Risk Factors for Young Adult Substance Use among Women who were Teenage Mothers

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Abstract

Teenage mothers may not "mature out" of substance use during young adulthood, and this non-normative trajectory of use may contribute to negative outcomes for teenage mothers and their offspring. Pregnant teenagers (age range = 12–18 years; 68% Black) were recruited from a prenatal clinic and interviewed about their substance use, and subsequently re-interviewed six and ten years later (*n* = 292). Consistent with the literature, early tobacco and marijuana use were risk factors for young adult use. Other substance use, peer adolescent use and mental health indicators were more important than race and socioeconomic status (SES) in determining which teenage mothers would use tobacco, engage in binge drinking, and use marijuana as young adults. However, race and SES were significant predictors of quitting tobacco use and marijuana use by the 10-year follow-up. Depression was associated with both persistent tobacco use and marijuana use in teenage mothers. These results illustrate the long-term consequences of teenage childbearing and identify modifiable risk factors for later health risks that should be addressed among younger mothers.

Keywords

Pregnancy in Adolescence; Smoking; Marijuana Smoking; Hostility; Adolescents; Alcohol Use

1. Introduction

Adolescence is a period of vulnerability for substance use and substance use disorders: some adolescents start engaging in substance use earlier than their peers, and early substance use is associated with a higher risk of adult dependence (Brook et al., 2007; Grant & Dawson,

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1997; SAMHSA, 2007; Winters & Lee, 2008). Sexual intercourse is also common among teens (Abma & Sonenstein, 2001; Eaton et al., 2006); and although the rate of teenage pregnancy had been steadily declining since 1991 (Martin et al., 2005), it increased again in 2006 (Hamilton et al., 2007). Moreover, the rate of teenage births in the US remains significantly higher than in other developed countries (CDC, 2005; Panchaud et al., 2000). Therefore, there is a subset of American adolescents who transition into risky behavior at younger ages than their peers, and these early transitions may be associated with negative health outcomes during adulthood.

According to Problem Behavior Theory, early transitions are inter-related because of underlying deviance proneness in these youth, and both risk and protective factors may account for variability in change in substance use and other risky behaviors over time (Donovan, 2005; Donovan & Jessor, 1985; Jessor, 1991; Jessor, Donovan & Costa, 1991; Jessor & Jessor, 1977). Similarly, other authors have suggested that drug use is associated with a premature adoption of adult roles, and that drug use impairs the normal progression and completion of adolescent developmental tasks (Newcomb, 1987; Newcomb & Bentler, 1988). This premature or pseudo-maturity may be especially evident in girls who become pregnant as adolescents, many of whom take on the role of parent at a very young age. In fact, smoking is prevalent among pregnant teenagers (Cornelius et al., 1995; Delpisheh et al., 2007; Trollestrup, Frost, & Starzyk, 1992), and both tobacco and marijuana use are common among pregnant teenagers (Albrecht et al., 1999) and young adult women who gave birth during adolescence (Gillmore et al., 2006; Moffitt, & E-Risk Study Team., 2002).

Moreover, patterns of substance use and pregnancy in adolescents differ substantially from that seen in adult women. In a study comparing pregnant teenage and adult women's drinking patterns, although adult women drank more alcohol per day on average, teenage girls were more likely to participate in more sporadic or binge drinking than adult drinkers (Cornelius et al., 2004). Furthermore, teenage mothers are at high risk for repeated conception during adolescence (Kalmuss & Namerow., 1994; Meade & Ickovics, 2005; Seitz & Apfel, 1993). Consequently, substance use in pregnant and childbearing teenagers is a major public health problem: not only are these young women shortening and reducing the quality of their own lives, but they are also placing multiple children at risk of prenatal substance exposure and secondhand smoke.

Although there are few prospective, longitudinal studies of teenage mothers, results from previous studies of this high-risk group suggest that their developmental patterns of substance use differ from other young women. Specifically, they do not appear to "age out" of substance use as they reach adulthood (Cornelius et al., 2004; Gillmore et al., 2006). Teenage motherhood is also associated with negative outcomes that may contribute to the continuity of problem behaviors into adulthood. For example, women who were pregnant teenagers are more likely to experience low socioeconomic status and to suffer from more mental health problems as adults (Boden, Fergusson, & Horwood, 2008; Deal & Holt, 1998; Horwitz et al., 1996). These circumstances may explain some or all of the effect of early motherhood on persistent substance use. Furthermore, racial/ethnic differences between women who give birth as adolescents and other young women may also promote differences in their adult patterns of substance use.

In one multi-ethnic (51% White, 28% Black, 21% Other) cohort of pregnant teenagers that has been followed over time, marijuana use declined substantially during pregnancy, increased slightly by 6 months post-partum, and then leveled off significantly below pre-pregnancy rates (Gilchrist et al., 1996). Tobacco use was more prevalent in this sample than marijuana use, increased markedly at 6 months post-partum, and then increased at a much slower rate 12 and 18 months after pregnancy. Long term follow-up of these young mothers revealed that their cigarette and drug use did not change significantly from 3.5 to 11.5 years post-partum.

