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Parent-reported Childhood Temperament and Adolescent Self-reported Substance Use Initiation

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Abstract

Children differ in their general temperament and these differences predict consequential outcomes, including mental health, peer relations, and academic performance. In adults, there is strong evidence that personality correlates with substance use, but the temporal direction of the relation is unclear, as substance use may alter personality. The present research uses data from the Longitudinal Study of Australian Children (N = 5,362) to examine whether temperament assessed by parents in early childhood is associated with adolescent self-reported initiation of alcohol, cigarette, marijuana, or other drug use. Children rated higher on sociability at 4–5 years old were at higher risk of initiation for all types of substances in adolescence (age 12 to 17), controlling for SES, single-parent household, parent substance use, and other demographic variables. Additionally, children rated higher on reactivity were at higher risk of cigarette or marijuana use initiation, and children rated higher on persistence had a lower risk of cigarette use initiation. This multi-informant prospective study demonstrates that early individual differences in psychological functioning predict risk of future substance use initiation and highlights the importance of considering temperament and personality when assessing risk of future substance use initiation.

Keywords

temperament; substance use; longitudinal; children; adolescents

1. Introduction

Childhood temperament is related to adult personality and predicts many consequential outcomes throughout the lifespan, such as mental health (Lewis & Olsson, 2011), peer relationships (Sanson et al., 2004), and academic performance (Schoen & Nagle, 1994). In

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Statement 2: Contributors

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Statement 3: Conflict of Interest

The Authors declare that there is no conflict of interest.

adulthood, there is substantial evidence from both meta-analyses and individual studies that personality correlates with substance use (Hakulinen, Elovainio, et al., 2015; Hakulinen, Hintsanen, et al., 2015; Mercado et al., 2016), but evidence is mixed as to whether this relation exists for temperament assessed in early childhood before substance use typically begins.

1.1. Child Temperament

In children, relatively stable individual differences in behavioral, emotional, and attentional self-regulation and reactivity are commonly referred to as temperament (Prior, Sanson, Smart, & Oberklaid, 2000; Sanson & Oberklaid, 2013). In adults, similar individual differences are called personality. Temperament in childhood is traditionally considered to include a narrower set of attributes than adult personality that are linked more directly to biological processes (De Pauw, 2017). The most widely accepted model of adult personality is the five-factor model (FFM; or the Big Five): *neuroticism*, *extraversion*, *openness*, *agreeableness*, and *conscientiousness* (McCrae & John, 1992). In contrast, there is less consensus on a single set of factors for child temperament, however three traits that are commonly investigated are *sociability*, *reactivity*, and *persistence* (Sanson & Oberklaid, 2013; Smart & Sanson, 2005).

Sociability refers to how comfortable a child is in new situations and how readily they approach new people, reactivity refers to the intensity and volatility of a child's emotional responses to frustrations of challenges, and persistence refers to a child's ability to stay focused on tasks and maintain attention until they are completed (Sanson & Oberklaid, 2013; Smart & Sanson, 2005). Children who are high in sociability, low in reactivity, and high in persistence tend to experience more positive outcomes in a variety of domains, including internalizing and externalizing disorders (Lewis & Olsson, 2011; Sanson & Prior, 1999), peer relationships and socialization (Sanson, Hemphill, & Smart, 2004), and skills in mathematics and reading (Schoen & Nagle, 1994). These three child temperament traits are also linked to three of the adult FFM personality traits: sociability in children is associated with extraversion in adults, reactivity is associated with neuroticism, and persistence is associated with conscientiousness (Prior et al., 2000).

1.2. Temperament/Personality and Substance Use

An extensive body of research has linked adult personality traits and substance use. Both meta-analyses and individual studies tend to show that lower conscientiousness and higher neuroticism are related to higher risk of using cigarettes (Hakulinen, Hintsanen, et al., 2015; Malouff, Thorsteinsson, & Schutte, 2006) and alcohol (Hakulinen, Elovainio, et al., 2015; Malouff, Thorsteinsson, Rooke, & Schutte, 2007), as well as marijuana and other drugs (Mercado et al., 2016; Terracciano, Löckenhoff, Crum, Bienvenu, & Costa, 2008; Turiano, Whiteman, Hampson, Roberts, & Mroczek, 2012). Additionally, in some studies, higher extraversion is associated with higher risk of substance use (e.g., Hakulinen, Elovainio, et al., 2015; Hakulinen, Hintsanen, et al., 2015; Mercado et al., 2016). Research comparing the outcomes of similar personality and temperament traits often, but not always, find similar results. Differences may at times arise if temperament fails to capture the full breadth of attributes present in personality (De Pauw, 2017; Prior et al., 2000). However, in studies

examining substance use, the results for temperament appear to be similar to those for personality. For example, cross-sectional meta-analyses with adolescents indicate that temperament traits related to low persistence and high sociability tend to be associated with higher risk of substance use (Rioux, Castellanos-Ryan, Parent, & Séguin, 2016; Stautz & Cooper, 2013), which is similar to the adult findings for associations between low conscientiousness and high extraversion and substance use (e.g., Hakulinen, Elovainio, et al., 2015; Hakulinen, Hintsanen, et al., 2015).

Although there are clear associations between personality/temperament and substance use, the temporal direction is less clear. It may be that personality differences lead to different rates of substance use, but it is also possible that substance use alters personality (MacLean, Johnson, & Griffiths, 2011) and/or that the association is bidirectional. Longitudinal studies that start in adolescence or adulthood cannot fully resolve this issue, as substance use often begins in adolescence and may have a substantial impact on psychological and neurological development during this sensitive period (Bava & Tapert, 2010). Better evidence for the temporal role of personality in substance use requires a longitudinal design where personality is measured in early childhood before substance use initiation. However, studies using this design have produced mixed results.

We identified a total of 12 published studies that examined the association between temperament measured in early or middle childhood (younger than 10 years old) and substance use in adolescence (13-17 years old)¹. Overall, five of these studies found significant associations, while seven did not (see Table 1). The studies investigated different temperament constructs and substance use outcomes, which may in part explain the mixed results. In general, though, traits similar to reactivity and persistence tended to be related to lower risk of substance use. Additionally, as might be expected, studies with larger sample sizes were more likely to find significant results. There were no apparent patterns distinguishing between results for different types of substances, but most studies only investigated a single substance or combined all substances into a single outcome variable. Additional research exploring multiple temperament traits and multiple types of substances with sufficiently large sample sizes is needed to clarify previous inconsistent results and to determine whether the associations vary for different traits and substances.

1.3. Present Research

The present research examines the association between three temperament traits measured in early childhood and use of four substances in adolescence. Specifically, we test whether parent-reported sociability, reactivity, and persistence assessed at 4–5 years old predict adolescent-reported initiation of cigarette, alcohol, marijuana, or other drug use between 12 and 17 years old. We hypothesize that higher sociability, higher reactivity, and lower persistence in early childhood predict higher risk of substance use initiation in adolescence.

¹We also identified a small number of studies examining the association between child temperament and substance use in adulthood, which had results similar to the adolescent substance use studies (e.g., Caspi et al., 1996; Shedler & Block, 1990; Tung, Noroña, Lee, Langley, & