

SUBSTANCE USE PROFILES FROM AGES 11 TO 18: PERSONALITY
CORRELATES AND RELATIONS WITH EMERGING ADULT ADJUSTMENT

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Dedication

This dissertation is dedicated to my husband, Erik Merilo, my parents, Jose and Peaches Oliva, and the rest of my family.

Abstract

Although the aim of the present study was to examine Shedler and Block's (1990) provocative claims that adolescent substance experimentation is associated with the healthiest psychological functioning while adolescent abstention and frequent use are both associated with poorer psychological functioning, this study extended their findings and helped fill in existing gaps in the extant literature. Utilizing a large community sample of male and female twins assessed at ages 11, 14, 18, and 21, this study was the first to incorporate all substances—tobacco, alcohol, and drugs—into an *a priori* substance classification scheme across time (i.e., created abstainer, experimenter, regular user and problem user classifications at ages 11, 14, and 18). Dimensional models of childhood and adolescent personality were used to examine the relations between both antecedent and concurrent personality characteristics and adolescent substance use profiles. Emerging adult outcomes at age 21 were assessed across multiple developmental domains. The role of developmental timing in the relations between substance use profiles and emerging adult outcomes was also investigated. The results for personality suggest that age 18 *experimenters* tend to have the most adaptive matrix of personality characteristics and *problem users* the least. Both *abstainers* and *regular users* at age 18 had personality characteristics of concern. The results for emerging adult outcomes suggest that substance use profiles have long-term developmental significance. Patterns emerged for each profile that highlighted the importance of examining outcomes *across* developmental domains while taking into account the role of *timing*. Despite garnering a

substantive amount of support for Shelder and Block's findings, *any* substance use was associated with poor emerging adult educational outcomes.

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Chapter 1. General Introduction

Adolescent substance use is an issue of serious public concern because of its association with a range of physical and psychological problems (Burt, 2002; Ellickson, Tucker, Klein, & Saner, 2004; U.S. Department of Health and Human Services, 2007). Adolescence is an especially important period because substance use initiation typically occurs during this time (Kandel & Logan, 1984) and the vast array of developmental changes that occur during adolescence (e.g., brain, puberty; Spear, 2000; Waylen & Wolke, 2004) result in a period characterized by both vulnerability and opportunity (Dahl, 2004; Schulenberg, Maggs, & Hurrelmann, 1997). Notably, dramatic increases in substance use occurs during adolescence, with rates approximately doubling between 8th and 12th grade in cigarette use (22% vs. 46%), alcohol use (39% vs. 72%), and illicit drug use (19% vs. 47%; Johnston, O'Malley, Bachman, & Schulenberg, 2007). Perhaps most troubling about these high rates is that adolescents may be particularly vulnerable to the long-term effects of substance use (Volkow & Li, 2005).

Clearly, not all adolescents who use substances develop substance use problems. Consequently, various researchers have utilized a person-centered approach that focuses on classifying individuals according to their specific profile of multiple behaviors/characteristics (Bergman & Magnusson, 1997). This person-centered approach has helped increase our understanding of common and uncommon pathways toward adaptation and maladaptation (Cicchetti & Rogosch, 1996). Moreover, it has helped identify developmental antecedents and consequences of various patterns of substance use.

Adolescent substance use has the potential to impact the transition to adulthood by not only setting the stage for later substance use but also hampering development in salient developmental tasks (e.g., academic, conduct). Thus, there has been interest in identifying factors that differentiate heterogeneous patterns of adolescent substance use behaviors (e.g., abstainers, experimenters, and frequent users) and examining whether these patterns are developmentally significant.

One of the classic studies on this topic was conducted by Shedler and Block (1990) who wrote a highly influential paper based on a small sample of individuals studied from preschool age into late adolescence ($N=85$). Based on this study, Shedler and Block concluded that adolescents who experimented with drugs (i.e., used marijuana “once or twice,” “a few times” or “once a month” and tried no more than one drug other than marijuana) were psychologically better adjusted than both drug abstainers (i.e., never tried marijuana or any other drug) and frequent drug users (i.e., used marijuana at least weekly *and* tried at least one other drug other than marijuana). One of the main findings of this study was that 18-year old adolescents with different drug use profiles could be differentiated by personality characteristics assessed earlier in development.

For instance, personality correlates at ages 7 and 11 suggested that compared to experimenters, abstainers were overcontrolled, timid, fearful, anxious, inhibited, and immobilized by stress, and that frequent users were maladjusted, insecure, unable to form good relationships, and emotionally distressed. Moreover, measures of concurrent personality taken when participants were age 18 suggested that, compared to experimenters, abstainers were overcontrolled, tense, constricted, somewhat isolated, and

lacking in interpersonal skills. Alternatively, frequent users at age 18 were characterized as relatively undercontrolled, alienated, withdrawn, unhappy, and antisocial.

Thus, both abstainers and frequent users had maladaptive personality characteristics in childhood and adolescence. Experimenters were rated as having the most adaptive personality characteristics. Based on these findings as well as findings from epidemiological studies that indicate that the majority of young adults have used marijuana yet do not go on to abuse drugs, Shedler and Block reasoned that “occasional drug use among adolescents may best be understood as a manifestation of *developmentally appropriate experimentation*” (p. 613).

This quote, regarding adolescent drug use, exemplifies one of the most significant limitations with research on adolescent substance use profiles. That is, despite the fact that adolescent substance use is generally not limited to one substance (i.e., alcohol, tobacco, or drugs), most studies have used single substances in their profile classification. Moreover, research suggests that these substances act on similar neurobiological substrates (Koob & Le Moal, 2001; Nestler, 2005) and that adolescents will use whatever substances are available and normative for their particular socio-historical circumstances (Le Moal & Koob, 2007; Resnick, Bearman, Blum, Bauman, Harris, Jones et al., 1997; Ridenour, Lanza, Donny, & Clark, 2006; Tarter, Vanyukov, Kirisci, Reynolds, & Clark, 2006). However, despite these findings, there does not appear to be any study that classifies adolescent substance use profiles using a composite substance use measure that includes tobacco, alcohol, and drugs.

Additionally, despite methodological concerns (e.g., small sample size, cohort characteristics), Shedler and Block's (1990) study has been cited over 500 times with few attempts at replication or extension. To the authors' knowledge, there are no other studies that have examined the relations between adolescent substance use profiles and robust, multidimensional measures of personality. Moreover, there are few studies that lend insight into the developmental significance of these adolescent substance use profiles for emerging adulthood outcomes.

Current Study

There are a number of gaps in our knowledge regarding the relations between adolescent substance use profiles and personality characteristics as well as emerging adult adjustment. First, despite the high rates of multiple-substance use among adolescents, no study has incorporated multiple substances into its classification scheme. Furthermore, previous studies that have examined abstainers, experimenters, and frequent users have identified a fourth group of individuals (ranging from 16-36% of the sample; Shedler & Block, 1990; Siebenbruner, Englund, Egeland, & Hudson, 2006; Tucker, Ellickson, Collins, & Klein, 2006) that were unclassifiable. Typically this group engages in patterns of use in-between that of experimenters and frequent users and can be differentiated based on antecedent developmental factors (e.g., parenting; Siebenbruner et al., 2006). In light of these findings, this study will utilize information about individuals' patterns of tobacco, alcohol, and drug use when classifying them into one of four substance use profiles (i.e., abstainers, experimenters, regular users, and problem users).

In terms of the specific research questions being examined in this study, there are two:

1. Do age 18 adolescent substance use profiles differ in antecedent (age 11) and concurrent (age 18) personality ratings?
2. Do substance use profiles at ages 11, 14, and 18 differ in age 21 emerging adult developmental outcomes?

Of note, one of Shedler and Block's (1990) main reasons for expecting *experimenters* to be the best adjusted is that they felt that drug experimentation at age 18 was *developmentally appropriate*. Thus, this current study will also examine the impact of *timing* on the relations between substance use profiles and developmental outcomes at age 21 (Question 2). If developmental appropriateness is a critical factor in these relations, one would expect that *experimentation* at age 11 would be prognostic of worse outcomes than *experimentation* at age 18 since experimentation at 11 is not developmentally appropriate.

The following two chapters will address each research question respectively. Further background information and specific hypotheses will be discussed in each chapter.

Chapter 2. Adolescent Substance Use Profiles: Antecedent and Concurrent Personality Differences in a Longitudinal Study

2.1 Introduction

Substance use behaviors are a major societal concern and have been linked to a wide range of adverse outcomes including poor health, high rates of physical injuries, impaired judgment and memory, poor academic and work performance, criminal and interpersonal violence, divorce, child maltreatment, and early death (Dore, Doris, & Wright, 1995; Haggard-Grann, Hallqvist, Langstrom, & Moller, 2006; McGinnis & Foege, 1999; Mokdad, Marks, Stroup, & Gerberding, 2004; National Highway Traffic Safety Administration, 2006; Rice, 1999; Rimsza & Moses, 2005; Roberts & Fallon, 2001; Stuart, 2005). There is an emphasis on studying adolescent substance use as increased rates of substance use over adolescence make it a period of both vulnerability and opportunity (Brown, McGue, Maggs, Schulenberg, Hingson, Swartzwelder, et al., 2008; Dahl, 2004; Schulenberg, Maggs, & Hurrelmann, 1997). Specifically, rates of substance use almost double during adolescence with epidemiological studies finding large differences between 8th and 12th graders in cigarette use (22% vs. 46%), alcohol use (39% vs. 72%), and illicit drug use (19% vs. 47%; Johnston, O'Malley, Bachman, & Schulenberg, 2007).

Besides being an important period in the development of substance use behaviors, adolescence is also a significant period for personality development. Traditionally, personality traits are characterized as enduring ways of behaving, thinking, and feeling that become increasingly stable over adulthood (Costa & McCrae, 1997; McCrae, Costa,

Ostendorf, Angleitner, Hrebickova, Avia, et al., 2000). Although there is stability in dispositional individual difference measures of personality observed as early as age 3, there is also considerable change over the life course (Roberts & DeVecchio, 2000; Shiner, Masten, & Roberts, 2003; Caspi, Roberts, & Shiner, 2005). In light of these and similar findings, a dynamic view of personality development proposes childhood and adolescence as important periods in personality development given the developing capacities of children and adolescents in physical, cognitive, social, and emotional domains. Additionally, there is evidence that adaptation and maladaptation in these developmental domains interact with personality development (Ge & Conger, 1999; Shiner, 1998; Shiner & Masten, 2002; Shiner & Caspi, 2003).

For instance, studies have documented personality-adaptation linkages: childhood and adolescent personality predict later adaptation and maladaptation, and childhood and adolescent adaptation and maladaptation predict personality (Elkins, King, McGue, & Iacono, 2006; Ge & Conger, 1999; Shiner, 2000; Shiner, Masten, & Roberts, 2003; see Tackett, 2006 for a review of personality-psychopathology linkages). Shiner and Masten's (2002) review of findings from a normative, longitudinal study of individuals followed from ages 10 to 30 showed significant relations between childhood personality at age 10 and adaptation up to 20 years later. They found that relations between personality and adaptation were bidirectional and transacted over time with childhood personality predicting adaptation in young adulthood as well as childhood adaptation predicting changes in certain personality traits (e.g., negative emotionality). Moreover,

their findings suggest complex personality-adaptation linkages that depend on the behavior and personality characteristics being studied as well as developmental timing.

Shiner (1998) suggests studying personality during developmental transitions to assess whether personality reorganization occurs during these transitions. Given the increases in substance use behaviors over the course of childhood into adolescence and the developing nature of personality during these time periods, there has been some effort to understand the nature of their relations. One approach at integrating these two research areas—i.e., substance use and personality—utilized a person-centered, *a priori* profile classification approach that yielded provocative findings (cf. Shedler & Block, 1990).

Person-centered approaches classify individuals according to their specific profile of multiple behaviors/characteristics (Bergman & Magnusson, 1997) and are useful for studying common and uncommon pathways towards adaptation and maladaptation (Cicchetti & Rogosch, 1996). These approaches have contributed to numerous advances in the field of developmental psychopathology (e.g., attachment, Ainsworth, Blehar, Waters, & Wall, 1978; antisocial behavior, Moffitt, 1993) a field defined by Sroufe and Rutter (1984) as “*the study of the origins and course of individual patterns of behavioral maladaptation, whatever the age of onset, whatever the causes, whatever the transformations in behavioral manifestation, and however complex the course of the developmental pattern may be*” (p. 18).

In contrast to empirically-derived person-centered approaches, which utilize statistical techniques such as latent class growth analysis (LCGA) and growth mixture modeling (GMM) to *estimate* profiles (or latent trajectory classes), an *a priori* person-

centered approach uses prior research and theory to construct profiles. Each approach has its strengths and weaknesses (e.g., Bauer & Curran, 2003; Cudeck & Henly, 2003; Muthén, 2003; Nagin & Tremblay, 2005; Sampson & Laub, 2005); however, the current study uses an *a priori* person-centered approach to examine relations between previously identified adolescent substance use profiles (Shedler & Block, 1990; Tucker, Ellickson, Collins, & Klein, 2006) and personality measured in childhood and adolescence.

Shedler and Block's (1990) finding that drug use profiles at age 18 could be differentiated by personality characteristics assessed earlier in development inspired the current study. They found that at age 18, compared to drug experimenters, drug abstainers had antecedent personality correlates at ages 7 and 11 that characterized them as being overcontrolled, timid, fearful, anxious, inhibited, and immobilized by stress. Additionally, they found that age 18 frequent drug users were maladjusted, insecure, unable to form good relationships, and emotionally distressed in childhood. Measures of concurrent personality when participants were 18 years old suggested that adolescent drug abstainers were overcontrolled, tense, constricted, somewhat isolated, and lacking in interpersonal skills and that adolescent frequent drug users were undercontrolled, alienated, withdrawn, unhappy, and antisocial. Given these findings, experimenters were viewed as the best adjusted profile. However, this study suffered from a number of shortcomings, including small sample size, potential cohort effects, and large number of statistical tests conducted. These findings have not been replicated in a larger, population-based sample with more robust personality measures.

Inspired, in part, by the “Big Five” factor model of adult personality, Shiner and Caspi (2003) proposed a preliminary taxonomy for childhood and adolescent personality traits. The Big Five personality factor model hierarchically organizes personality into five broad dimensions, or higher-order factors, with each broad dimension comprised of constituent lower-order factors (Digman, 1990). Traditionally, the Big Five factor model is comprised of *extraversion* (*positive emotionality*; e.g., an individual’s engagement in the world), *neuroticism* (*negative emotionality*; e.g., an individual’s likelihood of experiencing distress in the world), *conscientiousness* (*constraint*; e.g., an individual’s ability to control their impulses), *agreeableness* (e.g., interpersonal tendencies towards empathy vs. ruthlessness), and *openness to experience*. Shiner and Caspi (2003) did not include this last factor, *openness to experience*, in their preliminary taxonomy because of inconsistent findings among children and adolescents. Thus, findings in the childhood and adolescent individual differences literature involving temperament and personality can be organized around the aforementioned four higher-order personality traits, or superfactors. Lower-order personality traits contribute to these higher-order traits (e.g., social inhibition/shyness, sociability, dominance, and energy/activity level contribute to *extraversion*; Shiner & Caspi, 2003).

In terms of higher-order personality factors, in Shedler and Block’s (1990) landmark study, adolescent drug *abstainers*’ antecedent and concurrent personality characteristics suggest a history of being high in *negative emotionality* and *constraint* and low in *positive emotionality* during both childhood and late adolescence. Although adolescent *frequent users* were also high in *negative emotionality* and low in *positive*

emotionality during both childhood and late adolescence, they were also low in *constraint* and *agreeableness*. Adolescent *experimenters*, on the other hand, were characterized as low in *negative emotionality* and high in *agreeableness* and *positive emotionality* in childhood. In adolescence, they continued to be high in *positive emotionality* but scored in between *abstainers* and *frequent users* in *constraint*. These findings are consistent with previous research implicating the roles of *negative emotionality* and *constraint* in externalizing behaviors (Eisenberg, Sadovsky, Spinrad, Fabes, Losoya, Valiente et al., 2005; Gjone & Stevenson, 1997; Masse & Tremblay, 1997) and suggest that personality characteristics may identify subsets of individuals who vary in substance use risk (McGue, Slutske, & Iacono, 1999).

2.11 Current Study

A review of the literature on childhood and adolescent personality and adolescent substance use profiles identified two substantive shortcomings: (1) the use of single substances in profile classification and (2) a dearth of studies that use multidimensional personality ratings to examine the relations between adolescent substance use profiles and childhood and adolescent personality. Regarding the first shortcoming, the majority of research studies that utilize *a priori* profile classification focus on a specific type of substance (i.e., tobacco, alcohol, or drugs). However, there is compelling research suggesting that substances act on similar neurobiological substrates (Koob & Le Moal, 2001; Nestler, 2005) with adolescents being more likely to use whatever substances are available and normative for their particular environmental and socio-historical circumstances (Le Moal & Koob, 2007; Resnick, Bearman, Blum, Bauman, Harris, Jones

et al., 1997; Ridenour, Lanza, Donny, & Clark, 2006; Tarter, Vanyukov, Kirisci, Reynolds, & Clark, 2006).

Regarding the second shortcoming, although a few studies have found links between childhood personality characteristics and early-onset substance use behaviors (e.g., Cloninger, Sigvardsson, & Bohman, 1988; Masse & Tremblay, 1997), to our knowledge Shedler and Block's study (1990) is the only study that has examined the relations between adolescent substance use *profiles* and childhood and adolescent personality. Furthermore, the personality characteristics associated with early-onset substance use behaviors (e.g., high novelty-seeking and low harm avoidance) may differ from those associated with different patterns of adolescent substance use. Despite the strengths of Shedler and Block's study, it had a number of limitations including statistical problems (e.g., did not control for multiple *t*-tests), a small sample size, and potential cohort effects (e.g., drug use measured in the 1970s in the San Francisco area). Moreover, their findings have not been examined in a large, representative sample or with a profile classification approach that *uses all substances* (i.e., tobacco, alcohol, and drugs).

Understanding the relations between adolescent substance use profiles and childhood and adolescent personality can advance our knowledge of the underlying personality characteristics associated with adolescent substance use patterns and the extent to which these patterns are differentiable by factors assessed earlier in development. Specifically, this study will examine two research questions: (1) whether adolescent substance use profiles at age 18 differ in multidimensional personality characteristics at age 11 and (2) whether adolescent substance use profiles at age 18 differ

in concomitant (i.e., age 18) multidimensional, adolescent personality characteristics. The first question assesses prospective relations between personality and adolescent substance use profiles and the second question assesses concurrent relations between adolescent personality and substance use profiles. The answers to these two questions will increase our understanding of the nature of developing personality-substance use profile linkages and the amount of advance notice, if any, we can expect in predicting these relations. The research questions proposed can be straightforwardly answered through use of analysis of variance (ANOVA) techniques. Although longitudinal analytical approaches are useful in analyzing these types of data, they would answer different research questions (e.g., whether personality intercept and slope differ between substance use profiles) and would require more than two personality assessments to adequately model personality change.

Based on Shedler and Block's (1990) work we hypothesize that at ages 11 and 18: (a) *experimenters* will have the psychologically healthiest profile with moderate levels of *constraint*, low *negative emotionality*, and high *positive emotionality*; (b) *abstainers* will have relatively high levels of *constraint* and *negative emotionality* and low levels of *positive emotionality*; and (c) *problem users* will have relatively low levels of *constraint* and *positive emotionality* and high levels of *negative emotionality*. No directional hypotheses were made for *regular users*; however, there is some evidence that they may resemble experimenters (Siebenbruner et al., 2006).

