Published in final edited form as:
Dev Psychol. 2013 August ; 49(8): 1554–1564. doi:10.1037/a0030229.

The Developmental Significance of Late Adolescent Substance Use for Early Adult Functioning

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Abstract

This study examines the predictive significance of late adolescent substance use groups (i.e., abstainers, experimental users, at-risk users, and abusers) for early adult adaptation. Participants (N = 159) were drawn from a prospective longitudinal study of first-born children of low-income mothers. At 17.5 years of age participants were assigned to substance use groups based on their level of substance use involvement. At 26 years, early adult competence was assessed in the areas of education, work, romantic relationships, and global adaptation. Results indicate that 17.5 year substance use group membership significantly predicted high school completion, regular involvement in a long-term romantic relationship, good or better work ethic, and good or better global adjustment at 26 years when controlling for gender; IQ; 16 year internalizing and externalizing behavior problems, parental monitoring, and peer competence; and current substance use at 26 years. Group comparisons indicate that late adolescent substance use experimenters were significantly more likely in early adulthood to have (a) a high school diploma or higher level of education compared to abstainers (OR = 8.83); (b) regular involvement in long-term romantic relationships (OR = 3.23), and good or better global adaptation (OR = 4.08) compared to at-risk users; and (c) good or better work ethic (OR = 4.04) compared to abusers. This research indicates that patterns of late adolescent substance use has implications for early adult functioning in salient developmental domains.

Keywords

adolescence; drug use; early adulthood; longitudinal study; competence

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Rates of substance use show dramatic increases in adolescence; by the time students in the United States are seniors in high school, 72% have reportedly used alcohol, 42% have tried marijuana, and 24% have used other illicit drugs (Johnston, O'Malley, Bachman, & Schulenberg, 2010). Although experimentation with substances may be a relatively normative activity during late adolescence (Baumrind, 1991; Shedler & Block, 1990), concerns have been raised about the consequences of adolescent substance use for future developmental outcomes (e.g., Chassin, Pitts, & Prost, 2002; Oesterle, Hill, Hawkins, & Abbott, 2008). In response to these concerns, researchers have examined the developmental implications of adolescent substance use on early adult functioning. Results from these studies are somewhat contradictory, however. Some researchers (e.g., Fergusson & Boden, 2008; Wells, Horwood, & Fergusson, 2004; Windle & Wisner, 2004) find that heavy users/abusers have lower levels of competent functioning (e.g., educational attainment) and higher levels of maladaptive functioning (e.g., aggression, unemployment) compared to those who use lower amounts of substances, whereas others find no or few effects of adolescent substance use on adult functioning (Gotham, Sher, & Wood, 2003).

Inconsistent findings could potentially stem from a number of issues. First, most studies examine only one type of substance use in adolescence, usually either alcohol or marijuana. Evidence indicates, however, that there may be overlap in the pattern of adolescents' use of different substances and little differentiation in outcomes in early adulthood (Schulenberg et al., 2005; Tucker, Ellickson, Collins, & Klein, 2006). Examining groups that capture patterns of overall substance use, as in the current study, rather than use of one substance or another, may disentangle some of these contradictory findings (Tucker et al., 2006). Second, family socioeconomic status (SES) may play a role in the inconsistent findings across studies. For instance, one study (Staff, Patrick, Loken, & Maggs, 2008) found that adolescent alcohol use negatively affected educational attainment for low-income men but not for middle and upper-income individuals. These results suggest that it may be important to specifically examine low-income participants. To date, however, many longitudinal studies have examined either middle income or diverse SES samples. Although a few studies do include a significant number of low-income participants (e.g., Osterle et al., 2008) there is still a paucity of research exclusively examining this segment of the SES spectrum. In the current study we specifically investigate a sample of participants born into poverty, allowing us to extend previous research and target individuals who may be more likely to suffer negative developmental effects from adolescent substance use (Staff et al., 2008). The primary aim of this study is to examine whether diverse patterns of late adolescent substance use predict early adult adaptation in a poverty sample.

Theoretical Perspective

The organizational-developmental perspective (Sroufe, Egeland, Carlson, & Collins 2005) provides a framework for assessing the relation between adolescent substance use and early adult adaptation. Within this framework, specific tasks at each stage of development relate to well-being (Roisman, Masten, Coatsworth, & Tellegen, 2004). Competent functioning in early adulthood is conceptualized as the successful negotiation of salient developmental tasks, including educational attainment, work success, and the formation of romantic relationships (Schulenberg, Bryant, & O'Malley, 2004; Sroufe et al., 2005). From this perspective, adolescent substance use may situate individuals on developmental pathways of adaptation or maladaptation, laying a foundation for future substance use, and affecting how individuals approach the developmental issues of early adulthood (Schulenberg, Maggs, & O'Malley, 2003).

