In the current study, we used both logistic regression and PSA to control for the confounding effects of correlated background characteristics, the latter to confirm our confidence in the specific contribution of parental monitoring to early use of alcohol, tobacco, and cannabis.

The role of race/ethnicity

Numerous studies examining parental monitoring and substance use outcomes include individuals from various racial/ethnic minority groups (Byrnes et al., 2011; DiClemente et al., 2001; Fang et al., 2011; Klima et al., 2014; Marsiglia et al., 2012; Reifman et al., 1998; Stanton et al., 2002; Strunin et al., 2013; Tobler & Komro, 2010), and despite some evidence of lower parental monitoring levels in African American (AA) than European American (EA) families (Bird et al., 2001; Griesler & Kandel, 1998; Mahabee-Gittens et al., 2012), racial/ethnic differences in the degree of association between parental monitoring and early substance use have not been consistently reported (c.f., see Bohnert et al., 2009).

However, the evidence for differences between EA and AA individuals in patterns of substance use initiation is consistent. In addition to the lower prevalence of lifetime alcohol and cigarette use in AA individuals (Ellickson et al., 2004; Grucza et al., 2008; Heath et al., 1999; Scarinci et al., 2002; Vega et al., 2007), recent work by our group has revealed more nuanced distinctions in the course of alcohol, tobacco, and cannabis use. Duncan et al. (2012) reported a later age at first cigarette and a slower transition time from first cigarette to nicotine dependence onset in AA versus EA participants. In another study, we found a higher lifetime prevalence of cannabis use in AA versus EA women; interestingly, no difference in age at initiation of cannabis use was observed, but age at first drink was significantly older in AA versus EA women (Sartor et al., 2013). Furthermore, consistent with the few prior studies examining racial/ethnic distinctions in substance use initiation sequence (Guerra et al., 2000; White et al., 2006), AA women were more likely than EA women to initiate the use of cannabis before alcohol (Sartor et al., 2013).

Despite the absence of findings specifically on differences by race/ethnicity in the influence of parental monitoring on early substance use, the distinctions in the pathways to first use of alcohol, tobacco, and cannabis suggest that the relative influence of various psychosocial factors on initiation of these substances may differ between AA and EA individuals. A more rigorous approach accounting for co-occurring factors than has been applied in existing studies may uncover previously undetected differences.

Current study

The aim of this study was to examine the association between parental monitoring and early substance use separately in EA and AA girls. We hypothesized that lower levels of parental monitoring would be associated with an increased risk of early substance use in both EA and AA girls in logistic regression analyses. In addition, we hypothesized that respondent-reported parental monitoring would remain associated with early substance use when modeled using a propensity score approach applied separately for EA and AA girls. Our study extends the existing literature by controlling for familial and neighborhood factors that are associated with parental monitoring, which may differ by racial/ethnic group. Stratifying by race/ethnicity allowed us to evaluate the relationship between early use of each substance (i.e., alcohol, tobacco, and cannabis) and low parental monitoring among EA and AA girls separately. This is the preferred method when a minimal number of subsamples are examined (Green & Stuart, 2014) over the approach of creating a large number of interactions between race/ethnicity and other covariates. Understanding mechanisms by which low levels of parental monitoring are associated with early substance use within distinct racial/ethnic groups will be useful for tailoring prevention and intervention programs for high-risk individuals.

Method

Participants

Participants were twins from the Missouri Adolescent Female Twin Study (MOAFTS) (Heath et al., 1999, 2002; Knopik et al., 2005; Waldron et al., 2013), a population-based longitudinal study of female twin pairs identified from state birth records and born between July 1, 1975, and June

30, 1985, in Missouri to a mother who was a state resident. Twins were recruited using a cohort sequential sampling design, with ascertainment of successive 6-month cohorts of 13-, 15-, 17-, and 19-year-old twin pairs over a 2-year period and continued recruitment of 13-year-olds over 2 additional years. The sample was demographically representative of the Missouri population at the time the twins were born, with nearly 15% of twins being AA and the remainder being of European descent. A baseline interview was conducted with the twins beginning in 1995 (Mdn_{age} = 15 years). When possible, interviews were also conducted with at least one parent (usually the mother) at the time the twins entered the study. The Wave 4 young adult follow-up interview was conducted an average of 6 years after the baseline assessment (Mdn_{age} = 22 years). Because all members of the target cohort were 18 years of age or older at follow-up and study participation was no longer contingent on parental consent, all individuals from the original sampling frame were invited to participate at Wave 4, even if they had not participated at baseline. Only those twins who themselves refused future contact or whose parents had refused all future contact with family members were excluded from being recontacted at Wave 4. Measures for this project also included a questionnaire at the Wave 4 follow-up. Approximately 2 years after completing the Wave 4 interview, participants were invited to take part in the Wave 5 interview (Mdn_{age} = 24 years). All twins 18 years old or older gave informed consent before study participation. Parental consent and assent for the twins were obtained before participation in interviews conducted when twins were younger than 18 years. The protocol was approved by the Washington University School of Medicine Institutional Review Board.

Data for the present study were drawn primarily from Wave 4, which had the largest sample size of all waves of data collection and included detailed assessments of both substance use and parental monitoring. The sample for the current study was composed of 3,656 individuals (EA = 3,133; AA = 523), out of a total of 4,407 individuals with at least one wave of interview data. Of this sample, all participants had Wave 4 data, 2,766 individuals had Wave 1 interview data (EA = 2,453; AA = 313), and 3,265 had Wave 5 interview data (EA = 2,807; AA = 458). Parental Wave 1 interview data were available for the majority of individuals (n = 3,029; EA = 2,673; AA = 356). A detailed summary of response rates can be found elsewhere (Waldron et al., 2013).

Measures

Parental monitoring. Twin-reported parental monitoring was assessed from the Wave 4 questionnaire using an adaptation of the Parental Monitoring Scale (Silverberg & Small, 1991), a well-validated scale with high reliability (Li et al., 2000a, 2000b). The original scale consists of six items rated on a 5-point Likert scale (*never* to *always*): (a) My parents know where I am after school; (b) If I am going to be home late, I am expected to call my parents; (c) I tell my parent(s) who I am going to be with before I go out; (d) When I go out at night, my parent(s) know(s) where I am; (e) I talk with my parent(s) about the plans I have with my friends; and (f) When I go out, my parent(s) ask(s) me where I am going. Item wording from the original scale was altered by phrasing questions in the past tense and inserting "When I was 17" at the start of each question, as participants were 18 years or older at the time of assessment. Item responses were summed to create a continuous score using the combined EA and AA sample, and, because of the high skewness of the distribution, it was broken into quartiles. Low parental monitoring, defined as the lowest 25% on the parental monitoring score distribution, was used as the predictor for substance use based on its association with early initiation in prior literature. Although measures of parental monitoring at earlier ages would be ideal, given the demonstrated continuity in parental monitoring across early, middle, and late adolescence in prior studies (Li et al., 2000b; Van Ryzin et al., 2012), monitoring at age 17 years was expected to provide a reasonable index of parental monitoring across adolescence.