Although they were twice as likely to smoke tobacco and use marijuana as other young women their age, they reported significantly less alcohol use (Gillmore et al., 2006). In another study of this cohort (Oxford et al., 2003), there were distinct trajectories in alcohol use 10 years after the teenage pregnancy, in which early users were significantly more likely to increase both the quantity and frequency of use, consistent with epidemiological data on early users (Grant & Dawson, 1997; SAMHSA, 2007; Winters & Lee, 2008). Their results also suggest that teenage mothers who are slow to decrease their alcohol use over time and teenage mothers who increase their alcohol use over time are significantly more likely to use illicit drugs and to be involved in crime, consistent with Problem Behavior Theory.

In a second cohort of pregnant teenagers that has been prospectively followed (two-thirds Black and one-third White), tobacco use persisted during pregnancy and few (7%) of the teenage mothers managed to quit by the 6-year follow-up (Cornelius et al., 2004). Moreover, a significant portion (20%) of the young mothers started smoking after the index pregnancy and most (61%) of these young women reporting daily smoking 6 years later, as young adults. Peer adolescent tobacco use and White race were the best predictors of tobacco use at both time points in this lower socioeconomic (SES) sample.

Although the Reach for Health Longitudinal Study is not a study of teenage mothers per se, their findings are germane because roughly half their sample of disadvantaged Black and Hispanic women from Brooklyn, NY became pregnant during adolescence (Stueve & O'Donnell, 2007). In this sample, there was an increase in smoking from middle school (14%) to high school (26%) and then a slight decrease in smoking as young adults (22%). However, young women who were raising children were significantly more likely to be smokers at the last time point, consistent with the previous studies of teenage mothers. Nevertheless, the effect of teenage parenthood on smoking lost statistical significance after smoking history was entered in a stepwise logistic regression. Therefore, it is likely that the young mothers who smoked during young adulthood were also more likely to have smoked at the earlier time points than their non-childbearing peers, consistent with Problem Behavior Theory. However, little is known about the long-term risk factors for smoking, alcohol use, or marijuana use among young women who were pregnant teenagers.

The goals of the current study were to examine tobacco, alcohol and marijuana use in teenage mothers 6 years and 10 years post-partum in order to (1) identify antecedent risk factors for substance use during young adulthood, and (2) identify risk factors for late-onset and persistent use of tobacco, binge drinking, and use of marijuana. We hypothesized that White race, peer adolescent use, lower SES, and higher levels of psychological problems would predict smoking and binge drinking 6 and 10 years after a teenage pregnancy and persistent tobacco use across the decade. We hypothesized that Black race, peer adolescent use, lower SES, and higher levels of psychological problems would predict marijuana use 6 and 10 years after a teenage pregnancy.

2. Method

2.1 Study sample

In this cohort study, 445 pregnant adolescents (12–18 years old) were recruited from an outpatient prenatal clinic at a teaching hospital (448 were asked to participate and only 3 refused). The 413 adolescents who gave birth to live, singletons were eligible for follow-up visits 6 and 10 years later. Of the 32 who did not participate in the study at delivery, there was 1 refusal, 15 girls who moved out of the area, 3 gave birth to twins, 7 instances of miscarriage/ fetal death, and 6 whose infants who died due to premature birth. Complete substance use data for all 3 time points were available for 292 mothers (for a 68% follow-up rate). There were 10 refusals at the 6-year follow-up and 17 refusals at the 10-year follow-up phase. Although there

were slightly more Black women in the follow-up sample (71% vs. 67% of the birth cohort), women did not differ from the original birth cohort with respect to age at entry into the study, education, gravidity, age at first cigarette, age at first drink, age at first use of marijuana, cigarette use before pregnancy, alcohol use before pregnancy, marijuana use before pregnancy, levels of anxiety/depression, or levels of aggression during adolescence.

2.2. Data collection

Data from the adolescent phase were collected during interviews with the teenage mothers in a private room at the prenatal clinic of Magee-Womens Hospital in Pittsburgh, PA. Informed consent was obtained after assuring the girls of confidentiality, reinforced by a Certificate of Confidentiality from the Department of Health and Human Services. The Institutional Review Board of the University of Pittsburgh approved each phase of the study protocol. Demographic information and data on mothers' substance use, physical and mental health were obtained during the initial wave of testing (1990–1994) and during the young adult follow-up testing. The six-year and ten-year follow-up visits of the mothers and their offspring took place at our offices at the University of Pittsburgh between 1996 and 2004. For a more extensive description of the original methodology and measures, see Cornelius et al., 2002.

2.3. Measures

Interviewers collected demographic information including race, education, family income, and educational attainment of the pregnant teenager's mother. A widely-used, developmentally-appropriate, normed and reliable self-report instrument was used to assess problems with anxiety/depression and aggressive behavior during adolescence, the Youth Self-Report (YSR: Achenbach & Edelbrock, 1987). The YSR measures adaptive functioning and emotional and behavioral problems experienced in the past 6 months using items that are scored on a three-point scale: 0=not true; 1=somewhat or sometimes true; 2=very true or often true. The 112-item profile contains subscales measuring depression, thought disorder, delinquency, somatic complaints, aggression, and unpopularity. Achenbach (1991c) reports good test-retest reliability and discriminative validity on large normative samples.

At the six- and ten-year follow-up testing, depression was assessed with the Center for Epidemiologic Studies-Depression (CES-D). This is a 20-item self-report scale developed for use in general population samples (Radloff, 1977). This scale correlates well with other established measures of depression (e.g., Zung, $r = .90$; Beck, $r = .81$), establishing its validity (Myers & Weissman, 1980). Measures of anxiety and anger were assessed during young adulthood using the Spielberger State-Trait Personality Inventory (SS-TPI), a self-report measure of transitory (i.e., state) and dispositional (i.e., state) anger, anxiety, curiosity and depression. The SS-TPI consists of eight 10-item subscales: state and trait anxiety, state and trait anger, state and trait curiosity, and state and trait depression. The psychometric properties of this instrument have been examined extensively on a variety of populations (Spielberger et al., 1970). The state anxiety and state anger scales were examined as covariates of substance use in the current study.

