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Recommended Citation

Zapolski, Tamika; Yu, Tianyi; Brody, Gene; Banks, Devin; and Barton, Allen, "Why now? Examining antecedents for substance use initiation among African American adolescents." (2020). *Psychology Faculty Works*. 94.

DOI: <https://doi.org/10.1017/S0954579419000713>

Available at: <https://irl.umsl.edu/psychology-faculty/94>

Repository URL

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May 1, 2020

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Available at: <https://works.bepress.com/devin-banks/9/>



Published in final edited form as:

Dev Psychopathol. 2020 May ; 32(2): 719–734. doi:10.1017/S0954579419000713.

Why now? Examining antecedents for substance use initiation among African American adolescents

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Abstract

Current adolescent substance use risk models have inadequately predicted use for African Americans, with limited knowledge on differential predictability as a function of developmental period. Among a sample of 500 African American youth (ages 11–21), four risk indices (i.e., social, attitudinal, intrapersonal, and racial discrimination) were examined in the prediction of alcohol, marijuana, and cigarette initiation during early (ages 11–13), mid (ages 16–18) and late (ages 19–21) adolescence. Results showed that when developmental periods were combined, racial discrimination was the only index that predicted initiation for all three substances. However, when risk models were stratified based on developmental period, variation was found within and across substance types. Results highlight the importance of racial discrimination in understanding substance use initiation among African American youth and the need for tailored interventions based on developmental stage.

Keywords

adolescence; alcohol; marijuana; tobacco; initiation; African Americans

Adolescence has been described as a developmental period during which youth often engage in high-risk health behaviors (Steinberg, 2008). As such, the initiation of substance use typically begins by age 13 (Arnett, 2005), with engagement in use throughout adolescence associated with negative psychological, cognitive, behavioral consequences, including lower academic achievement and increased risk for depressive and anxiety symptomatology, aggression, delinquency, and substance addiction (DeWit, Adlaf, Offord, & Ogborne, 2000; DiFranza et al., 2000; Wu, Schlenger, & Galvin, 2003). Moreover, risk for such health consequences increases the earlier youth initiate substance use (Griffin & Botvin, 2010; King & Chassin, 2007; Odgers et al., 2008; Warner & White, 2003). For example, Sartor et al. (2016) found that early initiators of alcohol (i.e., youth who started drinking at age 14 or younger) were at increased risk for having an alcohol use disorder, whereas late initiators (i.e., youth who started drinking at age 17 or older) were at a reduced risk for having an

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alcohol use disorder. Dawson et al. (2008) also noted higher risk for alcohol abuse and dependence symptoms for individuals who began drinking before age 15, as well as those who initiated between ages 15 and 17, in comparison to those who delayed initiation of drinking until age 18 or older. In regards to marijuana use, Ellickson et al. (2005) also found based on a longitudinal study of youth from 8th grade through 12th grade, that earlier age of initiation was associated with greater marijuana consequences and use of illicit drugs at age 18. Lastly, Hu, Davies, and Kandel (2006) found that age of onset of cigarette use before age 18 was associated with increased daily smoking and lifetime nicotine dependence. Thus, a large body of work has been conducted to better understand risk for substance use initiation during adolescence in order to develop targeted preventative interventions to delay initiation and the associated negative health and behavioral outcomes.

One of the most comprehensive reviews on existing models of adolescent substance use appears in work by Petraitis, Flay, and Miller (1995), who highlighted three distinct types of risk for substance use – social influences (e.g., parent and peer influences), attitudinal influences (e.g., substance related attitudes or factors that directly influence attitudes, such as low school or religious involvement), and intrapersonal influences (e.g., personality traits, impulsiveness, aggressiveness, emotional distress, and self-esteem). Other more recent reviews have also confirmed the multi-factorial structure of risk for substance use initiation (e.g., Dodge et al., 2009; Donovan, 2004; Schulenberg & Maggs, 2002). Despite this general consensus, one prominent limitation noted by Petraitis et al. (1995) was the lack of attention in existing theoretical models to the contribution of race/ethnicity to adolescent substance use, despite its significance in understanding variations in child development (Quintana et al., 2006).

The need for specific attention to race/ethnicity is further supported by the growing evidence of distinct differences in substance use initiation, patterns of use, and consequences from use across groups. For instance, African American youth, relative to White youth, tend to report lower rates of both alcohol (Chen & Jacobson, 2012; Johnston et al., 2017; Khan, Cleland, Scheidell, & Berger, 2014) and cigarette use across development (Brown, Flory, Lynam, Leukefeld, & Clayton, 2004; Chen & Jacobson, 2012). Conversely, rates for marijuana use have been reported to be comparable or higher among African American youth compared to their White peers (Johnson et al., 2015). Yet, regardless of the substance used, the consequences associated with use, such as rates of dependence (Zapolski, Pedersen, McCarthy, & Smith, 2014), legal problems (Brown, Flory, et al., 2004; Nguyen, 2012), and interpersonal problems (Zapolski et al., 2014) are more severe for African American users compared to their White peers.

Thus, given evidence of differences in use and consequences, it has been posited (e.g., Brown, Miller, & Clayton, 2004) and empirically supported (e.g., Bersamin, Paschall, & Flewelling, 2005; Vega, Zimmerman, Warheit, Apospori, & Gil, 1993; Wallace & Muroff, 2002) that risk models constructed and tested among predominately White youth samples due not adequately explain risk for African American youth. It is proposed that in addition to factors, such as social (e.g., parent and peer influences; Clark, Belgrave, & Nasim, 2008; Elkington, Bauermeister, & Zimmerman, 2011), attitudinal (e.g., substance related attitudes, low school and religious involvement; Clark et al., 2008; Wills, Gibbons, Gerrard, & Brody,

2000), and intrapersonal (e.g., personality traits, impulsiveness, aggressiveness, and self-esteem; Wills et al., 2000; Wright & Fitzpatrick, 2004) factors that have been shown to increase risk for substance use within African American youth populations, there are also culturally-specific factors, such as exposure to racial discrimination, that may explain risk for substance use initiation among this population.

Over the past several decades, a large body of research has been conducted identifying racial discrimination as an important social mechanism in risk for health outcomes among minority populations (Lewis, Cogburn, & Williams, 2015; Noonan, Velasco-Mondragon, & Wagner, 2016; Williams & Williams-Morris, 2000). This work has been synthesized within several meta-analyses and systematic reviews documenting a significant negative association between racial discrimination and a range of psychological and physical health outcomes among African American populations (Pieterse, Todd, Neville, & Carter, 2012; Paradies et al., 2015). There is also a growing body of literature, including a meta-analysis by Carter et al. (2017), that has provided support for the direct and negative effect of racial discrimination on substance use outcomes among African Americans (Clark, Salas-Wright, Vaughn, & Whitfield, 2015; Gibbons et al., 2010; Gibbons, Gerrard, Cleveland, Wills, & Brody, 2004; Gilbert & Zembre, 2016; Guthrie, Young, Williams, Boyd, & Kintner, 2002; Williams, Neighbors, & Jackson, 2003). Yet, these studies are limited as the effect of racial discrimination is examined in isolation with the exclusion of other well-established risk factors for substance use. Risk models for substance use that included both racial discrimination and established risk factors are necessary in order to 1) provide a comprehensive understanding of substance use risk for African Americans, and 2) determine the potentially unique contribution of racial discrimination in relation to other established risk factors. Thus, the first aim of our study is to examine the influence of both established risk factors (i.e., social, attitudinal, and intrapersonal factors) and racial discrimination for substance use initiation among a sample of African American youth. Models will be run separately for alcohol, marijuana, and cigarette initiation given different patterns of use among African American youth populations.