2.2 Method

2.21 Participants

Participants were drawn from the Minnesota Twin Family Study (MTFS), a longitudinal study that has followed reared-together, same-sex male and female twin pairs since age 11 (see Iacono, Carlson, Taylor, Elkins & McGue, 1999 for more information on the MTFS study). Using birth records to identify eligible twins, the resultant study sample was demographically representative of Minnesota when the twins were born (~96% Caucasian). The male cohort ($n=376$ twin pairs) was recruited from 1977 to 1982 while the female cohort ($n=380$ twin pairs) was recruited from 1981 to 1985 (overall $N=1512$ participants, 50% male). The MTFS research protocol was approved by the University of Minnesota's Institutional Review Board. Participants recruited into the study lived within a day's drive of the University of Minnesota. Lengthy day-long assessments involved in this study precluded individuals with physical (e.g., blindness) or psychological (e.g., mental retardation) disabilities from participating. Approximately 17% of eligible families declined to participate in the intake MTFS assessment, but a comparison of participating and non-participating families revealed few significant differences with those choosing to participate being slightly better educated (mean of .3 more years of education). No other demographic, socioeconomic, or self-reported mental health differentiated participants from nonparticipants in the original study.

Individuals in the current study participated in two assessments. Participants were a mean age of 11.71 ($SD=.43$) at baseline with their later assessment occurring approximately six years later (mean age=18.16, $SD=.70$). With their parents' consent, participants gave their assent to participate in the study. The current study analyzes the

twins as individuals and does not seek to infer genetic and environmental contributions to phenotypic differences. To be eligible for the current study, participants had to have data on socioeconomic status (SES; a covariate in our statistical analyses that is described in the measures section), substance use profiles, and at least one personality measure at baseline or follow-up (age 18). Three-hundred and seventy-eight (26%) of intake participants were missing data for the baseline personality analyses (51% male) and 281 (18%) of participants (60% male) were missing data for the follow-up personality analyses. Table 1 contains demographic information about the sample.

Attrition analyses using baseline characteristics of gender, race, SES, and personality characteristics (described in more detail below) compared participants included in the current study to those excluded due to missing data. For baseline personality analyses, those not included in the analyses were significantly more likely to be non-white (6% non-white among those with missing data versus 3% non-white among those without missing data), lower in SES (Cohen's $d = -.45$), and lower in personality characteristics of well-being ($d = -.18$), achievement ($d = -.18$), traditionalism ($d = -.21$), and positive emotionality ($d = -.20$), and higher in aggression ($d = .17$). For age 18 analyses, individuals excluded from analyses were significantly more likely to be male (60% male among those missing data versus 47% males among those without missing data), lower in SES ($d = -.38$) and lower in baseline personality characteristics of well-being ($d = -.18$), achievement ($d = -.23$), control ($d = -.16$), traditionalism ($d = -.24$), positive emotionality ($d = -.21$), and constraint ($d = -.22$), and higher in aggression ($d =$

.19). In sum, most of the significant differences were small; however, there were medium effect sizes for SES.

2.22 *Measures*

Socioeconomic Status

Each parent's highest level of education was coded on a 6-point scale (1=less than high school, 2=GED, 3=high school degree, 4=some college/business certificate/associate's degree, 5=bachelor's degree, 6=professional degree). For each family, the highest occupational status for a full-time employed parent was coded on a 7-point Hollingshead scale (1=unskilled labor to 7=professional/executive positions). Educational scores for each parent and the highest occupational status scores for each family were standardized and summed. The summed scores were standardized again to form a composite socioeconomic (SES) status indicator with a mean of 0 and standard deviation of 1.

Substance Use

Substance use, abuse and dependence (e.g., tobacco, alcohol, marijuana, and other drugs) were assessed at the age 18 follow-up. Structured clinical interviews were administered independently to each participant by trained interviewers and included the Diagnostic Interview for Children and Adolescents-Revised, child version (DICA-R-C; Herjanic & Reich, 1982; Reich & Welner, 1988) and the expanded Substance Abuse Module (Robins, Babor, & Cottler, 1987) from the Composite International Diagnostic Interview (Robins et al., 1988). Substance abuse and dependence symptoms during the past three years were assessed using Diagnostic and Statistical Manual of Mental

Disorders, 3rd edition-revised, criteria (DSM-III-R; American Psychiatric Association, 1987), the standard diagnostic manual used when the MTFs study began; however, DSM-IV criteria (American Psychiatric Association, 1994) were also used. Substance abuse and dependence symptoms were assigned by consensus case conferences of two or more clinical psychology graduate students using all available information (diagnostic kappa reliabilities were all greater than .91; see Iacono et al., 1999 for more information).

Substance Use Profiles

The substance use measures were used to create substance use profiles for each individual at age 18. Based on previous research, the following criteria were used to create the four substance use profiles based on individual patterns of use at age 18:

- **Abstainer:** No substance use reported

- **Experimenter** (any of the following led to inclusion in this profile):
 - ALCOHOL: Drank alcohol without parent's permission but drank no more frequently than "once a month or less" or did not drink to intoxication more than 11 times
OR
 - TOBACCO: Had *ever* used tobacco (<daily/near daily)
OR
 - ILLICT DRUGS: Used an illicit drug; however, used any one drug less than 12 times (i.e., marijuana, amphetamines, barbiturates, tranquilizers, cocaine, heroin, opiates, PCP, other psychedelics, inhalants, OR other drugs)

- **Regular user** (any of the following led to inclusion in this profile):
 - ALCOHOL: Drank alcohol without parent's permission drinking "once a week or several times per week," "everyday or a couple times a week," or to intoxication at least 12 times.
OR
 - TOBACCO: Reported "daily/nearly daily tobacco use"
OR
 - ILLICT DRUGS: Used a single illicit drug at least 12 times (i.e., marijuana, amphetamines, barbiturates, tranquilizers, cocaine, heroin, opiates, PCP, other psychedelics, inhalants, OR other drugs)

OR

- CONSENSUS: Had one symptom of substance abuse or dependence (DSM-III-R or DSM-IV)
- **Problem users:** Had at least two symptoms of substance abuse or dependence for any one substance (DSM-III-R or DSM-IV)

Personality

Baseline—Parent-report

At baseline assessment, parents (over 99% maternal-report) completed a 34-item questionnaire asking them to rate their sons or daughters on characteristics similar to those used to create personality ratings using the Multidimensional Personality Questionnaire (MPQ; Tellegen & Waller, 1994; see below for more information). Factor scales were created to approximate 10 of the 11 MPQ primary scales which include well-being, social potency, achievement, social closeness, stress reaction, alienation, aggression, control, harm avoidance, and traditionalism. Baseline absorption, the 11th MPQ scale, was not used in this study. Each primary scale was comprised of three separate items (one item was not used for any of the scales) with each item being rated on a 4-point scale ranging from “my son/daughter is definitely low on this trait” to “my son/daughter is definitely high on this trait.” Higher-order superfactors similar to the three MPQ higher-order superfactors (i.e., *positive emotionality*, *negative emotionality*, and *constraint*) were also created by forming composites of the scales that load principally on each of the three MPQ higher-order factors. That is, *positive emotionality* was created by summing achievement, well-being, social potency, and social closeness; *negative emotionality* was created by summing alienation, aggression, and stress reaction; and *constraint* was created by summing traditionalism, harm avoidance, and control.

Internal consistency reliabilities for the individual 3-item primary scales ranged from .53 to .76 (mean=.63), which, although generally below the .70 standard, is reasonable given that each scale was comprised of 3 items. The composite reliabilities for the higher-order factors were all within the acceptable range (.73 to .82). Primary scale scores ranged from 3 or 4 to 12 and higher-order superfactors scores ranged from 21 to 48 for *positive emotionality*, 9 to 32 for *negative emotionality*, and 13 to 36 for *constraint*.

Age 18—Self-report

At age 18 participants completed a shortened (198-item) MPQ (Tellegen & Waller, 1994), a self-report personality instrument designed to assess a broad range of personality characteristics. The MPQ consists of the 11 aforementioned primary scales (18 items per subscale; each item rated on a 4-point scale from “strongly agree” to “strongly disagree”) that are used to compute the three aforementioned higher-order superfactors (see Table 2 for a description of the scales of interest in this study). The primary scales contribute to the three higher-order superfactors with ***positive emotionality*** primarily comprised of *achievement*, *well-being*, *social potency*, and *social closeness*; ***negative emotionality*** primarily comprised of *alienation*, *aggression*, and *stress reaction*; and ***constraint*** primarily comprised of *traditionalism*, *harm avoidance*, and *control*. MPQ internal consistency reliabilities range from .78 to .90 and 30-day test-retest reliabilities range from .82 to .92. Primary scale scores ranged from 18 to 23 up to 72. Higher-order superfactors ranged from 42 to 145 for *negative emotionality*, 64 to 165 for *positive emotionality*, and 67 to 186 for *constraint*.

2.23 Analysis Plan

Analysis of Variance (ANOVA) was used to investigate the relations between age 18 adolescent personality profiles and (1) antecedent (age 11) personality traits, and (2) concurrent (age 18) personality traits. Due to the clustered nature of these family data, hierarchical linear models using PROC MIXED of the Statistical Analysis System, version 9.1 (SAS 9.1) were used in all of the analyses. The model included covariates of gender, SES, and age when personality was assessed. A substance use profile by gender interaction was included to assess whether the effects differed by gender. ANOVAs were interpreted if they met significance after a Bonferroni correction for multiple tests (i.e., $.05/13 = .004$ level of significance). Post-hoc planned pair-wise comparisons were conducted for significant ANOVAs and compared: (1) abstainers and experimenters, (2) abstainers and regular users, (3) abstainers and problem users, (4) experimenters and regular users, (5) experimenters and problem users, and (6) regular and problem users. Effect sizes—estimated by dividing the difference in the covariate-adjusted means by the residual standard deviation—and confidence intervals are reported for all pair-wise comparisons. Since personality was assessed at ages 11 and 18, test-retest correlation coefficients were used to assess rank-order stability over time (i.e., the consistency in individuals relative ordering over time).

2.3 Results

Table 1 displays the demographic characteristics of the sample. Profile differences in demographic characteristics were found for gender ($p < .001$), SES ($p < .001$), age at baseline ($p < .001$), and age at follow-up ($p < .001$) with age 18 problem

users being more likely to be male, lower in SES, and older at baseline and age 18 assessments. These demographic differences were expected and provide further support for their use as statistical covariates. There were no significant profile by gender interactions observed for any of the analyses; thus, the profile means will be reported for both males and females combined. Table A3 contains a full summary of the ANOVA analyses for all variables included in the analytical models.

2.31 *Rank-order stability in personality from ages 11 to 18*

Table 2 displays the reliability estimates and scale descriptions for the age 11 personality characteristics assessed in this study. Pearson correlations were used to estimate the 7-year test-retest stability coefficients among the MPQ primary scales and higher-order factors. The stability coefficients were generally small to medium, ranging from .13 (e.g., social closeness) to .35 (constraint) with an average of .22. Thus, at a rank-order level, the MPQ primary and higher-order factor scales were not particularly stable from age 11 to age 18; however, at age 11 they were primarily based on maternal-report whereas at age 18 they were based on self-report.

2.32 *Antecedent (age 11) personality and age 18 substance use profiles*

To assist with interpretation and profile comparisons, personality scores were normed on a *T*-scale ($M=50$, $SD=10$) based on the mean and standard deviation of the overall sample (see Figure A1). After statistically adjusting for age at personality assessment, gender, and baseline SES, there were no significant profile group differences in *positive* or *negative emotionality*. There were significant profile group differences for the higher-order *constraint* superfactor and its primary contributory scales—control,

harm avoidance, and traditionalism (see Table 3). Effect sizes (ES) were medium to large in magnitude for *constraint* and small to large in magnitude for control, harm avoidance, and traditionalism (see Table A1).

Age 18 *abstainers* were significantly higher in baseline *constraint* compared to all other profiles (ES range=.32-.82). Age 18 *experimenters* scored between *abstainers* and *regular* and *problem users* in baseline *constraint* (ES range=.32-.50). Age 18 *regular* and *problem users* did not significantly differ from one another in baseline *constraint*.

Although these patterns of findings were generally observed for the primary scales of control, harm avoidance, and traditionalism, there were a few differences with age 18 *abstainers* and *experimenters* not significantly differing from one another in baseline traditionalism. *Experimenters* and *regular users* did not significantly differ in baseline harm avoidance.

2.33 Concurrent personality and age 18 substance use profiles

Age 18 personality scores were also normed on a *T*-scale ($M=50$, $SD=10$) based on the mean and standard deviation of the overall sample (see Figure A2). After statistically adjusting for age at personality assessment, gender, and baseline SES, significant differences in concurrent personality by age 18 substance use profiles were observed for *constraint*, *negative emotionality*, and their primary contributory scales (see Table 4). Although the findings for age 18 *constraint* were generally similar to the age 11 personality findings, the effect sizes were generally much larger at age 18 with all profiles significantly differing from one another (ES range=.34-1.44, see Table A2). Effect sizes for *negative emotionality* were in the medium to large range. The findings for

positive emotionality were more complicated. Specifically, although significant profile differences were found for social potency, achievement, and social closeness (i.e., three of the four primary contributory scales for *positive emotionality*), there were no significant profile differences in *positive emotionality*. These findings are perhaps best accounted for by considering the “agentic” versus “communal” patterns.

Prior work with the MPQ used a four-factor model of personality that breaks *positive emotionality* into two higher-order factors, namely “agentic” and “communal” factors (Blonigen, Carlson, Hicks, Krueger, & Iacono, 2008; Tellegen & Waller, 2007). Although social potency and well-being contribute to both scales, the *agentic* superfactor is described as an “effectance” characteristic that describes individuals’ motivation and ability to interact with and control one’s environment (Tellegen & Waller, 2007; cf. White, 1959). On the other hand, the communal superfactor characterizes the more interpersonal aspects of positive emotionality. Generally, the achievement scale is most associated with *agentic positive emotionality*, while social closeness is the scale most associated with *communal positive emotionality*. When analyses were conducted for these two superfactors separately, significant profile differences emerged with effect sizes in the medium to large range (ES range=.35-.71; see Table 4).

In terms of concurrent *constraint*, age 18 *abstainers* were still the highest in age 18 *constraint* (large ES range=.55-1.44), followed by *experimenters*, *regular users*, and *problem users*. The findings for the primary contributory scales—control, harm avoidance, and traditionalism—show a similar pattern; however, abstainers and

experimenters did not significantly differ from each another in harm avoidance nor did regular and problem users.

Regarding *negative emotionality*, age 18 *problem users* were the highest compared to all other profiles (medium to large ES range=.42-.55). This pattern was generally seen in the primary contributory scales (i.e., stress reaction, alienation, and aggression); however, abstainers were lower in alienation compared to experimenters (small ES=-.26) and all profiles differed from one another in aggression with abstainers being the least aggressive followed by experimenters, regular users, and problem users who were the most aggressive (small to large ES range=.30-1.08).

Significant profile differences in both *agentic* and *communal positive emotionality* were found. Effect sizes ranged from medium to large. For *agentic positive emotionality* and its primary contributory scale of achievement, *abstainers* were significantly higher than all other profiles (ES range=.37-.53 and .27-.52 respectively). *Experimenters* were also higher than problem users in achievement (small ES=.24). Interestingly, *abstainers* were lowest in social potency compared to all other profiles (medium to large ES range=-.34 to -.62) and *experimenters* were lower in social potency compared to regular and problem users. Problem and regular users did not significantly differ from one another in social potency.

For *communal positive emotionality*, *abstainers* were significantly lower than all other profiles (medium to large ES range=-.37 to -.71) and *experimenters* were lower than regular users (medium ES=-.35). For the primary contributory scale of social closeness, *regular users* were significantly higher than all other profiles (small to large

ES range=.25-.56) and *abstainers* were lower than experimenters (small to medium ES=.31). Although the findings for well-being approached significance, the *p*-value of .005 did not meet the .004 minimum criterion.

2.34 *Antecedent and concurrent relations between personality and substance use profiles*

Although a host of significant differences were observed when concurrent age 18 substance use profiles and age 18 personality were examined, with the exception of *constraint* and its primary contributory scales (i.e., control, harm avoidance, and traditionalism), these differences were not observed at baseline.

2.4 Discussion

This study examined whether adolescent substance use profiles at age 18 differ in antecedent (age 11) and concurrent (age 18) personality characteristics. Our findings suggest that age 18 substance use profiles antecedently and concurrently differed in the personality superfactor of *constraint*. A gradient of association between personality and substance use profiles was found with individuals high in constraint (overcontrolled, traditional, harm avoidant) being the least likely to use substances and those low in constraint (undercontrolled, non-traditional, risk-taking) being the most likely to have severe patterns of adolescent substance use. In addition, concurrent personality differences between substance use profiles were found for aspects of *positive* and *negative emotionality*. Notably, profile differences in *negative emotionality* suggest that compared to all other profiles, *problem users* were most likely to experience negative emotions.

Regarding the first hypothesis, that age 18 *experimenters* will have the healthiest personality functioning (i.e., moderate *constraint*, low *negative emotionality*, high *positive emotionality*), there was no substantive evidence of this for antecedent (age 11) or concurrent (age 18) personality functioning. Although age 18 *experimenters* scored moderately in concurrent *constraint*, in general, they tended to score moderately across all measures of personality, tending to have the most normative constellation of concurrent personality characteristics. Whether or not this constitutes the healthiest personality profile is debatable; however, compared to the other three profiles, they do not appear to have any particular personality characteristics of concern.

Regarding the second hypothesis, that age 18 *abstainers* would be relatively high in *constraint* and *negative emotionality* and low in *positive emotionality*, *abstainers* were the highest in *constraint* at ages 11 and 18; however, there were no significant differences in *positive* or *negative emotionality* at age 11. At age 18, *abstainers* were not relatively high in concurrent *negative emotionality* with mixed findings for *positive emotionality*. Although, *abstainers* were lowest in *communal positive emotionality*, they were highest in *agentic positive emotionality*. Thus, age 18 *abstainers* were constrained, overcontrolled, harm avoidant, and traditional individuals at ages 11 and 18. At age 18 they were also high in achievement but low in social potency and social closeness.

The personality characteristics of *abstainers* stimulate a number of questions for future research. For instance, would the personality characteristics of *abstainers* facilitate their functioning in conduct (rule-abiding behaviors) and academic domains but hinder their functioning in social domains (perhaps because they are high in constraint, raising

the possibility that they may be inhibited and less likely to be socially engaged)? In addition, do *abstainers*' constraint and poor interpersonal personality functioning continue over time and, if so, do the cumulative effects eventually have a negative impact on their well-being and feelings of alienation? Moreover, would success in academic and work domains potentially be protective and buffer them from the potential negative impact of poor social functioning? These questions are important because, as Shedler and Block (1990) suggested, the struggles faced by *abstainers* may go unnoticed since they are struggles of omission versus commission. That is, their constraint and interpersonal difficulties may not be evident to others and may make it difficult for them to fully engage in life and establish meaningful relationships.

In terms of the third hypothesis, that *problem users* would be relatively low in *constraint* and *positive emotionality* and high in *negative emotionality*, *problem users* were lower in *constraint* at age 11 relative to *abstainers* and *experimenters* (they did not significantly differ from *regular users*). However, no significant profile differences were found for *positive* or *negative emotionality*. The concurrent findings provide more support for this hypothesis, in that age 18 *problem users* scored lowest in *constraint* and highest in *negative emotionality*. Findings for *positive emotionality* were mixed; *problem users* scored higher than *abstainers* in *communal positive emotionality* but lower than *abstainers* in *agentic positive emotionality*. Interesting similarities and differences between *problem users* and other profiles emerged. Specifically, similar to *abstainers*, *problem users* were low in social closeness; however, similar to *regular users*, *problem users* were high in social potency.

Overall, these findings suggest that *problem users* have a maladaptive personality constellation in that they are undercontrolled, stress reactive, alienated, aggressive, non-traditional, risk-taking individuals who are low in achievement. Unexpectedly, *problem users* were also high in social potency. In general, these findings fit well with previous research suggesting links between substance abuse and undercontrol (Iacono et al., 1999). There is evidence that individuals with an undercontrolled personality constellation are typically not solely substance abusers, but also have problems in other externalizing domains and risk behaviors (e.g., conduct disorder; health risk behaviors; problem behaviors; Caspi, Begg, Dickson, Harrington, Langley, Moffitt et al., 1997; Iacono et al., 1999; Jessor, 1987; Krueger, Hicks, Patrick, Carlson, Iacono, & McGue, 2002; Loukas, Zucker, Fitzgerald, & Krull, 2003; Shiner, 1998; Taylor & Iacono, 2007).