Substance use was assessed for the year before pregnancy during the initial interview at recruitment, as well as six and ten years after the index pregnancy. At entry into the study, the pregnant adolescents were asked about their ages at initiation of cigarette, alcohol, marijuana, cocaine and other drug use. Dichotomous variables were created to denote early users of tobacco, alcohol and marijuana: smoking cigarettes (more than just a puff) by age 12 (15% of the sample), drinking more than a sip of alcohol by age 12 (18% of the sample), and using marijuana by age 13 (10% of the sample) were considered precocious. These early-use cutoffs were based on prospective studies that have demonstrated that children who use these substances by these ages are at greater risk for substance abuse and other negative outcomes

(Anthony & Petronis, 1995; Ellickson, Tucker, & Klein, 2003; Grant, 1998; Grant & Pickering, 1999; Gruber et al., 1996; Stueve & O'Donnell, 2005).

Peer use of cigarettes, alcohol, and marijuana during adolescence were measured by questions asking, for example, "how many friends do you have that smoke?" with forced choice responses: none, some, most, all.

Quantity and frequency of the usual, maximum, and minimum use of tobacco, alcohol and marijuana during the past year were assessed in the teenage mothers at all time points using a calendar. Alcohol use data also included frequency of binge drinking (4+ drinks per occasion for women: Wechsler et al., 1994), frequency of drinking to intoxication, and negative consequences as a result of drinking (Jessor, Donovan & Costa, 1989). The substance use data were used to derive dichotomous measures of ever cigarette use, binge drinking and marijuana use the year before the teenage pregnancy, 6 years after the teenage pregnancy, and 10 years after the teenage pregnancy.

Variables were created to capture changes in use from adolescence to the 10-year follow-up. Smoking status at the 6-year follow-up was not considered for the purpose of this analysis, which was conducted to investigate the correlates of onset of smoking by, quitting smoking by, and persistent smoking at the 10-year follow-up period. Ever-smokers were categorized into 3 groups: quitters (used prior to pregnancy but not one decade later), post-pregnancy onset users (did not use before pregnancy but used as an adult one decade later), or persistent smokers (used before pregnancy and a decade later). Binge drinking as a young adult was not associated with early drinking, frequent intoxication as an adolescent, heavy drinking as an adolescent, average daily quantity of alcohol at either time point, marijuana use at either time point, or any of the psychosocial correlates examined in this study, and therefore multivariate analyses were not conducted on binge drinking.

2.4. Statistical Analyses

Three levels of statistical analysis were conducted using SPSS 13.0 for Windows (Norusis, 2005). First, bivariate analyses were conducted, including an investigation of the inter-correlations among substance use measures at all 3 time points. T-tests and the χ^2 test of differences in proportions were used to examine the relations among race, age of onset of tobacco, alcohol and marijuana use, and substance use one year before and 10 years after the teenage pregnancy. Next, logistic regressions were utilized to test the independent, predictive value of early initiation of use, adolescent peer use, other substances used, demographic and psychological covariates on young adult substance use in women who were teenage mothers. Multinomial logistic regression was also utilized to ascertain which of the other substances, demographic, and psychological factors were important in predicting patterns of smoking and marijuana use across the past decade, and to identify factors important in persistence and quitting over time.

3. Results

3.1. Sample Characteristics

The participants' average age was 16.32 years ($SD = 1.89$) at entry into the study, 23.07 years ($SD = 1.38$) at the 6-year follow-up visit, and 27.12 years ($SD = 1.32$) at the 10-year follow-up visit, permitting us to examine substance use patterns across the important transition to young adulthood. Although one-third of the teenagers dropped out of school while pregnant, only 6% of the sample reported that they had completed less than 12 years of education when they were seen ten years later, indicating that most completed high school or obtained a General Equivalency Diploma (GED). The average monthly family income during adolescence was

$1,773 ($SD$ = 1,489), $1,267 ($SD$ = 1,142) at the 6-year follow-up visit, and $1,773 ($SD$ = 1,489) at the 10-year follow-up visit. This was the first pregnancy for 77% of the adolescent mothers, but most of them became pregnant again several times between the teenage pregnancy and the young adult waves of testing: 68% and 75% had been pregnant at least three times by the 6-year and 10-year follow-up visits[1].

Demographic profiles varied as a function of race: the Black girls had higher gravidity than the White girls at the time of entry into the study (M = 0.31 *vs.* M = 0.18, respectively; t = 2.12, p < .05) and at the 10-year follow-up visit (M = 3.87 *vs.* M = 3.20, respectively; t = 2.97, p < . 01). There were no significant differences in maternal age during the adolescent phase, when the pregnant teenagers were first identified in the prenatal clinic. However, the Black women were significantly younger (by 6 months) than the White women when they came in for the young adult phases of testing. The Black mothers also had significantly lower monthly family incomes at these time points (M = $1,170 vs. $1,507 at the 6-year follow up visit, p < .001; and M = $1,580 vs. $2,242 at the 10-year follow up visit, p < .001).