Early substance use. Substance use information was collected by telephone interview via an adaptation of the Semi-Structured Assessment for the Genetics of Alcoholism (Bucholz et al., 1994) based on the *Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition* (American Psychiatric Association, 1994). In addition to diagnostic criteria for substance use and other psychiatric disorders, the interview queried histories of substance use, including age at first use of alcohol, tobacco, and cannabis. Early use of each substance was defined as the lowest 25% of the distribution for age at first use (based on the earliest age reported at Waves 1, 4, or 5), thus capturing early use relative to same-sex peers in the same birth cohort. Lifetime alcohol use was defined as ever consuming a full alcoholic beverage; for tobacco or cannabis use, it was defined as ever smoking a cigarette or using cannabis, respectively. Using the full sample, for each substance, individuals who fell into the lowest quartile for age at initiation were designated as early users, yielding a cutoff for early use of age 14 years or younger for alcohol and cannabis and age 11 years or younger for tobacco.

Control variables. Birth cohort was represented as a continuous variable using the respondent's birth year, where twins born in 1975 were coded 0 and those born in 1985 were coded 9. This measure was included as a covariate instead of age at the time of assessment because we included information from multiple waves of data in the analyses.

Propensity score creation. In preliminary analyses, the association between low parental monitoring and each of the following sociodemographic variables was tested: fam-

ily structure (e.g., child separation from parent[s], parental divorce, or parents never married, compared with parents continuously married); parental alcohol history, including maternal, paternal, and twin reports (e.g., maternal/paternal alcohol problems, abuse, or dependence, and maternal/paternal drinking in front of twin during childhood); maternal and paternal education levels (less than high school diploma, high school, and some college, compared with 16 years or more of education); and the presence of older siblings (including full, half, step, or adopted siblings). Five sets of 1990 census-derived variables, using the twin's birth address geocoded to census tract (or zip code where assignment to census tract could not be achieved) that captured neighborhood factors were also tested for their prediction of low parental monitoring: neighborhood income, neighborhood poverty rate, neighborhood family disruption, neighborhood education, and rural or urban location. For all neighborhood variables other than rural/urban, a series of dummy variables was used to create quartiles, with the three higher-risk quartiles compared with the lowest-risk quartile; urban/rural had only three levels and, thus, only two dummy variables. In each of these preliminary models, the lowest risk group (typically the most prevalent) was the referent group. If any covariate within a group of indicators was significantly associated with low parental monitoring ($p < .05$), the whole group of indicators was retained and included in covariate-adjusted logistic regression models; these same indicators were used to estimate a predicted probability of low parental monitoring (propensity score) for each individual. For both EA and AA girls, a five-level categorical variable was computed from their separately derived continuous scores, with each level containing approximately 20% of the distribution.

Statistical analyses

Data preparation and preliminary analyses were conducted in SAS (SAS Institute Inc., Cary, NC). STATA (StataCorp LP, College Station, TX) was used to perform logistic regression and PSAs. Given the clustered nature of our data, for all analyses, we applied a Huber–White estimator to adjust standard errors for the non-independence of twin-family data (StataCorp LP, College Station, TX). Data analyses proceeded in two steps, each conducted separately for EA and AA participants. First, logistic regression analyses were used to examine the association between low parental monitoring and early substance use without and with covariate adjustment. Next, consistent with earlier work (e.g., Waldron et al., 2014, 2015), PSA was conducted to compare adolescents who reported low parental monitoring (lowest 25% within racial/ethnic group) and those who reported higher parental monitoring (upper 75%) based on their predicted probability of experiencing low parental monitoring. PSA is a statistical technique that can be used to reduce bias from confounding variables by matching groups on a range of highly correlated risk factors presumed to predate exposure (Green & Stuart, 2014; Rosenbaum, 2010; Rosenbaum & Rubin, 1983; West et al., 2014), in this case, to low parental monitoring. The predicted probability of low parental monitoring was estimated using logistic regression in STATA and categorized into quintiles. Within-quintile tests of the association between self-reported low parental monitoring and each of the background characteristics (used to estimate probabilities) were conducted to confirm that the parental monitoring groups were indeed matched on background characteristics. If matching was successful, we subsequently tested whether early substance use was associated with the parental monitoring group, also within quintiles. To the extent that earlier substance use was observed in twins reporting low versus higher monitoring across strata, we have increased confidence in logistic regression findings and, more broadly, the specificity of risk from parental monitoring.

Results

Substance use and low parental monitoring by race/ethnicity

As shown in Table 1, EA girls were more likely than AA girls to have ever used alcohol and tobacco, but there were no racial/ethnic differences in cannabis initiation. EA girls had their first full drink of alcohol significantly earlier than AA girls, but there were no racial/ethnic differences in the mean age at first use of tobacco or cannabis. A higher proportion of EA than AA girls reported early alcohol use (before age 15), but rates of early tobacco use (before age 12) and early cannabis use (before age 15) did not differ significantly by race/ethnicity. A significantly higher proportion of AA than EA girls reported low parental monitoring.

Logistic regression analyses

Odds ratios (ORs) from unadjusted and adjusted logistic regression analyses are presented in Table 2 for both EA and AA twins. For both EA and AA twins, low parental monitoring was associated with a significantly increased risk of early alcohol use (age 14 years or younger), with the ORs of 2.70 and 2.39, respectively, in the adjusted models only slightly different from the unadjusted models. For both groups, the effect was weakest for early tobacco use (age 11 years or younger), with the adjusted model remaining significant for EAs (adjusted OR = 1.94), but failing to reach significance in the smaller AA sample (OR = 1.77). Low parental monitoring was most strongly associated with early cannabis use (age 14 years or younger), with the ORs somewhat reduced in the adjusted model for EA girls (OR = 3.51) but not in the AA adjusted model (OR = 4.45).