It is likely that the personality characteristics of *problem users* at age 11 have both active and evocative genotype-environment effects (Scarr & McCartney, 1983) that have implications throughout development. For instance, *problem users* may choose situations and peers that promote both substance use behaviors and maladaptive personality development while their personality characteristics (e.g., undercontrolled, disinhibited) may attract other deviant peers or evoke treatment from adults and peers that put them at risk for problematic substance use (Feske, Tarter, Kirisci, Gao, Reynolds, & Vanyukov, 2008; Mezzich, Tarter, Kirisci, Feske, Day, & Gao, 2007; Wills & Dishion, 2004).

With regard to findings for *regular users*, their personality characteristics tend to fall in between those of experimenters and problem users. At age 11, *regular users* did not significantly differ from problem users in *constraint* (both were relatively low

compared to abstainers and experimenters); however, by age 18, *regular users* were higher than problem users in *constraint* but still lower than the other two profiles. At age 11, although *regular users* were not significantly more aggressive than experimenters, by age 18 they were significantly more aggressive. Notably, at age 18, *regular users* had an interesting personality matrix—along with problem users they were higher than experimenters and abstainers in social potency; however, unlike problem users they were among the highest in social closeness (did not differ from experimenters).

The findings for *regular users* suggest they may be at increased risk for problems in the domain of conduct (e.g., rule-abiding behaviors) given their relatively low *constraint* and high aggression. However, compared to the other profiles, *regular users* were high in interpersonally-related personality functioning and interestingly, were not high in personality characteristics related to internalizing problems (e.g., stress reactivity, alienation). These findings fit with Siebenbruner et al.'s (2006) research which found that the major difference between late-adolescent experimenters and regular (“at-risk”) users was parental monitoring. Although not assessed in this study, poor parental monitoring of adolescents who may be low in *constraint* may increase their risk for poor adaptation in areas in which *constraint* is important during adolescence (e.g., conduct; externalizing behavioral outcomes).

In general, the findings suggest that individuals who engage in more severe patterns of substance use at age 18 (i.e., *regular* and *problem users*) were the lowest in *constraint* at age 11 while substance *abstainers* were the highest. Moreover, at age 18, *problem users* were the highest in *negative emotionality* and *abstainers* were the lowest

in *communal positive emotionality*. Testing these relations in a *developmental cascades model* may increase our understanding of how personality systems work together (Shiner, 1998).

A *developmental cascades model* is a methodologically rigorous approach that examines the relations between factors over time using structural equation modeling to reduce confounds (cf. Masten, Roisman, Long, Burt, Obradovic, Riley et al., 2005). For example, using this approach, Masten and colleagues found that childhood externalizing problems undermined adolescent academic achievement, which in turn increased risk for young adult internalizing problems. Understanding the role that personality characteristics play in these developmental cascades may help identify mechanisms through which these cascades develop and carry forward. Although a number of studies suggest that “childhood personality foreshadows a variety of life outcomes at least through late adolescence and the beginnings of adulthood” (Shiner, Masten, & Roberts, 2003, p. 1148), there are few studies that test these relations in longitudinal, population-representative samples.

In addition to examining the cascades involved in personality development from childhood into adulthood, understanding other contextual influences involved in these transactions may help identify ways to promote healthy personality development. As Cicchetti and Rogosch aptly stated “The meaning of any one attribute, process, or psychopathological condition needs to be considered in light of the complex matrix of individual characteristics, experiences, and social-contextual influences involved, the timing of events and experiences, and the developmental history of the individual”

(Cicchetti & Rogosch, 1996, p. 599). This study suggests two potentially important personality characteristics that may warrant further contextual investigation—social potency and achievement.

With regard to social potency, although age 18 *regular* and *problem users* were both high in concurrent social potency, *regular* users were high in social closeness (medium effect size). Perhaps social dominance has differing effects depending on the person and his/her developmental history and context. For instance, social dominance in a person who is relatively warm and sociable (*regular user*) may have a different effect than social dominance in a person who is low in sociability and control and high in risk-taking, aggression, stress-reactivity, alienation, and who has low moral standards (*problem user*). Moreover, regarding achievement, in order to develop effective interventions, interventionists may want to examine *how* achievement negatively relates to substance use.

Additionally, understanding peer relationships among the different adolescent substance use profiles over time may lend insight into how their personality characteristics affect their peer relationships and vice versa. For instance, taking charge of a deviant peer group may amplify negative personality characteristics (e.g., increase the likelihood of engaging in deviant activities which may lead to the development, or perpetuation, of maladaptive personality characteristics). Furthermore, in terms of intervention, given the substance use patterns of *regular* and *problem users*, it may be important to examine the nature of their substance use (e.g., motivation, expectations) and the contexts in which it occurs as different interventions may be warranted (Metrik,

McCarthy, Frissell, MacPherson, & Brown, 2004; Neighbors, Lee, Lewis, Fossos, & Larimer, 2007; van Schoor, Bot, & Engels, 2008).

Notably, our data suggest considerable personality change from age 11 to age 18. Interestingly, among all substance use profiles, only age 18 *problem users* exhibited poor concurrent *negative emotionality*. It is unclear whether their problematic substance use is a result of, and/or a contributing factor to, their maladaptive personality functioning; however, our study adds to the substantive literature suggesting that the path towards problematic adolescent substance use begins with difficulties in age 11 *constraint*.

Future studies should test competing models of the personality-psychopathology relationship (cf. Tackett, 2006) using prospective, longitudinal designs. This approach may increase our understanding of the complex relations between personality and substance use behaviors. Moreover, dramatic developmental changes in a multitude of domains (e.g., physical, social, cognitive) occur over the course of middle childhood to adolescence, as well as adolescence into emerging adulthood, with evidence suggesting that adaptation and maladaptation in these domains can impact personality development (Ge & Conger, 1999; Shiner, Masten, & Tellegen, 2002). Therefore, short-term longitudinal studies that include measures of personality and adaptation may yield insight into the stability of personality and how it relates to adaptation (Shiner, 2000).

Limitations

This longitudinal study examined the antecedent (age 11) and concurrent (age 18) personality characteristics of adolescent substance use profiles at age 18 and found that adolescent substance use profiles differed in the personality measures of *constraint* at

ages 11 and 18 and aspects of *positive* and *negative emotionality* at age 18. Despite its contributions to the field, this study does have limitations. Firstly, this sample was predominantly Caucasian (96%); therefore, future studies should examine whether these findings hold in more diverse samples. Secondly, future research may want to explore the nature of the relations for individual substances (tobacco, alcohol, illicit drugs) as they may differ by substance. For instance, it may be that combining substances masks relations that exist primarily for illicit substances. Lastly, although our study partly addresses the need for research that examines personality continuity among children over time (Caspi, Roberts, and Shiner, 2005; Shiner, Masten, & Roberts, 2003), the rank-order stabilities of the MPQ scales were relatively small with parents reporting on children's personality at age 11 and participants reporting on their own personality at age 18. Thus, discrepant findings could be due to method factors.

However, another longitudinal study that used self-reported MPQ data at age 20 and multiple raters of childhood personality found similar small to moderate correlations between childhood personality characteristics and age 20 MPQ personality characteristics (Shiner, Masten, & Tellegen, 2002). Thus, our small stability coefficients are not anomalous and may instead reflect the developing nature of personality from age 11 to age 18. Future studies should extend these findings into adulthood as it has been argued that the study of personality from childhood into adulthood offers a more rigorous test of continuity (Shiner, Masten, & Roberts, 2003). In addition, studies looking to integrate multiple reporters may want to utilize teacher ratings as Shiner's (1998) review suggests

that teacher-ratings show more robust relations with the Big Five personality factors than parent-ratings with equivocal results found for child-ratings.

Summary

Our findings were somewhat consistent with Shedler and Block (1990) in that antecedent and concurrent personality characteristics of age 18 *abstainers* found them to be high in *constraint*, while *regular* and *problem users* were low in *constraint* (*experimenters* scored in between these two extremes). However, adolescent substance use profiles did not significantly differ in antecedent *positive* or *negative emotionality*. Concurrent relations suggest that *experimenters* have an adaptive matrix of personality characteristics with concerns arising for various aspects of personality functioning among the other three profiles—e.g., *abstainers*' combination of relatively high *constraint* and achievement and poor social functioning; *regular users*' relatively low *constraint* and high aggression, social potency and social closeness; *problem users*' relatively low *constraint* and high *negative emotionality*. Future research may want to utilize developmental cascades and short-term longitudinal approaches (e.g., examination of peer interactions) to help identify personality-psychopathology linkages and the moderating and mediating factors involved.

Table 1. Demographic characteristics of participants for age 11 and age 18 personality analyses as a function of age 18 substance use profiles.

	<u>Age 11 Personality Analyses (N=1134)</u>				<u>Age 18 Personality Analyses (N=1231)</u>			
	Age 18 ABS (n=236)	Age 18 EXP (n=387)	Age 18 RU (n=191)	Age 18 PU (n=320)	Age 18 ABS (n=262)	Age 18 EXP (n=416)	Age 18 RU (n=207)	Age 18 PU (n=346)
% male	39%	47%	43%	63%	40%	46%	40%	60%
Family SES (baseline)	.33 (1.00)	.17 (.97)	.15 (1.08)	-.15 (.92)	.29 (1.01)	.15 (.97)	.07 (1.10)	-.19 (.94)
% Caucasian	99%	96%	95%	97%	98%	95%	95%	95%
Baseline assessment age (years)	11.64 (.46)	11.71 (.42)	11.83 (.41)	11.77 (.40)	11.63 (.46)	11.70 (.43)	11.82 (.42)	11.77 (.41)
Age 18 assessment age (years)	17.91 (.57)	18.08 (.61)	18.39 (.73)	18.32 (.75)	17.90 (.57)	18.05 (.62)	18.41 (.74)	18.29 (.76)

Note. ABS=Abstainers; EXP=Experimenters; RU=Regular Users; PU=Problem Users

Table 2. *Reliability estimates and scale descriptions for personality primary scales and higher-order superfactors.*

<i>Personality</i>	<i>Age 11 Reliability</i>	<i>Age 18 Reliability</i>	<i>7-year Stability Coefficient</i>	<i>Description of a High Scorer</i>
<i>Primary scales</i>				
Well-being	.70	.90	.19*	Cheerful, optimistic, enthusiastic, feels good about self
Social potency	.68	.87	.30*	Persuasive, tends to take charge, enjoys being in the spotlight
Achievement	.76	.86	.25*	Ambitious, has high standards, works hard, persists in face of obstacles
Social closeness	.55	.87	.13*	Warm, enjoys company of others, values close interpersonal relationships
Stress reaction	.53	.88	.13*	Tense, nervous, irritable, easily hurt, tends to worry
Alienation	.59	.89	.13*	Feels s/he is treated poorly, exploited, and that life has handed her/him a raw deal
Aggression	.61	.90	.20*	Intimidates others, may seek revenge (e.g., fight) if s/he perceives wrongdoing
Control	.54	.85	.30*	Keeps things neat, clean, and orderly; is deliberate, careful, and planful
Harm Avoidance	.69	.83	.32*	Avoids risky or thrill-seeking activities; prefers boring (over dangerous) activities

Table 2. *continued.*

<i>Personality</i>	<i>Age 11 Reliability</i>	<i>Age 18 Reliability</i>	<i>7-year Stability Coefficient</i>	<i>Description of a High Scorer</i>
<i>Primary scales</i>				
Traditionalism	.60	.78	.17*	Believes in strict rules and firm discipline (high moral standards), rarely challenges authority
<i>Superfactors</i>				
Positive emotionality	.82			
Agentic	--	.82	.15*	High on achievement and social potency; tends to take charge, enjoys challenging tasks
Communal	--	.84	.16*	High on social closeness and well-being; takes pleasure from his/her social relationships
Negative emotionality	.73	.85	.16*	Tends to experience negative emotions (e.g., anger, sadness, anxiety)
Constraint	.74	.84	.35*	Cautious, planful, rule-abiding, avoids risky activities

Notes. Cronbach's alpha was used for reliability estimates of the 10 primary scales. Reliability estimates for the four higher-order superfactors were generated using a composite reliability. For positive emotionality, 7-year stability coefficients correlated baseline (age 11) positive emotionality with age 18 *agentic* and *communal* positive emotionality. * $p < .001$

Table 3. *Prospective relations between age 11 personality and age 18 substance use profiles using T-scores (M=50, SD=10) normed with overall sample means and standard deviations (N=1134).*

Age 11 personality	ANOVA (<i>F</i> , <i>p</i>)	Age 18 Substance Use Profiles			
		Abstainers (n=236) T-score (SD)	Experimenters (n=387) T-score (SD)	Regular Users (n=191) T-score (SD)	Problem Users (n=320) T-score (SD)
<i>Primary scales</i>					
Well-being	.31, <i>p</i> =.816	49.59 (10.28) _a	50.54 (9.82) _a	50.14 (9.94) _a	49.73 (10.07) _a
Social potency	1.84, <i>p</i> =.138	48.41 (10.32) _a	50.42 (10.25) _a	49.84 (10.33) _a	50.69 (9.13) _a
Achievement	3.69, <i>p</i> =.012	51.87 (9.72) _a	50.57 (9.56) _a	49.01 (10.72) _a	48.54 (10.04) _a
Social closeness	2.80, <i>p</i> =.039	47.86 (10.21) _a	50.45 (9.77) _a	51.04 (10.01) _a	50.45 (9.94) _a
Stress reaction	3.46, <i>p</i> =.016	51.78 (10.37) _a	49.14 (9.83) _a	48.74 (9.68) _a	50.52 (9.94) _a
Alienation	3.05, <i>p</i> =.028	50.75 (10.05) _a	49.31 (9.76) _a	48.22 (9.10) _a	51.32 (10.55) _a
Aggression	4.20, <i>p</i> =.006	49.23 (9.76) _a	48.58 (9.03) _a	49.59 (10.41) _a	52.66 (10.57) _a
Control	9.42, <i>p</i><.001	52.45 (10.07) _a	51.17 (9.64) _b	48.05 (10.94) _c	47.94 (9.16) _c
Harm Avoidance	5.30, <i>p</i>=.001	52.43 (10.09) _a	50.51 (9.51) _b	49.80 (10.67) _{bc}	47.77 (9.65) _c

Table 3. *continued.*

		Age 18 Substance Use Profiles			
Age 11 personality	<i>ANOVA (F, p)</i>	Abstainers (n=236) T-score (SD)	Experimenters (n=387) T-score (SD)	Regular Users (n=191) T-score (SD)	Problem Users (n=320) T-score (SD)
<i>Primary scales</i>					
Traditionalism	9.35, <i>p</i><.001	51.73 (8.98) _a	51.99 (9.74) _a	48.97 (9.77) _b	46.85 (10.31) _b
<i>Superfactors</i>					
Positive emotionality	.07, <i>p</i> =.975	49.39 (10.12) _a	50.63 (10.08) _a	50.00 (10.09) _a	49.67 (9.76) _a
Negative emotionality	3.10, <i>p</i> =.026	50.80 (9.75) _a	48.69 (9.51) _a	48.47 (9.10) _a	51.88 (10.90) _a
Constraint	13.27, <i>p</i><.001	52.89 (9.58) _a	51.53 (9.57) _b	48.64 (10.47) _c	46.81 (9.55) _c

Notes. T-scores based on overall group means and standard deviations (overall group mean set to T=50, SD=10). T-scores that share a subscript do not differ at $p < .004$.

Table 4. Concurrent relations between age 18 personality and age 18 substance use profiles using T-scores ($M=50$, $SD=10$) normed with overall sample means and standard deviations ($N=1231$).

Age 18 Personality	ANOVA (F , p)	Age 18 Substance Use Profiles			
		Abstainers ($n=262$) T-score (SD)	Experimenters ($n=416$) T-score (SD)	Regular Users ($n=207$) T-score (SD)	Problem Users ($n=346$) T-score (SD)
<i>Primary scales</i>					
Well-being	4.25, $p=.005$	51.29 (9.54) _a	50.01 (10.12) _a	51.28 (9.39) _a	48.22 (10.31) _a
Social potency	10.67, $p<.001$	47.13 (10.09) _a	49.88 (9.79) _b	51.46 (10.24) _c	51.46 (9.58) _c
Achievement	8.00, $p<.001$	52.03 (9.87) _a	50.31 (9.29) _b	48.82 (10.01) _{bc}	48.82 (10.66) _c
Social closeness	8.41, $p<.001$	48.06 (10.08) _a	50.72 (9.96) _{bd}	53.09 (8.81) _c	48.77 (10.16) _{ad}
Stress reactivity	9.64, $p<.001$	48.79 (9.97) _a	49.70 (9.72) _a	48.75 (9.90) _a	52.01 (10.15) _b
Alienation	8.20, $p<.001$	47.92 (9.43) _a	49.88 (9.65) _b	48.99 (9.39) _{ab}	52.33 (10.72) _c
Aggression	31.39, $p<.001$	46.19 (8.69) _a	48.66 (8.83) _b	49.89 (9.77) _c	54.55 (10.72) _d
Control	43.05, $p<.001$	54.70 (9.61) _a	51.14 (9.42) _b	48.30 (8.96) _c	46.07 (9.82) _d
Harm Avoidance	12.03, $p<.001$	52.30 (10.16) _a	50.98 (9.21) _a	49.64 (10.30) _b	47.31 (10.02) _b

Table 4. *continued.*

Age 18 Substance Use Profiles					
Age 18 Personality	<i>ANOVA (F, p)</i>	Abstainers (n=262) Mean (SD)	Experimenters (n=416) Mean (SD)	Regular Users (n=207) Mean (SD)	Problem Users (n=346) Mean (SD)
<i>Primary scales</i>					
Traditionalism	33.73, <i>p</i><.001	54.15 (9.67) _a	51.11 (9.99) _b	48.69 (9.24) _c	46.27 (9.21) _d
<i>Superfactors</i>					
Positive Emotionality	.76, <i>p</i> =.518	50.26 (10.36) _a	50.03 (9.93) _a	50.73 (10.06) _a	49.33 (9.77) _a
Positive Emotionality— Agentic	7.62, <i>p</i><.001	52.46 (10.05) _a	49.80 (9.59) _b	48.43 (9.71) _b	49.28 (10.32) _b
Positive emotionality— Communal	11.99, <i>p</i><.001	46.95 (9.67) _a	50.03 (9.92) _b	52.92 (9.01) _c	50.57 (10.31) _{bc}
Negative emotionality	10.28, <i>p</i><.001	48.45 (9.62) _a	49.42 (9.64) _a	48.30 (9.54) _a	52.90 (10.39) _b
Constraint	57.90, <i>p</i><.001	55.16 (9.55) _a	51.56 (8.84) _b	48.19 (9.25) _c	45.24 (9.71) _d

Notes. T-scores based on overall group means and standard deviations (overall group mean set to T=50, SD=10). T-scores that share a subscript do not differ at *p* < .004.

Appendix

Table A1. Standardized effect size estimates (*d*) from ANOVA of age 11 personality by age 18 substance use profiles.