3.2. Inter-correlations among substance use measures

Table 1 depicts the correlations among tobacco use, binge drinking, and marijuana user status at all 3 time points. The measures of substance user status were only moderately correlated. The strongest associations were between tobacco use status one year before the teenage pregnancy and tobacco use status 10 years after this pregnancy (r = .51), tobacco and marijuana use status one year before the target adolescent pregnancy (r = .38), and early marijuana use and marijuana use status the year before the teenage pregnancy (r = .32). None of the other correlations were higher than r = .30.

3.3. Substance use in teenage mothers and their peers

As seen in Figure 1, White teenage mothers started smoking at a significantly younger age (M = 12.67) than Black teenage mothers (M = 13.90; t = 3.97, p < .001). However, White teenage mothers did not begin using alcohol or marijuana at an earlier age than the Black teenage mothers. Peer cigarette and alcohol use during adolescence was normative in this sample. Thirty-five percent of the pregnant teenagers reported that some, 25% reported that most, and 24% reported that all of their friends had smoked cigarettes. Similarly, 46% of the pregnant teenagers reported that some, 15% reported that most, and 24% reported that all of their friends had used alcohol. Marijuana use was also common, with 45% reporting some friends that use, 16% with most of their friends as users, and 18% reporting that all of their friends were users during adolescence.

The results of cross-tabulations on tobacco use, alcohol use and marijuana use the year before the teenage pregnancy are presented in Figure 2. White mothers were significantly more likely to have smoked the year before pregnancy than were Black mothers (χ^2 = 26.80, p < .001), but were not significantly more likely to have used alcohol or marijuana. Binge drinking was also common at all 3 time points: 37% of the adolescent mothers reported that they engaged in binge drinking the year before this pregnancy. Roughly half of the young mothers (53% at the 6 year follow-up and 48% at the 10-year follow-up) engaged in binge drinking as young adults.

There were no statistically significant differences in the percentages of Black and White women who smoked cigarettes (60% and 56%), engaged in binge drinking (54% and 51%), or used marijuana (25% and 24%) at the 6-year follow-up visit. However, as seen in Figure 3, at the 10-year follow-up visit the White mothers were more significantly likely to smoke cigarettes

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[1]Thirteen of the young women (4.5 % of the sample) were pregnant at the 10-year follow-up assessment, but pregnancy at this time point was not significantly correlated with concurrent smoking (r = .04), drinking (r = −.09), or marijuana use (r = −.05).

(70% vs. 55% of Black mothers; $\chi 2 = 5.90$, p < .05). In contrast, the Black mothers were significantly more likely to use marijuana a decade after a teenage pregnancy (28% vs. 13% of the White mothers; $\chi 2 = 7.67$, p < .01).

3.4. Antecedent risk factors for substance use during young adulthood

The significant predictors of tobacco use, binge drinking, and marijuana use in teenage mothers during young adulthood are presented in Table 2, with effect size and significance tests. For smoking, concurrent binge drinking was the only significant predictor in the final logistic regression model of tobacco use at the 6-year follow-up. Women who engaged in binge drinking were more than twice as likely to also be smokers at this time point. At the 10-year follow-up, the most powerful predictor in the model was smoking the year before the teenage pregnancy. Concurrent binge drinking was no longer significantly associated with smoking, but concurrent marijuana use and higher levels of hostility were risk factors for tobacco use. Although the results of the bivariate analyses suggested that White race was an important risk factor for smoking during adolescent and young adulthood, race was not a significant predictor of tobacco use in the multivariate models, when SES, mental health, and other substance use were controlled.

Binge drinking at the 6-year follow-up was significantly associated with adolescent anxiety/ depression and concurrent tobacco use. Teenage mothers who reported higher levels of anxiety/ depression were less likely to engage in binge drinking 6 years after the teenage pregnancy, although the effect size was not large. There were no significant predictors of binge drinking at the 10-year follow-up.

The final model on marijuana use 6 years after teenage pregnancy revealed the importance of adolescent smoking as a risk factor for marijuana use during young adulthood. Teenage mothers who used cigarettes before pregnancy were more than twice as likely to use marijuana 6 years after the pregnancy than teenage mothers who were not cigarette smokers. Higher levels of adolescent anxiety/depression, lower levels of adolescent aggression, and higher levels of concurrent hostility were also associated with marijuana use at the 6-year follow-up. In contrast to the other models, race remained a significant predictor of marijuana use at the 10-year follow-up: Black mothers were more likely to use marijuana 10 years after a teenage pregnancy, even after controlling for lower family income. Higher levels of concurrent hostility and tobacco use were also risk factors for marijuana use at the 10-year follow-up.

3.5. Risk factors for late-onset and persistent substance use

In order to determine who would start, quit and persist in smoking tobacco and using marijuana after a teenage pregnancy, we conducted multinomial logistic regression analyses. The predictors that significantly contributed to models distinguishing quitters and late-onset users from persistent users (the reference category) are presented in Table 3. Most of the teenage mothers (64%) were persistent users. However, 13% of the young mothers quit between the first and last assessments, and 23% only began smoking after the index pregnancy. Therefore, although tobacco use was prevalent and most mothers smoked at both time points, there was some variation across time.

The results of the multinomial regression analysis suggest that many variables are associated with quitting tobacco use after a teenage pregnancy. Risk factors for persistent smoking in young adulthood included White race, early cigarette use (before age 12), adolescent peer use, and concurrent marijuana use. The only significant risk factor for late-onset tobacco use compared to persistent tobacco use was adolescent peer use. Teenage mothers with more peers who smoked were significantly more likely to smoke at both time points, compared to mothers with fewer peers who used tobacco.