In addition to the need to better understand the multi-faceted nature of risk for substance use initiation among African American youth there is also a need to examine risk through a developmental lens (Bronfenbrenner & Morris, 1998; Masten, Faden, Zucker, & Spear, 2009). As noted in work by Cicchetti and Rogosch (2002), adolescence is a dynamic developmental period that is marked by important changes within (i.e., physical, psychological, neurobiological changes) and outside (i.e., environmental and social changes) the individuals. In turn, as youth develop and interact within different systems and environment, the strength of the effect posed by these factors can also vary based on the age of the youth (e.g., Dick et al., 2007; Schulenberg & Maggs, 2002). Thus, it is highly plausible that impact of social, attitudinal, intrapersonal, and racial discrimination on substance use initiation varies based on a developmental stage.

However, to date, few studies have been published examining differential effects of risk factors for substance use or initiation based on age during adolescence (Donovan, 2004; Ellickson, Tucker, Klein, & Saner, 2004; Guo, Hill, Hawkins, Catalano, & Abbott, 2002; Mahabee-Gittens, Xiao, Gordon, & Khoury, 2013). Among available studies, differences

have been found. Tang and Orwin (2009) examined risk for marijuana initiation among a nationally representative sample of youth ages 10 to 16, finding that both parent and peer factors were influential on marijuana initiation during early (ages 11–13), but not late adolescence. Moreover, academic factors were found to be a fairly consistent predictor across most ages (Tang & Orwin, 2009). There is also evidence for age-related risk for smoking initiation, with parental smoking only impacting smoking initiation during early adolescence (prior to the age of 15) among a sample of predominantly non-Hispanic White smokers, whereas academic attainment was predictive at both developmental periods (initiation prior to age 15 and initiation between 15 and 18; Wilkinson, Schabath, Prokhorov, & Spitz, 2007). O’Loughlin et al. (2017) also examined age related differences for cigarette smoking initiation across adolescence among a large sample of Canadian youth, finding that peer smoking was only predictive during early and mid- adolescence, whereas depressive symptoms were a risk factor during early and mid-adolescence but were protective during late adolescence.

Collectively, these studies demonstrate the dynamic nature of risk factors, suggesting that not all risk factors have the same level of influence across adolescence. However, much of this existing literature is based on predominately White samples, with limited research examining changes in risk among racial/ethnic minority populations (Atherton, Conger, Ferrer, & Robins, 2016; Grigsby, Forster, Soto, & Unger, 2017). Moreover, to date, there are no existing studies utilizing a developmental perspective to examine variation in risk for substance use initiation among African Americans. Thus, the second aim of the current study is to examine the unique effect of the risk indices (i.e., social, attitudinal, intrapersonal, and racial discrimination) on substance use initiation during three developmental periods: early adolescence (age 11–14), mid adolescence (age 16–18) and late adolescence (age 19–21).

In addition to the four risk indices, models will also examine risk based on two sociodemographic variables: gender and socioeconomic status. In regard to gender, studies generally find higher prevalence rates (Byck, Bolland, Dick, Ashbeck, & Mustanski, 2013; Vidourek, King, & Montgomery, 2017; Lewis, Lee, Kirk, & Redmond, 2011) and earlier age of initiation (Doherty, Green, Reisinger, & Ensminger, 2008) among African American male youth in comparison to female youth. However, findings have been mixed as whether gender differentially *predicts* substance use risk, with several studies indicating a non-significant gender effect (Byck et al., 2013; Elkington et al., 2011; Myers, 2013; Zapolski, Beutlich, Fisher, & Barnes-Najor, 2018) or a gender effect for being male only for certain substances (Clark et al., 2011; Nasim, Utsey, Corona, & Belgrave, 2006). In regards to family socioeconomic status, findings have also been mixed, with some studies indicating greater risk of substance use among youth with lower socioeconomic status (Bachman, O’Malley, Johnston, Schulenberg, & Wallace, 2011; Elkington et al., 2011), while other studies have found a non-significant effect (Wallace et al., 1999) or an effect only for certain substances (McNeil Smith & Taylor, 2015). In turn, previous models that have examined within-group variation in substance use outcomes among African American youth have include at least one of these variables as a control within the analyses (Clark et al., 2008; Wills et al., 2000).

Method

Participants

The sample for the current study was taken from a longitudinal study of rural African American families that began in 2002 when youth were 11 years of age. The study sampled families residing in small towns and communities in rural Georgia where poverty rates are among the highest in the nation and unemployment rates are above the national average (DeNavas-Walt, 2014). From lists that schools provided of 5th-grade students, 667 families were selected randomly for an initial assessment (see Brody et al., 2013). Follow-up data were completed by participating families on an annual basis over the next 14 years.

Most (75%, $n = 500$) of the original sample provided data on cigarette, alcohol, and marijuana use status during at least one year from ages 11 to 14, ages 16 to 18, and ages 19 to 21. A little more than half of the final sample of youth were female (54.2%), and a majority of their primary caregiver were mothers (89.2%). Participants median family income per month was \$1740 ($SD = \1422), with 42.1% of families living below federal poverty standards.

Procedures

African American youth provided prospective data at 10 assessments from ages 11 to 13 and 16 to 21. At age 14, assessments on substance use outcomes were conducted but few other variables. At age 15, no data was collected due to grant funding. All procedures were approved by the Institutional Review Board of the sponsoring research institution. At each wave, project staff contacted participants regarding participation in the study. Primary caregivers consented to minor youth's participation in the study, and minor youth assented to their own participation. Youth age 18 and older consented to their own participation. African American field researchers visited families' homes to administer self-report instruments at each wave of data collection. All assessments, which lasted approximately two hours, were conducted in private, with no other family members present, using a standardized protocol. Child participants were compensated \$100 and parents were compensated \$80 at each data collection wave.

Measures

Substance use initiation—Each year from age 11 to 21, with the exception of age 15, youth participants provided data on substance use behaviors, including if they had ever smoked a cigarette or marijuana, or drank alcohol. Responses to these three items were recoded to a dichotomous variable indicating substance use initiation status at each wave for each substance (0 = never used substance; 1 = ever use substance). The initiation status was summed across three developmental periods, with data from ages 11 to 14 representing early adolescence, 16 to 18 representing mid adolescence, and 19 to 21 representing late adolescence.

Family SES risk index—When participants were 11 to 13, 16 to 18, and 19 to 21 years of age, caregivers of the child participants were asked about their family's socioeconomic status. Six dichotomous variables formed a socioeconomic risk index (see Evans, 2003; Kim

& Brody, 2005; Rutter, 1993). A score of 1 was assigned to each of the following: family poverty based on federal guidelines, primary caregiver unemployment, receipt of Temporary Assistance for Needy Families, primary caregiver single parenthood, primary caregiver education level less than high school graduation, and caregiver-reported inadequacy of family income. The six dichotomized indicators were summed to form the SES index score, with higher scores indicative of lower family socioeconomic status.

Social risk index—For ages 11–13, social risk was measured by parent’s report of *parent-child conflict* and youth’s report of *parent social support*. *Parent-child conflict* was measured using an adaptation of the 7-item Ineffective Arguing Inventory (IAI; Kurdek, 1994) through which respondents rate statements regarding conflicts they had with their children. Example items include, “You and your child’s arguments are left hanging and unsettled,” and “You and your child go for days being mad at each other,” with response options ranging from 1 (*disagree strongly*) to 5 (*agree strongly*). Cronbach’s alphas for the IAI ranged from .75 to .79 across the three waves. *Parental social support* was measured using a revised version of the 4-item Social Support for Emotional Reasons subscale (Carver, Scheier, and Weintraub, 1989). Example items include, “I get emotional support from my caregiver” and “I get sympathy and understanding from my caregiver,” with response options ranging from 1 (*not at all*) to 4 (*a lot*). Items were reversed coded such that higher scores indicated lower parental support. Cronbach’s alphas ranged from .78 to .87 across the three waves.