TABLE 1. Percentage of Missouri Adolescent Female Twin Study participants reporting each risk and outcome of interest, stratified by race/ethnicity

Variable	European Americans	African Americans	Statistical test	p^a
Low parental monitoring	**21.1%**	**30.4%**	**$\chi^2(1) = 21.41$**	**$p < .001$**
Substance use characteristics				
Alcohol initiation	**94.4%**	**86.2%**	**$\chi^2(1) = 47.62$**	**$p < .001$**
Alcohol use ≤ 14 years old	**24.8%**	**16.4%**	**$\chi^2(1) = 17.48$**	**$p < .001$**
Mean age at alcohol initiation, in years (*SD*)	**16.1 (2.8)**	**17.1 (3.2)**	**$F(1, 1914) = 32.47$**	**$p < .001$**
Tobacco initiation	**75.6%**	**67.8%**	**$\chi^2(1) = 14.20$**	**$p < .001$**
Tobacco use ≤ 11 years old	15.6%	14.2%	$\chi^2(1) = 0.65$	$p = .46$
Mean age at tobacco initiation, in years (*SD*)	13.9 (3.3)	14.2 (3.7)	$F(1, 1624) = 2.40$	$p = .12$
Cannabis initiation	51.9%	56.6%	$\chi^2(1) = 3.91$	$p = .08$
Cannabis use ≤ 14 years old	9.6%	12.4%	$\chi^2(1) = 3.96$	$p = .08$
Mean age at cannabis initiation, in years (*SD*)	16.5 (2.6)	16.7 (2.8)	$F(1, 1274) = 0.46$	$p = .50$

Notes: Low parental monitoring was defined as the lowest quartile on the parental monitoring score distribution. Significant values are in **bold** type. [a]*p* values adjusted for the nonindependence of twin pairs.

Propensity score analyses

For both EA and AA groups, significant indicators included family structure, parental alcohol history, and the presence of older siblings. For EA girls, additional indicators included parental education level and the geocoding variables for neighborhood income, education, and poverty. Within-quintile comparisons of EA background characteristics are shown in Table 3. The prevalence of reported low parental monitoring ranged from 11% in the 0–20th percent quintile (lowest risk quintile) of the propensity score distribution to 39% in the 81st–100th percent quintile (highest risk quintile). Within quintile, there was excellent matching on all background characteristics, with a significant difference between the lowest 25% and the top 75% reported parental monitoring groups only observed for the 61st–80th percentile risk stratum (i.e., those at moderately high predicted risk for low parental monitoring) on the medium-high income quartile (only 9% of the low reported monitoring group were in the medium-high income category, whereas 16% of the higher parental monitoring participants were in this income category). Thus, the PSA matching was successful for the EA families.

Within-quintile comparisons of AA background characteristics are shown in Table 4. The prevalence of low parental monitoring ranged from 9% in the 0–20th percentile quintile of the propensity score distribution to 59% in the 81st–100th percentile quintile. Although matching was generally achieved for parental marital status (only one significant difference for this measure, with the low parental monitoring group having significantly more participants whose parents had never married), matching was not achieved for the presence of older siblings (three of five within-quintile comparisons were statistically significant). In addition, zero-cells in both the maternal and paternal history of alcohol problems measures prevented these measures from being testable in

TABLE 2. Unadjusted and adjusted odds ratios from logistic regression analyses predicting early substance initiation from twin-reported low parental monitoring (lowest quartile, compared with higher 75%) in European American and African American twin pairs

	European Americans[a]		African Americans[b]	
Variable	Unadjusted	Adjusted	Unadjusted	Adjusted
Alcohol use ≤ 14 years	2.99* [2.45, 3.63]	2.70* [2.19, 3.34]	2.31* [1.41, 3.78]	2.39* [1.24, 4.60]
Tobacco use ≤ 11years	2.68* [2.13, 3.38]	1.94* [1.50, 2.50]	1.74* [1.02, 2.98]	1.77 [0.96, 3.25]
Cannabis use ≤ 14 years	4.70* [3.59, 6.15]	3.51* [2.65, 4.67]	4.11* [2.31, 7.34]	4.45* [2.26, 8.78]

Notes: 95% confidence intervals in brackets. [a]Unadjusted models controlled for birth cohort; adjusted models controlled for birth cohort and all measures that contributed to the European American propensity score (family structure, paternal and maternal alcohol history, parental education level, presence of older siblings, and the geocoding variables for neighborhood income, education, and poverty; [b]unadjusted models controlled for birth cohort; adjusted models controlled for birth cohort and all measures that contributed to the African American propensity score (family structure, paternal and maternal alcohol history, and presence of older siblings).
*$p < .05$.

Table 3. Family and neighborhood (geocoding) predictors of twin-reported parental monitoring in European American families, by predicted parental monitoring quintile