More than half (51%) of the teenage mothers also reported using marijuana at some time. Most of these ever users (53%) quit by young adulthood, but 19% of them started using after the teenage pregnancy, and 28% used marijuana before and 10 years after the teenage pregnancy. According to the multinomial regression analyses on marijuana users, early tobacco use and early marijuana use were both implicated in persistent tobacco use. Quitters were significantly less likely to have tried tobacco by age 12 or to have tried marijuana by age 13. Marijuana quitters were also significantly more likely to be White and less likely to be depressed in young adulthood. White race was significantly associated with onset of marijuana use after the teenage pregnancy, whereas mothers who were depressed were more likely to be persistent rather than late-onset marijuana users.

4. Discussion

The high rates of tobacco use, binge drinking, and marijuana use 10 years after the teenage pregnancy are remarkable compared to other women of similar age in the state of Pennsylvania (PA Department of Health, 2000). For example, 55% of Black mothers and 70% of white mothers reported cigarette use a decade after their teenage pregnancy, compared to 30% of 18–29 year olds across the state, and 22% of all female adults. Half of Black mothers and 45% of White mothers reported binge-drinking in young adulthood, compared to a rate of 37% for all 18–29 year olds in the state of Pennsylvania (PA), 11% in all female adults from PA, and 17% and 18% for all White and Black adults, respectively. In terms of illicit drug use, less than 5% of females across the state used illicit drugs in the past 30 days, compared to 28% of Black and 13% of White women in our cohort (PA Department of Health, 2005). These findings suggest that teenage mothers remain at much higher risk of substance use than other young women.

Tobacco use was not only highly prevalent during adolescence, but increased in the 10-year period under investigation, a finding consistent with the literature (Cornelius et al., 2004; Gillmore et al., 2006; Stueve & O'Donnell, 2007). Early onset users and young women who also used marijuana were more likely to report being smokers at the first and last assessments. Consistent with our hypotheses, adolescents who reported that more of their peers were also tobacco smokers were significantly more likely to smoke at both time points, and adolescent mothers who reported that fewer of their peers smoked were significantly less likely to begin smoking after the teenage pregnancy. Deviance proneness in peers may support the development and continuity of substance use and other problem behavior in this vulnerable group of girls.

This was the first study to examine young adult patterns of marijuana use among women who were teenage mothers. Marijuana use declined significantly between adolescence and young adulthood in this sample. Even so, over a quarter of the teenage mothers used marijuana at both time points, and nearly one-fifth began using marijuana after the teenage pregnancy. Moreover, the results of the Gillmore et al. (2006) study suggest that those young mothers who use drugs after a teenage pregnancy are unlikely to discontinue their use over the following decade. According to the present multinomial regression analysis, depression may play a role in both beginning to smoke after the teenage pregnancy and continuing to smoke in young adulthood. In support of our hypothesis, the association between depression and marijuana use was significant in the final regression model, even after controlling for the effects of early onset of marijuana use, concurrent cigarette use, and race.

Several longitudinal studies have demonstrated the linkage between tobacco and marijuana use and mental health (Brook et al., 2008; Georgiades & Boyle, 2007; Hayatbahsh et al., 2007). There is also evidence that teenage motherhood is associated with more depressive symptoms during adolescence (Passino et al., 1993; Schmidt et al., 2006; Troutman & Cutrona, 1990) as well as higher rates of depression in young adulthood (Deal & Holt, 1998; Horwitz et al.,

1996; Whitman et al., 2001). This propensity for depression among teenage mothers may promote continuity in tobacco and marijuana use over time in this vulnerable group of women. However, Boden et al. (2008) found that teenage motherhood had no effect on depression or other mental health symptoms, once SES was controlled for in the analyses. The majority of adolescent mothers from the Notre Dame Adolescent Parenting Project (NDAPP) were no more depressed than their peers by their early 30s, and prenatal risk factors, including anxiety/depression during pregnancy, accounted for 26% of the variance in depression scores during adulthood (Borkowski et al., 2007). The inclusion of maternal education and family income in the current analyses did not attenuate the effects of depression on persistent marijuana use. Depression may therefore have an independent effect on drug use within this high-risk group, regardless of SES.

Higher levels of hostility were a significant predictor of both tobacco and marijuana use 10 years after a teenage pregnancy, consistent with our hypothesis that higher levels of psychological problems would be associated with substance use at this time point. The literature supports this association between hostility/aggression and substance use in women (Calhoun et al., 2001; De Genna et al., 2006; Scherwitz et al., 1992; Siegler et al., 1992; Whiteman et al., 1997). According to a developmental model of childhood aggression and adolescent substance use, aggression promotes adolescent substance use via association with delinquent peers (Fite et al., 2007). There is also support for a psychobiological pathway for persistent tobacco use, because trait anger has been associated with greater withdrawal symptoms, craving and risk for early relapse (e.g., al'Absi, Carr, & Bongard, 2007).