Age 11 personality	<i>Age 18 Substance Use Profiles (F, p)</i>	<i>Abs. vs. Exp Effect size (95% CI)</i>	<i>Abs vs. RU Effect size (95% CI)</i>	<i>Abs vs. PU Effect size (95% CI)</i>	<i>Exp vs. RU Effect size (95% CI)</i>	<i>Exp. Vs. PU Effect size (95% CI)</i>	<i>RU vs. PU Effect size (95% CI)</i>
Primary scales							
Well-being	.31, <i>p</i> =.816	-.05 (-.31, .21)	-.05 (-.36, .26)	.06 (-.24, .37)	-.01 (-.25, .24)	.11 (-.14, .35)	.11 (-.15, .37)
Social potency	1.84, <i>p</i> =.138	-.17 (-.39, .04)	-.16 (-.42, .10)	-.29 (-.53, -.05)	.01 (-.20, .23)	-.11 (-.31, .09)	-.13 (-.35, .10)
Achievement	3.69, <i>p</i> =.012	.26 (.04, .49)	.32 (.05, .60)	.43 (.17, .69)	.06 (-.16, .28)	.17 (-.04, .38)	.11 (-.13, .34)
Social closeness	2.80, <i>p</i> =.039	-.29 (-.52, -.05)	-.35 (-.63, -.06)	-.36 (-.63, -.09)	-.06 (-.28, .17)	-.07 (-.29, .15)	-.01 (-.26, .23)
Stress reaction	3.46, <i>p</i> =.016	.32 (.10, .54)	.38 (.12, .65)	.21 (-.03, .46)	.06 (-.15, .28)	-.10 (-.31, .10)	-.17 (-.40, .06)
Alienation	3.05, <i>p</i> =.028	.12 (-.14, .38)	.33 (.01, .65)	-.06 (-.38, .25)	.21 (-.04, .46)	-.19 (-.44, .06)	-.40 (-.66, -.13)
Aggression	4.20, <i>p</i> =.006	.08 (-.17, .34)	-.18 (-.49, .13)	-.34 (-.65, -.04)	-.27 (-.51, -.02)	-.43 (-.67, -.18)	-.16 (-.42, .10)

Table A1. *continued.*

Age 11 personality	<i>Age 18 Substance Use Profiles (F, p)</i>	<i>Abs. vs. Exp Effect size (95% CI)</i>	<i>Abs vs. RU Effect size (95% CI)</i>	<i>Abs vs. PU Effect size (95% CI)</i>	<i>Exp vs. RU Effect size (95% CI)</i>	<i>Exp. Vs. PU Effect size (95% CI)</i>	<i>RU vs. PU Effect size (95% CI)</i>
Primary scales							
Control	9.42, p<.001	.24 (.02, .46)	.56 (.29, .82)	.59 (.34, .84)	.32 (.10, .53)	.35 (.15, .56)	.04 (-.20, .27)
Harm Avoidance	5.30, p=.001	.31 (.07, .56)	.44 (.15, .73)	.55 (.28, .83)	.12 (-.11, .36)	.24 (.01, .46)	.11 (-.14, .36)
Traditionalism	9.35, p<.001	.17 (-.11, .45)	.56 (.22, .89)	.78 (.45, 1.12)	.39 (.13, .64)	.61 (.35, .87)	.22 (-.05, .50)
Superfactors							
Positive emotionality	.07, p=.975	.00 (-.25, .25)	-.03 (-.33, .27)	.03 (-.26, .32)	-.03 (-.27, .21)	.03 (-.20, .27)	.06 (-.20, .32)
Negative emotionality	3.10, p=.026	.25 (-.01, .50)	.26 (-.04, .57)	-.04 (-.34, .25)	.01 (-.23, .25)	-.29 (-.53, -.05)	-.30 (-.56, -.04)
Constraint	13.27, p<.001	.32 (.08, .56)	.66 (.37, .95)	.82 (.55, 1.10)	.34 (.11, .57)	.50 (.28, .73)	.16 (-.08, .41)

Notes. Standardized effect size (ES) was computed as mean of first named profile minus mean of second named profile divided by residual standard deviation. Covariates included in the ANOVA models were gender and age at baseline. Models included a profile by gender interaction term to assess whether outcomes differed by both gender and profile. Significant effects are highlighted in bold.

Table A2. Standardized effect size estimates (*d*) from ANOVA of concurrent age 18 personality by age 18 substance use profiles.

Age 18 personality	<i>Age 18 Substance Use Profiles (F, p)</i>	<i>Abs. Vs. Exp Effect size (95% CI)</i>	<i>Abs vs. RU Effect size (95% CI)</i>	<i>Abs vs. PU Effect size (95% CI)</i>	<i>Exp vs. RU Effect size (95% CI)</i>	<i>Exp. Vs. PU Effect size (95% CI)</i>	<i>RU vs. PU Effect size (95% CI)</i>
Primary scales							
Well-being	4.25, <i>p</i> =.005	.16 (-.03, .36)	.04 (-.20, .27)	.34 (.13, .56)	-.13 (-.33, .08)	.18 (-.01, .37)	.31 (.10, .52)
Social potency	10.67, <i>p</i><.001	-.34 (-.54, -.14)	-.57 (-.82, -.33)	-.62 (-.85, -.39)	-.23 (-.44, -.02)	-.28 (-.47, -.09)	-.05 (-.27, .17)
Achievement	8.00, <i>p</i><.001	.27 (.08, .47)	.47 (.23, .70)	.52 (.30, .74)	.19 (-.01, .40)	.24 (.06, .43)	.05 (-.16, .26)
Social closeness	8.41, <i>p</i><.001	-.31 (-.51, -.11)	-.56 (-.80, -.32)	-.15 (-.38, .07)	-.25 (-.45, -.04)	-.16 (-.03, .34)	.41 (.19, .62)
Stress reaction	9.64, <i>p</i><.001	-.15 (-.35, .04)	-.02 (-.26, .21)	-.50 (-.72, -.28)	.13 (-.07, .33)	-.35 (-.53, -.16)	-.48 (-.69, -.27)
Alienation	8.20, <i>p</i><.001	-.26 (-.47, -.05)	-.17 (-.43, .08)	-.56 (-.80, -.33)	.09 (-.12, .30)	-.30 (-.50, -.10)	-.39 (-.61, -.16)
Aggression	31.39, <i>p</i><.001	-.35 (-.56, -.15)	-.66 (-.90, -.41)	-1.08 (-1.31, -.85)	-.30 (-.51, -.09)	-.72 (-.92, -.53)	-.42 (-.64, -.20)
Control	43.05, <i>p</i><.001	.45 (.26, .63)	.84 (.62, 1.07)	1.11 (.91, 1.31)	.40 (.20, .59)	.66 (.49, .83)	.26 (.06, .46)

Table A2. *continued.*

<i>Age 18 personality</i>	<i>Age 18 Substance Use Profiles (F, p)</i>	<i>Abs. vs. Exp Effect size (95% CI)</i>	<i>Abs vs. RU Effect size (95% CI)</i>	<i>Abs vs. PU Effect size (95% CI)</i>	<i>Exp vs. RU Effect size (95% CI)</i>	<i>Exp. Vs. PU Effect size (95% CI)</i>	<i>RU vs. PU Effect size (95% CI)</i>
<i>Primary scales</i>							
Harm Avoidance	12.03, <i>p</i><.001	.18 (-.03, .38)	.51 (.26, .76)	.63 (.40, .86)	.33 (.12, .54)	.45 (.26, .64)	.12 (-.10, .34)
Traditionalism	33.73, <i>p</i><.001	.51 (.31, .72)	.83 (.58, 1.08)	1.17 (.94, 1.40)	.31 (.10, .53)	.66 (.46, .85)	.34 (.12, .57)
<i>Superfactors</i>							
Positive emotionality	.76, <i>p</i> =.518	.08 (-.13, .28)	-.01 (-.26, .24)	.14 (-.10, .37)	-.09 (-.30, .13)	.06 (-.14, .26)	.14 (-.08, .37)
Positive emotionality— Agentic	7.62, <i>p</i><.001	.37 (.17, .57)	.53 (.29, .78)	.49 (.26, .72)	.16 (-.05, .38)	.12 (-.07, .31)	-.04 (-.27, .18)
Positive emotionality— Communal	11.99, <i>p</i><.001	-.37 (-.57, -.17)	-.71 (-.96, -.47)	-.52 (-.74, -.30)	-.35 (-.56, -.14)	-.15 (-.34, .03)	.19 (-.02, .41)
Negative emotionality	10.28, <i>p</i><.001	-.13 (-.34, .07)	-.05 (-.30, .20)	-.55 (-.78, -.32)	.08 (-.13, .30)	-.42 (-.61, -.22)	-.50 (-.72, -.28)
Constraint	57.90, <i>p</i><.001	.55 (.35, .76)	1.10 (.86, 1.35)	1.44 (1.21, 1.67)	.55 (.34, .76)	.89 (.69, 1.08)	.34 (.12, .56)

Table A2. *continued.*

Notes. Standardized effect size (ES) was computed as mean of first named profile minus mean of second named profile divided by residual standard deviation. Covariates included in the ANOVA models were gender and age at FU2. Models included a profile by gender interaction term to assess whether outcomes differed by both gender and profile. Significant effects are highlighted in bold.

Table A3. Full summary of variables included in the ANOVA analyses for personality outcomes at ages 11 and 18.

Personality Outcomes	Substance use profiles (<i>F, p</i>)	Gender (<i>F, p</i>)	Socioeconomic status (<i>F, p</i>)	Age at Personality Assessment (<i>F, p</i>)	Profile by gender interaction (<i>F, p</i>)
Primary scales					
Well-being					
Age 11	.31, .816	1.05, .305	2.55, .111	.78, .379	1.25, .291
Age 18	4.25, .005	.87, .350	6.87, .009	1.21, .271	1.73, .158
Social potency					
Age 11	1.84, .138	.14, .711	4.77, .029	.00, .948	.96, .413
Age 18	10.67, <.001	1.08, .299	13.43, <.001	.06, .811	.81, .487
Achievement					
Age 11	3.69, .012	4.94, .027	8.74, .003	.46, .497	.79, .498
Age 18	8.00, <.001	17.99, <.001	2.33, .127	10.89, .001	2.85, .036
Social closeness					
Age 11	2.80, .039	18.15, <.001	.16, .692	.88, .349	.58, .628
Age 18	8.41, <.001	30.58, <.001	.17, .678	.01, .941	1.43, .231
Stress reactivity					
Age 11	3.46, .016	.42, .518	2.71, .100	.15, .701	1.91, .126
Age 18	9.64, <.001	34.48, <.001	.54, .462	.03, .874	.84, .471

Table A3. *continued.*

Personality Outcomes	<i>Substance use profiles (F, p)</i>	<i>Gender (F, p)</i>	<i>Socioeconomic status (F, p)</i>	<i>Age at Personality Assessment (F, p)</i>	<i>Profile by gender interaction (F, p)</i>
<i>Primary scales</i>					
Alienation					
Age 11	3.05, .028	2.72, .100	1.64, .201	.82, .364	.53, .660
Age 18	8.20, <.001	.99, .319	13.59, <.001	2.14, .144	.33, .805
Aggression					
Age 11	4.20, .006	32.79, <.001	5.08, .024	1.07, .301	2.20, .087
Age 18	31.39, <.001	96.69, <.001	2.67, .103	19.50, <.001	.42, .736
Control					
Age 11	9.42, <.001	3.78, .052	2.35, .126	.29, .590	1.00, .393
Age 18	43.05, <.001	2.12, .146	.17, .678	15.50, <.001	1.85, .135
Harm avoidance					
Age 11	5.30, .001	32.52, <.001	.69, .407	1.69, .195	.79, .498
Age 18	12.03, <.001	126.56, <.001	10.10, .002	5.50, .019	1.85, .137
Traditionalism					
Age 11	9.35, <.001	7.55, .006	1.93, .166	.26, .612	1.27, .283
Age 18	33.73, <.001	1.39, .238	11.41, <.001	6.40, .012	.96, .412

Table A3. *continued.*

Personality Outcomes	<i>Substance use profiles</i> (<i>F, p</i>)	<i>Gender</i> (<i>F, p</i>)	<i>Socioeconomic status</i> (<i>F, p</i>)	<i>Age at Personality Assessment</i> (<i>F, p</i>)	<i>Profile by gender interaction</i> (<i>F, p</i>)
<i>Superfactors</i>					
Positive emotionality					
Age 11	.07, .975	5.73, .017	6.05, .014	.05, .820	.93, .427
Age 18	.76, .518	2.61, .106	9.05, .003	2.32, .128	2.88, .035
Positive emotionality-Agentive					
Age 18	7.62, <.001	30.02, <.001	13.72, <.001	7.11, .008	3.80, .010
Positive emotionality-Communal					
Age 18	11.99, <.001	9.65, .002	.25, .618	1.80, .180	.42, .739
Negative emotionality					
Age 11	3.10, .026	8.12, .004	4.52, .034	.03, .858	.177, .152
Age 18	10.28, <.001	1.60, .206	3.52, .061	1.15, .284	.14, .938

Table A3. *continued.*

Personality Outcomes	<i>Substance use profiles</i> (<i>F, p</i>)	<i>Gender</i> (<i>F, p</i>)	<i>Socioeconomic status</i> (<i>F, p</i>)	<i>Age at Personality Assessment</i> (<i>F, p</i>)	<i>Profile by gender interaction</i> (<i>F, p</i>)
<i>Superfactors</i>					
Constraint					
Age 11	13.27, <.001	20.81, <.001	2.19, .139	.87, .352	.56, .640
Age 18	57.90, <.001	42.01, <.001	10.56, .001	20.66, <.001	1.35, .257

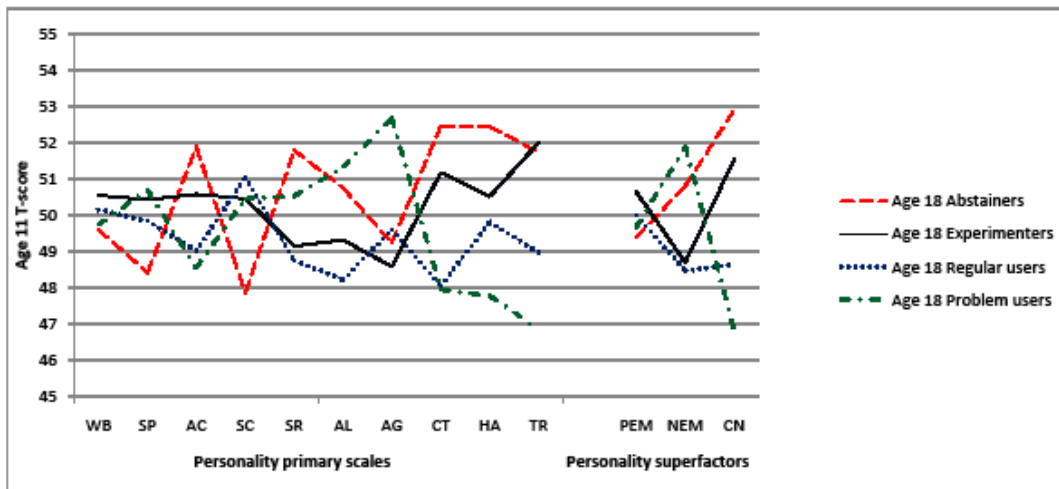


Figure A1. Age 11 personality T-scores (M=50, SD=10; normed on overall sample means and standard deviations) by age 18 substance use profiles.

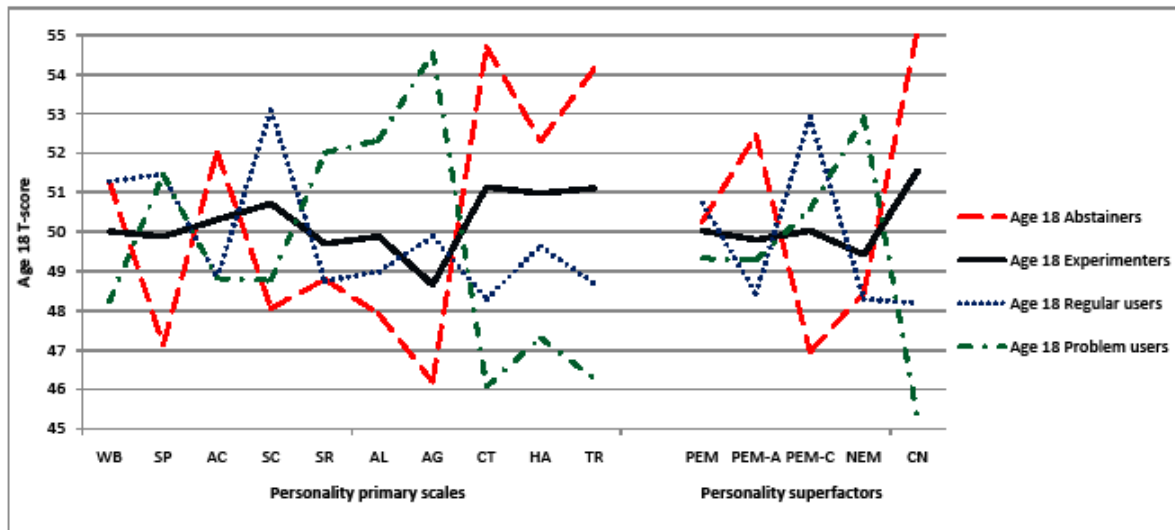


Figure A2. Age 18 personality T-scores (M=50, SD=10; normed on overall sample means and standard deviations) by age 18 substance use profiles.

Chapter 3. Antecedent Substance Use Profiles in Developmental Context: Shifting Relations with Emerging Adult Adjustment

3.1 Introduction

In 1990 Shedler and Block wrote “Adolescent drug use and psychological health: A longitudinal inquiry,” a classic paper in the field of adolescent substance use cited over 500 times. Based on a small sample studied from preschool into adolescence ($N=85$), the authors concluded that adolescents who experimented with drugs at age 18 were better adjusted than drug abstainers and frequent drug users. Compared to experimenters, abstainers were overcontrolled, constricted, isolated, and tense and had poor interpersonal skills. Frequent users were undercontrolled, antisocial, alienated, withdrawn, and unhappy. Shedler and Block expected these *inverted U-shaped* findings—with experimenters having the best concurrent outcomes—reasoning that “occasional drug use among adolescents may best be understood as a manifestation of *developmentally appropriate* experimentation” (p. 613, emphasis in original paper). Moreover, they cited epidemiological studies indicating that the majority of young adults have used marijuana yet do not go on to abuse drugs.

Shedler and Block’s (1990) study has made major contributions to our field and to our way of thinking about adolescent substance use. However, it also raised three important research questions: (1) whether adolescent substance use profiles (i.e., abstainers, experimenters, and frequent users) have long-term developmental significance for adult developmental outcomes, (2) whether *developmental timing* plays a role in the relations between substance use profiles and developmental outcomes, and (3) whether

Shedler and Block's (1990) findings hold for a composite measure of substance use that, in addition to drug use, takes into account alcohol and tobacco use.

With regard to the first question—whether these adolescent substance use profiles have long-term developmental significance for adult development—Shedler and Block (1990) did not examine the prospective relations between adolescent drug use and adult outcomes. In fact, in 2006, Tucker, Ellickson, Collins, and Klein replicated and extended Shedler and Block's findings among a larger, more diverse sample of 12th graders followed-up at age 23. Contrary to Shedler and Block's findings, Tucker et al. found no evidence for inverted U-shaped outcomes. Instead, they generally observed no differences between abstainers and experimenters. When differences were found more linear relations were observed with abstainers having the best outcomes and frequent users having the worst. These linear relations can be conceptualized as reflecting a *disinhibited continuum*, with greater disinhibition—i.e., more severe patterns of substance use behaviors—associated with poorer outcomes.

In terms of the second research question raised by Shedler and Block's (1990) study—whether *developmental timing* plays a role in the relations between substance use profiles and developmental outcomes—a substantive amount of research to date has implicated early-onset substance use as a major risk factor for a host of negative developmental outcomes (e.g., substance dependence, academic underachievement, behavioral disinhibition, early parenthood, low occupational expectations; Brook, Adams, Balka, & Johnson, 2002; Ellickson, Tucker, & Klein, 2001; McGue, Iacono, Legrand, Malone, & Elkins, 2001). Shedler and Block's (1990) rationale for the inverted U-shaped

findings rested upon the developmental appropriateness of experimentation at age 18. Based on this rationale experimentation should be examined in developmental context with experimentation during developmentally inappropriate times expected to predict poorer developmental outcomes.

The last important research question spurred by Shedler and Block's (1990) study is whether their findings hold for a composite measure of substance use. Adolescent substance use is typically not limited to one substance yet most studies examine use of single substances (i.e., alcohol, tobacco, or drugs). Current epidemiological studies suggest that adolescents use alcohol more than illicit drugs and illicit drugs as much as tobacco with 72% of 12th graders having used alcohol, 47% having used an illicit drug, and 46% having used cigarettes (Johnston, O'Malley, Bachman, & Schulenberg, 2007). Moreover, composite substance-use approaches may have greater utility given the common liability model of substance use which suggests that substance type may not be critically important because an individual's general liability to use substances is common across all types substances with the type of substance used dependent on what is available in one's environment and what is socio-historically normative (Le Moal & Koob, 2007; Resnick, Bearman, Blum, Bauman, Harris, Jones et al., 1997; Ridenour, Lanza, Donny, & Clark, 2006; Tarter, Vanyukov, Kirisci, Reynolds, & Clark, 2006; Vanyukov, Tarter, Kirisci, Kirillova, Maher & Clark, 2003).