	Predicted probability of low parental monitoring									
	Lowest risk quintile (0–20th percentile)		Moderately low risk (21st–40th percentile)		Middle risk quintile (41st–60th percentile)		Moderately high risk (61st–80th percentile)		Highest risk quintile (81st–100th percentile)	
Variable	Reported higher monitoring (n = 553)	Reported lower monitoring (n = 68)	Reported higher monitoring (n = 541)	Reported lower monitoring (n = 75)	Reported higher monitoring (n = 509)	Reported lower monitoring (n = 104)	Reported higher monitoring (n = 448)	Reported lower monitoring (n = 163)	Reported higher monitoring (n = 373)	Reported lower monitoring (n = 234)
Parental marital status, n (%)										
Never married	2 (0.4)	1 (1.5)	3 (0.6)	2 (2.7)	11 (2.2)	3 (2.9)	23 (5.1)	6 (3.7)	35 (9.4)	20 (8.6)
Separated/divorced	0 (0)	0 (0)	17 (3.1)	1 (1.3)	45 (8.8)	5 (4.8)	76 (17.0)	35 (21.5)	156 (41.8)	102 (43.6)
Missing	8 (1.5)	1 (1.5)	30 (5.6)	2 (2.7)	56 (11.0)	10 (9.6)	78 (17.4)	28 (17.2)	55 (14.8)	41 (17.5)
Mother history of alcohol problems (twin or dad report), n (%)										
Problems	3 (0.5)	0 (0)	14 (2.6)	1 (1.3)	18 (3.5)	4 (3.9)	35 (7.8)	17 (10.4)	105 (28.2)	76 (32.5)
Missing	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	4 (0.9)	1 (0.6)	0 (0)	0 (0)
Father history of alcohol problems (twin or mom report), n (%)										
Problems	18 (3.3)	1 (1.5)	39 (7.2)	7 (9.3)	113 (22.2)	22 (21.2)	201 (44.9)	67 (41.1)	239 (64.1)	162 (69.2)
Missing	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	1 (0.2)	0 (0)	12 (3.2)	9 (3.9)
Mother's education, n (%)										
Less than high school	2 (0.4)	0 (0)	0 (0)	0 (0)	21 (4.1)	5 (4.8)	49 (10.9)	23 (14.1)	105 (28.2)	69 (29.5)
High school graduate	207 (37.4)	30 (44.1)	220 (40.7)	32 (42.7)	223 (43.8)	44 (42.3)	177 (39.5)	61 (37.4)	120 (32.2)	70 (29.9)
13–15 years	97 (17.5)	10 (14.7)	165 (30.5)	19 (25.3)	154 (30.3)	37 (35.6)	123 (27.5)	45 (27.6)	97 (26.0)	61 (26.1)
Missing	0 (0)	0 (0)	2 (0.4)	0 (0)	15 (3.0)	4 (3.9)	37 (8.3)	11 (6.8)	16 (4.3)	11 (4.7)
Has an older sibling, n (%)										
Yes	169 (30.6)	16 (23.5)	300 (55.5)	44 (58.7)	181 (35.6)	36 (34.6)	149 (33.3)	62 (38.0)	157 (42.1)	101 (43.2)
Missing	8 (1.5)	1 (1.5)	65 (12.0)	5 (6.7)	148 (29.1)	35 (33.7)	165 (36.8)	50 (30.7)	106 (28.4)	77 (32.9)
Geocode: Neighborhood income, n (%)										
Medium-high quartile	180 (32.6)	22 (32.4)	115 (21.3)	16 (21.3)	76 (14.9)	20 (19.2)	73 (16.3)	14 (8.6)*	36 (9.7)	29 (12.4)
Medium-low quartile	104 (18.8)	15 (22.1)	129 (23.8)	19 (25.3)	167 (32.8)	37 (35.6)	141 (31.5)	51 (31.3)	146 (39.1)	82 (35.0)
Lowest quartile	60 (10.9)	7 (10.3)	78 (14.4)	9 (12.0)	77 (15.1)	13 (12.5)	116 (25.9)	48 (29.5)	115 (30.8)	78 (33.3)
Missing	18 (3.3)	1 (1.5)	32 (5.9)	3 (4.0)	44 (8.6)	9 (8.7)	33 (7.4)	10 (6.1)	24 (6.4)	21 (9.0)

Notes: Referent categories were married, no maternal/paternal history of alcohol problems, education ≥16 years, no older sibling, and highest neighborhood income quartile.
*Indicates that within propensity score quintile, the lowest 25% and upper 75% twin-report-based parental monitoring groups differed significantly at $p < .05$.

one or more quintiles. Given the poor matching of the AA sample on the background characteristics, no additional analyses comparing early versus later users were conducted for AA girls.

Given that EA girls were well matched on family background characteristics, we proceeded with tests of whether early substance use was associated with low parental monitoring within quintile of the predicted probability of low parental monitoring. As shown in Table 5, low parental monitoring was associated with early alcohol use in all quintiles, with the proportion of early alcohol use increasing from the lowest predicted probability quintile (0–20th percentile, where 35% of those who reported low parental monitoring also reported early alcohol use and a significantly lower 14% of those in the higher parental monitoring group reported early alcohol use) to the 81st–100th percentile quintile (where 51% of those who reported low parental monitoring also reported early alcohol use, and a significantly lower 32% of those who reported higher parental monitoring also reported early alcohol use). Results were generally similar for both tobacco and cannabis, with the rate of early substance use increasing from the lowest predicted probability quintile (0–20th percentile) to the 81st–100th percentile quintile for both substances, and with the within-quintile comparisons reaching statistical significance for three of five comparisons each. For early tobacco use, low parental monitoring was associated with higher rates of early tobacco use for the 0–20th percentile, 41st–60th percentile, and 81st–100th percentile comparisons, with $p = .12$ for the 21st–40th percentile comparison. For early cannabis use, low parental monitoring was associated with higher rates of early cannabis use for the 41st–60th percentile, 61st–80th percentile, and 81st–100th percentile comparisons, with $p = .10$ for the 21st–40th percentile comparison.

TABLE 4. Representative family predictors of twin-reported parental monitoring in African American families, by predicted parental monitoring quintile

	Predicted probability of low parental monitoring									
	Lowest risk quintile (0–20th percentile)		Moderately low risk (21st–40th percentile)		Middle risk quintile (41st–60th percentile)		Moderately high risk (61st–80th percentile)		Highest risk quintile (81st–100th percentile)	
Variable	Reported higher monitoring (n = 93)	Reported lower monitoring (n = 9)	Reported higher monitoring (n = 82)	Reported lower monitoring (n = 20)	Reported higher monitoring (n = 67)	Reported lower monitoring (n = 31)	Reported higher monitoring (n = 69)	Reported lower monitoring (n = 32)	Reported higher monitoring (n = 39)	Reported lower monitoring (n = 57)
Parental marital status, n (%)										
Never married	12 (12.9)	4 (44.4)*	36 (43.9)	10 (50.0)	29 (43.3)	10 (32.3)	37 (53.6)	17 (53.1)	19 (48.7)	27 (47.4)
Separated/divorced	0 (0)	0 (0)	4 (4.9)	1 (5.0)	10 (14.9)	3 (9.7)	14 (20.3)	5 (15.6)	7 (18.0)	15 (26.3)
Missing	27 (29.0)	2 (22.2)	9 (11.0)	2 (10.0)	6 (9.0)	3 (9.7)	3 (4.4)	3 (9.4)	3 (7.7)	3 (5.3)
Mother history of alcohol problems (twin or dad report),[a] n (%)										
Problems	0 (0)	0 (0)	4 (4.9)	0 (0)	3 (4.5)	0 (0)	3 (4.4)	2 (6.3)	18 (46.2)	32 (56.1)
Missing	0 (0)	1 (11.1)	0 (0)	1 (5.0)	0 (0)	1 (3.2)	0 (0)	0 (0)	0 (0)	0 (0)
Father history of alcohol problems (twin or mom report),[b] n (%)										
Problems	17 (18.3)	0 (0)	24 (29.3)	7 (35.0)	16 (23.9)	6 (19.4)	30 (43.5)	17 (53.1)	24 (61.5)	36 (63.2)
Missing	0 (0)	0 (0)	1 (1.2)	0 (0)	1 (1.5)	1 (3.2)	1 (1.5)	1 (3.1)	3 (7.7)	3 (5.3)
Has an older sibling, n (%)										
Yes	62 (66.7)	4 (44.4)*	37 (45.1)	11 (55.0)	15 (22.4)	7 (22.6)	7 (10.1)	9 (28.1)*	8 (20.5)	4 (7.0)*
Missing	24 (25.8)	2 (22.2)	16 (19.5)	4 (20.0)	26 (38.8)	18 (58.1)	40 (58.0)	17 (53.3)	23 (59.0)	28 (49.1)

Notes: Referent categories were married, no maternal/paternal history of alcohol problems, and no older sibling. [a]The test was not calculable for 0–20th percentile, 21st–40th percentile, and 41st–60th percentile predicted probability groups because there were not two or more groups in which both the top 75% and low 25% observed parental monitoring groups had nonzero cells; [b]the test was not calculable for 0–20th percentile predicted probability group because there were not two or more groups in which both the top 75% and low 25% observed parental monitoring groups had nonzero cells.
*Indicates that within propensity score quintile the lowest 25% and upper 75% twin-report based parental monitoring groups differed significantly at $p < .05$.