Patterns of alcohol use differed significantly from tobacco and marijuana use in this sample of teenage mothers. In contrast to data suggesting that, on average, White teens begin using alcohol before Black teens (Johnston et al, 2007; SAMHSA, 2008), we found that there was no significant difference in the age of onset of alcohol among our pregnant teenagers. These findings suggest that Black teenage mothers are more similar to White teenage mothers than to their non-pregnant peers. Black teens who become pregnant may not be as protected from early alcohol use than non-pregnant Black teens, and all teenage mothers may be more likely to persist in binge drinking into young adulthood, compared to other young women who delay childbearing. However, in a previous study of a subsample of these mothers at the age 6 follow-up, White adolescents were more likely to report using alcohol during their first sexual experience and experience 2 or more negative consequences of alcohol the year before pregnancy than pregnant Black adolescents. However, they were not significantly more likely to be heavy drinkers the year before pregnancy or to use more alcohol during the teenage pregnancy (De Genna, Larkby, & Cornelius, 2007).

Although the percentage of mothers reporting binge episodes increased significantly in the same period of time, there was little evidence of continuity between adolescence and young adulthood in this sample, a finding inconsistent with previous epidemiological studies linking early age of onset to later problematic drinking (Grant & Dawson, 1997; SAMHSA, 2007, Winters & Lee, 2008). In this sample of teenage mothers, early use of alcohol (by age 13) and average daily volume, frequency of intoxication and binge drinking one year before the teenage pregnancy were not significantly associated with binge drinking a decade after the teenage pregnancy. This is in stark contrast to Oxford et al's (2006) findings that teenage mothers who were early alcohol users were significantly more likely to become higher quantity and higher frequency users during young adulthood. This discrepancy may be partially explained by geographic and demographic differences: 71% of the participants in the current study were Black, compared to 28% in the Oxford et al. study. Moreover, although there was an association between tobacco and marijuana use at both young adult assessments, tobacco use was not a predictor of binge drinking during adolescence or at the last follow-up visit. However,

concurrent smoking was significantly associated with binge drinking 6 years after the teenage pregnancy, with smokers almost two and a half times more likely to engage in binge drinking.

Although this is the first study to examine patterns of tobacco, alcohol and marijuana use across a decade in young women who were pregnant teenagers, there are several limitations that should be borne in mind. First, the results of this investigation may not generalize to teenage mothers from other parts of the country, or from other socioeconomic or different racial/ethnic backgrounds. Another limitation of this study is that it relied on self-report of substance use, with no biochemical verification. However, in order to increase the accuracy of the data that were reported, we constructed detailed questions, carefully selected interviewers, and extensively trained our staff in interviewing techniques. Moreover, many biological measures can only assess substance use within a short window of time, whereas questionnaire data can elicit patterns of substance use over time. Additionally, there is support for the validity of self-reports of substance use in the literature (Cornelius et al., 2003; Fendrich et al., 2004; Hancock et al., 1991; Martin et al., 1988; Pedersen, 1990; Rouse et al., Kozel, & Richards,1985). Future research may also specifically examine concurrent or conjoint drug use, because there is evidence that polysubstance use is common, may be influenced by similar developmental trajectories, and may be more problematic (Jackson, Sher, & Schulenberg, 2008; Schmid et al., 2007).

Teenage pregnancy may no longer be on the decline in the US, and teenage mothers are more likely to smoke than other young women, endangering their health and the health of their children. An important finding was that being Black may not protect against substance use in young women who were teenage mothers. Unlike their non-childbearing peers, these teenage mothers were just as likely to use alcohol and marijuana during adolescence, and just as likely as the White teenage mothers to engage in binge drinking during young adulthood. Another contribution of this study was its descriptions of tobacco, alcohol, and marijuana use 10 years after a teenage pregnancy, and its portrayal of patterns of smoking and marijuana use within this high-risk sample. It is not only important to identify risk factors for smoking among pregnant teens, but also to identify risk factors for late-onset and persistent use. Post-partum counseling and support for teenage mothers may well have long-term effects on their later involvement in substance use.

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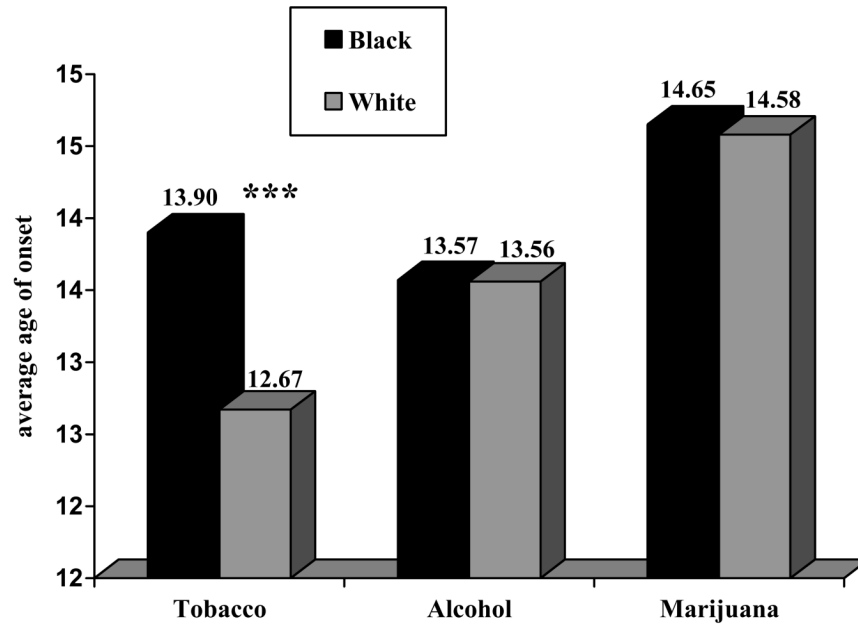
Figure 1.
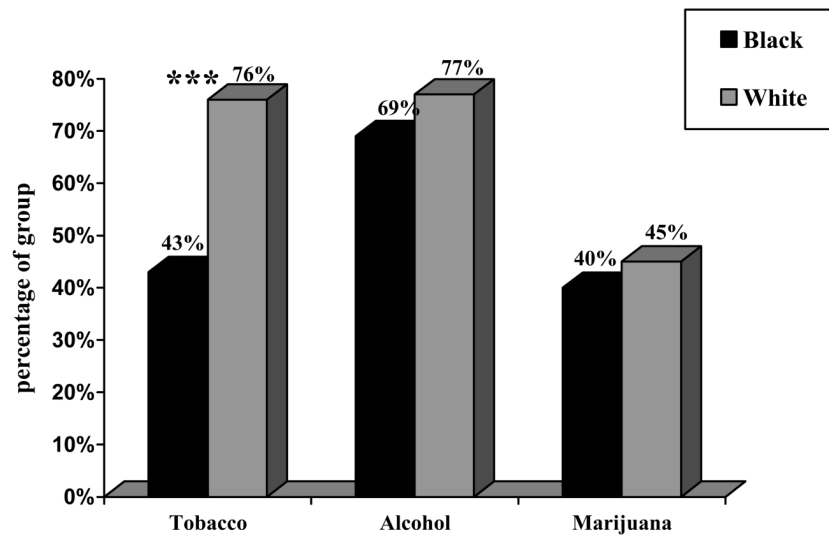Average age of onset for substance-using teenage mothers as a function of race