For ages 16–18 social risk was measured using the same youth’s report of *parent-child conflict* measure (7 items; IAI; Kurdek, 1994; Cronbach’s alphas ranged from .74 to .83 across the three waves) and *parent social support* measure (4 items; revised version of the Social Support for Emotional Reasons subscale, Carver, Scheier, & Weintraub, 1989; Cronbach’s alphas ranged from .93 to .95 across the three waves). A 4-item measure on *substance using peers* (developed for the study) was also included to assess the youth’s proportion of close friends who engaged in substance use (cigarettes, alcohol, marijuana, and excessive drinking). Response options for the measure were 1 (*none*), 2 (*some*), and 3 (*all*). This measure was first introduced into the study at age 16, and thus was not available for the ages 11–13. Cronbach’s alphas ranged from .87 to .90 across the three waves.

For ages 19–21 social risk was measured used the same youth’s report of *parent-child conflict* (7 items; IAI; Kurdek, 1994; Cronbach’s alphas ranged from .82 to .85 across the three waves) and *substance using peers* (4 items, developed for the study; Cronbach’s alphas ranged from .84 to .86 across waves). For ages 19–21, *parent social support* was measured by youth report using the 9-item Network Relationships Inventory (NRI; Furman & Buhrmester, 1985). The NRI assesses the youth’s reported frequency of emotion and instrumental support received and caregiving from parent, with response options ranging 1 (*never*) to 4 (*very often*). Cronbach’s alpha was .90 across the three waves.

Attitudinal risk index—For ages 11–13 attitudinal risk was measured based on youth’s report on *attitudes towards risky behaviors* and *goal orientation* and parent’s report of youth *academic competence*. *Attitudes towards risky behavior* was assessed using the 16-item Attitudes Toward Risky Behavior scale (Conger, 1989). Example items include, “It is okay for someone your age to smoke marijuana, use alcohol, hit someone with the idea of hurting

them,” with response options ranging from 1 (*never*) to 5 (*always*). Cronbach’s alphas ranged from .86 to .90 across the three waves. *Goal orientation* was assessed using the 5-item Future-Oriented Goals scale (Brody et al., 2004), which measures youths’ ability to set, sustain, and achieve goals for the future. Example items include “I have thought of some goals I want to reach when I grow up,” and “I know some specific steps to take to reach my goals,” with response options ranging from 0 (*not true*) to 2 (*very or often true*). Cronbach’s alphas ranged from .60 to .69 across the three waves. *Academic competence* was assessed using the 7-item measure by Harter (1982) that measures parents report of their youths’ engagement and competence in academic activities. Example items include “the child is very good at his/her school work; the child is just as smart as other kids his/her age; the child does well in class,” with response options ranging from 1 (*not at all*) to 4 (*always*). Cronbach’s alphas ranged from .83 to .92 across the three waves.

For ages 16–18, attitudinal risk was measured using the same youth’s report *goal orientation* (5 items; Future-Oriented Goals scale, Brody et al., 2004; Cronbach’s alphas ranged from .60 to .69 across the three waves). At ages 16–18 attitudinal risk was also measured using youth’s report of *tolerance for deviance*, *religiosity*, and *school engagement*. *Tolerance for deviance* was measured using the 10-item Tolerance for Deviance scale (developed for the study) which assessed youths’ attitudes toward risky behaviors. Example items include, “how wrong do you think it is to hit someone because you did not like what they said or did, to take things that do not belong to you, and to start a fight,” with response options ranging from 1 (*not at all wrong*) to 5 (*very wrong*). Cronbach’s alphas ranged from .89 to .92 across the three waves. *Religiosity* was assessed based on youth’s report on the 7-item Religiosity of Emerging Adults Scale (Arnett & Jensen, 2002), which measures religious attendance, the importance ascribed to religion, the certainty of the youth’s beliefs, and exposure to religion. Cronbach’s alphas ranged from .76 to .81 across the three waves. *School engagement* was assessed using the 20-item scale Academic Orientation scale developed for use in the Family and community Health Study (Brody et al., 2001). The measure assesses youth’s academic performance, liking of school, boredom with school, effort at school, completion of homework, and the importance of grades, with response options ranging from 1 (*strongly agree*) to 5 (*strongly disagree*). Cronbach’s alphas for the scale were .90 to .91.

For ages 19–21, attitudinal risk factor was measured using the same youth’s report on *school engagement* (Academic Orientation; Brody et al., 2001; Cronbach’s alphas for the scale were .87 to .92). For ages 19–21 attitudinal risk was also measured using youth’s report on *religiosity* and *future/goal orientation*. *Religiosity* was measured using the 7-item Multidimensional Measure of Religious Involvement (Levin, Taylor, & Chatters, 1995), which assesses youth’s reported religious attendance and importance ascribed to religion. Cronbach’s alphas ranged from .76 to .78 across the three waves. *Future/goal orientation* was measured using the 12-item Future/goal Orientation subscale from MacArthur Reactive Responding Scale (Taylor & Seeman, 1999). Example items include “It is important to me to take time to plan out where I am going in life; I have many long-term goals that I will work to achieve; I set goals for my future,” with response options ranging from 1 (*strongly disagree*) to 5 (*strongly agree*). Cronbach’s alphas ranged from .71 to .77 across the three waves.

Intrapersonal risk index—For ages 11–13 intrapersonal risk was measured based on parent’s report of youth *externalizing behaviors* and *self-control* and youth’s report of *self-esteem*. *Externalizing behaviors* were assessed using the Child Behavior Checklist (CBCL, Achenbach & Edelbrock, 1983). We computed a score for the second-order factor of *externalizing problems* (35 items) which included first-order factors of aggressive behavior and rule breaking behavior. For each item, parents indicated whether the statement was (0) *not true for the child*, (1) *somewhat or sometimes true*, or (2) *very or often true*. Cronbach’s alphas ranged from .85 to .92 across the three waves. *Self-control* was assessed based on parents report on the 12-item Self-Control Inventory (Humphrey, 1982). Example items include “how often the child sticks to what he/she is doing even during long, unpleasant tasks until finished; how often the child works toward a goal; how often the child pays attention to what he/she is doing,” with response options ranging from (0) *never* to (4) *almost always*. Cronbach’s alphas ranged from .86 to .88 across the three waves. *Self-esteem* was measured based on youth’s self-report on the 10-item Rosenberg Self-Esteem scale (Rosenberg, 1965). Example items include, “I am able to do things as well as most other people” and “I take a positive attitude toward myself,” with response options ranging from 1 (*completely false*) to 5 (*completely true*). Cronbach’s alphas ranged from .73 to .78 across the three waves.

For ages 16–18 intrapersonal risk was measured using the same parent’s report of youth *externalizing behaviors* (35 items; second-order factor of Externalizing Problems CBCL, Achenbach & Edelbrock, 1983; Cronbach’s alphas ranged from .90 to .92 across the three waves) and *self-control* (12 items; Self-Control Inventory, Humphrey, 1982; Cronbach’s alphas ranged from .72 to .73). For ages 16–18 intrapersonal risk was also assessed based on youth’s report of *depression* and *anger*. *Depression* was measured using the 26-item Child Depression Inventory (CDI, Kovacs, 1985), which assesses for depressed mood, interpersonal problems, ineffectiveness, anhedonia, and negative self-esteem. For each item the youth indicated (0) *absence of symptoms*, (1) *mild symptoms*, or (2) *definite symptoms*. Cronbach’s alphas ranged from .84 to .86. *Anger* was measured using the 15-item Anger subscale taken from the State-Trait Anger Expression Inventory (Spielberger, Jacobs, Russell, & Crane, 1983). Respondents are asked about their feelings over the past three months and to rate discrete emotions (e.g., “I am furious”; “I feel angry”) on a scale ranging from 1 (*always*) to 5 (*never*). Cronbach’s alphas ranged from .91 to .92.