Discussion

We investigated the association between low parental monitoring and early substance use among EA and AA adolescent girls, first using logistic regression analyses that adjusted for correlated psychosocial risk factors and then using PSA to identify the independent association between low parental monitoring and early substance use. Although a higher proportion of AA than EA girls reported low parental monitoring, a lower proportion of AA girls reported early alcohol use, and there were no differences by race/ethnicity in the prevalence of early initiation of tobacco or cannabis use. Consistent with prior studies linking low parental monitoring during adolescence to early substance use (Habib et al., 2010; Hemovich et al., 2011; Jackson & Schulenberg, 2013; Latendresse et al., 2008; Steinberg et al., 1994; Van Ryzin et al., 2012; Wang et al., 2009; White et al., 2006; Wright & Fitzpatrick, 2004), for both EA and AA girls we found an association between low parental monitoring and increased risk of early alcohol, tobacco, and cannabis use across race/ethnicity using logistic regression analyses. With the exception of early tobacco use by AA girls, estimates from logistic regression models remained significant after controlling for background factors likely to be associated with low parental monitoring (e.g., parental marital status and parental alcohol problems, having an older sibling).

For EA girls, our confidence in the logistic regression results increased when we conducted PSA. Here we obtained excellent matching on key covariates across predicted probability of low monitoring and found strong evidence, across all PSA strata, that twin-reported low parental monitoring was significantly associated with an increased risk for early alcohol use, thus supporting the independent association of low parental monitoring with early alcohol use. Similar patterns were observed for both early tobacco use and early cannabis use by EA girls, although associations were statistically significant only in the higher PSA strata for early cannabis initiation.

For AA girls, matching on background characteristics was not consistent, with the presence of cells with no observations being especially problematic for both maternal and paternal alcohol history measures. Poor matching was also an issue for having an older sibling, where within three of five strata, self-reported low parental monitoring differed significantly from the higher 75%, indicating that the low and higher monitoring groups were not matched on this background measure. Consequently, we did not conduct within PSA-quintile tests of early versus later substance use by AA girls as a function of self-reported low parental monitoring. PSA findings for AA girls raise questions about the interpretability of the logistic regression analyses presented in Table 2 for the AA girls, and the specificity of risk from parental

TABLE 5. Prevalence of early substance involvement in European American twins from twin-reported low and higher parental monitoring families, by predicted parental monitoring quintile[a]

	Predicted probability of low parental monitoring									
	Lowest risk quintile (0–20th percentile)		Moderately low risk (21st–40th percentile)		Middle risk quintile (41st–60th percentile)		Moderately high risk (61st–80th percentile)		Highest risk quintile (81st–100th percentile)	
Variable	Reported higher monitoring	Reported lower monitoring	Reported higher monitoring	Reported lower monitoring	Reported higher monitoring	Reported lower monitoring	Reported higher monitoring	Reported lower monitoring	Reported higher monitoring	Reported lower monitoring
Alcohol use ≤14										
n in group	553	68	541	75	509	104	448	163	373	234
n early users (%)	76 (13.7)	24 (35.3)*	100 (18.5)	25 (33.3)*	108 (21.2)	38 (36.5)*	81 (18.1)	67 (41.1)*	118 (31.6)	120 (51.3)*
Tobacco use ≤11										
n in group	537	65	535	72	499	103	443	163	369	234
n early users (%)	20 (3.7)	7 (10.8)*	43 (8.0)	10 (13.9)	49 (9.8)	22 (21.4)*	88 (19.9)	40 (24.5)	91 (24.7)	94 (40.2)*
Cannabis use ≤14										
n in group	553	68	541	75	509	104	448	163	373	234
n early users (%)	13 (2.4)	2 (2.9)	23 (4.3)	7 (9.3)	17 (3.3)	15 (14.4)*	39 (8.7)	43 (26.4)*	48 (12.9)	78 (33.3)*

[a]All models also included birth cohort as a covariate.
*Indicates that within propensity score quintile the lowest 25% and upper 75% twin-report-based parental monitoring groups differed significantly at $p < .05$.

monitoring more broadly in this racial/ethnic group. Findings further suggest that caution should be used in assuming the same psychosocial risk and protective factors apply to both AA and EA adolescents. Future research with a larger AA sample size would increase statistical power, which was limited in the present report by the smaller number of AA participants. Increased statistical power would enhance the PSA by increasing numbers for the risk strata and thereby improving the likelihood of successful matching, and would also aid in the assessment of the extent to which low parental monitoring is indeed associated with earlier-onset substance use among AA girls.

In addition to the reduced power for the AA sample, our study has several limitations that should be noted. First, parental monitoring was retrospectively reported by adolescents and referred specifically to parenting behaviors when the participant was 17 years of age, whereas our early substance use outcomes examined the use of alcohol and cannabis before age 15 years and tobacco before age 12 years. Although research suggests moderate to strong continuity of parental monitoring across early, middle, and late adolescence (Li et al., 2000b; Van Ryzin et al., 2012), there is the possibility that parental monitoring was not consistent across adolescence and may even have increased (or decreased) in response to early substance use. Given that increases in monitoring behaviors by the parents of early users might reduce the association between parental monitoring and early substance use, that parental monitoring was a significant predictor of early use suggests that the true effect size may have been underestimated in our analyses. An additional limitation regarding our assessment is that participants could have recall bias for parental monitoring at age 17. Prospective longitudinal studies that query monitoring more frequently, and beginning during very early adolescence, would help to clarify issues regarding directionality, peer effects versus peer selection, rater effects, and recall bias. Finally, these findings reflect data from females only, and additional work is needed with male samples to determine their generalizability.