Figure 2.
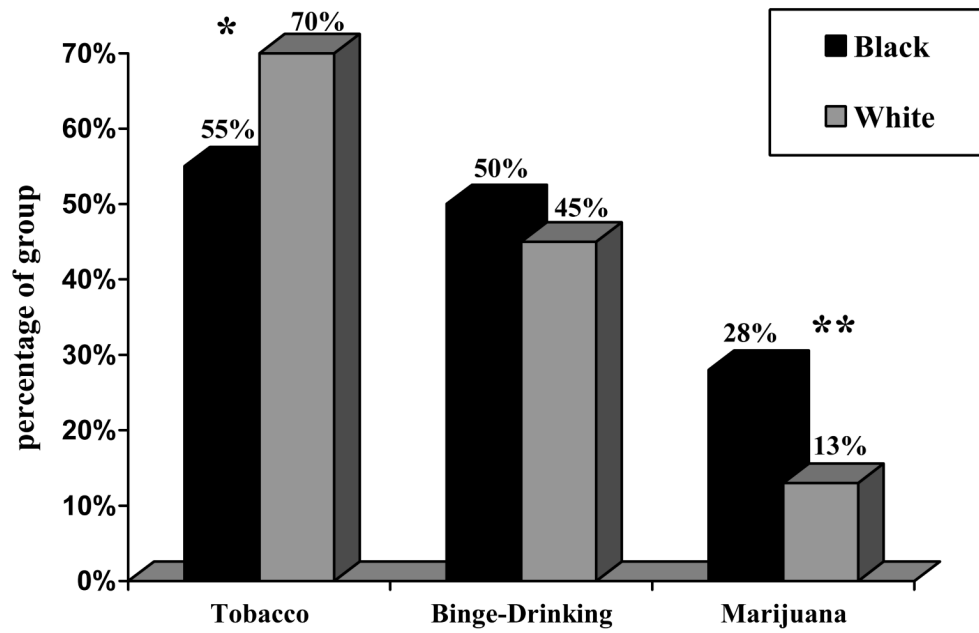Prevalence of substance use one year before the teenage pregnancy as a function of race

Figure 3.
Prevalence of substance use ten years after the teenage pregnancy as a function of race

Table 1

Correlations among measures of substance use in teenage mothers

		1	2	3	4	5	6	7	8	9	10	11	12
1	Early tobacco use (< 12 yrs)	-	-.03	.21**	.29**	.04	.02	.03	.08	.02	.12*	-.01	.03
2	Early alcohol use (< 12 yrs)	-	-	-.07	.01	.02	-.07	.03	.08	.02	-.02	-.06	-.05
3	Early marijuana use (< 13 yrs)	-	-	-	.18**	-.02	.32**	.07	.10^t	.09	.07	.05	.11^t
4	Tobacco use 1 yr < teen pregnancy	-	-	-	-	.15**	.38***	-.09	-.02	.12*	.51***	-.03	.13*
5	Alcohol use 1 yr < teen pregnancy	-	-	-	-	-	.07	-.11^t	-.07	.00	.19**	.06	.03
6	Marijuana use 1 yr < teen pregnancy	-	-	-	-	-	-	-.01	-.04	-.00	.27***	.05	.22***
7	Tobacco use 6 yrs > teen pregnancy	-	-	-	-	-	-	-	.25***	.09	-.11^t	.01	.05
8	Binge drinking 6 yrs > teen pregnancy	-	-	-	-	-	-	-	-	.15*	.01	.02	-.06
9	Marijuana use 6 yrs > teen pregnancy	-	-	-	-	-	-	-	-	-	.02	.03	.00
10	Tobacco use 10 yrs > teen pregnancy	-	-	-	-	-	-	-	-	-	-	.05	.21***
11	Binge drinking 10 yrs > teen pregnancy	-	-	-	-	-	-	-	-	-	-	-	.02
12	Marijuana use 10 yrs > teen pregnancy	-	-	-	-	-	-	-	-	-	-	-	-