For ages 19–21 intrapersonal risk was measured by the same parent’s report of youth *self-control* (12 items; Self-Control Inventory, Humphrey, 1982; Cronbach’s alphas ranged from .85 to .86). For ages 19–21, intrapersonal risk was also measured by youth’s self-report of *externalizing behaviors*, *depression*, and *anger/hostility*. *Externalizing behaviors* were measured using the Aggressive, Intrusive, and Rule Breaking subscales from the 36-item Adult Self-Report (Achenbach & Rescorla, 2003; Cronbach’s alpha was .92). *Depression* was measured using the 20-item Center for Epidemiologic Studies Depression scale (CES–D; Radloff, 1977). Respondents rated each of 20 symptoms on the following scale: 0 (*rarely or none of the time*), 1 (*some or little of the time*), 2 (*occasionally or a moderate amount of time*), or 3 (*most or all of the time*). Cronbach’s alphas ranged from .84 to .86. *Anger/Hostility* was measured using the 8-item Anger/Hostility Scale (Joe, Broome, Rowan-Szal,

& Simpson, 2002). Youths were asked about their feelings and to rate discrete emotions (e.g., “I feel a lot of anger inside me”; “I get mad at another people easily”) on a scale ranging from 1 (*strongly disagree*) to 5 (*strongly agree*). Cronbach’s alpha was .90.

Racial discrimination—*Past year racial discrimination* was measured at ages 16–18 and 19–21 using the 9-item Schedule of Racist Events (SRE; Landrine & Klonoff, 1996). This measure was first introduced into the study at age 16, and thus was not available for the ages 11–13. The SRE measures perceptions of specific discriminatory events, which were designed to be developmentally appropriate for adolescents, such as racially based slurs and insults, disrespectful treatment from community members, physical threats, and false accusations from business employees or law enforcement officials. Response options for each item range from 0 (*never happened*) to 2 (*happened a lot*). Cronbach’s alphas ranged from .87 to .92.

Statistical Analyses

We used the substance use initiation status to identify groups of youths who started to use substances during early adolescence (ages 11–14), mid adolescence (ages 16–18), and late adolescence (ages 19–21). Table 1 presents the sample characteristics of the risk indices for each developmental period. Attrition across the three developmental periods was low, with 75% of participants provided complete data across all the developmental periods. Youth were retained in the study and included in the analyses if they provided complete data across the three developmental periods. Compared to youth excluded due to having missing data, our study sample (i.e., those with complete data) had more favorable attitudes towards risky behaviors, but less externalizing behaviors during early adolescence. Attrition analysis suggested that the missing was not at random, thus listwise deletion was used to handle missing data within the analysis. See Table 2 for details regarding comparison on study variables based on youth with complete versus missing data.

Four indices of risk factors were examined: social, attitudinal, intrapersonal, and racial discrimination. The risk indices were created using the following steps: 1) Individual risk measures were scored in the direction with higher scores indicating greater risk, with items summed to create a composite score for each measure; 2) Composite scores for each measure were averaged across all time points within a given developmental period (e.g., three parent-child conflict scores from ages 11 to 13 averaged to produce an early adolescence parent-child conflict score); 3) Each measure within an index was standardized and summed to create a composite standardized risk index score within each developmental period (e.g., the average scores for parent-child conflict and reverse coded parent support from ages 11 to 13 were standardized and summed to form the social risk index during early adolescence). Items comprising each risk factor index were all significantly correlated ($p < .01$) with other items in the composite at that time point. Additionally, the risk indices were also significantly correlated across developmental periods, with an average correlation of 0.42 (ranged from 0.25 to 0.66) for the social index, 0.46 (ranged from 0.35 to 0.68) for the attitudinal index, 0.56 (ranged from 0.46 to 0.74) for the intrapersonal index, and 0.77 for the racial discrimination index.

All analyses were conducted using SPSS version 25 (IBM Corp., Armonk, NY, USA). To address the first aim, a logistic regression model was run that examined the effect of all four risk indices on substance use initiation across developmental period. For the model, group membership of abstainers (coded as 0) vs. substance users (coded as 1) was entered as the dependent variable, with social, attitudinal, and intrapersonal risk factors at early adolescence (ages 11–13) and the racial discrimination risk factor at mid adolescence (ages 16–18, the first time this index was measured) entered simultaneously into the model as predictor variables. Gender and family SES risk index were included as controls.

To address the second aim, we stratified the sample into early (ages 11–14), mid (ages 16–18), and late (ages 19–21) adolescent initiators for each substance and examine whether risk indices differentially predicted risk for substance use initiation based on age of initiation. Multinomial regression was run when predicting group membership for more than one group, with logistic regression used when predicting membership of only one group, using the abstainer group as the reference group. Specifically, Model 1 used a multinomial regression analysis to predict the early adolescent risk indices on early, mid, and late adolescence initiation. Similarly, Model 2 used a multinomial regression analysis which examined mid-adolescent risk indices in the prediction of mid and late adolescent initiation. Lastly, Model 3 used a logistic regression analysis, which examined the prediction of late adolescent risk indices on late adolescence initiation. For the regression models, a negative coefficient indicates a greater likelihood of inclusion in the reference group (abstainers), and a positive coefficient indicates a greater likelihood of inclusion in a comparison group.

Result

Substance use initiation groups

A majority of the sample had initiated alcohol ($n = 455, 91.0\%$) and more than half of the sample had initiated cigarette use ($n = 263, 52.6\%$) and marijuana use ($n = 257, 51.4\%$) by late adolescence. Gender differences were also observed within the group distributions for marijuana ($\chi^2(3) = 16.505, p = .001$) and cigarette ($\chi^2(3) = 27.453, p < .001$) initiation, with no statistically significant differences found for alcohol initiation ($\chi^2(3) = 5.177, p = .159$). Specifically, female youth were more likely to be in the abstainers group for both marijuana and cigarette use than were male youth. Conversely, male youth were more likely an early adolescent initiator for marijuana and cigarette use, a mid adolescent initiator for marijuana use, and a late adolescent initiator for cigarette use than were female youth. Figure 1 summarizes these results

Aim 1: Prediction of substance initiation across adolescence

The first models tested the effect of social, attitudinal, and intrapersonal risk factors during early adolescence (ages 11–13) and the racial discrimination risk factor at mid adolescence (ages 16–18) on substance use initiation at any time point; models were run separately for alcohol, marijuana, and cigarette use. Results showed that for alcohol, racial discrimination was the only significant risk factor for initiation by age 21 (OR = 1.169, 95% CI [1.034, 1.322], $p = .013$). However, lower family socioeconomic status was protective against alcohol initiation (OR = 0.783, 95% CI [0.614, 0.999], $p = .049$). For marijuana use, being

male (OR = 1.910, 95% CI [1.316, 2.772], $p = .001$) and racial discrimination (OR = 1.135, 95% CI [1.065, 1.210], $p < .001$) predicted initiation by age 21. For cigarette use, being male (OR = 2.235, 95% CI [1.525, 3.276], $p < .001$), high levels of intrapersonal risk (OR = 1.217, 95% CI [1.084, 1.367], $p = .001$) and racial discrimination (OR = 1.107, 95% CI [1.037, 1.182], $p = .002$) predicted initiation by age 21. A non-significant effect was found for all other risk indices. See Table 3 for more detailed results of the analyses.

Aim 2: Prediction of initiation at specific developmental stages

Alcohol use.—Based on early adolescent risk factors, lower family socioeconomic status was protective against alcohol initiation by age 14 (OR = 0.762, 95% CI [0.590, 0.984], $p = .037$), as well as initiation during late adolescence (OR = 0.701, 95% CI [0.531, 0.926], $p = .012$). Based on mid adolescent risk factors, lower family socioeconomic status during mid adolescence was also protective against initiation during mid adolescence (OR = 0.692, 95% CI [0.525, 0.912], $p = .009$) and during late adolescence (OR = 0.615, 95% CI [0.458, 0.825], $p = .001$). Lastly, based on late adolescent risk factors, lower family socioeconomic status continued to be protective against alcohol initiation by age 21 (OR = 0.684, 95% CI [0.525, 0.891], $p = .005$). See Table 4 for more detailed results of the analyses.