Although our analytic approach allowed us to examine the specificity of early substance risk associated with low parental monitoring, the use of propensity scores is also not without limitations (see Austin, 2011; Biondi-Zoccai et al., 2011; Shah et al., 2005). Especially pertinent to the present analyses, PSA cannot balance groups on *unobserved* covariates. Our findings are therefore limited to analyses derived from background characteristics available in the current data set. Although we limited PSA to risk factors significantly related to self-reported low monitoring and conducted PSA separately for EA and AA girls, future studies should consider other additional important risk and protective factors such as religiosity, the presence of alternate parent figures, other parent–child relationship characteristics, and deviant peer affiliation. In addition, our within-quintile PSA do not take into account the fact that the propensity scores were estimated rather than known.

In summary, the present study extends previous research by using both logistic regression and PSA to identify the remaining unique association between low parental monitoring and early substance use above and beyond other correlated characteristics. Our results highlight the role of parental monitoring in adolescent substance initiation, at least among EA girls. Future studies using larger samples of AA girls and of other racial/ethnic groups and males are critical. As a modifiable behavior (Dishion & McMahon, 1998), low parental monitoring is an important target for prevention efforts. Replication in more diverse samples, including males, would provide additional support for the potential of preventive interventions with parents to reduce the risk for early substance use.

References

Abar, C. C., Turrisi, R. J., & Mallett, K. A. (2014). Differential trajectories of alcohol-related behaviors across the first year of college by parenting profiles. *Psychology of Addictive Behaviors, 28,* 53–61. doi:10.1037/a0032731.

American Psychiatric Association. (1994). *Diagnostic and statistical manual of mental disorders* (4th ed.). Washington, DC: Author.

Arria, A. M., Kuhn, V., Caldeira, K. M., O'Grady, K. E., Vincent, K. B., & Wish, E. D. (2008). High school drinking mediates the relationship between parental monitoring and college drinking: A longitudinal analysis. *Substance Abuse Treatment, Prevention, and Policy, 3,* 6. doi:10.1186/1747-597X-3-6.

Ary, D. V., Duncan, T. E., Biglan, A., Metzler, C. W., Noell, J. W., & Smolkowski, K. (1999). Development of adolescent problem behavior. *Journal of Abnormal Child Psychology, 27,* 141–150. doi:10.1023/A:1021963531607.

Austin, P. C. (2011). An introduction to propensity score methods for reducing the effects of confounding in observational studies. *Multivariate Behavioral Research, 46,* 399–424. doi:10.1080/00273171.2011.568786.

Biondi-Zoccai, G., Romagnoli, E., Agostoni, P., Capodanno, D., Castagno, D., D'Ascenzo, F., . . . Modena, M. G. (2011). Are propensity scores really superior to standard multivariable analysis? *Contemporary Clinical Trials, 32*, 731–740. doi:10.1016/j.cct.2011.05.006.

Bird, H. R., Canino, G. J., Davies, M., Zhang, H., Ramirez, R., & Lahey, B. B. (2001). Prevalence and correlates of antisocial behaviors among three ethnic groups. *Journal of Abnormal Child Psychology, 29,* 465–478. doi:10.1023/A:1012279707372.

Bohnert, K. M., Ríos-Bedoya, C. F., & Breslau, N. (2009). Parental monitoring at age 11 and smoking initiation up to age 17 among Blacks and Whites: A prospective investigation. *Nicotine & Tobacco Research, 11,* 1474–1478. doi:10.1093/ntr/ntp160.

Bucholz, K. K., Cadoret, R., Cloninger, C. R., Dinwiddie, S. H., Hesselbrock, V. M., Nurnberger, J. I., Jr., . . . Schuckit, M. A. (1994). A new, semi-structured psychiatric interview for use in genetic linkage studies: A report on the reliability of the SSAGA. *Journal of Studies on Alcohol, 55,* 149–158. doi:10.15288/jsa.1994.55.149.

Byrnes, H. F., Miller, B. A., Chen, M. J., & Grube, J. W. (2011). The roles of mothers' neighborhood perceptions and specific monitoring strategies in youths' problem behavior. *Journal of Youth and Adolescence, 40,* 347–360. doi:10.1007/s10964-010-9538-1.

Chassin, L., Pillow, D. R., Curran, P. J., Molina, B. S., & Barrera, M., Jr. (1993). Relation of parental alcoholism to early adolescent substance use: A test of three mediating mechanisms. *Journal of Abnormal Psychology, 102,* 3–19. doi:10.1037/0021-843X.102.1.3.

D'Amico, E. J., & McCarthy, D. M. (2006). Escalation and initiation of younger adolescents' substance use: The impact of perceived peer use. *Journal of Adolescent Health, 39,* 481–487. doi:10.1016/j.jadohealth.2006.02.010.

DiClemente, R. J., Wingood, G. M., Crosby, R., Sionean, C., Cobb, B. K., Harrington, K., . . . Oh, M. K. (2001). Parental monitoring: Association with adolescents' risk behaviors. *Pediatrics, 107,* 1363–1368. doi:10.1542/peds.107.6.1363.

Dishion, T. J., & McMahon, R. J. (1998). Parental monitoring and the prevention of child and adolescent problem behavior: A conceptual and empirical formulation. *Clinical Child and Family Psychology Review, 1,* 61–75. doi:10.1023/A:1021800432380.

Duncan, A. E., Lessov-Schlaggar, C. N., Sartor, C. E., & Bucholz, K. K. (2012). Differences in time to onset of smoking and nicotine dependence by race/ethnicity in a Midwestern sample of adolescents and young adults from a high risk family study. *Drug and Alcohol Dependence, 125,* 140–145. doi:10.1016/j.drugalcdep.2012.04.003.

Ellickson, P. L., Orlando, M., Tucker, J. S., & Klein, D. J. (2004). From adolescence to young adulthood: Racial/ethnic disparities in smoking. *American Journal of Public Health, 94,* 293–299. doi:10.2105/AJPH.94.2.293.

Fang, L., Barnes-Ceeney, K., & Schinke, S. P. (2011). Substance use behavior among early-adolescent Asian American girls: The impact of psychological and family factors. *Women & Health, 51,* 623–642. doi:10.1080/03630242.2011.616575.

Flannery, D. J., Williams, L. L., & Vazsonyi, A. T. (1999). Who are they with and what are they doing? Delinquent behavior, substance use, and early adolescents' after-school time. *American Journal of Orthopsychiatry, 69,* 247–253. doi:10.1037/h0080426.

