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Substance Use and Early Marriage

Prior work indicates that substance use is related to adolescent marriage. We describe two different processes that may account for this relationship and hypothesize patterns of association that would be consistent or inconsistent with each. Using data from a study that followed west coast youth from 7th grade to young adulthood (N = 3,324), we assessed the effects of cigarette, alcohol, and marijuana use in 7th and 10th grade on the probability of marriage prior to age 20. When gender, race, and SES were controlled, cigarette use in adolescence, but not other substance use, was associated with early marriage. Low educational attainment and early unwed parenthood each uniquely mediated this association. These results suggest that the link between substance use and early marriage reflects a disposition toward risky or unconventional behavior, not the judgment-impairing effects of drug and alcohol use.

Drug use has a number of serious consequences for youth; among them is thought to be a heightened probability of adolescent marriage (Chassin, Presson, Sherman, & Edwards, 1992; Newcomb & Bentler, 1988). Marriage in adolescence has been associated with several negative socioeconomic outcomes. Individuals who marry in adolescence subsequently earn less, hold less prestigious occupations, and accumulate fewer

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financial assets than those who postpone marriage until adulthood (Teachman, Polonko, & Scanzoni, 1986; Teti & Lamb, 1989; Teti, Lamb, & Elster, 1987). Adolescent marriages are also associated with a higher rate of dissolution than marriages that occur in adulthood (Heaton, Albrecht, & Martin, 1985; Teachman et al.; Teti & Lamb; Teti et al.). For example, one study found marital dissolution to be twice as likely among young people who married before age 20 as it was among those who postponed marriage until their twenties (Teachman, 1983).

Substance use may be related to early marriage for at least two reasons. First, substance use is associated with some important features of personality that may foster early marriage. Impulsivity and sensation seeking are two highly correlated dimensions of personality that are strongly and consistently associated with substance use (Newcomb & Earleywine, 1996; Wills, Vaccaro, & McNamara, 1994). Characterized by a heightened reactivity to reinforcement, a strong reward focus, and a lack of prior consideration of the consequences of one's behavior (Patterson & Newman, 1993), impulsivity has been linked to alcohol use (Colder & Chassin, 1997), cigarette smoking (Mitchell, 1999), and marijuana and other illicit substance use (see Brady, Myrick, & McElroy, 1998 for a review of this literature). Sensation seeking has been defined as a need for varied and novel experiences, and the willingness to take risks to obtain such experiences (Zuckerman, 1979). Sensation seeking has been associated with alcohol, cigarette, and other drug use, both cross-sectionally (e.g., Nagoshi, Wilson, & Rodriguez, 1991; Zuckerman, Ball, & Black, 1990) and longitudinally (e.g., Newcomb & McGee, 1991). Others

have found that sensation seeking accounts for the relationship between substance use and other risk behaviors (Parent & Newman, 1999), and it may account for the relationship between substance use and early marriage.

Alternatively, cognitive deficits that result from substance use could be responsible for the link between substance use and early marriage. For example, impaired judgment from the use of substances such as alcohol and marijuana may lead adolescents to engage in risky sexual behavior (Curtain, Patrick, Lang, Cacioppo, & Birbaumer, 2001; MacDonald, Zanna, & Fong, 1986). Unplanned pregnancies that arise from this risky behavior could then prompt early marriage. Similarly, substance use may impair educational performance and limit aspirations (Dozier & Barnes, 1997; Yamada, Kendix, & Yamada, 1996), prompting early marriage as a substitute for schooling or career development.

A careful examination of the unique effects of different types of substance use on early marriage could help in deciding between these explanations. If personality factors drive the association between substance use and early marriage, we would expect that use of any of the three substances during adolescence would predict early marriage at the bivariate level. That is, use of alcohol, cigarettes, or marijuana may indicate a sensation seeking or impulsive personality. We would also expect that the form of substance use most strongly associated with these traits would emerge as an independent predictor of early marriage in models that examine all three substances simultaneously. Although analyses comparing adolescent use of different substances on these dimensions are rare, some studies suggest that adolescent cigarette use most strongly indicates impulsivity. For example, one study found that adolescent smoking was a stronger predictor of school dropout than adolescent drinking or use of drugs, suggesting that this very public form of drug use indicates particularly strong indifference to the long-term consequences of behavior (Ellickson, Bui, Bell, & McGuigan, 1998). Similarly, others have documented links between smoking and other problem behaviors and characteristics such as rebelliousness, risk taking, and social deviance (Grunberg, Winders, & Wewers, 1991; Simon, Sussman, Dent, Burton, & Flay, 1995).

In contrast, if impaired judgment resulting from substance use is the cause of early marriage, then only alcohol and marijuana use should be predictive of this outcome in a multivariate model. These two substances are likely to produce the kinds of cognitive effects on adolescents thought to impair decision making, whereas cigarette use, per se, is not. Cigarette use may predict early marriage in bivariate tests under this theory, but only because adolescent smoking is highly correlated with adolescent drinking and drug use. In multivariate models, it should drop out.

Previous investigations of the association between substance use and early marriage have either examined only a single substance (Chassin et al., 1992; Yamaguchi & Kandel, 1985) or used different types of substance use as indicators of a latent substance use factor (Newcomb & Bentler, 1988). Because all three forms of use tend to be highly correlated, any one substance may stand in for the effects of others in such models. The primary aim of the current study was to examine simultaneously the prospective influence of cigarette, alcohol, and marijuana use on the likelihood of early marriage. An independent positive effect of cigarette use would pull strongly for a personality explanation. If, however, alcohol and/or marijuana use predicts early marriage but cigarette use does not, an impaired judgment explanation would be preferred. If all three substances independently predict early marriage, both explanations would be viable.

Another aim of the current study was to determine whether educational attainment and early unwed parenthood mediate the association between substance use and early marriage. Irrespective of whether impaired judgment or personality is at its source, the relationship between substance use and early marriage is unlikely to be a direct one. Sensation seekers' tendencies to engage in novel and risky behaviors are unlikely to cause them to enter into marriage, which is not typically viewed as a novel or risky activity. Similarly, although adolescents might make a decision to marry while impaired by the influence of alcohol or marijuana, this too seems a low-probability event.

However, either process—impaired judgment or personality—would predict effects of substance use on marriage through lowered educational attainment and/or early unwed parenthood. Use of alcohol and other drugs may result in impaired cognitive functioning and thereby diminish performance in school, discouraging or prohibiting higher levels of educational attainment. Similarly, dispositional features that

indicate a lack of self-control may foster delinquency, deviant peer associations, and other behavioral problems (Colder & Stice, 1998; Newcomb & Earleywine, 1996; White et al., 1994) that decrease the likelihood of high educational attainment among sensation-seeking or impulsive adolescents. In both cases, the limited career prospects associated with low educational attainment may increase the likelihood that adolescents will marry prematurely, a hypothesis consistent with studies that demonstrate a relationship between low educational attainment and an accelerated transition into marriage (Goldscheider & Waite, 1986; Kobrin & Waite, 1984; Marini, 1985). This reasoning is also supported by Chassin and colleagues' (1992) research indicating that low educational attainment partly mediates the association between adolescent cigarette use and early entry into marriage.

Early unwed parenthood may explain the portion of the effect of substance use that was unmediated by educational attainment in the study by Chassin and her colleagues. That is, educational attainment and early unwed parenthood may both independently mediate the association between substance use and early marriage. Adolescent substance users may be more likely than nonusers to marry prematurely because they are more likely to have children prematurely (e.g., Kellogg, Hoffman, & Taylor, 1999; Mensch & Kandel, 1992; Yamaguchi & Kandel, 1987), an outcome that hastens the transition into marriage (e.g., Furstenberg, 1976; McCarthy & Menken, 1979). Although disapproval of unmarried childbearing has decreased over the past couple of decades, societal support for marital childbearing remains strong (Ganong, Coleman, & Mapes, 1990).

The potential link between substance use and early unwed parenthood can also be explained by either the impaired judgment perspective (substance use creates a barrier to condom use by clouding one's decision-making ability) or the personality perspective (substance use signifies a willingness to take risks, such as having unprotected sex, and an inability to control one's impulses). In support of the latter argument, studies have demonstrated a link between personality characteristics (e.g., impulsivity, sensation seeking) and safe sex behavior (e.g., Temple, Leigh, & Schafer, 1993). In support of the former argument, a recent national survey found that one in five teens report having had unprotected sex after drinking or using illicit drugs (Kaiser Family Foundation, 2003).

We also note that educational attainment may mediate the substance use-early marriage relationship *because* of its association with early unwed parenthood. Research has shown that adolescent mothers and fathers experience clear disadvantages in educational attainment compared to those individuals who postpone childbearing into adulthood (Furstenberg, Brooks-Gunn, & Chase-Lansdale, 1989). Given the relationship between early unwed parenthood and educational attainment, if these variables were examined simultaneously as mediators of the relationship between substance use and early marriage, educational attainment might no longer predict early marriage.

CURRENT STUDY

Using data from 3,324 adolescents followed from Grade 7 through age 23, this study provides a prospective assessment of whether adolescent use of alcohol, cigarettes, or marijuana is associated with early marriage (marriage prior to age 20) and, if so, whether educational attainment and early unwed parenthood uniquely mediate that relationship. To test the impaired judgment and personality explanations of such a relationship, we examined the simultaneous influence of these three substances on early marriage. We expected that substance use in adolescence would predict decreased educational attainment and an increased probability of early unwed parenthood, and that one or both of these effects would in turn predict early marriage. Based on research showing gender differences in the timing and ordering of adult roles (e.g., Steel, Abeles, & Card, 1982), we also expected that the link between early unwed parenthood and early marriage would be stronger for women than men. Single women who have a child often feel compelled to marry in order to avoid the social stigma associated with being an unwed mother and/or to obtain help with the financial and child-rearing responsibilities of being a parent. Unmarried fathers are less likely to feel compelled to marry for either reason. In addition, we expected that the link between educational attainment and early marriage would be stronger among women than men. Women with less education may have limited job and financial prospects and may view marriage as a way to obtain greater financial security. Because of traditional

gendered beliefs, men are less likely to make the same calculations. To test these assumptions, we included in our model interaction terms that captured the joint influence of gender and each of our hypothesized mediating variables on early marriage.

We also examined the effects of both early and late adolescent substance use to determine their relative influence on early marriage. If a link between substance use and early marriage could be established as far back as early adolescence, it would provide an important means to identify those at risk for early marriage as soon as possible, and would suggest a focus on transitions to adulthood as part of any middle school drug prevention program.

We included parental education (as an indicator of familial SES), racial and ethnic background, and gender as covariates in our analyses. These factors are likely to confound relationships between substance use, educational attainment, early unwed parenthood, and early marriage, because they are associated with the first three factors. Adolescents from higher socioeconomic strata engage in substance use later and less frequently than do adolescents from lower socioeconomic strata (e.g., Kadushin, Reber, Saxe, & Livert, 1998; Winkleby, Jatulis, Frank, & Fortmann, 1992); they also have higher levels of educational attainment (Duncan, Yeung, Brooks-Gunn, & Smith, 1998). Similarly, women from lower socioeconomic strata have higher rates of adolescent and unwed childbearing than women from higher socioeconomic strata (Bumpass & McLanahan, 1989; Mensch & Kandel, 1992; Robbins, Kaplan, & Martin, 1985). Black and Asian American adolescents consistently report lower use of alcohol and illicit drugs than do White and Hispanic adolescents (Barnes, Welte, & Hoffman, 2002; Johnston, O'Malley, & Bachman, 2000; O'Malley, Johnston, & Bachman, 1999). In contrast, the fertility rate among Black adolescents is twice the rate among White adolescents, and four times the rate among Asian American adolescents (Martin, Hamilton, Ventura, Menacker, & Park, 2002), whereas college graduation rates among Asian Americans are approximately 50% higher than they are among Whites, and more than twice as high as they are among African Americans and Hispanics (U.S. Bureau of the Census, 2002). Finally, rates of substance use are typically higher among male adolescents than among female adolescents (e.g., O'Malley, Johnston, & Bachman).

Parental education, race/ethnicity, and gender are also important factors in early marriage and worth examining in their own right. Being from an advantaged socioeconomic background reduces the probability of early marriage (Bayer, 1969; Goldscheider & Waite, 1986; Marini, 1978), as does being Black and being male (Michael & Tuma, 1985). The probability of first marriage by age 20 is lowest among Blacks (1.9%), followed by Asian Americans (2.5%), Whites (2.6%), and Hispanics (5.0%; Fields & Casper, 2001). Among men, the probability of first marriage by age 20 is nearly three times lower than it is among women (1.5% versus 4.1%, respectively; Fields & Casper).

METHOD

Sample

The sample consisted of participants in Waves 1, 6, and 8 of the RAND Adolescent/Young Adult Panel Study. The panel study cohort was originally recruited in 1985, when they were in Grade 7, for participation in a substance use prevention intervention (Project ALERT) and its evaluation. The baseline panel of 6,527 adolescents was drawn from 30 middle and junior high schools in eight California and Oregon school districts representing widely diverse school and community environments. Nine of the 30 schools had a minority population of 50% or more, and 18 served neighborhoods with incomes below the median for their states. The 30 schools, which were chosen to provide a broad test of the substance use prevention intervention, encompass urban, suburban, and rural communities of the northern and southern regions of California and Oregon.

The sample reflects the diversity of the schools from which they were drawn. At baseline, 44% came from families without two coresidential biological parents, and 53% had a father with a high school education or less. Average adjusted family income was $21,010. Mean GPA was 2.64. Girls made up 48% of the baseline sample. Sixty-seven percent of the baseline sample were White, 10% Hispanic, 10% Black, 8% Asian, and 4% from other racial and ethnic backgrounds. The response rate at baseline was 86%. Analyses of demographic and school achievement data gathered from nonrespondents showed that nonresponse did not bias the baseline sample (Bell, Gareleck, & Ellickson, 1990).

Of the original participants, 3,466 participated in Wave 8 (age 24), and of these, 3,324 also participated in Wave 6 (age 16). Care was taken to track and include school dropouts and those who transferred to another school. By Wave 8, however, the sample included slightly smaller percentages of Black, Hispanic, and male youth, as well as slightly smaller percentages of participants who had ever used cigarettes, marijuana, and alcohol by Grade 7. For this reason, the data presented below were weighted to better represent the original seventh-grade sample. Weights were inversely proportional to the predicted probability of response at age 24 based on a logistic regression using seventh-grade characteristics. As Table 1 shows, the weights removed more than 90% of the bias caused by attrition.

Procedure

Participants completed self-administered surveys in school at Grades 7 and 10 (Waves 1 and 6), and by mail at age 24 (Wave 8). To examine the validity and reliability of self-reported tobacco use over the first four waves of the study, we collected saliva samples prior to the survey and compared the results for cotinine (a metabolite of nicotine) with self-reported smoking (Ellickson, Bell, Thomas, Robyn, & Zellman, 1988). The results suggest that the majority of students were honest about their tobacco use. At baseline and 15 months later, 95% of students with cotinine scores that identified them as recent tobacco users had admitted to using cigarettes or smokeless tobacco on their questionnaires (Freier, Bell, & Ellickson, 1991). We also examined the consistency of self-reported use of cigarette, alcohol, and marijuana use over time. Across four waves

of data, the proportion of students who denied using one of these substances after previously admitting use averaged about 5%. Retractions of frequent use averaged less than 1% (Reinisch, Bell, & Ellickson, 1991).

Measures

Outcome variable: early marriage. At Wave 8 (age 24), participants reported whether they had ever been married. Participants who indicated that they had previously been or were currently married were asked to report the month and year in which their first marriage occurred. We used this information along with participants' ages at Wave 1 to determine age at first marriage. Consistent with previous research on the timing of marriage (e.g., Michael & Tuma, 1985; Teti & Lamb, 1989), we defined an early marriage as one occurring prior to 20 years of age. Participants who met this criterion were assigned a value of 1 on our index of early marriage; all other participants, including those who had never been married, were assigned a value of 0.

Predictor variables. Demographics included age at Grade 7, gender ($0 = male$, $1 = female$), and race/ethnicity (dummy coded as White versus Black, Hispanic, Asian, and Other). The highest level of education attained by either of the participants' parents was used to indicate family socioeconomic status. *Adolescent substance use* was measured at Grade 7 and Grade 10. At Grade 7, participants reported their lifetime use of cigarettes, alcohol, and marijuana. Those participants who had not used any of these three substances by Grade 7 (reference group) were compared to three mutually exclusive groups of participants:

TABLE 1. HOW SAMPLE WEIGHTS REDUCE ATTRITION BIAS

Variable Measured at Baseline	Grade 7 ($N = 6,527$)	Age 23/24 ($N = 3,328$)	
	Unweighted %	Unweighted %	Weighted %
Gender			
Female	48.0	54.3	48.1
Race/Ethnicity			
White	67.3	71.7	67.4
Black	10.3	7.3	10.1
Hispanic	10.3	8.6	10.1
Asian	8.2	9.7	8.2
Other race	4.0	2.7	4.1
Ever used cigarettes, Gr. 7	54.4	46.3	53.4
Ever used alcohol, Gr. 7	77.2	75.3	77.5
Ever used marijuana, Gr. 7	21.5	14.0	20.6

those who had used alcohol only, those who had used cigarettes but not marijuana, and those who had used marijuana. We chose these categories because substance use tends to be sequenced, and use of later substances in this sequence is highly related to use of earlier substances. In our sample, 92.2% of students who had used cigarettes in seventh grade had also used alcohol; 95.7% of students who had used marijuana in seventh grade had used alcohol, and 95.2% had used cigarettes. At Grade 10, information about past-month use was used because lifetime use was common by that age. We created three dichotomous variables: past-month cigarette use ($0 = no$, $1 = yes$), past-month alcohol use ($0 = no$, $1 = yes$), and past-month marijuana use ($0 = no$, $1 = yes$), based on any self-reported use in the past month. This categorization captured the more varied patterns of use observed among 10th-grade students.

Hypothesized Mediator Variables: Educational Attainment and Early Unwed Parenthood

At Wave 8, participants reported their highest levels of educational attainment ($1 = high school diploma or less$; $2 = some post-high school education$; $3 = four-year college degree or more$), and whether they had biological children. Participants with biological children reported the month and year of the birth of their first child. As with the marriage variable, we used this information along with participants' ages at Wave 1 to determine participants' ages at the time of the births of their children. By comparing this to age at first marriage, we classified as early unwed parents those participants who bore children prior to age 20, and also prior to their first marriages. To account for pregnancies that were in progress at the time of first marriage but that had not yet resulted in births, we also included as early unwed parents those people who had a child within 6 months after their first marriages (and prior to age 20). Of the 345 respondents classified as early unwed parents, 42 had a child within 6 months of marriage. Although the label "early unwed parents" is imprecise as applied to these individuals, we chose to define them as such because we believe that these cases best illustrate our hypothesis that early parenthood among adolescent substance users prompts early marriage (these individuals appear to have married soon after discovering their pregnancies). Moreover, previous research supports such a definition of early unwed parenthood. For example, in a prospective study of the relationship between substance use and unwed pregnancy, Yamaguchi and Kandel (1987) considered a marriage as having been the result of an unwed pregnancy if a birth occurred within 8 months of the marriage.

Analysis Strategy

We began our analyses by assessing the bivariate associations between each of our predictor variables and early marriage. To do so, we computed likelihood ratio χ^2 statistics to test for differences in prevalence of early marriage across the categories of each of our predictors. In our multivariate analyses, we used logistic regression analyses to determine the odds of early marriage based on respondents' adolescent substance use. We tested mediation using the method described by Baron and Kenny (1986). We first ran the logistic regression model without the hypothesized mediating variables and examined the odds ratios for each substance use variable. Next, we added the hypothesized mediators to the model individually and then jointly. Finally, we regressed each of the hypothesized mediators on our measures of adolescent substance use. Evidence of mediation would be present if (a) early marriage was significantly associated with adolescent substance use in the first model, (b) the mediating variables were significantly associated with adolescent substance use, and (c) the effect of adolescent substance use became smaller when the mediating variables were entered into the model. Evidence of a multiply mediated association between adolescent substance use and early marriage would exist if (a) both mediating variables were significantly associated with early marriage when entered simultaneously into the model, and (b) each mediator was shown to contribute uniquely and significantly to the reduction of the unmediated effect of adolescent substance use on early marriage. Finally, to determine whether educational attainment and early unwed parenthood predicted early marriage comparably for men and women, we computed and then tested the predictive utility of interaction terms representing the joint effect of gender and each hypothesized mediator. In all of our analyses, we controlled for three previously documented predictors of early marriage: gender, race, and socioeconomic status.

To account for the use of nonresponse weights and the dependence of observations within

schools due to clustering, Huber variance estimates were computed using the Stata program's *svylogit* command (Huber, 1967; Stata Statistical Software: Release 6.0, 1999).

Although the students who participated in the study generally completed the entire survey, a small amount of missing data (ranging from 0% to 2.3%) was observed for each of the individual predictors. To avoid any bias and loss of information that would be incurred by excluding missing observations, we imputed the missing values using least-squares regression imputation. We first selected a set of 30 measures that would likely be associated with our set of predictors. These included (but were not limited to) characteristics such as age, race, gender, religiosity, income, household composition, mental health, and education. This set of predictors was then used in least-squares regression to generate a predicted value for the variable being imputed. This predicted value was then substituted for the missing value (Little, 1992). We did not, however, impute missing data on our outcome variable. Sixteen participants were missing data on marital status at age 24 and thus were excluded from our analyses.

RESULTS

In our young adult sample, 4.2% of men and 10.7% of women married prior to age 20. Four participants reported that they had married prior to our 10th-grade survey. Because we were interested in prospectively predicting marriage from our Grade 10 substance use measures, we excluded these four participants from our analyses. The rates of early marriage observed in our sample are roughly consistent with those in the U.S. population at this time period (Ventura, Mathews, & Hamilton, 2002). Because preliminary analyses indicated that the substance use prevention curriculum had no influence on rates of early marriage, $F(2, 3442) < 1$, we did not include treatment condition as a predictor in our subsequent analyses.

As shown in Table 2, early marriage could be reliably predicted from all but two of our measures of adolescent substance use in bivariate analyses. Cigarette and marijuana use at Grade 7 were both significantly associated with early marriage. Participants who had initiated cigarette but not marijuana use by Grade 7 were consistently more likely to marry by age 20 than those who reported no use of alcohol, cigarettes, or marijuana, $\chi^2 (1) = 4.52$, $p < .05$. Similarly, participants who had used marijuana by Grade 7 were consistently more likely to marry by age 20 than those who reported no substance use, $\chi^2 (1) = 5.55$, $p < .05$. There was no difference in prevalence of early marriage between those participants who had only used alcohol by Grade 7 and those who reported no substance use, $\chi^2 (1) < 1$. At Grade 10, current alcohol and cigarette use were each reliably associated with a higher likelihood of early marriage, χ^2 values with 1 degree of freedom $= 12.46$ and 16.01, respectively (both ps $< .01$). The relationship between current marijuana use at Grade 10 and early marriage was not significant, $\chi^2 (1) = 3.81$, $p = .06$.

Among our demographic variables, gender and parent education were both strongly associated with early marriage. Consistent with other studies (e.g., Lowe & Witt, 1984; Michael & Tuma, 1985; Waite & Moore, 1978), the rate of early marriage was significantly greater among women than men, $\chi^2 (1) = 50.86$, $p < .001$. Also consistent with previous work (e.g., Bayer, 1969; Goldscheider & Waite, 1986; Marini, 1978), the likelihood of early marriage was greater among participants whose parents had lower levels of educational attainment, $r = - .12$, $p < .001$. We found no association between race/ethnicity and early marriage at the bivariate level of analysis, $\chi^2 (4) < 1$.

Finally, both of our hypothesized mediator variables were strongly associated with the likelihood of early marriage. Not surprisingly, participants who became parents early and outside of marriage were much more likely to marry early, $\chi^2 (1) = 218.58$, $p < .001$. Participants whose formal education ended prior to or with the completion of high school were more likely to marry early than were participants who obtained some schooling beyond high school (e.g., technical or vocational school) or participants who completed a 4-year college degree or more, χ^2 values with 1 degree of freedom $= 33.02$ and 72.97, respectively (both ps $< .001$).

We began our multivariate analyses by predicting early marriage from our measures of seventh-grade substance use, controlling for gender, race/ethnicity, and parent education. Unlike the results of our bivariate analyses, none of the measures of substance use at seventh grade was associated with early marriage when demographic characteristics were held constant (ORs ranged from .86 to 1.31, all ps $> .15$). Only gender and parent education

TABLE 2. BIVARIATE ASSOCIATIONS BETWEEN EARLY MARRIAGE AND ALL PREDICTOR VARIABLES ($N = 3,304$)

Variable (reference group in italics)	Percent Married Early
Grade 7 substance use	
No use of any substance	6.0
Alcohol use only	5.3
Cigarette use, no marijuana use	8.4*
Marijuana use	9.3*
Grade 10 alcohol use in past month	
No	5.6$_a$
Yes	8.7$_b$
Grade 10 cigarette use in past month	
No	6.1$_a$
Yes	10.7$_b$
Grade 10 marijuana use in past month	
No	6.7
Yes	9.9
Gender	
Male	4.2$_a$
Female	10.7$_b$
Ethnicity	
White	7.7
Black	6.2
Hispanic	8.0
Asian	3.6
Other	9.9
Parent education	
Less than high school	10.8
High school diploma	5.8*
Education beyond high school	3.9*
Educational attainment	
High school diploma or less	12.7
Some education beyond high school	6.6*
Four-year college degree or more	0.8*
Early unwed parenthood	
No	4.6$_a$
Yes	28.0$_b$

Note: In the case of dichotomous predictor variables, subgroups not sharing a common subscript are different at $p < .05$. In the case of polytomous predictor variables, an asterisk denotes that a category differs significantly ($p < .05$) from the reference category.

emerged as significant predictors of early marriage, with women being more likely to marry early than men (OR = 2.75, $p < .001$), and those whose parents were better educated being less likely to marry early than those whose parents were less well educated (OR = .74, $p < .001$). Because none of the measures of seventh-grade substance use influenced the likelihood of early marriage, these measures were not considered in our subsequent multivariate models.

Table 3 shows the multivariate association between 10th-grade substance use and early marriage. The left side of Table 3 presents the odds ratios controlling for gender, race, and parent education but not for the hypothesized mediator variables (Model 1). Without the hypothesized mediator variables in the model, cigarette use at Grade 10 was significantly associated with an increased likelihood of early marriage. The odds of early marriage among participants who used cigarettes in 10th grade were one and a half times as large as they were among participants who had not used cigarettes in 10th grade (OR = 1.50, $p < .05$). Although 10th-grade alcohol use was associated with early marriage at the bivariate level of analysis, it did not emerge as a predictor of early marriage when demographics and participants' standing on the other measures of Grade 10 substance use were statistically controlled in the multivariate model.

To assess the relationship between 10th-grade cigarette use and each of the hypothesized mediators, we ran logistic regression models to separately predict educational attainment and early marriage from 10th-grade substance use, gender, race, and parent education. These analyses revealed that cigarette use in Grade 10 was negatively associated with educational attainment ($b = -.86$, SE = .13, $p < .001$), and related to an increased likelihood of early unwed parenthood (OR = 1.63, $p < .01$). Thus, the second criterion for mediation was met for each of the hypothesized mediators.

To test whether educational attainment and early unwed parenthood mediated the association between 10th-grade cigarette use and early marriage, we added each of these variables to the model individually and then jointly. Table 3 (Model 2) shows that with educational attainment in the model, the effect of 10th-grade cigarette use on early marriage became nonsignificant (OR = 1.23, $p = .24$). Further, educational attainment was associated significantly with a decreased likelihood of early marriage (OR = .40, $p < .001$). As shown in Table 3, Model 3, when early unwed parenthood was added to the model instead, the effect of cigarette use on early marriage again became nonsignificant (OR = 1.29, $p = .15$), and again, the estimate of the effect of the mediator (early unwed parenthood) was strong and significant (OR = 6.56, $p < .001$). Thus, it can be concluded that educational attainment and early unwed parenthood each mediate the association between cigarette use in 10th grade and the likelihood of early marriage.

The next question we addressed was whether each of these variables uniquely mediated the

TABLE 3. LOGISTIC REGRESSION MODELS PREDICTING EARLY MARRIAGE ($N = 3,304$)

Predictor	Model 1		Model 2		Model 3		Model 4	
	Odds ratio	SE	Odds ratio	SE	Odds ratio	SE	Odds ratio	SE
Gender[a]	2.66***	.39	3.03***	.44	2.35***	.40	2.35***	.40
Ethnicity[b]								
Black	.76	.20	.69	.20	.53*	.17	.50*	.15
Hispanic	.75	.18	.71	.17	.61	.15	.59*	.15
Asian	.51	.25	.66	.31	.60	.27	.70	.32
Other	.92	.51	.79	.40	.57	.30	.51	.25
Parent education	.73***	.04	.84**	.05	.81**	.05	.88	.06
Grade 10 substance use[c]								
Alcohol	1.24	.18	1.22	.18	1.30	.20	1.28	.21
Cigarettes	1.50*	.26	1.23	.22	1.29	.22	1.12	.20
Marijuana	0.99	.21	.93	.20	.78	.18	.76	.18
Educational attainment[d]	–	–	.40***	.04	–	–	.50***	.06
Early unwed parenthood[e]	–	–	–	–	6.57***	1.10	5.48***	.94

Note: [a]$0 = male$; $1 = female$. [b]Each group compared against White. [c]Past month use: $0 = no\ use$; $1 = use$. [d]$1 = high\ school\ diploma\ or\ less$; $2 = some\ post\ high\ school$; $3 = 4\text{-}year\ college\ degree\ or\ greater$. [e]$0 = no$; $1 = yes$.

*$p < .05$. **$p < .01$. ***$p < .001$.

association between cigarette use and early marriage. Because of the strong association between educational attainment and early unwed parenthood (χ^2 (2) = 193.94, $p < .001$), it was possible that the mediating influence of these variables would be largely redundant. We tested a full model that included both mediators, along with our measures of 10th-grade substance use and demographic characteristics. The outcome of this analysis is presented in the last two columns of Table 3 (Model 4). As can be seen in this table, the effects of each of the mediating variables remained significant when entered simultaneously (educational attainment OR = .50, early unwed parenthood OR = 5.48, both ps < .001). In this final model, gender and race/ethnicity were also significant predictors of early marriage, with women more likely than men to marry early (OR = 2.35, $p < .001$) and Black and Hispanic youth more likely than White youth to marry early (ORs = .50 and .59, respectively, ps < .05).

Figure 1 presents standardized regression coefficients for the full mediational model. As the figure shows, the parameter estimate representing the direct effect of 10th-grade cigarette use on early marriage was nonsignificant (OR = 1.12, $\beta = .03$, $p = .52$), with both mediating variables in the equation. Comparing the mediated effect of cigarette use to the unmediated effect and prior to controlling for education and early unwed parenthood, we found that the mediators explained approximately 73% of the total effect of 10th-grade cigarette use. Eighteen percent of the reduction was due to educational attainment, and 82% of the reduction was due to early unwed parenthood. Baron and Kenny (1986) provide a direct test of whether the reduction of an effect due to a mediator is statistically significant. This test, a modification of one proposed by Sobel (1982), yields a statistic that is approximately distributed as Z. Using the Baron and Kenny modification of the Sobel test, we found that the reduction due to educational attainment is statistically significant ($z = 4.29$, $p < .001$), and so too is the reduction due to early unwed parenthood ($z = 3.04$, $p < .01$).

Our final research question was whether educational attainment and early unwed parenthood predicted early marriage similarly for men and women. To address this question, we computed multiplicative interaction terms representing the joint effect of gender and each of our mediating variables, and then added these interaction terms to the full logistic model. This analysis revealed a significant interaction between gender and early unwed parenthood (OR = .26, $p < .01$) in predicting early marriage. To interpret the interaction, we used our full logistic model to predict prevalence rates of early marriage in each cell in our 2 (gender: *male*, *female*) by 2 (early parent: *yes*, *no*) table. These follow-up analyses demonstrated that the association between early unwed parenthood and early marriage was slightly stronger among men than women. The predicted probability of early marriage among women was 3.71 times greater when they were early

FIGURE 1. MEDIATION OF ADOLESCENT CIGARETTE USE ON EARLY MARRIAGE BY EDUCATIONAL ATTAINMENT AND EARLY UNWED PARENTHOOD

Educational Attainment

−.16***   −.27***

Cigarette Use in Adolescence   .03   Early Marriage

.11***   .28***

Early Unwed Parenthood
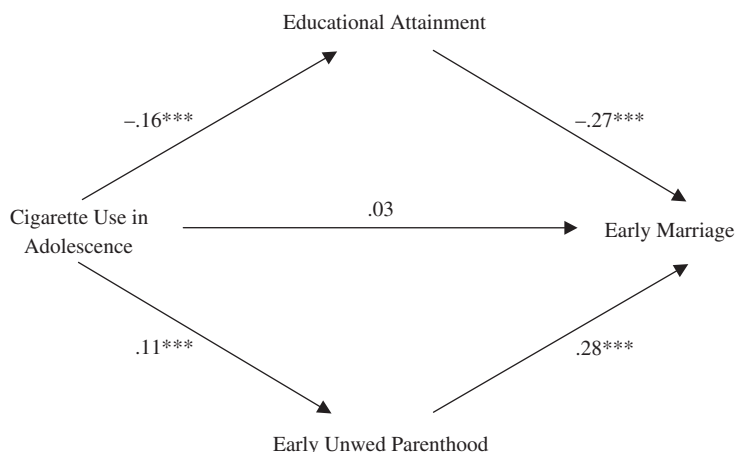
Standardized Regression Coefficients are Shown. ***$p < .001$.

parents, whereas among men it was 4.64 times greater.

DISCUSSION

This study sought to provide a prospective assessment of the relationship between adolescent substance use and early marriage, clarifying whether the relationship could be attributed to impaired judgment or personality factors and identifying potential mediators of this relationship. Consistent with the findings of Chassin and colleagues (1992), we found that use of cigarettes in 10th grade, but not alcohol or marijuana, predicted early marriage when controlling for gender, race, and socioeconomic status. We also found that decreased educational attainment and early unwed parenthood each uniquely mediated this association, results that both replicate and extend those of Chassin et al. (1992). These results support the notion that substance use in adolescence indicates low self-control and a willingness to take risks without regard for the potential negative ramifications of one's behavior, and that these characteristics foster early marriage by decreasing educational attainment and increasing the likelihood of early unwed parenthood. We were unable to detect an effect of cigarette use in early adolescence on early marriage, however, probably because use of cigarettes at early ages is often experimental and fluctuates from early to

later adolescence (Orlando, Tucker, Ellickson, & Klein, in press).