Marijuana use.—Based on early adolescent risk factors, high levels of attitudinal risk (OR = 1.322, 95% CI [1.038, 1.683], $p = .023$) predicted marijuana use initiation by age 14. Being male predicted marijuana use initiation during mid adolescence (OR = 1.910, 95% CI [1.208, 3.018], $p = .006$) and during late adolescence (OR = 1.680, 95% CI [1.066, 2.646], $p = .025$). Based on mid adolescent risk factors, being male (OR = 2.140, 95% CI [1.306, 3.504], $p = .003$), high levels of racial discrimination (OR = 1.118, 95% CI [1.024, 1.220], $p = .012$), social risk (OR = 1.244, 95% CI [1.079, 1.434], $p = .003$), and attitudinal risk (OR = 1.107, 95% CI [1.000, 1.226], $p = .049$) predicted initiation of marijuana use between ages 16 and 18. Moreover, being male also predicted later initiation of marijuana use at ages 19 through 21 (OR = 1.692, 95% CI [1.066, 2.686], $p = .026$). Based on late adolescent risk factors, being male (OR = 1.663, 95% CI [1.035, 2.672], $p = .036$) and high levels of social risk (OR = 1.230, 95% CI [1.064, 1.422], $p = .005$) predicted initiation between ages 19 to 21. See Table 5 for more detailed results of the analyses.

Cigarette use.—Based on early-adolescent risk factors, being a male (OR = 2.010, 95% CI [1.225, 3.297], $p = .006$) and high levels of both attitudinal risk (OR = 1.197, 95% CI [1.030, 1.390], $p = .019$) and intrapersonal risk (OR = 1.274, 95% CI [1.104, 1.470], $p = .001$) predicted cigarette initiation by age 14. Being a male (OR = 1.822, 95% CI [1.131, 2.933], $p = .014$) and high levels of intrapersonal risk (OR = 1.208, 95% CI [1.048, 1.392], $p = .009$) also predicted cigarette initiation between ages 16 and 18. Moreover, being male also predicted later initiation of cigarette use at ages 19 through 21 (OR = 3.628, 95% CI [1.885, 6.982], $p < .001$). Based on mid adolescent risk factors, being a male (OR = 2.131, 95% CI [1.286, 3.532], $p = .003$) and high levels of social risk (OR = 1.241, 95% CI [1.072, 1.437], $p = .004$) predicted initiation of cigarette use between ages 16 and 18. Being male also predicted later initiation of cigarette use at ages 19 through 21 (OR = 3.702, 95% CI [1.914, 7.157], $p < .001$). Based on late adolescent risk factors, being male (OR = 4.526, 95% CI [2.264, 9.046], $p < .001$) and lower family socioeconomic status (OR = 1.297, 95%

CI [1.037, 1.622], $p = .023$) predicted initiation between ages 19 to 21. See Table 6 for more detailed results of the analyses.

Discussion

The current study provided a comprehensive risk model for African American youths' alcohol, marijuana, and cigarette initiation based on four risk indices (i.e., social risk, attitudinal risk, intrapersonal risk, and racial discrimination risk), and examined variation in risk at three stages of development: early adolescence, mid adolescence, and late adolescence. Findings showed that when developmental periods were combined, racial discrimination was the only factor that predicted initiation for all three substances. This finding provides further evidence on the negative effect experiences of racial discrimination have on health and behavioral outcomes for African American youth (Williams & Mohammed, 2009; Williams et al., 2003), including substance use (Brody, Kogan, & Chen, 2012; Fuller-Rowell et al., 2012). Moreover, our finding extends this previous work by documenting the unique effect of racial discrimination above established risk factors, which highlights the importance of acknowledging and intervening on the impact of racial discrimination on health outcomes for African American youth.

We also examined risk for substance use initiation based on developmental period, and among these findings the effect of racial discrimination was only found for mid-adolescent marijuana initiation. We believe that the absence of an effect for racial discrimination among the other substance categories is driven by the exclusion of early adolescent initiators, as when mean scores for mid-adolescent racial discrimination were compared across developmental groups, the highest scores tended to be among early adolescent initiators. Given findings by Hurd et al. (2014) and Fuller-Rowell et al. (2012) that racial discrimination prospectively predicts substance use with no evidence that earlier substance use predicts later perceptions of racial discrimination among African Americans, we believe our findings suggest that racial discrimination was likely highest among early adolescent initiators than during both early- and mid-adolescence, and that the overall association between racial discrimination and substance initiation is driven by this effect. Future studies utilizing longitudinal designs that assess racial discrimination from early to late adolescence is needed to confirm this hypothesis, as there may be a critical period during adolescence for which the effect of racial discrimination on substance outcomes is the strongest (Seaton et al., 2018).

Moreover, these findings could point to developmental periods when interventions on discrimination are most pertinent. Yet, to date, only a limited in number of interventions have been developed and empirically tested to specifically address the impact of racial discrimination on substance use outcomes among African American youth. These interventions focus on the stress response of discrimination, as based on theory (e.g., Brondolo, Brady, Pencille, Beatty, & Contrada, 2009; Clark et al., 1999; Wills & Shiffman, 1985) and supported by empirical evidence (Brody, Kogan, & Chen, 2012; Clark, 2014; Gibbons, Stock, O'Hara, & Gerrard, 2016; Guthrie et al., 2002), it has been shown that racial discrimination causes physiological and psychological stress responses, such as depressive and anxiety symptoms and anger/hostility, that result in substance use as a coping

response to the distress. For example, Brody et al., (2012) developed the Strong African American Families Teen program, which is a family-centered program designed for African Americans that teaches emotion regulation skills to youth and parenting skills, including racial socialization approaches, to parents to aid in adaptively dealing with racial discrimination. Although this program has shown evidence to reduce substance use risk among African American youth (Brody et al., 2012), further research is needed in this area to develop and refine intervention programs that explicitly address racial discrimination and skills to mitigate its effect of on health outcomes among African American youth. Moreover, our findings highlight the need for policies to decrease biases and discriminatory actions towards African Americans given the impact such experiences have on health outcomes.

Our findings also documented the effect of social, attitudinal, and intrapersonal risk on substance initiation, although risk varied based on both developmental periods of initiation and substance type. Specifically, among those youth who initiated during early adolescence, attitudinal risk factors (i.e., attitudes toward risky behaviors, low goal orientation and academic competence) was the only significant predictor for marijuana use, with both attitudinal and intrapersonal risk factors (i.e., externalizing behaviors, low self-control and self-esteem) predicting early initiation for cigarette use. This finding suggests that interventions, such as competence enhancement prevention programs (Botvin, 2000; Botvin, Griffin, Diaz, & Ifill-Williams, 2001), may be particularly beneficial for African American early adolescents, as they address cognitions associated with risk taking and competency skills that can indirectly increase academic performance and decrease risk for marijuana and cigarette use. Moreover, given risk posed by intrapersonal factors, implementation of competence enhancement prevention programs geared towards teaching youth cognitive-behavioral skills for building self-esteem and selfcontrol could be particularly beneficial for African American youth who are at risk for cigarette initiation (Botvin et al., 2001). Additionally, given that elevation of intrapersonal risk factors during early adolescence were also significantly predictive for mid-adolescent cigarette initiation, it is plausible that intervening early may have longer-lasting effects for those who initiate cigarette use during the 16–18 developmental period.