Developmental Outcomes of Adolescent Substance Use

Education

Negative and positive effects of adolescent substance use on later educational attainment have been demonstrated. Some studies indicate that adolescent substance abstainers are more likely to obtain higher educational credentials in early adulthood than users (Tucker, Ellickson, Orlando, Martino, & Klein, 2005; Tucker et al., 2006). Other researchers, in contrast, have found that adolescents who drank more than their peers during high school had an increased likelihood of completing more schooling two years later (Maggs, Frome, Eccles, & Barber, 1997). Additional research indicates, however, that it is not so much use versus non-use, but, rather level of substance use in adolescence that is important for later educational outcomes. For instance, in a middle-class sample both marijuana abstainers and experimental users in adolescence had higher educational attainment in early adulthood than high chronic marijuana users (Windle & Wisner, 2004). Examining patterns of late adolescent substance use, rather than a specific substance in isolation, may be advantageous in bridging these divergent findings

Work

Empirical evidence examining the impact of adolescent substance use on early adult work outcomes is indeterminate. Some investigators find that higher levels of alcohol consumption in mid-adolescence and increasing, as well as higher, rates of cannabis use across adolescence predict higher rates of unemployment in early adulthood (Fergusson & Boden, 2008; Schulenberg et al., 2005; Wells et al., 2004). Other researchers, however, find no effect of substance use on adult employment status (Osterle et al., 2008; Windle, Mun, & Windle, 2005). Furthermore, studies exploring the effects of adolescent substance use on aspects of work competence other than employment status are sparse; Osterle et al. (2008) did find that adolescent alcohol misuse did not have a negative effect on adults' commitment and bonding to work. Investigating additional aspects of work competence rather than only considering employment status may provide a more comprehensive understanding of early adult work outcomes associated with varying levels of adolescent substance use. The current study examines work competence at 26 years by considering participants' level of involvement in work, level of motivation and commitment to work, and level of responsible behavior at work over a three year period in early adulthood.

Romantic relationships

A number of studies have examined the impact of adolescent substance use on early adult relationship status, with conflicting results. Moderate or heavy marijuana use or heavy alcohol use in adolescence and increases in binge drinking or marijuana use from adolescence to early adulthood may decrease the likelihood of involvement in an early adult romantic relationship (Patton et al., 2007; Tucker et al., 2005). Other studies, however, have not found any associations between either adolescent marijuana use (Brook, Adams, Balka, & Johnson, 2002) or alcohol use disorders (Gotham et al., 2003) and intimate relationship measures in early adulthood. Furthermore, adolescent alcohol use predicted a reduction of loneliness in early adult romantic relationships (Newcomb & Bentler, 1988) and, for adolescent males, alcohol abstinence was associated with a decreased likelihood of being involved in a steady relationship during the mid-20's (Pape & Hammer, 1996). Given that romantic relationship status can change across early adulthood, it is possible that conflicting results were obtained due to fluctuations in relationship status across early adulthood. In order to take into consideration potential changes in romantic relationships, the current study examines the pattern of romantic relationships from ages 23 to 26 years, a three year period in early adulthood, rather than at one point in time.

Overall Adjustment

Adolescent substance use has the potential to influence not only specific developmental tasks in early adulthood, but also early adults' overall adjustment. Based on research conducted thus far, however, the link between adolescent substance use and overall competence in early adulthood is unclear. For instance, Chassin Pitts, and DeLucia (1999) found that adolescents who used drugs or were heavy drinkers were overall less competent in positive activities in early adulthood. In contrast, Oesterle et al. (2008) revealed that adolescent alcohol misuse did not have a negative effect on overall positive functioning in early adulthood. Furthermore, Pape and Hammer (1996) observed that men who were either late beginning drinkers or abstainers were delayed in their adjustment to adult roles. Given that few studies actually incorporated a global measure of overall adaptation in their research, the impact of adolescent substance use on overall competence in early adulthood has yet to be established. In the current study we consider not only how well individuals negotiate specific developmental tasks important in early adulthood, but also examine overall adjustment, including participants' sense of purposefulness and goal-directedness, and their capacity for self-evaluation and reflectiveness. Consideration of these aspects of individuals' development in conjunction with task competence will extent previous research by providing a broader and more thorough understanding of early adult functioning related to patterns of substance use in adolescence.

Patterns of Adolescent Substance Use and Early Adult Functioning

A limited number of studies (Milich et al., 2000; Tucker et al., 2006) have specifically explored patterns of adolescent substance use as a predictor of early adult functioning. Milich and colleagues (2000) found that patterns of adolescent alcohol use (i.e., abstainers, experimenters, heavy users) generally did not predict differences in levels of psychopathology, deviant behavior, and personality characteristics at age 20. Abstainers and experimenters were relatively equivalent with respect to 20 year outcomes; heavy users, in contrast, engaged in more delinquent activity and had higher sensation seeking scores than experimenters and abstainers. Tucker and colleagues (2006) exploring patterns of adolescent marijuana use (i.e., abstainers, experimenters, frequent users) discovered that any use increased the risk for poor developmental adaptation both concurrently (grade 12) and at 23 years. Linear relations were found for several outcomes (e.g., educational attainment), with abstainers having the best outcomes, followed by experimenters, and then frequent users. Although these studies suggest that early adult functioning is influenced by adolescent substance use patterns, results are not consistent. Inconsistent results may be due to past studies examining patterns of use for one type of substance only (e.g., only alcohol or marijuana). Given the potential heterogeneity of adolescent substance use, our study explores more generally patterns of adolescent substance use, regardless of type of substance, in relation to early adult adaptation. Furthermore, the current study extends previous research by looking at outcomes at 26 years rather than earlier in development.

Current Study

This prospective longitudinal study examines whether diverse patterns of late adolescent substance use differentially predict early adult functioning in a sample originally at-risk for poor developmental adaptation at participants' birth due to family poverty (100%), as well as mothers' marital status (58% were single), age (44% were teens), and educational attainment (33% had not graduated from high school). The current study builds on earlier work (Siebenbruner, Englund, Egeland, & Hudson, 2006) wherein the antecedents of four groups of adolescent substance users were explored. By age 17.5 years *abstainers* never used any alcohol or drugs, past or present; *experimenters* used alcohol and/or marijuana but did not endorse any clinical symptoms; *at-risk users* used alcohol, marijuana and/or other drugs

and demonstrated some impairment in functioning but did not fully meet DSM-III-R criteria for a substance use disorder; *abusers* experienced repeated problems in at least two areas of functioning due to use of a substance. Abstainers were more likely than experimenters to have (a) higher levels of maternal hostility at 24-42 months, (b) higher levels of internalizing behavior problems at 16 years, and (c) lower levels of externalizing behavior problems at 16 years; at-risk users were more likely than experimenters to have lower levels of parental monitoring at age 16; and abusers were more likely than experimenters to (a) be male, (b) have higher levels of externalizing behavior problems at 16 years, and (c) have lower levels of parental monitoring at 16 years. To extend these earlier findings, the present study examines the differential prediction of these adolescent substance use groups to early adult functioning at 26 years in the developmental domains of education, work, romantic relationships, and global adjustment. Given our earlier findings, we specifically examined adolescent substance use experimenters with the other three groups. To control for factors that may play a role in determining adult outcomes, we included variables shown to relate to competence in adulthood, including gender, IQ, current substance use, and measures of adolescent competence (externalizing and internalizing behavior problems, peer competence, and parental monitoring; Johnston et al., 2010; Siebenbruner et al., 2006).

We hypothesize that adolescent substance use groups will differentially predict early adult competence. More specifically, based on results from Siebenbruner et al. (2006) as well as consideration of earlier work (esp. Milich et al., 2000 and Tucker et al., 2006) we predict:

1. Abstainers and experimenters will have similar levels of competence in early adulthood, with the exception of romantic relationship competence. Based on our theoretical perspective and our findings from earlier work with this sample, we expect that poorer mother-child relationships in early childhood on the part of abstainers (Siebenbruner et al., 2006) would provide a developmental underpinning leading to poorer relationships with romantic partners in early adulthood.
2. The at-risk and the abuser groups will have poorer levels of functioning than the experimenter group. Although our previous findings indicate that at-risk substance users were similar in their developmental history to experimenters, we propose that problematic use in late adolescence would have a negative influence on their future development and would propel at-risk users to poorer outcomes in early adulthood, similar to adolescent substance abusers.

Methods

Participants

Participants (N = 159; 79 males) were drawn from a longitudinal study of first-born children of mothers who were below poverty level at the birth of their first child (see Egeland & Brunnquell, 1979). In 1975-1977 mothers were recruited in their third trimester of pregnancy during prenatal visits to public health clinics. Sample demographics were consistent with the demographics from which the sample was drawn—primiparous women receiving prenatal care from public health clinics in Minneapolis in the mid-1970's.

Of the 176 participants who completed the 17.5 year assessments, 159 also completed 26 year assessments and were included in the analyses. For the current sample, mothers' ages ranged from 15 to 34 (M = 20.72; SD = 3.55) at the participants' birth. Fifty-eight percent of the mothers were unwed and 33% had not completed high school at the time of their child's birth (range = 8 – 20 years of education; M = 11.93, SD = 1.75). Mothers were 84% Caucasian, 11% African-American, and 5% Native American or Hispanic. Sixty-seven percent of the current participants were Caucasian, 10% were African American, 2% were Native American or Hispanic, 18% were mixed ethnicity, and 3% were missing father data.

No significant differences were found between the retained and the attrition sample from 17.5 to 26 years for prenatal or 16 year SES; age, marital status, or educational level of the mothers at participant's birth; mothers' race; participants' IQ, race, or 17.5 year substance use group. Participants in the retained sample were significantly more likely to be female ($\chi^2 = 9.17$, $p = .002$).

Adolescent Substance Use Groups—Four substance use groups—abstainers, experimenters, at-risk, and abusers—were identified based on responses to questions focused on past and present substance use in the Adolescent Diagnostic Interview (ADI; Winters, Stinchfield, Fulkerson, & Henly, 1993) and the Kiddie Schedule for Affective Disorders and Schizophrenia for Adolescents (K-SADS; 11-18 years; Puig-Antich & Chambers, 1978) given to participants at 17.5 years. The ADI and the K-SADS are structured diagnostic interviews that assessed DSM-III-R criteria for substance use disorders among adolescents. Information obtained included substance use onset, frequency, duration, symptoms, and level of functioning. Based on ADI items and the K-SADS, scores were derived and a clinical diagnostic decision was made regarding whether adolescents meet criteria for substance use abuse or dependence.

Participants were assigned to substance use groups based on their responses to the following: (a) ever used a substance (alcohol, marijuana, or other illicit drug), (b) frequency of substance use, and (c) consequences of using substances. *Abstainers* ($n = 18$; 9 females, 9 males) had never used alcohol, marijuana, or any other illicit drugs at any time past or present. *Experimenters* ($n = 58$, 31 females, 27 males) had used alcohol and/or marijuana, past or present, but had not used any other illicit drugs and had not endorsed clinical symptoms of substance abuse/dependence. *At-risk* ($n = 58$; 37 females, 21 males) adolescents had used substances (alcohol, marijuana, and/or other illicit drugs) and demonstrated some impairment in functioning (e.g., skipped school or work to drink or get high), but did not meet full criteria for a substance use disorder diagnosis. *Abusers* ($n = 25$; 3 female, 22 males) met diagnostic criteria for a past or present substance use disorder (abuse or dependence). A pattern of repeated problems in at least two areas of functioning were exhibited by these adolescents and those who meet criteria for dependence, also exhibited tolerance and/or withdrawal behavior. (See Siebenbruner et al., 2006 for further information regarding the categorization of adolescents into substance use groups). All adolescents that completed an assessment at age 17.5 years were assigned to a substance use group; no participants engaged in only use of other drugs without using alcohol and/or marijuana. Frequency of substance use by adolescent substance use groups is reported in Table 1.