^{t}N.B. $p < .10$,

*
$p < .05$,

**
$p < .01$,

***
$p < .001$

Table 2

Predictors of substance use in teenage mothers from logistic regression models

	6-year follow-up visit	10-year follow-up visit
Predictors of Tobacco Use	**Binge-drinker at 6-year follow-up** Beta = .87, Wald = 10.43[***] Exp (B) = 2.39 (CI=1.41–4.05)	**Smoker pre teen pregnancy** Beta = 2.27, Wald = 43.74[***] Exp (B) = 9.72 (CI=4.96–19.07)
		Hostility at 10-yr follow-up Beta = 1.12, Wald = 5.78[*] Exp (B) = 1.12 (CI=1.02–1.23)
		Marijuana at 10-yr follow-up Beta = .88, Wald = 4.69[*] Exp (B) = 2.42 (CI=1.09–5.37)
Model Statistics:	Hosmer-Lemeshow χ^2= 7.78, *ns* Regression model χ^2= 36.03[***] Nagelkerke R^2 = .17	Hosmer-Lemeshow χ^2= 7.02, *ns* Regression model χ^2= 103.6[***] Nagelkerke R^2 = .42
Predictors of Binge drinking	**Adolescent anxiety/depression** Beta = −.09, Wald = 6.90[**] Exp (B) = 0.91 (CI=0.85–0.98)	No significant regression model
	Smoker at 6-year follow-up Beta = .91, Wald = 10.73[***] Exp (B) = 2.48 (CI=1.44–4.27)	
Model Statistics:	Hosmer-Lemeshow χ^2= 11.09, *ns* Regression model χ^2= 44.31[***] Nagelkerke R^2 = .20	
Predictors of Marijuana Use	**Adolescent anxiety/depression** Beta = .13, Wald = 5.91[*] Exp (B) = 1.14 (CI=1.03–1.26)	**White race** Beta = −1.34, Wald = 8.86[**] Exp (B) = 0.26 (CI=0.11–0.63)
	Adolescent aggression Beta = −.10, Wald = 5.91[*] Exp (B) = 0.91 (CI=0.84–0.98)	**Income at 10-year follow-up** Beta = .00, Wald = 4.34[*] Exp (B) = 1.00 (CI=0.99–1.00)
	Smoker pre teen pregnancy Beta = .86, Wald = 5.48[**] Exp (B) = 2.35 (CI=1.15–4.81)	**Hostility at 10-yr follow-up** Beta = .13, Wald = 7.43[**] Exp (B) = 1.14 (CI=1.04–1.24)
	Hostility at 6-year follow-up Beta = .10, Wald = 5.46[*] Exp (B) = 1.10 (CI=1.02–1.93)	**Smoker at 10-yr follow-up** Beta = 1.00, Wald = 6.73[**] Exp (B) = 2.71 (CI=1.28–5.76)
Model Statistics:	Hosmer-Lemeshow χ^2= 7.97, *ns* Regression model χ^2= 42.60[***] Nagelkerke R^2 = .21	Hosmer-Lemeshow χ^2= 9.73, *ns* Regression model χ^2= 77.79[***] Nagelkerke R^2 = .36

N.B. , *ns* = $p > .10$;

[t] $p < .10$;

[*] $p < .05$;

[**] $p < .01$;

[***] $p < .001$

Table 3

Predictors of patterns of teenage mothers' smoking and marijuana use across a decade from multinomial logistic regression models

TOBACCO USE		Beta	Wald	Exp(B)	C.I.
Variables distinguishing QUITTERS from persistent tobacco users	White race	−1.26	9.48[**]	0.28	(0.13–0.63)
	Early cigarette use	−1.35	6.01[**]	0.26	(0.09–0.76)
	Teen peer use	−0.62	13.13[***]	0.54	(0.38–0.75)
	Family income	0.00	5.03[*]	1.00	(1.00–1.00)
	Marijuana user	−1.26	7.19[**]	0.28	(0.11–0.71)
Variables distinguishing LATE-ONSET users from persistent tobacco users	Teen peer use	−0.48	7.23[**]	0.62	(0.44–0.87)
				Regression Model χ^2 = 87.79[***]	
				Deviance χ^2 = 517.84, *ns*	
				Nagelkerke R^2 = .30	

MARIJUANA USE		Beta	Wald	Exp(B)	C.I.
Variables distinguishing QUITTERS from persistent marijuana users	White race	1.26	4.97[*]	3.53	(1.17–10.72)
	Depression	−0.08	8.33[**]	0.93	(0.88–0.98)
	Early marijuana use	−3.10	15.77[***]	0.05	(0.01–0.21)
	Cigarette user	−1.97	13.96[***]	0.14	(0.05–0.39)
Variables distinguishing LATE-ONSET users from persistent marijuana users	White race	1.26	5.42[*]	3.54	(1.22–10.26)
	Depression	−0.10	14.67[***]	0.91	(0.86–0.95)
				Regression Model χ^2 = 105.32[***]	
				Deviance χ^2 = 466.25, *ns*	
				Nagelkerke R^2 = .36	

N.B. , *ns* = $p > .10$;

[t] $p < .10$;

[*] $p < .05$;

$**$
$p < .01;$

$***$
$p < .001$