Whereas attitudinal and intrapersonal risk factors were the most robust predictors during early adolescence, social risk (i.e., parent-child conflict, peer substance use, and low parental social support) was the most consistent predictor during mid adolescence. This finding is consistent with previous literature on the impact of family and peers on adolescent risk behaviors (Bahr, Hoffmann, & Yang, 2005; Donovan, 2004; Donovan & Molina, 2011; Van Ryzin, Fosco, & Dishion, 2012) and supports the notion that social interactions are a driving force for adolescence substance use initiation. Moreover, Van Ryzin et al. (2012) found that greater family relationship quality decreased substance use indirectly by reducing contact with deviant peers. These findings suggest that interventions that target parent-youth relationships, in particular, may be effective at reducing adolescent substance use directly and indirectly through reducing negative influences by risky peers (Van Ryzin et al., 2012). It should also be noted that for midadolescent marijuana initiation, in addition to risk posed by social risk factors, elevations in attitudinal factors and racial discrimination also increased risk for use. This finding suggests that during the 16–18 developmental period, risk for marijuana initiation for African American youth is complex, being influenced by individual

level factors, social networks, and race-based stress exposure, which may require more multifaceted intervention approaches to address these varying influences of risk.

Lastly, during late adolescence, of the four risk indices, only social risk factors were shown to be predictive of initiation, increasing risk for marijuana use. As mentioned above, this finding supports the notion that social interactions are a driving force for adolescence substance use initiation that extends to late adolescence, at least for marijuana initiation for African American youth. Thus, interventions that target youth's social networks may be effective at reducing risk for marijuana use during late adolescence for African American youth (Baer, Kivlahan, Blume, McKnight, & Marlatt, 2001; Reid, Carey, Merrill, & Carey, 2015; Turrisi, Jaccard, Taki, Dunnam & Grimes, 2001; Van Ryzin, Roseth, Fosco, Lee, & Chen, 2016). However, it should also be noted that our finding contradicts work by Tang and Orwin (2009) who found that the effect of parent and peer factors did not extend to late adolescence. However, the Tang and Orwin (2009) study was not restricted to only African American youth, suggesting that the influence of parent and peer influences during adolescence may vary across racial/ethnic groups.

Although outside of the four indices of risk, the current study also examined the effect of sociodemographic factors (i.e., gender and family socioeconomic status) on substance use initiation across the developmental periods. Similar to the four risk indices, the influence of the sociodemographic factors varied based on both substance type and developmental period. For gender, it was found that being male increased risk for marijuana and cigarette initiation, with a non-significant gender effect for alcohol use. The gender effect for marijuana and cigarette initiation was also fairly consistent across developmental periods, with an effect found for each initiation period except for early adolescent marijuana initiation. These findings suggest that for rural African American youth, males are at greater risk for initiating marijuana and cigarette use in comparison to their female counterparts. It is plausible that these gender effects may also moderate the effect of the observed risk posed by the other risk indices. Future research is needed to examine the potential moderating effect of gender based on developmental periods on substance use initiation among African American youth.

As for family socioeconomic status, although low socioeconomic status has been shown to be a risk factor for both substance use initiation (Roberts, Spillane, Colby, & Jackson, 2017) and dependence (Meier et al., 2016) among studies comprised of predominately White youth, findings have been less consistent among African American youth with some studies finding a weaker (Bachman et al., 2011) or non-significant effect (Wallace et al., 1999). Our findings support this mixed effect for African American youth, with low family socioeconomic only being found to elevate risk for initiation during late adolescence for marijuana use and being found to be protective across all developmental periods for alcohol initiation. As for cigarette use, no significant effect of low socioeconomic status on initiation was observed. It is also plausible that variability in the effect of socioeconomic status may be a byproduct of geographic location, as differences in risk for substance use have been observed among African American youth residing in urban versus rural neighborhoods (Clark, Nguyen, & Belgrave, 2011). Thus, low income may be more of a protective factor for alcohol use among rural communities, where as it may pose risk in urban communities.

We postulate that this protective process among low-income rural African American communities may also operate through community characteristics, such as affiliation with religious traditions (Kim, Harty, Takahashi, & Voisin, 2018; Nasim, Fernander, Townsend, Corona, & Belgrave, 2011) which tend to discourage substance use. However, based on our findings, the protection from socioeconomic status was only found for alcohol use, thus future studies are needed to determine whether the protective effect extends to other substances, as well as if there are particular environments in which the effect is observed.

Although the current study's findings on the effects of racial discrimination and established risk factors for substance use initiation across three developmental periods among African American youth is novel and significant, there are some limitations to note. First, although efforts were made to use the same measures to assess the four risk indices (i.e., social risk, attitudinal risk, intrapersonal risk, and racial discrimination) at each developmental period, there were some slight differences in measures across waves and the racial discrimination measure was only available at ages 16–21. We attempted to address this limitation by picking measures based on theoretical consideration, in that the measures were believed to be assessing similar constructs, which was supported through significant correlations within each index. However, we cannot guarantee that there were no instrumental effects, that may have influenced the study results. Future studies are needed to replicate the study findings with repeated measures that are consistent across developmental periods. Moreover, given a lapse in funding, youth did not provide data for substance use and related risk factors at age 15. Second, although our model attempted to provide a comprehensive assessment of risk for substance use, there were factors that were not assessed. Future studies can expand upon the current study by including additional factors, such as family history of substance use as a social risk factor and racial identity as a cultural risk factor. Third, the sample for the current study was recruited from rural communities in the southeastern United States, with participants in our study reporting higher lifetime rates of alcohol, marijuana, and cigarette use than national estimates for African Americans at comparable ages (Substance Abuse and Mental Health Services Administration, 2009; 2013). Additionally, participants who were included in the study analyses differed significantly on some study variables from those individuals excluded from analysis. These factors could influence both power to detect and effect and generalizability of finding, thus replication of findings are needed to support generalizability of effects to other diverse populations. Fourth, engaging in substance use during late adolescence includes unique experiences that are qualitatively different from youth during early and mid-adolescence (e.g., identity exploration changing social roles and responsibilities, new social groups; Arnett, 2005; Perry et al., 2018; Sussman & Arnett, 2014; Wood et al., 2018). During this developmental period, youth are also within the legal age to engage in cigarette and alcohol use. These unique circumstances and factors that represent late adolescence, also referred to as emerging adulthood or young adulthood, were not assessed in the current study and may prove to be stronger risk factors for substance initiation. Thus, future studies are warranted to examine other factors that may predict initiation among this specific developmental period. Relatedly, there is also evidence for within-group variability on risk for substance use among African Americans (Clark, 2014) and the effects of racial discrimination on health outcomes (e.g., Seaton, Caldwell, Sellers, & Jackson, 2008) based on country of origin (i.e., African American versus African

Caribbean) and gender. Thus, future studies are warranted examining within group variation in the proposed risk model.

In sum, the current study is one of the first to investigate a comprehensive risk model for substance use initiation for African Americans across adolescence that includes both racial discrimination and established risk indices (i.e., social risk, attitudinal risk, intrapersonal risk) within the same model. Moreover, given that adolescence is a dynamic developmental period that is marked by important changes within (i.e., physical, psychological, neurobiological changes) and outside (i.e., environmental and social changes) of the individuals (Cicchetti & Rogosch, 2002), we documented the differential effects of risk indices on substance initiation as a function of developmental period and substance type among African American youth. We believe these findings are significant, as they provide a stronger foundational understanding of the collective and unique risk posed by the four risk indices assessed on substance use risk for African American youth, which has to date been understudied in the field. Future research can build on this work and advances in the field of developmental psychopathology by examining how these sets of risk factors predict substance use into emerging and young adulthood, mechanisms involved within the risk process, and interactions among risk/protective variables in predicting risk (e.g., Chassin, Sher, Hussong, & Curran, 2013; Dodge et al., 2009; Wang & Dishion, 2012). Such work can ultimately inform intervention programming on specific developmentally-appropriate targets for reducing substance use risk among African American youth.