In sum, Shedler and Block's (1990) seminal study has made a major impact in the field of adolescent substance use and has generated a number of important research questions. Moreover, an attempt to replicate and extend their study into emerging

adulthood yielded contradictory findings. The purpose of the current study is to address the three aforementioned research questions in a population-based sample of twins studied from ages 11 to 21. In particular, this study will examine whether Shedler and Block's *inverted U-shaped* hypothesis (1990) or Tucker et al.'s *disinhibited continuum* hypothesis (2006) best describes the relations between substance use profiles and developmental outcomes. An organizational, developmental task framework highlighting the cumulative nature of development guided the developmental outcomes chosen for this study (Sroufe, 1979) with particular interest in outcomes shown, or expected, to be disrupted by substance use.

3.11 Developmental outcomes

The developmental outcomes in this study were assessed during emerging adulthood and were chosen based on a developmental task perspective and previous research in the area of substance use and developmental outcomes. Arnett (2000) describes emerging adulthood as a distinct period of development when many individuals in their late teens to early twenties view themselves as being in between adolescence and adulthood. Moreover, it has been characterized as an important period in identity exploration and formation. A developmental task perspective examines individual functioning in areas in which individuals are expected to become competent with competence in these tasks reflecting developmental adaptation. Influenced by Havighurst (1952), Masten and colleagues identified five major developmental tasks for emerging adults: three stemming from childhood—i.e., social (e.g., peer relationships), academic, and conduct (e.g., rule-abiding vs. rule-breaking behavior) tasks—and two emerging

during late adolescence—i.e., job and romantic tasks (Masten, Coatsworth, Neeman, Gest, Tellegen, & Garmezy, 1995; Roisman, Masten, Coatsworth, & Tellegen, 2004).

In addition to relations with developmental tasks, previous research has investigated linkages between adolescent substance use profiles and psychopathology as well as parent-child relationships (Shedler & Block, 1990; Siebenbruner, Englund, Egeland, & Hudson, 2006; Tucker et al., 2006). Characterizing the constellation of adaptation and maladaptation for child and adolescent substance use profiles in relation to developmental task domains (i.e., social, academic, conduct, job, and romantic relationships) as well as psychopathology and familial relationship functioning, offers a more holistic view of the impact of child and adolescent substance use on emerging adult development. The few studies that have examined these relations prospectively (i.e., substance use profiles predating the outcomes being assessed) are described below.

Social Competence

Tucker et al. (2006) created substance use profiles based on marijuana and other illicit drug use. They attempted to replicate and extend Shedler and Block's (1990) study using a large, diverse sample of 12th graders followed-up at age 23. Social competence findings were mixed in that concurrent relations between 12th grade drug use profiles and social competence suggested that although drug abstainers were the least likely to attend parties/dances (followed by experimenters and then frequent users) and were also less likely than frequent users to be socially competent with the opposite gender, there were no profile differences in self-reported peer support or loneliness. By age 23, however, 12th grade abstainers had the highest self-rated friend satisfaction, followed by

experimenters and then frequent users. Notably, Tucker et al. also created a profile for stringent substance abstainers which incorporated cigarette and alcohol use—i.e., had never used cigarettes or marijuana and had not used alcohol in the past year. The pattern of findings was the same for the 12th grade concurrent outcomes; however, for age 23 outcomes, there was no difference between stringent abstainers and experimenters with regard to friend satisfaction.

Academic Competence

Ellickson et al. (2001) found that 7th grade smoking abstainers had the best concurrent academic functioning and smokers the worst (experimenters were in-between). Specifically, 7th grade smoking abstainers were the least likely to be absent, have class problems, poor grades, or repeat grades. These relations generally held in 12th grade, with 7th grade smoking abstainers being the least likely to have academic problems and smokers being the most likely. Tucker et al. (2006) found that in 12th grade, compared to drug experimenters and frequent users, drug abstainers were more likely to do their homework and have A or B grades. At age 23, these 12th grade drug abstainers were also more likely to graduate from college.

Conduct Competence

Ellickson et al. (2001) found that 7th grade smokers were the most likely to steal in 7th grade, followed by smoking experimenters, and then abstainers. Five years later, in 12th grade, these trends continued with 7th grade smokers tending to have the worst conduct (e.g., most likely to sell drugs, engage in predatory violence, be early parents and, among females, have early pregnancies) and abstainers the best. Consistent with

these findings, Milich and colleagues (2000) found that age 20 deviancy differed by 10th grade alcohol profiles with 10th grade heavy drinkers engaging in a greater number of lifetime delinquent acts at age 20 compared to 10th grade abstainers and experimenters. Interestingly, however, at age 20, there were no significant differences between alcohol use profiles in past year delinquent acts.

Tucker et al. (2006) found that across the vast majority of concurrent (12th grade) and early adult (age 23) conduct outcomes, 12th grade drug abstainers had the best outcomes, followed by experimenters, and then frequent users. In 12th grade, drug abstainers had the greatest participation in extracurricular activities and were the least deviant in the past year. Furthermore, at age 23, 12th grade drug abstainers were less likely to sell drugs in the past year.

Romantic Competence

Tucker et al. (2006) found that in 12th grade, drug abstainers were less likely than experimenters to go on dates. Ellickson et al. (2001) also found that in 12th grade, 7th grade smokers were the most likely to be early parents and, among females, have early pregnancies, while abstainers were the least likely. To our knowledge no studies have prospectively examined adolescent substance use profiles in relation to adult romantic competence.

Familial Relationships

Windle (1996) examined alcohol use profiles among 10th and 11th graders over an 18-month period in relation to family support and cohesion. Although alcohol use profiles at the final follow-up assessment (age ~18 years) did not differ in concurrent

maternal-rated family cohesion, they did differ in perceived family support with problem drinkers reporting lower levels of perceived family support compared to heavy drinkers. Moreover, Tucker et al. (2006) found that 12th grade drug abstainers and experimenters had greater family satisfaction at age 23 compared to frequent users.

Psychopathology

Milich et al. (2000) found that measures of psychopathology at age 20—measured with the Brief Symptom Inventory (e.g., depression, anxiety)—did not differ by 10th grade alcohol profiles. However, Rohde, Lewinsohn, and Seeley's (1996) examination of alcohol use profiles in relation to concurrent psychiatric measures in a community sample of adolescents (mean age=17.7 years) found significant differences between profiles. Despite finding that abstainers generally did not differ from experimenters or social drinkers in their psychopathology (tended to exhibit similar low rates of depression and disruptive behavior disorders as well as anxiety disorders among females), Rohde et al. found that adolescents with alcohol use disorders and problem alcohol use generally had the highest rates of those disorders. In addition, Tucker et al. (2006) found that in 12th grade, 12th grade drug abstainers had better past 30 day mental health functioning—better mood—than experimenters. But, at age 23, there were no profile differences in past 30 day mental health, nor were there differences in limitations due to emotional problems.

Summary—Developmental outcomes

In summary, there is evidence that adolescent substance use profiles differ in competence in developmental tasks as well as ratings of familial relationships and psychopathology. The prospective differences found for social, academic, and conduct

competence as well as familial relationships generally tend to favor the *disinhibited continuum* hypothesis. Despite the lack of prospective adult studies linking adolescent substance use profiles and adult romantic competence, the data available suggest *inverted U-shaped* relations. Prospective studies of psychopathology yielded mixed findings with brief measures suggesting no profile differences and in-depth measures suggesting differences for more severe substance use profiles. To our knowledge there have not been any studies that examine adolescent substance use profiles in relation to *job competence*. However, Masten and colleagues' (1995) assessment of the structure of job competence suggests that childhood academic and conduct domains relate to job competence; therefore, one might hypothesize that *job competence* might fit with the *disinhibited continuum* hypothesis.

3.12 *Current Study*

This study seeks to answer the three research questions discussed in the introduction: (1) whether adolescent substance use profiles—created with a composite measure of substance use that includes tobacco, alcohol, and drugs—have long-term developmental significance for emerging adult developmental outcomes, (2) whether *developmental timing* plays a role in the relations between substance use profiles and developmental outcomes, and (3) whether the pattern of relations across developmental domains and at different ages fit more with the *inverted U-shaped* hypothesis or the *disinhibited continuum* hypothesis. To answer these questions, substance profiles will be developed at ages 11, 14, and 18 using *all substances* (i.e., tobacco, alcohol, and illicit drugs) to examine the relations between these substance profiles and emerging adult

outcomes. A particular strength of this study is its ability to measure outcomes across multiple domains of functioning. Specifically, this study will examine relations between substance use profiles at ages 11, 14, and 18 and age 21 functioning in academic, social, conduct (externalizing symptoms), work, romantic, familial relationships, and internalizing psychopathology domains. In addition, four substance use profiles—i.e., abstainers, experimenters, regular users, and problem users—will be created because one notable aspect of many prior studies using three profiles was the existence of a group of individuals who did not fit into a category. These unclassifiable groups account for a substantial portion of previous studies—e.g., 16% in Shedler & Block’s (1990) study, 21% in Tucker et al.’s (2006) study, and 36% in Siebenbruner et al.’s (2006) study.

Hypotheses

Based on previous research we hypothesize that the *disinhibited continuum* will characterize outcomes in emerging adult *social, academic, externalizing, job, and familial relationship* domains with age 18 abstainers having the best outcomes and problem users the worst outcomes. *Inverted U-shaped* relations are hypothesized for *romantic competence*. Given the mixed findings in the literature regarding the concurrent and prospective relations between adolescent substance profiles and *internalizing psychopathology* no directional hypotheses are made.

In terms of *timing*, we hypothesize that the likelihood that substance use profiles will be associated with positive or negative outcomes will depend on the participants’ age at classification and the developmental appropriateness of substance use at those ages. For instance, since *abstention* is more normative at ages 11 and 14, we hypothesize that it

will be associated with more positive emerging adult outcomes at age 21. However, since *experimentation* is more normative at age 18, we hypothesize that it will be associated with more positive emerging adult outcomes.

3.2 Method

3.21 Participants

Participants were drawn from the Minnesota Twin Family Study (MTFS), a longitudinal study that has followed reared-together, same-sex male and female twin pairs since age 11 (see Iacono, Carlson, Taylor, Elkins & McGue, 1999 for more information on the MTFS study). Birth records were used to identify eligible twins and the resultant study sample was demographically representative of Minnesota when the twins were born (~96% Caucasian). The male cohort ($n=376$ twin pairs) was recruited from 1977 to 1982 while the female cohort ($n=380$ twin pairs) was recruited from 1981 to 1985 (overall $N=1512$ participants, 50% male). The MTFS research protocol was approved by the University of Minnesota's Institutional Review Board. Participants recruited into the study lived within a day's drive of the University of Minnesota. Lengthy day-long assessments involved in this study precluded individuals with physical (e.g., blindness) or psychological (e.g., mental retardation) disabilities from participating. Approximately 17% of eligible families declined to participate in the intake MTFS assessment, but a comparison of participating and non-participating families revealed few significant differences with those choosing to participate being slightly better educated (mean of .3 more years of education). No other demographic, socioeconomic, or self-

reported mental health differentiated participants from nonparticipants in the original study.

Individuals in the current study participated in four assessments. Their first assessment occurred at age 11 and their latter assessments occurred approximately every three years thereafter (baseline mean age=11.71, SD=.43; follow-up 1 [FU1] mean age=14.79, SD=.53; follow-up 2 [FU2] mean age=18.15, SD=.70); and follow-up 3 [FU3] mean age=21.44, SD=.81). When participants were younger than age 18, with their parents consent, they gave their assent to participate in the study and after age 18 they gave their informed consent to participate. The current study analyzes the twins as individuals and does not seek to infer genetic and environmental contributions to phenotypic differences. To be eligible for the current study, participants had to have data on socioeconomic status (SES; a covariate in our statistical analyses that is described in the measures section) and at least one FU3 outcome. At FU3 14.8% of the sample was missing all outcome data ($n=224$, 62% male) and .6% ($n=10$, 80% male) was missing SES data. These 234 participants were excluded from the study, resulting in a study sample of ($n=1278$, 47% male). Table 1 contains demographic information about the sample.

Attrition analyses using baseline characteristics of gender, SES, race, alcohol, tobacco, illicit drug use, and baseline substance use profiles (described below) were conducted comparing participants who were included in the current study to those who were excluded due to missing data. No differences were found for race, tobacco use, or baseline substance use profiles. Differences were found for gender, SES, and baseline

alcohol and drug use with participants excluded from the study being more likely to be male (63% vs. 47%), to have lower mean SES ($z=-.26$, $SD=.89$ vs. $z=.04$, $SD=1.01$), and to have drunk alcohol (8% vs. 4%) and used drugs (1.3% vs. .3%) at baseline.

3.22 *Measures*

Socioeconomic Status

Each parent's highest level of education was coded on a 6-point scale (1=less than high school, 2=GED, 3=high school degree, 4=some college/business certificate/associate's degree, 5=bachelor's degree, 6=professional degree). For each family, the highest occupational status for a full-time employed parent was coded on a 7-point Hollingshead scale (1=unskilled labor to 7=professional/executive positions). Educational scores for each parent and the highest occupational status scores for each family were standardized and summed. The summed scores were standardized again to form a composite socioeconomic (SES) status indicator with a mean of 0 and standard deviation of 1.

Substance Use

Substance use, abuse and dependence (e.g., tobacco, alcohol, marijuana, and other drugs) were assessed at baseline, FU1, and FU2. Structured clinical interviews were administered independently to each participant and his/her mother by trained interviewers. At all three assessments, substance abuse and dependence symptoms were assessed using Diagnostic and Statistical Manual of Mental Disorders, 3rd edition-revised, criteria (DSM-III-R; American Psychiatric Association, 1987), the standard diagnostic manual used when the MTFS study began. In addition, DSM-IV criteria (American Psychiatric Association, 1994) were available for females at FU1 and for both males and

females at FU2. Substance abuse and dependence symptoms were assigned by consensus case conferences of two or more clinical psychology graduate students using all available information (diagnostic kappa reliabilities were all greater than .91; see Iacono et al., 1999 for more information).

Self-report

At baseline and FU1, child/adolescent interviews included the Diagnostic Interview for Children and Adolescents-Revised, child version (DICA-R-C; Herjanic & Reich, 1982; Reich & Welner, 1988). Males reported on their lifetime symptomatology at both timepoints. Females reported on their lifetime symptomatology at baseline and on their symptoms since baseline at FU1. At FU2 the adolescent interview for both males and females included the expanded Substance Abuse Module (Robins, Babor, & Cottler, 1987) from the Composite International Diagnostic Interview (Robins et al., 1988). Symptoms were assessed since participants' previous visit at FU1.

Maternal-report

Administration of a modified version of the DICA-R at baseline and FU1 (parent version; DICA-R-P; Reich & Welner, 1988) allowed mothers to report on their children's substance abuse and dependence symptoms.

Substance Use Profiles

The substance use measures (i.e., self- and maternal-reported substance use as well as consensus symptoms) were used to create substance use profiles for each individual at baseline, FU1, and FU2 (see Table 1 for distribution of substance use profiles across time). When both self- and maternal-reported data were available, the most severely rated substance use behaviors (e.g., presence of a symptom versus absence of a symptom) were used to determine the individual's substance use profile. When only

self-reported substance use and substance use disorder (i.e., abuse and dependence) symptoms were available, individuals were still assigned a substance use profile. However, when only maternal-reported substance use and disorder behaviors were available, participants substance use profiles were coded as missing. Data were available to create profiles for all 1278 participants at baseline, 1221 participants at FU1 (95%) and 1187 participants at FU2 (93%).

Attrition analyses for baseline, FU1, and FU2 substance use profiles were conducted using baseline characteristics of gender, SES, race, alcohol, tobacco, and illicit drug use. No significant differences were found for gender, race, alcohol, or illicit drug use. However, at FU1, participants who could not be assigned a substance use profile were less likely than those with FU1 substance use profiles to smoke at baseline (0% vs. 11% respectively). In addition, at FU2, participants whose substance use profile was missing had lower mean baseline SES than participants with FU2 substance use profiles (mean=-.25, SD=.96 vs. mean=.07, SD=1.01).

Building on prior work and to allow for reasonable statistical power and consistency of profile classification (i.e., the same classification scheme at baseline, FU1, and FU2), the following criteria were used to create four substance use profiles based on individual patterns of use at baseline, FU1, and FU2:

- **Abstainer:** No substance use reported
- **Experimenter** (any of the following led to inclusion in this group):
 - ALCOHOL: Drank alcohol without parent's permission but drank no more frequently than "once a month or less" or did not drink to intoxication more than 11 times
 - OR

- TOBACCO: Had *ever* used tobacco (<daily/near daily)
OR
- ILLICT DRUGS: Used an illicit drug, however, used any one drug less than 12 times (i.e., marijuana, amphetamines, barbiturates, tranquilizers, cocaine, heroin, opiates, PCP, other psychedelics, inhalants, or other drugs)
- **Regular user** (any of the following led to inclusion in this group):
 - ALCOHOL: Drank alcohol without parent's permission drinking "once a week or several times per week," "everyday or a couple times a week," or to intoxication at least 12 times.
OR
 - TOBACCO: Reported "daily/nearly daily tobacco use"
OR
 - ILLICT DRUGS: Used a single illicit drug at least 12 times (i.e., marijuana, amphetamines, barbiturates, tranquilizers, cocaine, heroin, opiates, PCP, other psychedelics, inhalants, or other drugs)
OR
 - CONSENSUS: Had one symptom of substance abuse or dependence (DSM-III-R or DSM-IV)
- **Problem users:** Had at least two symptoms of substance abuse or dependence for any one substance (DSM-III-R or DSM-IV)

These 4 profiles were created to characterize individuals' use at each assessment. Based on epidemiological data we did not anticipate that many baseline and FU1 participants would be using illicit drugs (Substance Abuse and Mental Health Services Administration, 2007); however, to maintain a consistent classification scheme across time it was necessary to apply the same definitional criteria at each time point.

Participants were classified as *abstainers* if there was no endorsement of substance use over the period for which they were assessed. For instance, at FU2 both males and females reported on their use over the past three years. Thus, *abstainers* at FU2 could have been substance users at baseline or FU1; however, this was not typical

with only 5% of FU1 *abstainers* ($n=32$ of 678) and 8% of FU2 *abstainers* ($n=21$ of 249) having a previous substance using profile (see Figure 1).

Experimenters screened into the profile if they drank alcohol once a month or less, used tobacco less than daily, or used any one illicit drug less than 12 times. The cutoff of 12 times was used because that would generally translate into using approximately four times per year (less than monthly) at FU1 and FU2. The decision to use an illicit drug use criterion for *experimenters* that included use of any one illicit drug less than 12 times was influenced by limitations of other studies in this area (e.g., Shedler & Block, 1990; Siebenbruner et al., 2006; Tucker et al., 2006). Specifically, previous studies have limited *experimenters* to trying no other illicit drugs other than marijuana (Siebenbruner et al., 2006) or no more than one drug other than marijuana (Shedler & Block, 1990; Tucker et al., 2006). These limitations, in part, contributed to a number of unclassifiable participants who were excluded from analyses. In our sample, all three baseline illicit drug users had used a drug other than marijuana, 28 of the 138 FU1 illicit drug users (20%) had used a drug other than marijuana, and 128 of the 442 FU2 illicit drug users (29%) had used a drug other than marijuana. Thus, a substantial proportion of illicit drug users had used more than one illicit drug.

Individuals screened into the *regular use* profile if they drank alcohol at least weekly, were intoxicated at least 12 times, used tobacco daily/nearly daily, used an illicit drug at least 12 times, or had one substance use disorder symptom. These regular use criteria fit relatively well with previous studies (e.g., Colder & Chassin, 1999; Lewinsohn, Rohde, & Brown, 1999; Milich et al., 2000; Siebenbruner et al., 2006).

However, the decision to utilize only one SUD symptom for the *regular use* profile was based in part on the desire to have an adequate sample of *problem users* at baseline, FU1, and FU2. In a high risk sample, Siebenbruner et al.'s (2006) strict criteria led to an abuser profile constituting 16% of their sample at age 17.5. Thus, to increase our likelihood of having an adequate sample of *problem users* at baseline, FU1, and FU2, the criterion for *problem use* was set to include individuals who presented with two or more SUD symptoms. Moreover, unlike Siebenbruner et al.'s (2006) study, the current study does not use SUD diagnosis as the criterion for the *problem use* profile because the goal was to create profiles that would yield sufficient power to detect differences across time.

FU3 (Age 21)—Social Adjustment Interview

At the FU3 assessment in emerging adulthood (i.e., mean age=21.44, SD=.81), participants were interviewed using the Social Adjustment Interview (developed by MTFs research staff). This instrument was used to obtain information on participants' functioning in important developmental domains with the current study assessing functioning in the following areas: social, romantic relationships, family relationships, academic, work, and psychopathology (i.e., internalizing and externalizing [conduct] symptomatology). With the exception of questions in the educational domain, questions for all other domains were rated on a 4-point scale (e.g., "very true" to "not at all true").

Social

Eight items comprised the *social competence* composite score ($\alpha=.70$).

Participants rated their ability to make and maintain friends, their popularity and leadership qualities, problems with friends, and how much they like doing things with others. The questions comprising this scale are listed in Appendix A (see Table A1).

Seven of these questions were rated on a 4-point scale ranging from (1) “very true” to (4) “not at all true.” One question, “In your free time, do you like to do things with other people or by yourself”, was rated on a 4-point scale from (1) “almost always with others” to (4) “almost always by yourself.” Seven of the eight items were reverse-scored so that higher scores indicated greater social competence. Participants had to answer at least seven of the eight scale items, otherwise the scale was coded as missing. Mean imputation was used for individuals who had one missing item. Scores in this sample ranged from 15 to 32.

Romantic

Romantic competence was assessed with a composite measure of two items that were significantly correlated, $r = .20$ ($p < .01$). The first item was a yes/no question that asked participants “Have you ever dated or gone out with someone?”. This item was reverse-scored so that a higher number indicated dating experience. The second item asked participants to answer on a 4-point scale ranging from (1) “very true” to (4) “not at all true” whether “I have trouble establishing romantic relationships with other people”. In general, the *romantic competence* measure assesses an individual’s ability to establish romantic relationships. To create the *romantic competence* composite each item was standardized and then summed. The summed scores were standardized again to form a composite with a mean of 0 and standard deviation of 1. To receive a composite score, individuals had to answer both items.

Family relationships

A *family relationships* composite was created by summing participants' responses to twelve items assessing the degree to which they have close relationships with, confide in, and have problems getting along with, their mother, father, twin, and closest sibling. Participants responded to all items using a 4-point scale ranging from (1) "very true" to (4) "not at all true". Eight items were reverse-scored so that higher composite scores suggest closer, less problematic family relationships (scores ranged from 19 to 48).

Academic

Academic competence was assessed with a measure of participants' highest level of *educational attainment* at FU3. Based on participants' responses to a series of educational questions (e.g., whether they had a high school degree or ever attended vocational/trade school/community college/4-year university) a composite variable was created rating their highest level of educational attainment on a 6-point scale (0=No high school degree nor GED, 1=High school degree through GED program, 2=High school degree, 3=Post high school vocational training or trade school, 4=Attended community college, 5=Attended a 4-year college or university).

Work

Given the heterogeneity in work behaviors at FU3 (e.g., some individuals were in school and not working while others were working full-time), a single-item assessing whether participants had *long-term career goals* was used. Specifically, participants responded to the question "I have long-term career goals" on a 4-point scale ranging from

“very true” to “not at all true”. Items were reverse-scored so that higher scores indicated a greater likelihood of having long-term career goals.

FU3 (Age 21)—Internalizing and Externalizing Symptom Counts

At FU3, participants were assessed by trained interviewers for DSM-III-R internalizing and externalizing symptoms. Interviewers held bachelors or masters degrees in psychology or a related field and the presence or absence of each symptom was decided upon by consensus case conferences of two or more clinical psychology graduate students.

Using the Structured Clinical Interview for DSM-III-R (SCID; Spitzer, Williams, & Gibbon, 1987), an internalizing symptom count was created based on a sum of participants’ symptoms—since FU2—for Major Depressive Disorder, Social Phobia, and Generalized Anxiety Disorder (scores ranged from 0 to 15). Since many of the current externalizing spectrum models include substance use symptoms (cf. Krueger, Markon, Patrick, & Iacono, 2005; Hicks et al., 2007), and to examine adult externalizing in domains other than substance use, we examined adult antisocial behavior (i.e., adult criteria for antisocial personality disorder; ASPD) using a structured interview similar to the Structured Clinical Interview for Axis II Personality Disorders (First, Gibbon, Spitzer, & Williams, 1997). Scores ranged from 0 to 7. The externalizing symptom count was used as a measure of *conduct competence*.

3.23 *Analysis Plan*

Analysis of Variance (ANOVA) was used to investigate the effects of baseline, FU1, and FU2 substance use profiles on emerging adult outcomes at FU3. Due to the clustered nature of these family data, hierarchical linear models using PROC MIXED of

the Statistical Analysis System, version 9.1 (SAS 9.1) were used in all of the analyses. The model included covariates of gender and SES. A substance use profile by gender interaction was included to assess whether the effects differed by gender. ANOVAs for each measure of adult adjustment were interpreted if they met significance after a Bonferroni correction for multiple tests (i.e., $.05/7 = .007$ level of significance). Given their skewness, internalizing and externalizing symptom counts were log-transformed prior to the analysis. Post-hoc planned pair-wise comparisons were conducted for significant ANOVAs and compared: (1) abstainers and experimenters, (2) abstainers and regular users, (3) abstainers and problem users, (4) experimenters and regular users, (5) experimenters and problem users, and (6) regular and problem users. Analyses were also conducted for stringent abstainers (i.e., individuals who have never used any substances in their lifetime). Effect sizes—estimated by dividing the difference in the covariate-adjusted means by the residual standard deviation—and confidence intervals are reported for all pair-wise comparisons.

3.3 Results

Figure 1 highlights the developmental changes that occur over time in abstention versus non-abstention. Consistent with epidemiological data, the vast majority of individuals in our study were abstainers at baseline and non-abstainers at age 18. Given the small sample sizes of baseline regular and problem users ($n=3$ in each profile), analyses of baseline substance use profiles compared only baseline abstainers and experimenters. Profile differences in demographic characteristics suggest that substance use profiles across all ages differed in SES and gender with abstainers tending to be

highest in SES and problem users lowest in SES. Generally, females were more likely to be abstainers at all timepoints while males were more likely to engage in non-normative substance use (e.g., experimenters at baseline and problem users at age 18). The intercorrelations of all variables used in the current study are displayed in Table 2. Tables 3 through 5 display the ANOVA *F*-statistics as well as the age 21 mean outcomes by substance use profiles at ages 11, 14, and 18 respectively. Effect sizes (ES) for the planned comparisons are summarized in Tables 3, A2 and A3. Table A4 contains a full summary of the ANOVA analyses for all variables included in the analytical models. The pattern of findings comparing stringent abstainers to experimenters was generally the same as the pattern comparing abstainers to experimenters (see Tables A2 and A3).

3.31 Question 1: Do adolescent substance use profiles have long-term developmental significance for emerging adult developmental outcomes?

As seen in Table 5, age 18 substance use profiles have long-term developmental significance for emerging adult outcomes at age 21. Specifically, age 18 substance use profiles differed in age 21 social, romantic, family, academic, work, and externalizing domains. No differences were found in the internalizing domain.

In the *social domain*, age 18 *abstainers* had significantly lower mean competence scores at age 21 compared to all other profiles with ES comparisons in the small to large range (-.26 to -.53). *Regular users* had higher mean social competence compared to problem users (ES=.28). *Romantically*, age 18 *abstainers* also had the lowest mean age 21 romantic competence *z*-scores compared to all other profiles with large effect sizes ranging from -.58 to -.86. Although *regular users* did not differ from problem users in

mean romantic competence, they were significantly higher than experimenters (ES=.28). In the domain of *family relationships*, age 18 *experimenters* had the highest mean age 21 family relationship score compared to all other profiles (small to medium ES range=.26 to .43).

Academically, age 18 *abstainers* and *experimenters* had the highest mean educational attainment at age 21, followed by regular users and then problem users. There were large effect sizes when all profiles were compared to *problem users* (ES range=.90 to 1.37). Small to medium ES comparisons were found when *abstainers* and *experimenters* were compared to regular users, .47 and .26 respectively. In terms of *work*, or having long-term career goals, age 18 *abstainers* and *experimenters* were more likely to have long-term career goals at age 21 compared to problem users (medium ES=.38 to .47). In addition, age 18 *experimenters* were more likely than age 18 regular users to have long-term career goals at age 21 (small ES=.28). There was no significant difference between age 18 regular and problem users.

Regarding *externalizing* symptomatology, significant differences were found between all substance use profiles with, from lowest to highest respectively, age 18 *abstainers* having the lowest mean number of age 21 externalizing symptoms, followed by experimenters, regular users, and then problem users (highest mean symptoms). Effect sizes ranged from medium to large, -.48 to -1.82.

3.32 *Question 2: Does developmental timing play a role in the relations between substance use profiles and emerging adult developmental outcomes?*

Our findings suggest that developmental timing plays an important role in understanding the relations between substance use profiles and emerging adult developmental outcomes (see Tables 3 through 5 for mean differences and Tables 3, A2 and A3 for effect sizes). Results will be discussed within each developmental domain.

Social

In terms of *social competence*, the relations between *abstention* and *experimentation* to age 21 social competence shifted between ages 11 to 18. Although age 11 *abstainers* had greater mean age 21 social competence compared to experimenters (small to medium ES=.32), this relation reversed by age 14 with age 14 abstainers having lower mean age 21 social competence than age 14 experimenters (small ES=-.29). In addition, compared to all other substance use profiles, age 14 *problem users* had the lowest mean age 21 social competence (large ES range=.59 to .88). By age 18 this relation no longer held with age 18 abstainers having the lowest mean age 21 social competence compared to all other profiles (small to large ES range=-.26 to -.53). In sum, the relations between substance use profiles and *social competence* appear to depend greatly upon developmental timing with age 11 abstention, age 14 experimentation, and age 18 regular use associated with greater emerging adult social competence. Age 14 problem users and age 18 abstainers had the poorest emerging adult social competence.

Romantic

No significant differences in age 21 *romantic competence* were found for age 11 profiles. For age 14 profiles, the only significant difference was that *abstainers* had the lowest mean age 21 romantic competence compared to all other profiles (medium ES

range=-.32 to -.49). Although the negative association between abstinence and poor emerging adult romantic competence does not appear until age 14, it becomes amplified at age 18 (lower mean z -score and larger ES range=-.58 to -.86). Incorporating the age 18 results, abstainers at ages 14 and 18 are the least romantically competent in emerging adulthood, while age 18 regular users tend to be high in romantic competence.

Family relationships

Similar to *social competence*, the results for *family relationships* also show a shift in relations over time, particularly for abstainers and experimenters. Although age 11 *abstainers* had the highest mean age 21 family relationship ratings compared to experimenters (medium ES=.42), the reverse was true at age 18 with age 18 *experimenters* having the highest mean age 21 family relationship ratings (small ES=.26). In sum, age 11 abstinence and age 18 experimentation were associated with higher emerging adult family relationship ratings.

Academic

The pattern of relations between substance use profiles and *educational attainment* was generally the same across time with the exception that *abstainers* at ages 11 and 14 had significantly greater age 21 *educational attainment* compared to experimenters at ages 11 and 14 (large, .73, and medium, .38, ES respectively). Recall that there was no difference between age 18 abstainers and experimenters in age 21 educational attainment. Notably, problem users at ages 14 and 18 had the worst age 21 educational attainment compared to all other profiles (large ES range=.66 to 1.82). To summarize, abstinence at ages 11, 14, and 18 as well as age 18 experimentation were

associated with greater emerging adult educational attainment while problem use at ages 14 and 18 was associated with poorer emerging adult educational attainment.

Work

There were no significant differences between age 11 abstainers and experimenters in long-term career goals at age 21; however, at age 14, *problem users* were less likely to have long-term career goals at age 21 compared to all other age 14 profiles (medium to large ES range=-.44 to -.60). Taking into account the age 18 results, lower emerging adult long-term career goals were associated with problem use at ages 14 and 18 as well as age 18 regular use.

Externalizing symptom count

At all three timepoints, significant differences in age 21 externalizing symptomatology were found between substance use profiles. Specifically, at all timepoints, abstainers had the lowest mean number of age 21 externalizing symptoms compared to all other profiles (medium to large ES range=-.51 to -1.82). At ages 14 and 18, problem users had the highest mean number of age 21 externalizing symptoms compared to all other profiles (medium to large ES range= -.48 to -1.82). In sum, abstainers at all ages had the lowest emerging adult externalizing symptomatology, while early and late adolescent problem users had the highest.

3.33 *Question 3: Do the patterns of relations across developmental domains and over time fit more with the inverted U-shaped hypothesis or the disinhibited continuum hypothesis?*

The patterns of relations between age 18 substance use profiles and age 21 outcomes will serve as the basis of comparison given that the *inverted U-shaped* and *disinhibited continuum* hypotheses were based on studies of 18 year-olds. To summarize the age 18 results, the *inverted U-shaped* hypothesis best describes the relations between age 18 substance use profiles and age 21 emerging adult outcomes in the three interpersonal domains—i.e., social, romantic, and family relationships. In contrast, findings in the age 21 *academic*, *work*, and *externalizing* domains best fit with the *disinhibited continuum* hypothesis. Notably, however, no significant differences were found between age 18 *abstainers* and *experimenters* in the age 21 *academic* and *work* domains.

Interestingly, the patterns of relations for the interpersonal domains were not consistent with the *inverted U-shaped* hypothesis over time. In terms of *social competence*, the pattern of relations between age 11 abstention and age 21 social competence was not consistent with the *inverted U-shaped* hypothesis with age 11 abstainers having higher mean age 21 social competence than baseline experimenters; however, by age 14 the pattern reversed and was consistent with the *inverted U-shaped* hypothesis. Thus, the *inverted U-shaped* pattern did not consistently explain the relations between substance use profiles and social competence over time.

Similarly, the pattern of relations for *family relationships* also reversed over time with age 11 abstainers having higher mean age 21 family relationship ratings compared to age 11 experimenters with the reverse being true for age 18 abstainers and

experimenters. Thus, the *inverted U-shaped hypothesis* only characterized the relations between age 18 substance use profiles and age 21 *family relationships*.

With regard to *romantic competence*, although the *inverted U-shaped* pattern of relations between substance use profiles and *romantic competence* begins to appear at age 14, it is not clear until age 18 (recall that the only significant age 14 difference was that age 14 *abstainers* had the lowest mean age 21 romantic competence compared to all other profiles).

In contrast to the results in the interpersonal domains the *disinhibited continuum* hypothesis tended to characterize the relations between substance use profiles at ages 11, 14, and 18 and functioning in *academic* and *externalizing* domains at age 21. In terms of *work*, although the results tend to support the *disinhibited continuum* hypothesis more than the *inverted U-shaped* hypothesis, the pattern of relations between age 14 substance use profiles and age 21 long-term career goals is not completely consistent with the *disinhibited continuum hypothesis* (e.g., only age 14 problem users significantly differed from the other profiles).

3.4 Discussion

Summary of major findings

This study examined the relations between substance use profiles at ages 11, 14, and 18 and emerging adult developmental outcomes at age 21. The findings suggest that these relations differ across the various timepoints as well as in particular domains. The results partially support our hypotheses regarding the relations between age 18 substance use profiles and age 21 developmental outcomes. As hypothesized, the *disinhibited*

continuum hypothesis characterized outcomes in the *academic, conduct* (externalizing symptoms), and *work* domains and the *inverted U-shaped* hypothesis characterized *romantic* outcomes. Unexpectedly, the *inverted U-shaped* hypothesis also characterized outcomes in the two other interpersonal domains—*social* and *family relationships*. Notably, relations between ages 11 and 14 substance use profiles and age 21 *academic, conduct, and work* outcomes continued to be consistent with the *disinhibited continuum* hypothesis; however, the *inverted U-shaped* hypothesis did not consistently characterize relations in the three interpersonal domains (i.e., *social, romantic, and family relationships*). Thus, the relations between substance use profiles and emerging adult social, romantic, and family relationship outcomes changed over time.

The finding that the *inverted U-shaped* hypothesis was not supported for substance use profiles at ages 11 and 14 is not surprising considering that Shedler and Block (1990) refrained from suggesting that it reflected a psychological law and instead suggested that it was a product of sociohistorical circumstances. Our findings support this notion in that our hypothesis that developmental timing plays an important role in understanding the relations between substance profiles and emerging adult outcomes was supported. As hypothesized, age 11 abstinence and age 18 experimentation were associated with the most adaptive constellation of emerging adult outcomes. Unexpectedly, the findings for age 14 abstainers and experimenters were not as clear, but this may be due to the shifting relations between substance use profiles and interpersonal outcomes. Problem use at ages 14 and 18 was associated with the most maladaptive constellation of emerging adult outcomes. The findings for regular users were somewhat

mixed (e.g., age 18 regular users do well in social and romantic domains but not in academic and externalizing domains).

Overall, our findings suggest that more severe substance use patterns *at any age* relate to poorer outcomes in *academic* and *externalizing* domains. This was not true for outcomes in interpersonal domains with age 11 abstinence and age 18 experimentation generally associated with better outcomes in *social*, *romantic*, and *family relationship* domains. Contrary to our predictions, no differences were found for internalizing *psychopathology* (i.e., internalizing symptoms and trait anxiety). It is unclear why studies fail to find differences in internalizing psychopathology. Perhaps these differences do not emerge until later in adulthood or when with the cumulative effects of developmental maladaptation become more pronounced.

Discussion of major findings

It is perhaps in the domain of emerging adult interpersonal outcomes—i.e., social, family relationships, and romantic—that the most interesting findings from this study emerge. Specifically, our findings suggest that there is a developmental shift in the relations between abstinence versus experimentation and emerging adult interpersonal competence. Specifically, age 11 abstinence was linked with higher social competence and family relationship ratings at age 23; however, the relations begin to reverse at age 14 with experimentation at age 14 linked with higher emerging adult social and romantic competence. By age 18, experimenters were higher than abstainers in all three emerging adult interpersonal domains. Interestingly, age 18 experimenters did not have the highest mean scores in each of these interpersonal domains. Although compared to all other

profiles experimenters were highest in family relationship ratings, age 18 *regular users* did not significantly differ from experimenters in social competence (both were high) or from problem users in romantic competence (both were high).

In interpreting these findings it is clear that a better understanding of interpersonal contexts is needed. For instance, more information is needed about the peers and romantic partners with whom these adolescents and emerging adults interact. For instance, although not assessed in the current study, research suggests that it is important to understand not only *whether* a person can establish a romantic relationship, but the type of romantic relationship (e.g., *quality, security*) and with *whom* (Fletcher, Simpson, & Thomas, 2000; Gottman & Krokoff, 1989; Gurung, Sarason, & Sarason, 1997; van Dulmen, Goncy, Haydon, & Collins, 2008). Further investigation surrounding these topics may be necessary given the risks associated with substance use in peer (Feske, Tarter, Kirisci, Gao, Reynolds, & Vanyukov, 2008; Sieving, Perry, & Williams, 2000; Steinberg, Fletcher, & Darling, 1994) and romantic relationships (e.g., risky sexual behaviors; Tapert, Aarons, Sedlar, & Brown, 2001) as well as the potential protective role of supportive friendships and romantic partners for deviant adolescents (Sampson & Laub, 1993).

The relations between abstention and positive emerging adult *academic* outcomes were generally consistent over time with abstainers tending to have the highest educational attainment, followed by experimenters, regular users, and then problem users. On the contrary, however, there were no differences in educational attainment for age 18 abstainers versus experimenters. This finding is consistent with Tucker et al.'s study

(2006) as well as with research that has shown the negative impact of adolescent substance use behaviors on emerging adult academic outcomes (Mun, Windle & Schainker, 2008).

In terms of *externalizing* symptomatology, our findings suggest negative relations between substance use profiles at ages 11, 14, and 18 and externalizing symptomatology at age 21 (i.e., abstainers lowest in externalizing and problem users highest in externalizing). This finding is consistent with previous research suggesting that substance use behaviors are a subset of behaviors reflecting a general, underlying liability towards externalizing behaviors (McGue & Iacono, 2008; Krueger et al., 2005). Moreover, our study has shown that age 14 and 18 regular and problem users engage in higher rates of age 21 externalizing behaviors and have the poorest academic outcomes. These findings are consistent with emergent “developmental cascades” research that underscores the interrelatedness of developmental tasks over time, especially externalizing behaviors and academic competence (Masten, Roisman, Long, Burt, Obradovic, Riley, et al., 2005). Our findings suggest that one important area for future research would be to investigate the moderating role of substance use profiles in these developmental cascades.

With regard to *work*-related outcomes, age 14 problem users were the least likely to have long-term career goals at age 21. This finding held up between age 18 substance use profiles with the exception that regular and problem users no longer significantly differed. Thus, heavy substance use during peak periods of adolescent substance use negatively relates to having emerging adult career-goals. Future research should further

investigate whether individuals engaging in these patterns of behavior may benefit from early vocational interventions.

Contrary to our predictions, no differences were found for internalizing *psychopathology* (i.e., internalizing symptoms and trait anxiety). It is unclear why studies fail to find differences in internalizing psychopathology. Perhaps these differences do not emerge until later in adulthood, when the cumulative effects of development become more pronounced.

Limitations

This study has several strengths that contribute to the literature on substance profiles and emerging adult functioning. The longitudinal design allowed us to examine the impact of developmental timing of substance profiles at ages 11, 14, and 18 in relation to emerging adult functioning at age 21. It also examines emerging adult functioning across a multitude of salient developmental outcomes. Furthermore, it is one of the only studies to include multiple substances in its classification scheme—an important characteristic that likely yields a better measure of patterns of substance use given the high rates of substance use across various substances.

However, this study also has several limitations. The results need to be interpreted in light of the fact that individuals who were missing outcome data were more likely to be male, have lower mean baseline SES, and to have drunk alcohol and used drugs at baseline. Given these attrition characteristics, it is more likely that our results underestimate the effects of substance profiles at ages 11, 14, and 18. In addition due to small sample sizes for regular and problem users at age 11, comparisons could only be

made between baseline abstainers and experimenters. Furthermore since this is a predominantly Caucasian, middle-class sample, these findings may not generalize to more diverse, lower-income populations. Findings should be replicated in a more diverse sample.

Summary

Our findings suggest the importance of examining adolescent substance profiles developmentally and across multiple domains. For instance, both abstention and experimentation have different meanings and impacts depending on when they were assessed and the outcomes examined. Clear evidence of this can be seen in the age 11 findings which show that experimentation at age 11 was linked with poor emerging adult outcomes. Although abstention at age 11 was associated with positive social, academic, and conduct outcomes, by age 18 relations with outcomes were mixed with abstention continuing to relate to better academic and conduct outcomes, but negatively relating to social and romantic outcomes.

The negative outcomes associated with abstention at age 18 tend to be less obvious, yet they are important developmental tasks that impact functioning across adulthood. Therefore, while abstainers may do well academically, they may have difficulty developing social support networks and romantic partners in the future. Further research is needed to address whether this is a legitimate long-term issue for abstainers. As expected problem use at ages 14 and 18 was associated with poor emerging adult outcomes. The findings for regular users were mixed in that although they were relatively high in social and romantic competence they were also high in externalizing. Consistent

with Shedler and Block's (1990) findings, age 18 experimenters showed an adaptive constellation of emerging adult outcomes.

Table 1. Demographic characteristics of the final sample of participants (N=1278) as a function of substance use profiles over time.

	<u>Baseline</u> <u>Age 11 (N=1278)</u>				<u>FU1</u> <u>Age 14 (N=1221)</u>				<u>FU2</u> <u>Age 18 (N=1187)</u>			
	ABS (n=1102)	EXP (n=170)	RU (n=3)	PU (n=3)	ABS (n=678)	EXP (n=372)	RU (n=68)	PU (n=103)	ABS (n=249)	EXP (n=399)	RU (n=200)	PU (n=339)
% male	45%	63%	67%	100%	43%	53%	54%	47%	39%	46%	40%	59%
Family SES (baseline)	.12 (1.01)	-.38 (.89)	-.94 (.82)	-1.35 (1.29)	.19 (1.02)	-.05 (.95)	-.06 (1.05)	-.36 (.91)	.29 (1.00)	.17 (.98)	.08 (1.09)	-.22 (.94)
% Caucasian	97%	92%	100%	100%	98%	96%	88%	91%	99%	96%	95%	95%
% used alcohol	0%	29%	67%	100%	0%	62%	84%	94%	0%	87%	98%	97%
% used tobacco	0%	78%	67%	100%	0%	75%	97%	99%	0%	68%	88%	99%
% used illicit drugs	0%	2%	33%	0%	0%	10%	38%	72%	0%	17%	54%	80%
FU3 assessment age (years)	21.41 (.81)	21.60 (.78)	21.50 (.86)	22.03 (.31)	21.31 (.81)	21.54 (.77)	21.55 (.58)	21.61 (.78)	21.20 (.80)	21.41 (.81)	21.40 (.69)	21.61 (.78)

Note. ABS=Abstainers; EXP=Experimenters; RU=Regular Users; PU=Problem Users; SES=socioeconomic status; FU=Follow-up

Table 2. *Pairwise correlations of variables included in the study.*

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13
1. Gender	1												
2. SES	.07	1											
3. Age at age 21 assessment	-.62	-.06	1										
4. Age 11 profiles	-.13	-.15	.07	1									
5. Age 14 profiles	-.08	-.17	.13	.35	1								
6. Age 18 profiles	-.15	-.19	.16	.23	.57	1							
<i>Age 21 outcomes</i>							1						
7. Social competence	-.01	.10	.03	-.10	-.06	.04							
8. Family relationships	.13	.06	.00	-.13	-.06	-.08	.29	1					

Table 2. *continued.*

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13
9. Romantic competence	.05	-.07	.06	.02	.14	.22	.29	.16	1				
10. Academic	.18	.36	-.11	-.23	-.32	-.40	.13	.15	-.05	1			
11. Work	.14	.11	-.05	-.08	-.11	-.13	.37	.24	.19	.25	1		
12. Internalizing symptom count	.06	.06	-.02	.04	.04	.05	-.17	-.08	-.07	.00	-.13	1	
13. Externalizing symptom count	-.36	-.15	.25	.22	.40	.52	-.01	-.18	.06	-.36	-.21	.14	1

Notes. Values in bold are significant at $p < .05$. Gender is coded as 1=male and 2=female. SES=socioeconomic status. Profiles at age 11 included abstainers (0) and experimenters (1). Profiles at ages 14 and 18 were coded as 0=abstainer, 1=experimenter, 2=regular user, and 3=problem user.

Table 3. Age 21 emerging adult outcomes (unadjusted means) by age 11 substance use profiles. Includes standardized effect size estimates (d).

Age 21 Emerging Adult Outcomes	Age 11 Abstainers (n=1102) Mean (SD)	Age 11 Experimenters (n=170) Mean (SD)	ANOVA (F, p)	Abs. vs. Exp Effect size (95% CI)
Social competence	26.78 (2.65)	25.96 (3.10)	7.27, p=.007	.32 (.09, .55)
Family relationships	39.44 (5.15)	37.34 (5.75)	9.48, p=.002	.42 (.15, .69)
Romantic competence (z-score)	-.01 (1.02)	.04 (.85)	.43, p=.514	-.08 (-.31, .16)
Academic—Educational attainment	No HS degree/GED=2% HS degree thru GED=2% HS degree=10% Voc/Trade school=10% Community college=15% 4-year university=61%	No HS degree/GED=8% HS degree thru GED=8% HS degree=19% Voc/Trade school=17% Community college=17% 4-year university=31%	26.51, p<.001	.69 (.39, .98)
Work—Long-term career goals	3.48 (.73)	3.28 (.89)	5.88, p=.015	.28 (.05, .51)
Internalizing symptom count	.93 (2.33)	1.15 (2.54)	4.04, p=.045	-.21 (-.40, -.01)
Externalizing symptom count	.86 (1.12)	1.70 (1.56)	18.14, p<.001	-.51 (-.75, -.28)

Notes. Covariates included in the ANOVA models were gender, SES, and age at FU3. Models included a profile by gender interaction term to assess whether outcomes differed by both gender and profile. Standardized effect size (ES) was computed as mean of first named profile minus mean of second named profile divided by residual standard deviation. Significant effects are highlighted in bold.

Table 4. Age 21 emerging adult outcomes (unadjusted means) by age 14 substance use profiles. ANOVA results displayed.

Age 21 Emerging Adult Outcomes	Age 14 Abstainers (n=678) Mean (SD)	Age 14 Experimenters (n=372) Mean (SD)	Age 14 Regular users (n=68) Mean (SD)	Age 14 Problem users (n=103) Mean (SD)	ANOVA (<i>F</i> , <i>p</i>)
Social competence	26.53 (2.62) _a	27.22 (2.47) _b	26.89 (2.98) _{ab}	25.19 (3.46) _c	11.23, <i>p</i><.001
Family relationships	39.39 (5.10) _a	39.15 (5.30) _a	39.80 (5.38) _a	37.76 (5.55) _a	1.82, <i>p</i> =.142
Romantic competence (z-score)	-.15 (1.13) _a	.14 (.79) _b	.31 (.61) _b	.17 (.76) _b	6.48, <i>p</i><.001
Academic— Educational attainment	No HS degree/GED=1% HS degree thru GED=2% HS degree=8% Voc/Trade school=8% Community college=13% 4-year university=68% a	No HS degree/GED=3% HS degree thru GED=2% HS degree=14% Voc/Trade school=12% Community college=15% 4-year university=54% b	No HS degree/GED=6% HS degree thru GED=9% HS degree=20% Voc/Trade school=19% Community college=15% 4-year university=31% c	No HS degree/GED=16% HS degree thru GED=11% HS degree=20% Voc/Trade school=19% Community college=23% 4-year university=11% d	38.02, <i>p</i><.001
Work—Long-term career goals	3.49 (.71) _a	3.48 (.74) _a	3.37 (.83) _a	3.10 (.99) _b	5.17, <i>p</i>=.001
Internalizing symptom count	.94 (2.40) _a	.91 (2.24) _a	.84 (1.96) _a	1.39 (2.75) _a	1.53, <i>p</i>=.205
Externalizing symptom count	.61 (.97) _a	1.23 (1.17) _b	1.48 (1.06) _b	2.20 (1.69) _c	53.25, <i>p</i><.001

Table 4. *continued.*

Notes. Covariates included in the ANOVA models were gender, SES, and age at FU3. Models included a profile by gender interaction term to assess whether outcomes differed by both gender and profile. Significant effects are highlighted in bold. Scores that share a subscript do not significantly differ from each other.

Table 5. Age 21 emerging adult outcomes (unadjusted means) by age 18 substance use profiles. ANOVA results displayed.

Age 21 Emerging Adult Outcomes	Age 18 Abstainers (n=249) Mean (SD)	Age 18 Experimenters (n=399) Mean (SD)	Age 18 Regular Users (n=200) Mean (SD)	Age 18 Problem Users (n=339) Mean (SD)	ANOVA (F, p)
Social competence	26.12 (2.50) _a	26.90 (2.55) _{bc}	27.28 (2.87) _b	26.48 (2.87) _c	6.82, p<.001
Family relationships	39.21 (5.47) _a	40.14 (4.85) _b	39.45 (5.07) _a	38.43 (5.44) _a	5.63, p<.001
Romantic competence (z-score)	-.51 (1.38) _a	.01 (.96) _b	.27 (.66) _c	.15 (.78) _{bc}	18.96, p<.001
Academic—Educational attainment	No HS degree/GED=.4% HS degree thru GED=.4% HS degree=6% Voc/Trade school=8% Community college=7% 4-year university=78% a	No HS degree/GED=.3% HS degree thru GED=.6% HS degree=7% Voc/Trade school=9% Community college=14% 4-year university=69% a	No HS degree/GED=1% HS degree thru GED=1% HS degree=11% Voc/Trade school=11% Community college=15% 4-year university=61% b	No HS degree/GED=9% HS degree thru GED=7% HS degree=19% Voc/Trade school=16% Community college=19% 4-year university=30% c	46.66, p<.001
Work—Long-term career goals	3.54 (.62) _{ab}	3.60 (.64) _a	3.45 (.77) _{bc}	3.27 (.87) _c	8.50, p<.001
Internalizing raw symptom count	.68 (1.97) _a	.96 (2.33) _a	.81 (2.10) _a	1.15 (2.57) _a	3.46, p=.016
Externalizing symptom count	.27 (.62) _a	.60 (.84) _b	1.05 (.95) _c	1.80 (1.47) _d	104.15, p<.001

Table 5. *continued.*

Notes. Covariates included in the ANOVA models were gender, SES, and age at FU3. Models included a profile by gender interaction term to assess whether outcomes differed by both gender and profile. Significant effects are highlighted in bold. Scores that share a subscript do not significantly differ from each other.

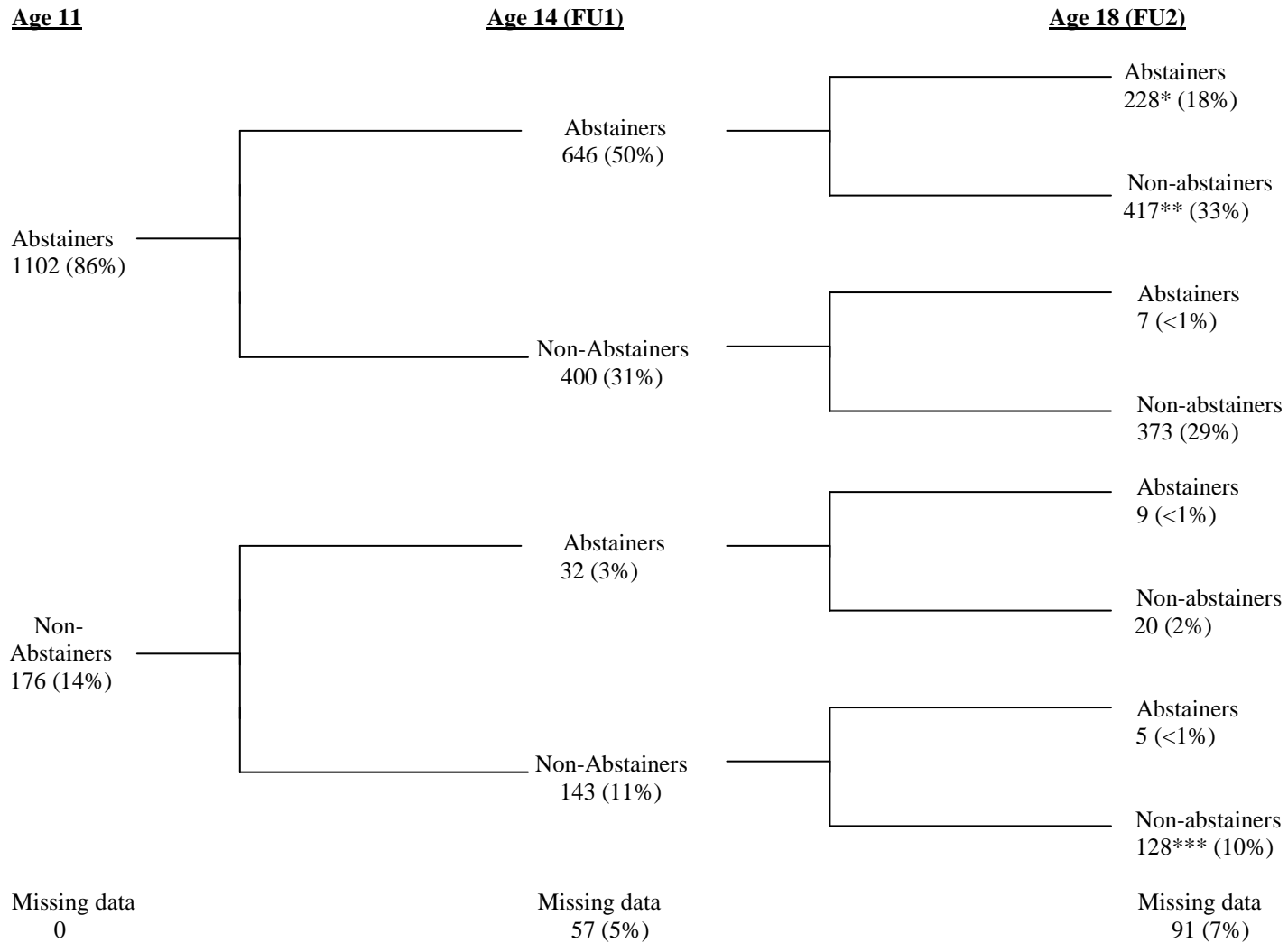


Figure 1. Patterns of abstinence and non-abstinence over time for 1278 participants.

Figure 1. continued.

Note. *8 had missing data at FU1; **20 had missing data at FU1; ***1 had missing FU1 data

Appendix

Table A1. *Description of items contained in scales created for age 21 outcomes.*

<i>Social Competence</i> ($\alpha=.70$)		<i>Close Family Relationships</i> ($\alpha=.82$)	
1. In your free time, do you like to do things with other people or by yourself?*	5. I am a leader among my friends.	1. I have what I consider to be a close relationship with my mother.	7. I confide in/talk about personal things with my twin.
2. I make new friends easily.	6. In my free time, I like to hang out with my friends.	2. I have what I consider to be a close relationship with my father.	8. I confide in/talk about personal things with my (closest) sibling.
3. I am popular with others.	7. I attend social functions when invited.	3. I have what I consider to be a close relationship with my twin.	9. I have problems getting along with my mother (reverse-coded).
4. I have a steady group of friends.	8. I have problems getting along with my friends (jealousy, arguments, etc.).	4. I have what I consider to be a close relationship with my (closest) sibling.	10. I have problems getting along with my father (reverse-coded).
		5. I confide in/talk about personal things with my mother.	11. I have problems getting along with my twin (reverse-coded).
		6. I confide in/talk about personal things with my father.	12. I have problems getting along with my (closest) sibling (reverse-coded).

Notes. With one exception all items were rated on a 4-point scale ranging from “very true”, “pretty true”, “not very true”, to “not at all true”. *4-point scale from “almost always with others”, “usually with others”, “usually by yourself”, to “almost always by yourself.”

Table A2. Standardized effect size estimates (*d*) from ANOVA of age 21 emerging adult outcomes by age 14 substance use profiles (including stringent abstainers compared to experimenters).

Age 21 Emerging Adult Outcomes	<i>SU profiles at age 14 (F, p)</i>	<i>Stringent Abs. vs. Exp Effect size (95% CI)</i>	<i>Abs. Vs. Exp Effect size (95% CI)</i>	<i>Abs vs. RU Effect size (95% CI)</i>	<i>Abs vs. PU Effect size (95% CI)</i>	<i>Exp vs. RU Effect size (95% CI)</i>	<i>Exp. Vs. PU Effect size (95% CI)</i>	<i>RU vs. PU Effect size (95% CI)</i>
Social competence	11.23, p<.001	-.29 (-.47, -.12)	-.29 (-.46, -.12)	-.04 (-.36, .28)	.59 (.29, .89)	.24 (-.08, .57)	.88 (.57, 1.18)	.63 (.23, 1.03)
Family relationships	1.82, <i>p</i> =.142	.09 (-.10, .29)	.06 (-.13, .26)	-.01 (-.38, .35)	.41 (.05, .77)	-.08 (-.45, .29)	.35 (-.01, .71)	.42 (-.03, .88)
Romantic competence	6.48, p<.001	-.32 (-.49, -.14)	-.33 (-.50, -.15)	-.49 (-.82, -.17)	-.32 (-.63, -.02)	-.17 (-.49, .16)	.00 (-.31, .31)	.17 (-.23, .57)
Academic—Educational attainment	22.43, p<.001	.47 (.27, .67)	.45 (.25, .64)	.96 (.59, 1.32)	1.36 (.98, 1.74)	.51 (.14, .88)	.91 (.53, 1.30)	.41 (-.06, .87)
Work—Long-term career goals	5.17, p=.001	.06 (-.11, .23)	.04 (-.13, .21)	.16 (-.15, .48)	.60 (.30, .90)	.12 (-.20, .44)	.56 (.25, .87)	.44 (.04, .84)
Internalizing symptom count	1.53, <i>p</i> =.205	-.03 (-.18, .12)	-.04 (-.19, .11)	-.04 (-.33, .25)	-.28 (-.54, -.02)	-.003 (-.30, .29)	-.24 (-.51, .02)	-.24 (-.60, .12)
Externalizing symptom count	53.25, p<.001	-.75 (-.93, -.57)	-.69 (-.86, -.52)	-1.01 (-1.33, -.69)	-1.61 (-1.91, -1.32)	-.32 (-.64, .00)	-.92 (-1.22, -.62)	-.60 (-.99, -.21)

Table A2. *continued.*

Notes. Standardized effect size (ES) was computed as mean of first named profile minus mean of second named profile divided by residual standard deviation. SU=Substance use. Abs=Abstainers. Exp=Experimenters. RU=Regular users. PU=Problem users. Covariates included in the ANOVA models were gender, SES, and age at FU3. Models included a profile by gender interaction term to assess whether outcomes differed by both gender and profile. Significant effects are highlighted in bold.

Table A3. Standardized effect size estimates (*d*) from ANOVA of age 21 emerging adult outcomes by age 18 substance use profiles (including stringent abstainers compared to experimenters).

Age 21 Emerging Adult Outcomes	<i>SU profiles at age 18 (F, p)</i>	<i>Stringent Abs. vs. Exp Effect size (95% CI)</i>	<i>Abs. vs. Exp Effect size (95% CI)</i>	<i>Abs vs. RU Effect size (95% CI)</i>	<i>Abs vs. PU Effect size (95% CI)</i>	<i>Exp vs. RU Effect size (95% CI)</i>	<i>Exp. Vs. PU Effect size (95% CI)</i>	<i>RU vs. PU Effect size (95% CI)</i>
Social competence	6.82, <i>p</i><.001	-.45 (-.68, -.22)	-.40 (-.62, -.19)	-.53 (-.79, -.28)	-.26 (-.49, -.02)	-.13 (-.35, .09)	.15 (-.05, .35)	.28 (.05, .51)
Family relationships	5.63, <i>p</i><.001	-.24 (-.51, .03)	-.26 (-.50, -.02)	.08 (-.20, .38)	.17 (-.10, .44)	.35 (.10, .59)	.43 (.21, .66)	.08 (-.18, .35)
Romantic competence	18.96, <i>p</i><.001	-.54 (-.77, -.30)	-.58 (-.79, -.37)	-.86 (-1.11, -.61)	-.77 (-1.00, -.54)	-.28 (-.49, -.06)	-.19 (-.38, .01)	.09 (-.13, .32)
Academic competence	41.35, <i>p</i><.001	.31 (.04, .57)	.31 (.07, .55)	.71 (.43, .99)	1.39 (1.12, 1.66)	.40 (.16, .63)	1.08 (.86, 1.30)	.68 (.43, .93)
Long-term career goals	8.50, <i>p</i><.001	-.10 (-.32, .11)	-.09 (-.30, .11)	.19 (-.05, .43)	.38 (.16, .61)	.28 (.07, .49)	.47 (.28, .67)	.20 (-.03, .42)
Internalizing symptom count	3.46, <i>p</i> =.016	-.17 (-.38, .04)	-.15 (-.34, .03)	-.09 (-.31, .13)	-.32 (-.52, -.11)	.06 (-.13, .26)	-.16 (-.34, .01)	-.23 (-.43, -.02)
Externalizing symptom count	104.15, <i>p</i><.001	-.65 (-.89, -.40)	-.51 (-.72, -.31)	-1.33 (-1.58, -1.09)	-1.82 (-2.04, -1.59)	-.82 (-1.03, -.61)	-1.30 (-1.49, -1.11)	-.48 (-.70, -.26)

Table A3. *continued.*

Notes. Standardized effect size (ES) was computed as mean of first named profile minus mean of second named profile divided by residual standard deviation. SU=Substance use. Abs=Abstainers. Exp=Experimenters. RU=Regular users. PU=Problem users. Covariates included in the ANOVA models were gender, SES, and age at FU3. Models included a profile by gender interaction term to assess whether outcomes differed by both gender and profile. Significant effects are highlighted in bold.

Table A4. Full summary of variables included in the ANOVA analyses at ages 11, 14, and 18 by emerging adult outcomes at age 21.

Emerging Adult Outcomes	Substance use profiles (<i>F, p</i>)	Gender (<i>F, p</i>)	Socioeconomic status (<i>F, p</i>)	Age at Age 21 Assessment (<i>F, p</i>)	Profile by gender interaction (<i>F, p</i>)
Age 21 Social competence					
Age 11	7.27, .007	.41, .523	11.06, .001	1.62, .203	2.20, .138
Age 14	11.23, <.001	.27, .602	8.76, .003	1.44, .231	.22, .881
Age 18	6.82, <.001	.15, .696	10.73, .001	.24, .625	1.61, .186
Age 21 Family relationships					
Age 11	9.48, .002	10.11, .001	1.72, .190	6.24, .013	.00, .99
Age 14	1.82, .142	19.38, <.001	1.65, .199	6.87, .009	.45, .715
Age 18	5.63, <.001	20.93, <.001	.88, .347	7.41, .007	1.51, .211
Age 21 Romantic competence					
Age 11	.43, .514	8.51, .004	3.40, .066	12.76, <.001	.11, .741
Age 14	6.48, <.001	6.27, .012	2.58, .109	8.50, .004	.76, .516
Age 18	18.96, <.001	9.76, .002	1.16, .283	8.53, .004	1.06, .367
Age 21 Academic competence					
Age 11	21.11, <.001	4.39, .036	104.29, <.001	.00, .96	.51, .475
Age 14	22.43, <.001	6.04, .014	98.41, <.001	.24, .625	1.42, .236
Age 18	41.35, <.001	10.89, .001	90.82, <.001	1.13, .288	.43, .734

Table A4. *continued.*

Emerging Adult Outcomes	<i>Substance use profiles</i> (<i>F, p</i>)	<i>Gender</i> (<i>F, p</i>)	<i>Socioeconomic status</i> (<i>F, p</i>)	<i>Age at Age 21 Assessment</i> (<i>F, p</i>)	<i>Profile by gender interaction</i> (<i>F, p</i>)
Age 21 Long-term career goals					
Age 11	3.54, .060	5.01, .025	9.50, .002	2.64, .105	1.73, .189
Age 14	5.27, .001	14.73, <.001	6.87, .009	3.11, .078	1.26, .287
Age 18	6.01, <.001	13.12, <.001	3.52, .061	3.51, .061	.55, .645
Age 21 Internalizing symptom count	4.04, .045	7.67, .006	4.16, .042	.86, .355	1.96, .162
Age 11	1.53, .205	7.04, .008	4.45, .035	.37, .545	1.81, .143
Age 14	3.46, .016	2.39, .122	5.56, .019	.00, .949	1.28, .278
Age 18					
Age 21 Externalizing symptom count					
Age 11	18.14, <.001	44.84, <.001	12.13, <.001	1.14, .285	1.00, .318
Age 14	53.25, <.001	65.05, <.001	6.01, .014	.07, .797	.99, .395
Age 18	104.15, <.001	76.52, <.001	2.59, .108	.44, .505	2.87, .035

Chapter 4. General discussion

The two studies reported here examined: (1) whether antecedent (age 11) and concurrent (age 18) personality characteristics differentiated 18-year old adolescent substance use profiles, and (2) whether emerging adult functioning at age 21 differed by substance use profiles at ages 11, 14, and 18. We found evidence to suggest that adolescent substance use profiles differed in antecedent and concurrent personality as well as in emerging adult outcomes. In addition, developmental timing played an important role in understanding the relations between substance use profiles at ages 11, 14, and 18 and emerging adult outcomes. Major findings for each substance use profile are discussed below.

Abstainers

In terms of personality, 18-year old *abstainers* had a developmental history of being overcontrolled, harm avoidant and traditional (i.e., highest in *constraint* at ages 11 and 18). By age 18, abstinence was concurrently associated with high achievement and low social potency, social closeness, aggression, and alienation. These personality characteristics generally fit well with abstainers' emerging adult outcomes. In particular, 18-year old *abstainers* tended to have poor interpersonal outcomes at age 21—i.e., poor social and romantic competence. However, they had excellent educational outcomes (high educational attainment) and the least externalizing symptomatology. As expected, *timing* was an important factor in understanding the relations between abstinence and emerging adult outcomes. Notably, 11-year old abstainers were more socially competent at age 21 than experimenters; however, this relation shifted by age 14 with 14-year old

abstainers lower in social competence at age 21 compared to experimenters. This relation held at age 18.

Experimenters

Although not evident at age 11, 18-year old *experimenters* had an adaptive constellation of concurrent personality characteristics. At age 18 they scored moderately across measures of personality—i.e., in between abstainers and regular/problem users. Compared to the other profiles, 18-year old experimenters rated their age 21 family relationships the highest and were moderate in *constraint* (control, traditionalism), *communal positive emotionality* (social closeness), achievement, and social potency. These personality characteristics generally fit well with their emerging adult developmental outcomes. Specifically, at age 21, 18-year old *experimenters* were characterized as scoring high in social competence, family relationships, and educational attainment and low in externalizing symptomatology. They were also relatively likely to have long-term career goals at age 21. Interestingly, compared to 18-year old *regular users*, experimenters had poorer romantic competence.

Regular users

The antecedent and concurrent personality characteristics of 18-year old *regular users* were interesting in that although they scored relatively low in *constraint* at ages 11 and 18, they did not differ from *problem users* in *constraint* at age 11. However, at age 18 they were higher than problem users in constraint. Additionally, concurrent findings suggest that 18-year old *regular users* were relatively high in *communal positive emotionality* (social closeness), social potency, and aggression, and low in *agentic*

positive emotionality (achievement). Notably, although 18-year old *regular users* were similarly high in age 18 social potency compared to *problem users*, unlike *problem users* they were among the highest in social closeness. Generally, the personality characteristics of age 18 *regular users* suggest that they may be at-risk for poor emerging adult conduct (e.g., externalizing) outcomes but not social outcomes. One might also expect their educational outcomes to be poor given their low achievement-motivation.

Our emerging adult findings were consistent with these expectations. In emerging adulthood, 18-year old *regular users* were socially competent and able to establish romantic relationships; however, they had poor educational outcomes (low educational attainment) and relatively high externalizing symptomatology. Generally, regular users and experimenters did not differ much in terms of emerging adult outcomes, with the exception of regular users having slightly worse educational outcomes and greater externalizing, but better social outcomes. Siebenbruner et al. (2006) suggested that regular users in her study (“at-risk youth”) may be most responsive to intervention because they have a developmental history of both adaptation and maladaptation. Interestingly, they found that the major difference between experimenters and “at-risk” youth was that “at-risk youth” had lower parental monitoring.

Problem users

As expected, 18-year old *problem users*’ maladaptive personality characteristics were seen as early as age 11 (low in *constraint*). Additionally, concurrent personality measures at age 18 suggested that not only do *problem users* continue to be low in *constraint* and high in *negative emotionality* (aggression), they also become high on other

aspects of *negative emotionality*—i.e., stress reactivity and alienation—and low in achievement. Unexpectedly, *problem users* were also high in social potency. Based on these personality characteristics as well as previous research, age 18 *problem users* might be expected to evidence difficulty across all emerging adult domains.

Our findings suggest that 18-year old *problem users* have poor emerging adult functioning in specific domains. At age 21, they had the worst educational outcomes (lowest educational attainment), were less likely to have long-term career goals, and were high in externalizing symptomatology. Surprisingly, age 18 *problem users* did not generally have poorer social outcomes; however, they were less socially competent at age 21 than *regular users*. Notably, in terms of timing, although 14-year old *problem users* had the lowest age 21 social competence, examination of age 18 substance use profiles suggested that it was *abstainers* who had the lowest social competence at age 21.

In discussing this problem use profile, it should be noted that 30% of 18-year old *problem users* had enrolled in a 4-year university by age 21. Although this is less than half the rate of the other three profiles, it suggests that even among a high-risk population, there are individuals who manage to meet some of society's expectations. Understanding what differentiates these relatively adaptive *problem users* from other *problem users* may help identify important factors involved in promoting positive adaptation in this high-risk population.

Developmental timing and cascades

We found that *any* substance use in late childhood or adolescence was associated with poor emerging adult educational outcomes and increased externalizing

symptomatology. One notable exception was that there was no significant difference between 18-year old abstainers and experimenters in educational attainment at age 21. Thus, substance experimentation during a developmentally appropriate time may not have negative long-term relations with educational attainment. Contrary to our expectations, the developmental shifts in the relations between substance use profiles at ages 11, 14, and 18 and emerging adult outcomes were found primarily for interpersonal outcomes (social competence and family relationships).

Previous research by Baumrind (1991) suggests one reason we may not have seen as many effects—we did not assess individuals' *reasons* for abstaining. Specifically, Baumrind found that understanding why individuals abstain is important. She found that risk-avoidant (e.g., did not use substances because they held irrational/unrealistic fears) and rational (e.g., realistic reasons for not using) nonusers were distinguishable from one another. Risk-avoidant nonusers were reported to be “less explorative, resilient, individuated, and optimally competent [and to have] a more internal locus of control” than rational nonusers (p. 85). At 15-years old, risk-avoidant nonusers, were more fearful, had less stable home lives, and had mothers who were more coercive, less structuring and less intellectually stimulating. Baumrind (1991) posited that these risk-avoidant nonusers were similar to the abstainers in Shedler and Block's (1990) study. In general, Baumrind's findings highlight the importance of examining individuals' *reasons* for *abstaining* from substance use. Her study also identified the existence of multiple pathways towards abstention, an important component in facilitating our understanding of substance use and abuse (Cicchetti & Luthar, 1999).

In addition, developing an understanding of the types of individuals with whom 14- and 18-year old experimenters socialize in adulthood might yield better insight into the ways in which different pathways lead to the same outcome (equifinality, cf. Cicchetti & Rogosch, 1996) as well as the ways in which these different pathways are developmentally significant. For instance, among 14-year old experimenters, 62% were regular or problem users at age 18 (23% and 39% respectively), whereas among 18-year old experimenters, 29% were age 14 experimenters whereas 66% of them were age 14 abstainers. Thus, most 14-year old experimenters go on to become heavier users at age 18 whereas most 18-year old experimenters were abstainers at age 14. These characteristics suggest different pathways and potentially different *meanings* of social competence. The “friends” reference group probably refers to different types of individuals for the different profiles and may be an important factor to consider in understanding their varied developmental outcomes.

Our findings suggest that one pathway towards poor academic achievement and externalizing is early onset substance use. However, early onset substance use often arises in the context of poor academic achievement and externalizing behaviors. Thus, developmental cascade research that more rigorously tests the relations between substance use and developmental task performance may be critical to better understanding the nature of these relations. For instance, Masten and colleagues (2005) utilized a developmental cascades model approach and found that childhood externalizing was linked to poorer adolescent academic competence which in turn was linked to young adult internalizing problems. Testing these hypotheses in developmental cascade models

may help identify the important pathways on which to focus while also yielding insight into the *timing* and potential *focus* of intervention programs (e.g., which interventions are important when). In addition, these models should incorporate antecedent risk factors. King, Meehan, Trim and Chassin (2006) have shown that incorporating shared risk factors for substance use in statistical models can help distinguish whether substance use is a marker or a mediator of the outcomes of interest. Moreover, understanding the role that personality plays in these relations will also broaden our understanding of personality-adaptation and personality-psychopathology linkages (Ge & Conger, 1999; Shiner, Masten, & Tellegen, 2002; Tackett, 2006).

Limitations

Despite this study's strengths, there were a number of limitations. First and foremost, in examining our outcomes we did not control for antecedent personality, functioning, or other risk factors (besides SES) that relate to substance use. In addition, for our emerging adult outcomes, we did not control for concurrent substance use nor did we examine the role of emerging adult personality. Future research should utilize developmental cascade models to more adequately test these relations over time; especially given the accumulating evidence suggesting the importance of examining personality continuity and change during emerging adulthood (Blonigen, Carlson, Hicks, Krueger, & Iacono, 2008; Roberts, Caspi, & Moffitt, 2001) and the important role that personality plays in salient developmental outcomes up to 20 years later and vice versa (Shiner & Masten, 2002; Shiner, Masten, & Roberts, 2003). Moreover, this was a

predominantly Caucasian sample. Thus, these findings need to be replicated in more diverse samples.

Summary and future directions

Taken as a whole, these two studies suggest that using person-centered approaches to studying substance use behaviors can provide rich, developmentally meaningful insights into the pathways towards and away from heterogeneous patterns of substance use. In particular, they exemplify one way in which applying a developmental psychopathology perspective helps in identifying pathways towards heavy substance use as well as abstinence (Cicchetti & Luthar, 1999). The findings suggest that personality characteristics at ages 11 and 18 significantly relate to age 18 substance use profiles and that age 18 substance use profiles significantly relate to emerging adult outcomes. Timing was also important in understanding the developmental significance of substance use profiles for later functioning. Interestingly, there were no significant gender differences in these relations suggesting that patterns of linkages were the same for males and females.

In general these findings were consistent with Shedler and Block's (1990) study. Specifically, we found that 18-year old experimenters had an adaptive constellation of personality characteristics as well as good emerging adult outcomes. However, consistent with Tucker et al. (2006), 18-year old abstainers had the best educational outcomes and problem users the worst. Our findings underscore the importance of intervening with unconstrained, undercontrolled children early on as these characteristics put them at risk

for not only problematic substance use and externalizing behaviors but also poor academic and social functioning in emerging adulthood.

Besides focusing on this well-known group of at-risk children, it appears that 18-year old abstainers may also be at-risk for poor outcomes, particularly in the social domain. Future research should investigate the *mechanisms* that may help explain these differences. That is, *how* does adolescent abstention relate to poorer social outcomes and better educational outcomes? We are not suggesting that society begin encouraging adolescents to smoke, drink, or do drugs. Instead, as Shedler and Block (1990) have suggested and from what our data suggest, *constraint* as early as age 11 may forecast later interpersonal difficulties which may become more pronounced over time as they may cascade into other personality domains and realms of adaptation. However, these are empirical questions that should be tested.

Given the high degree of academic and achievement-orientation among abstainers, perhaps social skills training in college preparation/advanced placement/honors classes may help improve their social outcomes. If such an intervention is attempted, it would be important to assess for any iatrogenic effects of this intervention (e.g., reducing educational outcomes, increasing substance use).

In sum, these studies suggest that heterogeneous patterns of substance use in childhood and adolescence are psychologically significant. Not only are adolescent substance use profiles differentiated by antecedent and concurrent personality, but they also differentiate emerging adult outcomes. In addition, developmental timing was found to play a role in the relations between substance use profiles and emerging adult

outcomes. Future research should utilize developmental cascades models to better understand the interplay between personality development, adaptation, and substance use behaviors from childhood into adulthood. These models underscore the importance of looking across multiple developmental domains and are consistent with the notion that “The meaning of any one attribute, process, or psychopathological condition needs to be considered in light of the complex matrix of individual characteristics, experiences, and social-contextual influences involved, the timing of events and experiences, and the developmental history of the individual” (Cicchetti & Rogosch, 1996, p. 599). Applying this developmental framework to the understanding of the etiology of substance use behaviors holds great promise for substance use researchers as well as for individuals interested in intervention and prevention.

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