Early Adult Functioning at 26 Years

Educational attainment—Educational attainment was based on participants' self-report of their highest level of educational attainment during a semi-structured interview conducted when the participants were 26 years old. Responses were coded on a scale ranging from 0 to 4 as follows: 0 = didn't graduate from high school, 1 = GED, 2 = high school graduate, 3 = some college, and 4 = 4-year college degree or higher.

Work ethic—Work ethic was derived from participants' self-report of work experiences, including employment history and work-related behavior. All available information regarding work from a self-reported work experience questionnaire, work interview, and interviewers' written summaries were considered in making work ethic ratings. Two independent coders rated work ethic on a 5-point scale (1 = little or no work ethic, 2 = minimal, 3 = moderate, 4 = good, 5 = outstanding) based on the degree that participants indicated work was an important part of their lives, including whether they were currently seeking employment if unemployed; their level/frequency of irresponsible behavior at work

or school in the past year (e.g., messing up on purpose to get back at other people at work); and participants' level of involvement in work between ages 23 to 26 years. Interrater reliability was calculated based on 10% of the available cases, the intraclass correlation was .89. This measure shows concurrent validity: it is correlated with any unemployment between 23-26 years ($r = -.47$, $p = .000$), length of unemployment between 23-26 years ($r = -.54$, $p = .000$), participants' rating of how important their job is to them ($r = .27$, $p = .001$), and how often in the past year participants stayed away from work because they didn't feel like going ($r = .46$, $p = .000$).

Romantic relationship involvement—As part of a semi-structured interview at age 26, detailed information was obtained regarding the number, length, and status (e.g., dating, married) of participants' romantic relationships from ages 23 to 26. Based on these self-reports, coders rated participants' pattern of romantic relationships from ages 23-26 years, not the specific relationship status of the participant at any one point in time on a 5-point scale (1 = little or no romantic relationships, 2 = mostly short-term relationships (less than 4 months), 3 = balance of short-term and long-term relationships, 4 = mostly long-term relationships, and 5 = only long-term relationships [4 + months or longer]). Interrater reliability was calculated based on 46% of the available cases, the intraclass correlation among the 3 coders was .97. Our measure of romantic relationship involvement has good concurrent validity: 26 year romantic relationship involvement is correlated with current involvement in a romantic relationship ($r = .39$, $p = .000$), length of time in current relationship ($r = .39$, $p = .000$), participants' expectations regarding current relationships in five years ($r = .38$, $p = .000$), and number of romantic relationships from 23-26 years ($r = -.24$, $p = .002$).

Global adjustment—Global adjustment is an overall interviewer rating of how meaningfully engaged participants are in work/education and close relationships, their sense of purposefulness and goal-directedness, and their capacity for self-evaluation and reflectiveness. At the 26-year assessment (M [length] = 3.5 hours, range = 2 – 5 hours), interviewers obtained detailed information about participants' functioning in the areas of work, close relationships, overall well-being, and their capacity to plan for the future and reflect on their current situation. After each assessment, trained interviewers rated participants based on their overall impressions on a 5-point scale: 1 = poor functioning in all major areas and the presence of pervasive and chronic problems, 2 = poor adaptation in at least two areas but some indication that functioning may improve, 3 = fair adaptation such that there may have been minor problems in more than one area or adequate functioning in most areas with pervasive problems in one area, 4 = good adaptation with possible minor problems in one or two areas, 5 = excellent adaptation but not the total absence of problems or issues. Our global adaptation measure shows good concurrent validity; it is correlated with the developmental task measures at age 26 (educational attainment, $r = .47$, $p = .000$; work ethic, $r = .52$, $p = .000$; romantic relationship involvement, $r = .25$, $p = .002$), life stress at age 26 ($r = -.38$, $p = .000$), and externalizing scale scores from the Achenbach Young Adult Self Report ($r = -.21$, $p = .006$; Achenbach, 1997).

Control Variables

Descriptive statistics for control variables are reported in Table 1.

Gender—Participants' gender obtained from birth records (male = 79, female =80).

IQ at 9 years—The abbreviated short form (vocabulary, similarities, block design sub-tests) of the Wechsler Intelligence Scale for Children – Revised (WISC-R; Wechsler, 1974) was administered by trained graduate students. The reliabilities of each subtest are .79 or

greater, and a validity coefficient of .93 with the Full Scale IQ is reported by Sattler (1982). Derived IQ's, using Sattler's (1982) computational method for short forms, are included in analyses.

Externalizing and internalizing behavior problems at 16 years—English teachers completed the Teacher's Report Form (TRF; Achenbach & Edelbrock, 1986) when participants were 16 years old. Teachers rated items on the behavior checklist on a 3-point scale of not true (0), somewhat or sometimes true (1), and very true or often true (2). Normalized t-scores from the broad-band externalizing and internalizing scales were used in the current study. Higher scores indicate higher levels of behavior problems.

Peer competence at 16 years—A teacher nomination procedure was used to assess participant's level of social competence with peers at age 16 years. The teachers were asked to read a description of a socially competent adolescent (e.g., good social skills, peer group acceptance, has friends) and rank order the target adolescent in relation to other adolescents in the classroom. Each adolescent's rank score was calculated into a percentile rank by taking the number of adolescents below the participant's ranking divided by the number of adolescents in the class multiplied by 100. Higher scores are associated with higher levels of peer competence.

Parental monitoring at 16 years—Participants' mothers responded to questions about parental monitoring during interviews conducted when participants were 16 years old. Six questions assessed caregivers' (a) knowledge of their adolescent's friends and activities, (b) knowledge of adolescents' whereabouts, and (c) limit-setting behavior. A global rating of parental monitoring was assigned: "low" (1) to "high" (3). Interrater reliability was calculated based on 20% of the available cases, the intraclass correlation was .79.

Current substance use at 26 years—Questions on the Adult Health Survey (modified version of the Adolescent Health Survey; Blum, Resnick, & Bergeisen, 1989) were used to develop 3-point (0 to 2) variables of alcohol quantity, marijuana frequency, and frequency of illicit drug use. Participants reported on the amount of alcohol they usually drink in one sitting and the frequency of marijuana and other illicit drug use during the past year. The amount of alcohol consumed (0 = none, 1 = light to moderate use [1-3 drinks for women and 1-4 for men], 2 = heavy use [4 or more drinks for women and 5 or more for men] was obtained from participants' responses to the question "If you drink beer/wine/hard liquor, generally, how much do you drink at one time." Marijuana frequency (0 = never, 1 = once a month or less, 2 = more than once a month) was based on participants' responses to the question "How often do you use marijuana". Frequency of other illicit drug use (0 = never, 1 = once a month or less, 2 = more than once a month) was based on participants' responses to a series of questions asking "How often do you use _____" for each of the following drugs: pcp, lsd, inhalants, meth, downers-sedatives, cocaine, crack, heroin, and club drugs. These three variables were then added together to form a single variable of current substance use (0 to 6) with 0 indicating no use of substances and 6 indicating heavy use of alcohol, marijuana, and at least one other illicit drug.

Missing Data

All participants included in data analysis had been previously assigned to an adolescent substance use group and had complete data for all of the variables included in the analyses with the exception of IQ and substance use at age 26. Missing data were as follows: IQ = 5.7% and substance use at age 26 years = 0.6%.

Data Analysis Plan

Multiple imputation was used to impute missing values based on the variables included in the analysis as well as mother's age at the birth of the participant and mother's level of education when participant was 16 years. MPlus 6.1 (Muthén & Muthén, 1998-2010) was used to impute missing values of IQ and 26 year substance use, with ten imputed datasets used for each analysis.

Initially we intended to conduct an ordinal regression analysis examining each outcome measure. However, there was gross evidence that the parallel regressions (proportional odds) assumption was violated, suggesting that different scale locations were operating differently for different substance use groups. Given this violation, we created theoretically relevant binary splits of each outcome variable as follows: (a) educational attainment—high school graduation or higher (n = 129) vs. did not complete high school (n = 30), (b) work ethic—good or better work ethic (n = 80) vs. poor to fair work ethic (n = 79), (c) romantic relationship involvement— dominant pattern of only long-term (4 months or longer) relationships (n = 99) vs. little or no relationship to less than regular involvement in long-term relationships (n = 60), and (d) global adjustment—good or better global adjustment (n = 91) vs. poor to fair adaptation (n = 68). Figure 1 shows the frequencies of each adolescent substance use group on each of the binary splits for all four outcome measures.

Logistic regression analyses were conducted to determine whether substance use groups at age 17.5 years predicted the likelihood of having a higher score on the binary split of each outcome measure controlling for gender; IQ; externalizing and internalizing behavior problems, peer competence, and parental monitoring at 16 years; and substance use at 26 years. Multiple group comparisons were used to determine which substance use groups had significantly different probabilities.

Results

The logistic regression coefficients for the outcomes and comparisons of adolescent substance use experimenters to the three other adolescent substance use groups on the outcome measures are reported in Table 2. Data presented in the table indicate the increased or decreased probability of each outcome comparing experimenters with abstainers, at-risk youth, and abusers. Since all outcomes are examined as binary splits, when the parameter estimates are positive (negative), the odds ratio (OR) indicates the increased (decreased) odds of the adolescent substance use experimenters having a specified outcome compared to the comparison group after controlling for all of the covariates.

Educational Attainment

Adolescent experimenters were 8.83 times more likely than abstainers to have a high school diploma or higher level of education at 26 years. At-risk youth were not significantly different from abstainers, experimenters, or abusers when examining educational attainment at 26 years, abstainers were also not significantly different from abusers.

Work Ethic

Adolescent experimenters were 4.04 times more likely than abusers to have good or better work ethic between the ages of 23 and 26 years. The work ethic of adolescent abstainers was not significantly different from experimenters, at-risk users, or abusers; at-risk youth were also not significantly different from abusers on work ethic.

Romantic Relationship Involvement

Young adults who were adolescent substance use experimenters were 3.23 times more likely than at-risk youth to have had regular involvement in long-term romantic relationships in early adulthood. Adolescent abstainers, at-risk users, and abusers were not significantly different on romantic relationship status at age 26 years.

Global Adjustment

Adolescent experimenters were 4.08 times more likely than at-risk users to have good or excellent global adjustment at age 26 years. Abstainers were not significantly different on 26 years global adaptation compared to experimenters, at-risk users, or substance abusers in adolescence. At-risk users were also not significantly different from abusers.

Discussion

The prediction of early adult adaptation as a function of diverse patterns of adolescent substance use was explored in the current study. We investigated this question from a developmental organizational perspective, considering competence as both an overall global construct and also specifically focusing on competence within the developmentally salient domains of education, work, and romantic relationships. Results demonstrate that diverse patterns of adolescent substance use differentially predicted adaptation in early adulthood.

Adolescent experimenters demonstrated positive developmental competence in early adulthood compared to young people who engaged in alternative patterns of substance use. Individuals who experimented with alcohol or marijuana in late adolescence were significantly more likely than adolescent substance abstainers to have graduated from high school, were significantly more likely than adolescent substance abusers to have good or better work ethic, and were significantly more likely than adolescent at-risk substance users to have regular involvement in long-term romantic relationships and to have good or better global adjustment at 26 years. Given our stringent controls and the small sub-sample size of the abuser group ($n = 25$), consideration of marginal effects suggests that the abuser group may have been doing poorly in all areas of functioning in early adulthood compared to the experimenter group. Furthermore, it appears that late adolescents who were engaged in substance use at a rate where they endorsed at least one problem associated with their use (at-risk users) were doing nearly as poorly in early adulthood in developmental salient areas of functioning as adolescent substance abusers, with the exception of educational attainment.

One potential explanation for the relations could be due to the role substance use may play during adolescence. Experimentation with substances during middle to later adolescence may represent, in part, youth's active engagement in the process of identity formation, a salient developmental task of the adolescent period (Erikson, 1963). Several researchers have proposed that experimental or occasional drug use may be best understood as a developmentally normative activity that occurs during middle to late adolescence (Chassin et al., 2002; Shedler & Block, 1990). Moreover, Cicchetti and Rogosch (1999) have advocated that some use of drugs does not necessarily represent psychopathology, but rather may be associated with the developmental transitions of adolescence. Findings from the current study support this perspective. In addition, previous research with this sample examining developmental pathways contributing to experimental substance use during adolescence found that this level of substance use involvement is predicted by earlier as well as concurrent positive developmental adaptation (Siebenbruner et al., 2006). It appears that youth who are using alcohol and marijuana at a level that does not exceed experimentation during adolescence (i.e., low levels of use with no indication of problems associated with use) have developmental histories defined by adaptation, are competently engaged in the

salient developmental tasks of adolescence, and are more likely to demonstrate competent functioning in the salient developmental tasks of later years, as suggested by the results of the present study.

Adolescent abstainers did not appear to differ significantly in developmental adaptation in early adulthood from youth who experimented with substances, engaged in at-risk substance use, or abused substances during this same time frame, except with respect to educational attainment. In contrast to much of the available research suggesting that less involvement with substances is more predictive of greater educational attainment (Tucker at al., 2005, 2006; Windle & Wisner, 2004); late adolescent abstainers in our sample were less likely to have obtained a high school diploma or higher level of education compared to experimenters. Corresponding to our results, however, Maggs et al. (1997) found that high school students who drank more than their peers had an increased likelihood of completing more schooling two years later.

At first glance, it may be somewhat perplexing, given results from previous research (Tucker et al., 2006) that adolescent abstainers were not found to be significantly different from adolescent substance abusers and at-risk users on any measures of adult adaptation. One possible explanation for this finding is that past studies considered only one type of substance use or examined only abstention within a prescribed length of time (e.g., Schulenberg et al., 2005); in contrast, in the current study abstainers had never used any substances, including alcohol, prior to age 17.5 years. Although a number of our participants had not used any substances in the 6 months prior to the age 17.5-year assessment, they were classified as experimenters ($n = 37$), at-risk users ($n = 16$), or abusers ($n = 3$) based on substance use occurring prior to that date. Because of the way we classified abstainers, our sample of abstainers may have differed qualitatively from those identified in other studies. Furthermore, there may be subgroups within our adolescent abstainer group that are not captured by the current analyses. Examining the frequencies for adolescent abstainers on the outcome measures supports this possibility, for example while 22% of abstainers showed poor global adaptation; another 22% demonstrated excellent adaptation. The small group of adolescent abstainers in our sample, however, precludes further exploration of this possibility.

Adolescent at-risk substance users appeared to demonstrate poorer developmental adaptation in early adulthood than adolescent experimenters in both the area of romantic relationships and global adjustment. These youth were characterized as “at-risk” because their substance use was interfering, to a degree, with their ability to function in adolescence, but these individuals did not met the full diagnostic criteria for abuse, thus placing them on a continuum of substance use between experimenters and abusers. It seems reasonable, therefore, for adolescent at-risk users to demonstrate both developmental adaptation and maladaptation in early adulthood.

With respect to developmental adaptation within the domain of education, at-risk youth did not significantly differ from experimenters in terms of educational attainment. One reason why at-risk youth may have paralleled experimenters in educational attainment is that these youth may have experienced some degree of developmental adaptation prior to or during adolescence thus allowing for a certain degree of educational success. Our previous work examining the developmental precursors of diverse patterns of adolescent substance use supports this perspective in that at-risk youth had similar developmental histories as experimenters with the exception that they had lower levels of parental monitoring in adolescence (Siebenbruner et al., 2006). A foundation of educational competency prior to and during adolescence may have provided the basis for greater educational attainment in early adulthood.

However, within the domains of romantic relationships and global adaptation youth who engaged in at-risk substance use were less competent than adolescent experimenters. The formation of romantic relationships is a developmental task that begins to emerge during late adolescence (Roisman et al., 2004), a time when these youth are engaging in substance use that has caused at least some degree of problems in their lives. It seems likely that problematic use of substances would negatively disrupt developmental adaptation in tasks that are emerging during the same time period. Furthermore, although these youth may have experienced a developmental history characterized by some aspects of adaptation, the history of these young people may also be defined, in part, by aspects of developmental maladaptation. Thus global adaptation in early adulthood would likely also be affected by problematic substance use in late adolescence.

Although adolescent abusers had significantly poorer developmental adaptation in early adulthood only in the area of work ethic compared to experimenters, there was a trend suggesting that abusers had poorer developmental adaptation in all of the other areas of competence compared to adolescent experimenters. Our previous work indicates that adolescent substance abusers had early histories of externalizing problems, indicating a potential externalizing pathway to adolescent substance abuse (Siebenbruner et al., 2006). Although difficulty negotiating developmental tasks from childhood into adolescence may set the stage for poorer adaptation later in development, substance abuse may not only rouse challenges with the salient developmental tasks of adolescence, but will likely exacerbate an already maladaptive developmental pathway contributing to poor functioning during early adulthood. Given the small sample of adolescent abusers and that we controlled for adolescent externalizing behavior problems in this study, as well as other potential developmental predictors and current substance use, our results provide tentative support for this supposition.

Although our prospective, longitudinal design allows us to obtain detailed and comprehensive measures across time, there are trade-offs in terms of limitations to the study. One limitation is the relatively small sample size, leading to even smaller sub-group sizes. Our significant results despite these small groups and stringent controls, however, suggest our findings are robust. It may be, however, that there are further differences among the groups on adult outcome measures that are not evident due to type II error, this likelihood is evident given the large number of marginal effects. Another limitation is the use of a static conceptualization of adolescent substance use rather than trajectories of substance use; this limitation does not allow us to examine continuity and discontinuity of substance use patterns in relation to early adult adaptation. Although our sample allowed us to specifically examine a segment of the population that was at-risk for poor developmental adaptation due to being born into poverty, a population not previously examined in earlier research, it precludes generalizability of the study findings to other populations. A further limitation is that we obtained substance use data from self-report rather than substantiating these reports with biochemical analyses; however, much of the data in this area are self-reported and we have found that our participants, having been involved in the study all of their lives, have an affiliation with the study and are likely to accurately report sensitive data of this nature. Furthermore, national data indicate that in 1992, approximately 87% of high school seniors have used alcohol at some point in the past (Substance Abuse and Mental Health Data Archive, 2012); similar to the approximately 89% of our sample of 17.5 year-olds who indicated they had used either alcohol or marijuana, providing further substantiation of the accuracy of this self-reported substance use data. Despite these limitations, a significant strength of our study is that we included stringent controls in our analyses, incorporating age 16 year measures previously found to predict our late adolescent substance use groups as well as gender, IQ, and current substance use. Given this, our results are noteworthy.

Summary

Overall, the results of this study suggest that experimentation with substances may be not only normative in adolescence, but also predictive of developmental competence in early adulthood. Youth who experimented with substances, but did not reach a level of at-risk use in late adolescence, were significantly more likely to demonstrate positive adaptation both globally and in the early adult developmental tasks of education, work, and romantic relationships compared to the other adolescent substance use groups, especially adolescent at-risk substance users and abusers. Previous research on this sample (Siebenbruner et al., 2006) indicates that substance use experimenters had a history of successful adaptation up to adolescence and that engagement in low levels of alcohol and marijuana use (as evidenced by our experimenter group) may be but one possible indication of healthy identity exploration. It is important to acknowledge that the general conclusion that experimental substance use during adolescence is associated with better developmental adaptation in early adulthood does not advance the idea that adolescents should experiment with substances if they desire to function more competently in early adulthood. Adolescent experimental substance use will not cause young people to develop competencies in early adulthood. Instead, we propose that late adolescent substance use is but one aspect in development among a vast array of developmental factors that have the potential to influence early adult competence and that earlier adaptation, in concert with current circumstances, impacts how individuals negotiate salient developmental tasks.

Based on the results of this study, we propose that given the limited amounts of funding available for substance use intervention and prevention efforts, programs should target adolescents who demonstrate some degree of impairment due to their substance use rather than attempting to cast a wide net by developing programs that promote abstinence only. This does not preclude preventative efforts aimed at delaying the onset of substance use given previous research findings indicating that early onset predicts later substance abuse; however, our research suggests that adolescents who are abusing substances or are at-risk of abusing substances will benefit most from substance abuse intervention programs. Future research should explore the developmental implications of adolescent substance use later in adulthood to determine whether adolescent substance use continues to add to the prediction of adaptation across development.

Acknowledgments

This research was supported in part by grants from the National Institute of Child Health & Human Development (R01HD054850) and the National Institute of Mental Health (R01MH40864). The views expressed here are those of the authors and do not necessarily represent those of the Department of Veterans Affairs.

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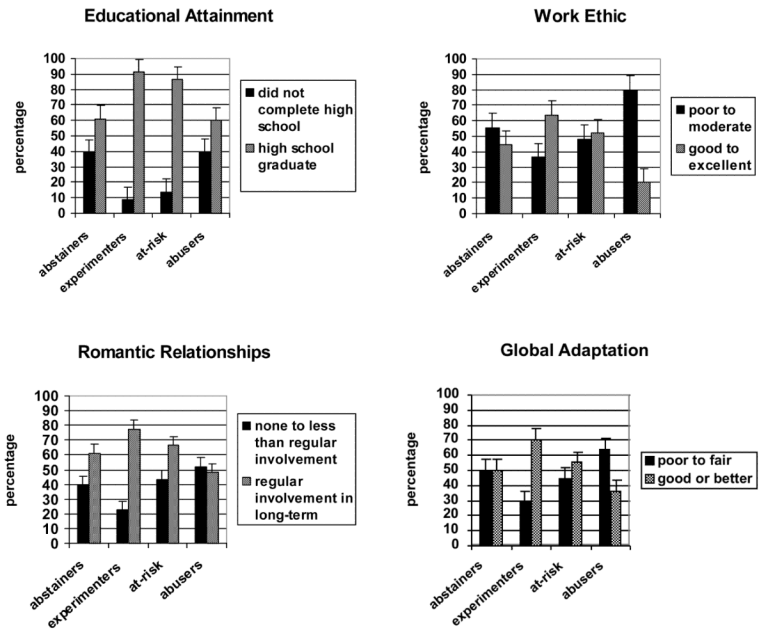

Figure 1.

Observed frequencies of educational attainment, work ethic, romantic relationship status, and global adaptation at 26 years by age 17.5 years substance use groups.

Note: Error bars indicate one standard error.

Table 1
Descriptive Statistics for Predictor Variables

Variable	*Mean*	*S.D.*	*Range*	*Frequency*
Substance Use at 17.5 by SU Group				
Alcohol Use (Past 6 months)				
Abstainers (n = 18)	0	0	0	
Experimenters (n = 58)	1.02	2.83	0-20	
At-risk (n = 58)	4.16	6.64	0-38	
Abusers (n = 25)	16.67	29.25	0-124	
Marijuana Use (Past 6 months)				
Abstainers	0	0	0	
Experimenters	.48	2.67	0-20	
At-risk	6.29	18.59	0-100	
Abusers	66.50	75.04	0-224	
Other Drug Use (Past 6 months)				
Abstainers	0	0	0	
Experimenters	0	0	0	
At-risk	.36	2.04	0-15	
Abusers	2.00	5.47	0-25	
Control Variables				
Gender				Male = 79 Female = 80
I.Q.	104.30	15.37	56-142	
Externalizing Behaviors at 16 years	55.46	9.07	40-80	
Internalizing Behaviors at 16 years	53.67	8.24	38-76	
Peer Competence at 16 years	51.90	25.82	3.33-100	
Parental Monitoring	1.99	.55	1-3	
Current Substance Use at 26				
Abstainers	1.28	.9	0-3	
Experimenters	1.50	1.06	0-4	
At-risk	1.84	1.34	0-5	
Abusers	2.56	1.45	0-6	

Table 2

Logistic Regression Analyses Predicting26 year Outcomes

	Global Adjustment Good or Better				Educational Attainment High School Diploma or Better				Work Ethic Good or Better				Romantic Relationships Regular Involvement in long-term relationships			
	B	**SE**	**p-value**	***OR***	**B**	**SE**	**p-value**	***OR***	**B**	**SE**	**p-value**	**OR**	**B**	**SE**	**p-value**	***OR***
Adolescence SU Groups																
Experimenters (*n* = 58) vs. Abstainers (*n* = 18)	.86	.68	.203	2.36	**2.18**	**.81**	**.007**	**8.83**	.63	.62	.308	1.88	1.07	.61	.081	2.92
Experimenters (*n* = 58) vs. At-Risk (*n* = 58)	**1.41**	**.52**	**.007**	**4.08**	.91	.75	.223	2.48	.74	.44	.093	2.10	**1.17**	**.45**	**.009**	**3.23**
Experimenters (*n* = 58) vs. Abusers (*n* = 25)	1.24	.69	.072	3.45	1.60	.83	.054	4.93	**1.40**	**.69**	**.041**	**4.04**	1.06	.61	.083	2.89
Sex																
Female vs. Male	.41	.45	.361	1.52	−.16	.59	.789	.85	.45	.41	.279	1.56	.49	.41	.227	1.64
IQ	**.07**	**.02**	**.000**	**1.07**	.03	.02	.066	1.04	**.03**	**.01**	**.023**	**1.03**	−.02	.01	.272	.99
Int. 16 yrs	−.00	.03	.970	1.00	−.02	.04	.532	.98	−.02	.03	.442	.98	.04	.03	.134	1.04
Ext. 16 yrs	−.02	.03	.552	.98	−.04	.03	.220	.96	−.00	.03	.955	1.00	−.04	.02	.119	.96
Parental Monitoring 16 yrs	.15	.39	.703	1.16	.92	.51	.071	2.51	.59	.38	.121	1.80	−.40	.35	.248	.67
Peer Competence 16 yrs	**.02**	**.01**	**.016**	**1.02**	**.03**	**.01**	**.023**	**1.03**	.01	.01	.109	1.01	.01	.01	.247	1.01
Current SU 26 yrs	**−.50**	**.18**	**.006**	**.61**	−.09	.19	.623	.92	−.25	.16	.127	.78	−.09	.15	.553	.92

Note: *OR* = Odds Ratio; SU = Substance Use.