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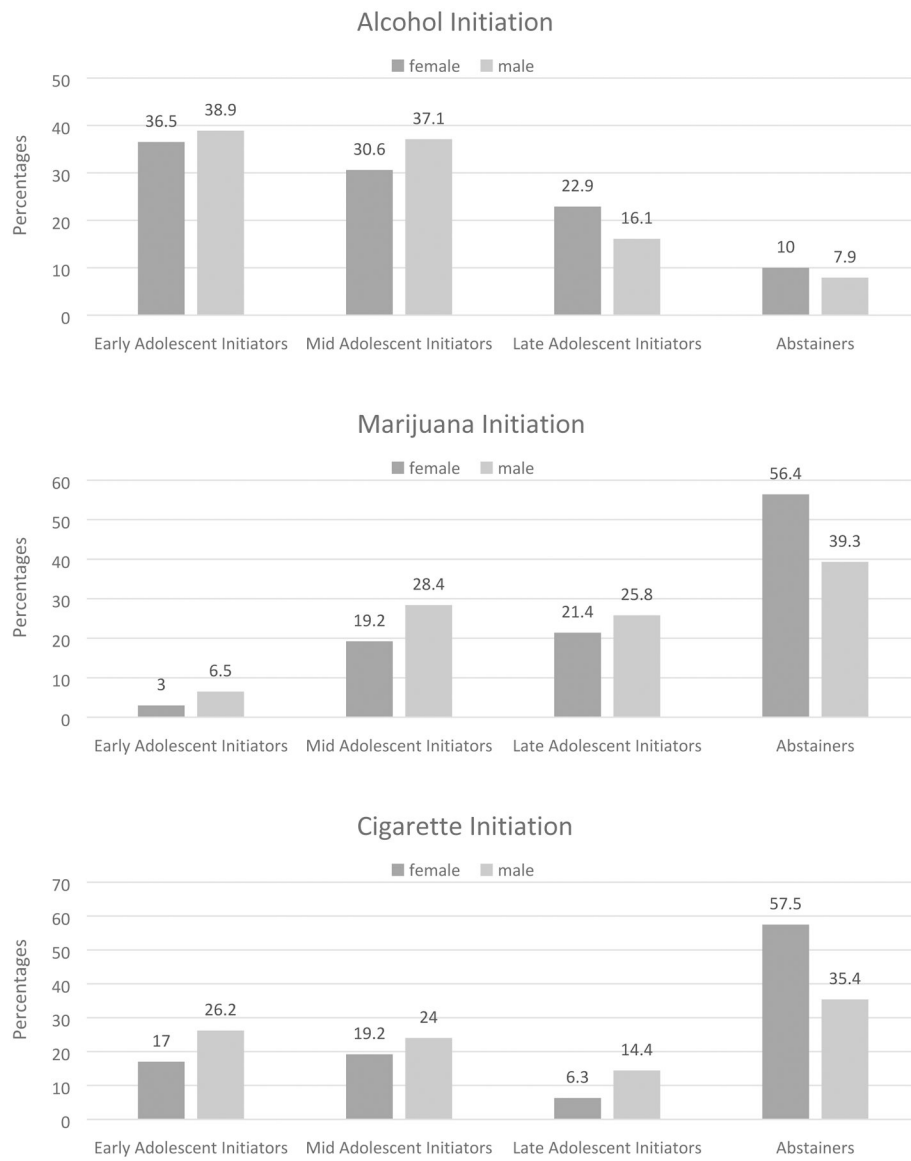


Figure 1.
Substance use initiation groups, stratified by gender

Table 1

Sample Characteristics

Stage	Variable	<i>M</i> (<i>SD</i>)	Range
Early Adolescence (ages 11–14)	Family SES	2.26 (1.34)	0 – 6
	Social	0 (1.50)	–3.13 – 6.21
	Attitudinal	0 (1.95)	–3.10 – 6.80
	Intrapersonal	0 (2.36)	–4.30 – 8.84
Mid Adolescence (ages 16–18)	Family SES	2.25 (1.25)	0 – 6
	Social	0 (2.30)	–4.27 – 9.82
	Attitudinal	0 (3.01)	–4.82 – 12.77
	Intrapersonal	0 (3.06)	–6.39 – 11.89
	Racial Discrimination	4.04 (2.98)	0 – 18
Late Adolescence (ages 19–21)	Family SES	2.79 (1.54)	0 – 6
	Social	0 (2.21)	–4.67 – 7.79
	Attitudinal	0 (2.34)	–5.73 – 6.84
	Intrapersonal	0 (3.03)	–5.39 – 12.23
	Racial Discrimination	3.06 (3.03)	0 – 18

Note: N = 500

Table 2

Characteristics of Subjects with Complete Versus Missing Data

Demographics at age 11	With Completed Data (n = 500)		Without Completed Data (n = 167)	
	<i>n</i>	%	<i>n</i>	%
Gender, male	229	45.8%	86	51.5%
Family poverty	190	42.1%	64	43.0%
Single-parent status	284	57.4%	88	53.0%
Parent unemployment status	108	21.6%	38	22.9%
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Parent education	4.58	1.26	4.11	1.63
Parent age	37.36	7.14	38.86*	8.83
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Characteristics at ages 11–13				
Family SES	2.26	1.34	2.20	1.37
Parent-child conflict	13.48	3.58	13.89	3.83
Parent social support	15.66	3.08	15.66	3.17
Attitudes towards risky behaviors	19.94	4.87	19.78*	4.31
Goal orientation	9.15	0.93	9.05	1.17
Academic competence	23.16	3.52	22.96	3.25
Externalizing behaviors	10.93	7.81	12.49*	8.84
Self-control	29.81	7.17	28.83	7.76
Self-esteem	42.51	5.04	42.56	4.99

Note:

* mean differences between completed sample and missing sample were significant ($p < .05$).

Table 3

Log Odds Coefficients and Odds Ratio for Each Type of Substance User Group with Gender, Family SES, and Risk Factors Predicting Initiation Across Adolescence

Group	Effect	Logit	Odds ratio	95% CI	<i>R</i> ²
Cigarette User (52.6%)	Male	0.804 ***	2.235	1.525, 3.276	
	Family SES risk	0.044	1.045	0.902, 1.210	
	Social	-0.064	0.938	0.806, 1.091	
	Attitudinal	0.083	1.086	0.960, 1.229	
	Intrapersonal	0.196 **	1.217	1.084, 1.367	
	Racial Discrimination ¹	0.102 **	1.107	1.037, 1.182	.164
Alcohol User (91.0%)	Male	0.229	1.257	0.657, 2.403	
	Family SES risk	-0.245 *	0.783	0.614, 0.999	
	Social	0.084	1.088	0.842, 1.406	
	Attitudinal	0.021	1.021	0.823, 1.266	
	Intrapersonal	-0.014	0.986	0.818, 1.188	
	Racial Discrimination ¹	0.156 *	1.169	1.034, 1.322	.060
Marijuana User (51.4%)	Male	0.647 **	1.910	1.316, 2.772	
	Family SES risk	0.009	1.010	0.875, 1.164	
	Social	-0.073	0.930	0.803, 1.077	
	Attitudinal	0.087	1.091	0.968, 1.230	
	Intrapersonal	0.048	1.049	0.941, 1.170	
	Racial Discrimination ¹	0.127 ***	1.135	1.065, 1.210	.096

Note: N=500. Abstainers as reference group. CI: confidence interval. *R*²: Nagelkerke R-square.

¹Racial discrimination was measured at mid adolescence.

* *p* < .05.