Green, K. M., & Stuart, E. A. (2014). Examining moderation analyses in propensity score methods: Application to depression and substance use. *Journal of Consulting and Clinical Psychology, 82,* 773–783. doi:10.1037/a0036515.

Griesler, P. C., & Kandel, D. B. (1998). Ethnic differences in correlates of adolescent cigarette smoking. *Journal of Adolescent Health, 23,* 167–180. doi:10.1016/S1054-139X(98)00029-9.

Grucza, R. A., Bucholz, K. K., Rice, J. P., & Bierut, L. J. (2008). Secular trends in the lifetime prevalence of alcohol dependence in the United States: A re-evaluation. *Alcoholism: Clinical and Experimental Research, 32,* 763–770. doi:10.1111/j.1530-0277.2008.00635.x.

Guerra, L. M., Romano, P. S., Samuels, S. J., & Kass, P. H. (2000). Ethnic differences in adolescent substance initiation sequences. *Archives of Pediatrics & Adolescent Medicine, 154,* 1089–1095. doi:10.1001/archpedi.154.11.1089.

Habib, C., Santoro, J., Kremer, P., Toumbourou, J., Leslie, E., & Williams, J. (2010). The importance of family management, closeness with father and family structure in early adolescent alcohol use. *Addiction, 105,* 1750–1758. doi:10.1111/j.1360-0443.2010.03021.x.

Heath, A. C., Howells, W., Bucholz, K. K., Glowinski, A. L., Nelson, E. C., & Madden, P. A. (2002). Ascertainment of a mid-western US female adolescent twin cohort for alcohol studies: Assessment of sample representativeness using birth record data. *Twin Research, 5,* 107–112. doi:10.1375/1369052022974.

Heath, A. C., Madden, P. A., Grant, J. D., McLaughlin, T. L., Todorov, A. A., & Bucholz, K. K. (1999). Resiliency factors protecting against teenage alcohol use and smoking: Influences of religion, religious involvement and values, and ethnicity in the Missouri Adolescent Female Twin Study. *Twin Research, 2,* 145–155. doi:10.1375/136905299320566013.

Hemovich, V., Lac, A., & Crano, W. D. (2011). Understanding early-onset drug and alcohol outcomes among youth: The role of family structure, social factors, and interpersonal perceptions of use. *Psychology, Health & Medicine, 16,* 249–267. doi:10.1080/13548506.2010.532560.

Jackson, K. M., & Schulenberg, J. E. (2013). Alcohol use during the transition from middle school to high school: National panel data on prevalence and moderators. *Developmental Psychology, 49,* 2147–2158. doi:10.1037/a0031843.

Jacob, T., & Johnson, S. (1997). Parenting influences on the development of alcohol abuse and dependence. *Alcohol Health and Research World, 21,* 204–209.

Klima, T., Skinner, M. L., Haggerty, K. P., Crutchfield, R. D., & Catalano, R. F. (2014). Exploring heavy drinking patterns among Black and White young adults. *Journal of Studies on Alcohol and Drugs, 75,* 839–849. doi:10.15288/jsad.2014.75.839.

Knopik, V. S., Sparrow, E. P., Madden, P. A. F., Bucholz, K. K., Hudziak, J. J., Reich, W., . . . Heath, A. C. (2005). Contributions of parental alcoholism, prenatal substance exposure, and genetic transmission to child ADHD risk: A female twin study. *Psychological Medicine, 35,* 625–635. doi:10.1017/S0033291704004155.

Korhonen, T., Huizink, A. C., Dick, D. M., Pulkkinen, L., Rose, R. J., & Kaprio, J. (2008). Role of individual, peer and family factors in the use of cannabis and other illicit drugs: A longitudinal analysis among Finnish adolescent twins. *Drug and Alcohol Dependence, 97,* 33–43. doi:10.1016/j.drugalcdep.2008.03.015.

Latendresse, S. J., Rose, R. J., Viken, R. J., Pulkkinen, L., Kaprio, J., & Dick, D. M. (2008). Parenting mechanisms in links between parents' and adolescents' alcohol use behaviors. *Alcoholism: Clinical and Experimental Research, 32,* 322–330. doi:10.1111/j.1530-0277.2007.00583.x.

Li, X., Feigelman, S., & Stanton, B. (2000a). Perceived parental monitoring and health risk behaviors among urban low-income African-American children and adolescents. *Journal of Adolescent Health, 27,* 43–48. doi:10.1016/S1054-139X(99)00077-4.

Li, X., Stanton, B., & Feigelman, S. (2000b). Impact of perceived parental monitoring on adolescent risk behavior over 4 years. *Journal of Adolescent Health, 27,* 49–56. doi:10.1016/S1054-139X(00)00092-6.

Mahabee-Gittens, E. M., Xiao, Y., Gordon, J. S., & Khoury, J. C. (2012). The role of family influences on adolescent smoking in different racial/ethnic groups. *Nicotine & Tobacco Research, 14,* 264–273. doi:10.1093/ntr/ntr192.

Marsiglia, F. F., Nagoshi, J. L., Parsai, M., & Castro, F. G. (2012). The influence of linguistic acculturation and parental monitoring on the substance use of Mexican-heritage adolescents in predominantly Mexican enclaves of the Southwest US. *Journal of Ethnicity in Substance Abuse, 11,* 226–241. doi:10.1080/15332640.2012.701566.

Miranda, R., Jr., Reynolds, E., Ray, L., Justus, A., Knopik, V. S., McGeary, J., & Meyerson, L. A. (2013). Preliminary evidence for a gene-environment interaction in predicting alcohol use disorders in adolescents. *Alcoholism: Clinical and Experimental Research, 37,* 325–331. doi:10.1111/j.1530-0277.2012.01897.x.

Odgers, C. L., Caspi, A., Nagin, D. S., Piquero, A. R., Slutske, W. S., Milne, B. J., . . . Moffitt, T. E. (2008). Is it important to prevent early exposure to drugs and alcohol among adolescents? *Psychological Science, 19,* 1037–1044. doi:10.1111/j.1467-9280.2008.02196.x.

Pinchevsky, G. M., Arria, A. M., Caldeira, K. M., Garnier-Dykstra, L. M., Vincent, K. B., & O'Grady, K. E. (2012). Marijuana exposure opportunity and initiation during college: Parent and peer influences. *Prevention Science, 13,* 43–54. doi:10.1007/s11121-011-0243-4.