Our finding that neither alcohol nor marijuana use predicts early marriage raises doubts about the impaired judgment explanation for the link between substance use and early marriage. The association between cigarette use and adolescent marriage is unlikely to reflect a process whereby intoxicated teenagers fail to use contraception and consequently experience unwanted pregnancy and, ultimately, early marriage. Nor is it likely to reflect a process whereby drug use impairs cognitive judgment, decreases educational performance, and fosters early marriage as a substitute for diminished career expectations. Measurements of alcohol and marijuana use that are more proximal to pregnancy might have uncovered an association between substance use and early marriage that could be attributed to impaired judgment, but we lacked data on whether our respondents were using these substances prior to conception. Nevertheless, if an episode-specific relationship between substance use and sexual risk taking exists, this relationship should also be detected at the general level—that is, those who use substances more often are probably more likely to be under the influence at any one time, and therefore more likely to take risks. Moreover, our findings are consistent with a recent review of research on the connection between substance use and sexual

risk-taking that found little evidence that being intoxicated during sexual activity influences the likelihood of condom use (Weinhardt & Carey, 2000).

Our finding that the two mediating processes are not more important for women than men may be an artifact of our methodology. Because men may not be aware of all instances in which they become parents and may not recall them as accurately when they are aware, accuracy in the reporting of early unwed parenthood is likely to be lower for men than for women. Therefore, men who report becoming parents before marriage may represent a special subset that is more likely to get married once they know they will be fathers and to relinquish educational goals to meet the responsibilities of marriage and parenting.

In drawing conclusions from our study, several limitations should be considered. First, attrition between Waves 1 and 8 of our study was substantial, resulting in a loss of almost half of the original sample. We weighted the data to correct for the potential bias caused by attrition. Although these weights may not fully correct attrition bias, the weighted sample very closely approximated the original seventh-grade sample in the percent who had engaged in deviant behavior (used alcohol, cigarettes, or marijuana by Grade 7), as well as the percent women, White, Black, Asian, and Hispanic. Nevertheless, any undetected bias from the loss of nonconforming adolescents might have attenuated the test of the relationship between substance use and early marriage.

A second limitation is the use of self-reported information about substance use. Although research on the quality of self-report data on alcohol, marijuana, and cigarette use suggests that it is generally reliable (Mensch & Kandel, 1988; O'Malley, Bachman, & Johnston, 1983), and our tests to validate self-reported tobacco use in this sample showed the reports to be highly accurate (Ellickson & Bell, 1990), there may have been some underreporting of alcohol and marijuana use that led to an attenuation in the relationship between use of these substances and early marriage. Previous analyses, however, have shown that prevalence rates for substance use in this cohort are within the range typically found in national studies (Ellickson, McGuigan, Adams, Bell, & Hays, 1996; Ellickson, Saner, & McGuigan, 1997).

Third, because we did not have information on the timing of participants' educational attain-

ments, we cannot establish precisely the sequence of educational and marital roles. It is likely that lower educational attainment is both a cause and consequence of early marriage. We believe that it is important to have tested this relationship with our limited data, however, as the hypothesis that lower educational attainment fosters early marriage is strongly suggested by our theoretical perspective on substance use and early marriage. Consistent with this perspective, prior evidence shows that individuals with limited educational and occupational prospects tend to get married sooner than their counterparts (Goldscheider & Waite, 1987; Kobrin & Waite, 1984). Other authors have also suggested that the dominant direction of influence is from the effects of educational attainment to occupational, marital, and parental roles (Mariani, 1985; Yamaguchi & Kandel, 1987). Nevertheless, we recommend caution in the interpretation of this result.

Finally, although we have argued that cigarette use in adolescence indicates low self-control or impulsiveness and hypothesized a causal relationship between these characteristics and early marriage, an alternative explanation for our findings is that adolescent cigarette use and early marriage, as well as low educational attainment and early unwed pregnancy, are all indicators of a single underlying tendency or trait. For example, problem behavior theory (Jessor & Jessor, 1977) holds that substance use in adolescence is one of several manifestations of an overall psychosocial proneness toward social deviance. Similarly, Gottfredson and Hirschi (1990) have proposed that most deviant behavior can be explained by an absence of self-control. Future research is needed to determine whether a single underlying trait can explain the relationships between substance use, educational attainment, early unwed pregnancy, and early marriage.

In conclusion, we have demonstrated that cigarette use in adolescence, but not alcohol or marijuana use, predicts early entry into marriage through a process that involves early unwed parenthood and low educational attainment. These results suggest that adolescent smokers may be important targets for programs aimed at promoting high school completion and college attendance and preventing teenage pregnancy. Such programs might also reduce the incidence of early marriage. Finally, the link between cigarette use and early entry into marriage may also presage difficulties in fulfilling the marital role. In the study by Chassin and colleagues (1992),

adolescent smokers were both more likely to marry early and more likely to divorce than adolescent nonsmokers, results that are consistent with the notion that adolescent substance users are likely to assume adult roles earlier than nonusers but unlikely to have the skills or maturity to succeed in those roles (Newcomb & Bentler, 1988). Adolescents who marry early because of poor self-control or a desire to be nonconforming may make poor choices of partners or may lack the psychosocial assets associated with a lasting marriage. Hence, future research should examine the links between smoking, early marriage, and divorce.

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