** *p* < .01.

*** *p* < .001.

Table 4
Log Odds Coefficients and Odds Ratio for Alcohol Drinking Initiation Groups with Gender, Family SES, and Risk Factors

Initiation Groups	Effect	Model 1			Model 2			Model 3		
		Logit	Odds ratio	95% CI	Logit	Odds ratio	95% CI	Logit	Odds ratio	95% CI
Early Adolescent Initiators (37.6%)	Male	0.152	1.165	0.589, 2.302						
	Family SES	-0.272*	0.762	0.590, 0.984						
	Social	0.176	1.193	0.912, 1.561						
	Attitudinal	0.155	1.168	0.938, 1.456						
Mid Adolescent Initiators (33.6%)	Intrapersonal	0.007	1.007	0.829, 1.223						
	Male	0.439	1.552	0.784, 3.073	0.315	1.370	0.671, 2.798			
	Family SES	-0.222	0.801	0.620, 1.035	-0.368**	0.692	0.525, 0.912			
	Social	0.047	1.048	0.798, 1.375	0.227	1.255	0.987, 1.297			
Late Adolescent Initiators (19.8%)	Attitudinal	-0.051	0.951	0.757, 1.194	0.128	1.136	0.948, 1.362			
	Intrapersonal	0.014	1.015	0.833, 1.236	-0.081	0.923	0.786, 1.083			
	Racial	--	--	--	0.121	1.128	0.984, 1.293			
	Discrimination									
Late Adolescent Initiators (19.8%)	Male	-0.060	0.942	0.448, 1.981	-0.213	0.808	0.379, 1.725	-0.293	0.746	0.340, 1.638
	Family SES	-0.355*	0.701	0.531, 0.926	-0.487**	0.615	0.458, 0.825	-0.380**	0.684	0.525, 0.891
	Social	0.009	1.009	0.750, 1.357	-0.020	0.980	0.757, 1.270	0.104	1.110	0.830, 1.483
	Attitudinal	0.018	1.018	0.797, 1.301	0.106	1.112	0.916, 1.351	-0.025	0.976	0.780, 1.221
Late Adolescent Initiators (19.8%)	Intrapersonal	-0.130	0.878	0.704, 1.095	-0.145	0.865	0.726, 1.030	-0.034	0.967	0.817, 1.144
	Racial	--	--	--	0.071	1.074	0.927, 1.244	0	1.000	0.843, 1.188
	Discrimination									
	Nagelkerke R ²	.105			.190			.103		

Note: reference group is abstainers. Model based on early adolescent risk factors (N=500); Model based on mid adolescent risk factors (N=312); Model based on late adolescent risk factors (N=144).

* $p < .05$.

** $p < .01$. CI: confidence interval.

Table 5
Log Odds Coefficients and Odds Ratio for Marijuana Use Initiation Groups with Gender, Family SES, and Risk Factors

Initiation Groups	Effect	Model 1			Model 2			Model 3		
		Logit	Odds ratio	95% CI	Logit	Odds ratio	95% CI	Logit	Odds ratio	95% CI
Early Adolescent Initiators (4.6%)	Male	0.907	2.478	0.982, 6.253						
	Family SES	-0.043	0.958	0.676, 1.358						
	Social	0.163	1.177	0.837, 1.655						
Mid Adolescent Initiators (23.4%)	Attitudinal	0.279*	1.322	1.038, 1.683						
	Intrapersonal	0.070	1.072	0.840, 1.370						
	Male	0.647**	1.910	1.208, 3.018	0.761**	2.140	1.306, 3.504			
Late Adolescent Initiators (23.4%)	Family SES	0.034	1.035	0.870, 1.232	-0.059	0.943	0.776, 1.146			
	Social	-0.062	0.940	0.786, 1.125	0.219**	1.244	1.079, 1.434			
	Attitudinal	0.106	1.112	0.962, 1.285	0.102*	1.107	1.000, 1.226			
Discrimination	Intrapersonal	0.087	1.091	0.956, 1.244	0.061	1.063	0.957, 1.181			
	Racial	--	--	--	0.111*	1.118	1.024, 1.220			
	Male	0.519*	1.680	1.066, 2.646	0.526*	1.692	1.066, 2.686	0.508*	1.663	1.035, 2.672
Discrimination	Family SES	-0.052	0.949	0.798, 1.129	-0.104	0.902	0.751, 1.082	-0.123	0.885	0.756, 1.035
	Social	-0.098	0.906	0.755, 1.088	0.115	1.121	0.975, 1.290	0.207**	1.230	1.064, 1.422
	Attitudinal	0.076	1.079	0.930, 1.250	0.064	1.067	0.962, 1.182	-0.005	0.942	0.865, 1.144
Discrimination	Intrapersonal	-0.015	0.985	0.858, 1.130	-0.031	0.970	0.872, 1.079	0.043	1.044	0.935, 1.166
	Racial	--	--	--	0.061	1.063	0.977, 1.156	0.049	1.050	0.966, 1.141
	Nagelkerke R^2	.087			.180			.117		

Note: reference group is abstainers. Model based on early adolescent risk factors ($N = 500$); Model based on mid adolescent risk factors ($N=477$); Model based on

late adolescent risk factors ($N=360$)

* $p < .05$.

** $p < .01$. CI: confidence interval.

Table 6
Log Odds Coefficients and Odds Ratio for Cigarette Use Initiation Groups with Gender, Family SES, and Risk Factors

Initiation Groups	Effect	Model 1			Model 2			Model 3		
		Logit	Odds ratio	95% CI	Logit	Odds ratio	95% CI	Logit	Odds ratio	95% CI
Early Adolescent Initiators (21.2%)	Male	0.698 **	2.010	1.225, 3.297						
	Family SES	-0.029	0.972	0.804, 1.175						
	Social	-0.008	0.934	0.820, 1.200						
	Attitudinal	0.180 *	1.197	1.030, 1.390						
Mid Adolescent Initiators (21.4%)	Intrapersonal	0.242 **	1.274	1.104, 1.470						
	Male	0.600 *	1.822	1.131, 2.933	0.757 **	2.131	1.286, 3.532			
	Family SES	0.004	1.004	0.838, 1.204	0.158	1.172	0.962, 1.428			
	Social	-0.071	0.932	0.773, 1.124	0.216 **	1.241	1.072, 1.437			
Late Adolescent Initiators (10.0%)	Attitudinal	0.050	1.052	0.901, 1.227	0.047	1.049	0.941, 1.168			
	Intrapersonal	0.189 **	1.208	1.048, 1.392	0.067	1.069	0.953, 1.199			
	Racial	--	--	--	0.074	1.076	0.984, 1.177			
	Discrimination									
Late Adolescent Initiators (10.0%)	Male	1.289 ***	3.628	1.885, 6.982	1.309 ***	3.702	1.914, 7.157	1.510 ***	4.526	2.264, 9.046
	Family SES	0.177	1.193	0.937, 1.519	0.156	1.169	0.907, 1.505	0.260 *	1.297	1.037, 1.622
	Social	-0.126	0.882	0.679, 1.144	0.106	1.111	0.909, 1.359	0.126	1.135	0.913, 1.410
	Attitudinal	0.031	1.031	0.836, 1.272	0.066	1.068	0.921, 1.239	-0.200	0.819	0.671, 1.001
Late Adolescent Initiators (10.0%)	Intrapersonal	0.078	1.081	0.889, 1.315	-0.046	0.955	0.816, 1.117	0.118	1.125	0.971, 1.304
	Racial	--	--	--	0.044	1.045	0.928, 1.176	0.040	1.041	0.923, 1.174
	Discrimination									
	Nagelkerke R^2	.157			.189			.157		

Note: reference group is abstainers. Model based on early adolescent risk factors ($N = 500$); Model based on mid adolescent risk factors ($N = 394$); Model based on late adolescent risk factors ($N = 287$)

* $p < .05$.

** $p < .01$.

*** $p < .001$. CI: confidence interval.