Ramirez, J. R., Crano, W. D., Quist, R., Burgoon, M., Alvaro, E. M., & Grandpre, J. (2004). Acculturation, familism, parental monitoring, and knowledge as predictors of marijuana and inhalant use in adolescents. *Psychology of Addictive Behaviors, 18,* 3–11. doi:10.1037/0893-164X.18.1.3.

Reifman, A., Barnes, G. M., Dintcheff, B. A., Farrell, M. P., & Uhteg, L. (1998). Parental and peer influences on the onset of heavier drinking among adolescents. *Journal of Studies on Alcohol, 59,* 311–317. doi:10.15288/jsa.1998.59.311.

Rosenbaum, P. R. (2010). *Design of observational studies.* New York, NY: Springer.

Rosenbaum, P. R., & Rubin, D. B. (1983). The central role of the propensity score in observational studies for causal effects. *Biometrika, 70,* 41–55. doi:10.1093/biomet/70.1.41.

Sartor, C. E., Agrawal, A., Lynskey, M. T., Duncan, A. E., Grant, J. D., Nelson, E. C., . . . Bucholz, K. K. (2013). Cannabis or alcohol first? Differences by ethnicity and in risk for rapid progression to cannabis-related problems in women. *Psychological Medicine, 43,* 813–823. doi:10.1017/S0033291712001493.

Scarinci, I. C., Robinson, L. A., Alfano, C. M., Zbikowski, S. M., & Klesges, R. C. (2002). The relationship between socioeconomic status, ethnicity, and cigarette smoking in urban adolescents. *Preventive Medicine, 34,* 171–178. doi:10.1006/pmed.2001.0967.

Shah, B. R., Laupacis, A., Hux, J. E., & Austin, P. C. (2005). Propensity score methods gave similar results to traditional regression modeling in observational studies: A systematic review. *Journal of Clinical Epidemiology, 58,* 550–559. doi:10.1016/j.jclinepi.2004.10.016.

Silverberg, S. B., & Small, B. (1991). *Parental monitoring, family structure and adolescent substance use.* Paper presented at the meeting of the Society of Research in Child Development, Seattle, WA.

Stanton, B., Li, X., Pack, R., Cottrell, L., Harris, C., & Burns, J. M. (2002). Longitudinal influence of perceptions of peer and parental factors on African American adolescent risk involvement. *Journal of Urban Health, 79,* 536–548. doi:10.1093/jurban/79.4.536.

Steinberg, L., Fletcher, A., & Darling, N. (1994). Parental monitoring and peer influences on adolescent substance use. *Pediatrics, 93,* 1060–1064.

Strunin, L., Díaz Martínez, A., Díaz-Martínez, L. R., Heeren, T., Kuranz, S., Winter, M., . . . Solís-Torres, C. (2013). Parental monitoring and alcohol use among Mexican students. *Addictive Behaviors, 38,* 2601–2606. doi:10.1016/j.addbeh.2013.06.011.

Tobler, A. L., & Komro, K. A. (2010). Trajectories or parental monitoring and communication and effects on drug use among urban young adolescents. *Journal of Adolescent Health, 46,* 560–568. doi:10.1016/j.jadohealth.2009.12.008.

Tornay, L., Michaud, P. A., Gmel, G., Wilson, M. L., Berchtold, A., & Surís, J. C. (2013). Parental monitoring: A way to decrease substance use among Swiss adolescents? *European Journal of Pediatrics, 172,* 1229–1234. doi:10.1007/s00431-013-2029-0.

van den Bree, M. B., & Pickworth, W. B. (2005). Risk factors predicting changes in marijuana involvement in teenagers. *Archives of General Psychiatry, 62,* 311–319. doi:10.1001/archpsyc.62.3.311.

Van Ryzin, M. J., Fosco, G. M., & Dishion, T. J. (2012). Family and peer predictors of substance use from early adolescence to early adulthood: An 11-year prospective analysis. *Addictive Behaviors, 37,* 1314–1324. doi:10.1016/j.addbeh.2012.06.020.

Vega, W. A., Chen, K. W., & Williams, J. (2007). Smoking, drugs, and other behavioral health problems among multiethnic adolescents in the NHSDA. *Addictive Behaviors, 32,* 1949–1956. doi:10.1016/j.addbeh.2006.12.022.

Waldron, M., Bucholz, K. K., Lynskey, M. T., Madden, P. A. F., & Heath, A. C. (2013). Alcoholism and timing of separation in parents: Findings in a midwestern birth cohort. *Journal of Studies on Alcohol and Drugs, 74,* 337–348. doi:10.15288/jsad.2013.74.337.

Waldron, M., Doran, K. A., Bucholz, K. K., Duncan, A. E., Lynskey, M. T., Madden, P. A. F., . . . Heath, A. C. (2015). Parental separation, parental alcoholism, and timing of first sexual intercourse. *Journal of Adolescent Health, 56,* 550–556. doi:10.1016/j.jadohealth.2015.01.011.

Waldron, M., Vaughan, E. L., Bucholz, K. K., Lynskey, M. T., Sartor, C. E., Duncan, A. E., . . . Heath, A. C. (2014). Risks for early substance involvement associated with parental alcoholism and parental separation in an adolescent female cohort. *Drug and Alcohol Dependence, 138,* 130–136. doi:10.1016/j.drugalcdep.2014.02.020.

Walls, T. A., Fairlie, A. M., & Wood, M. D. (2009). Parents do matter: A longitudinal two-part mixed model of early college alcohol participation and intensity. *Journal of Studies on Alcohol and Drugs, 70,* 908–918. doi:10.15288/jsad.2009.70.908.

Wang, J., Simons-Morton, B. G., Farhat, T., & Luk, J. W. (2009). Sociodemographic variability in adolescent substance use: Mediation by parents and peers. *Prevention Science, 10,* 387–396. doi:10.1007/s11121-009-0141-1.

West, S. G., Cham, H., Thoemmes, F., Renneberg, B., Schulze, J., & Weiler, M. (2014). Propensity scores as a basis for equating groups: Basic principles and application in clinical treatment outcome research. *Journal of Consulting and Clinical Psychology, 82,* 906–919. doi:10.1037/a0036387.

White, H. R., McMorris, B. J., Catalano, R. F., Fleming, C. B., Haggerty, K. P., & Abbott, R. D. (2006). Increases in alcohol and marijuana use during the transition out of high school into emerging adulthood: The effects of leaving home, going to college, and high school protective factors. *Journal of Studies on Alcohol, 67,* 810–822. doi:10.15288/jsa.2006.67.810.

Wright, D. R., & Fitzpatrick, K. M. (2004). Psychosocial correlates of substance use behaviors among African American youth. *Adolescence, 39,* 653–667.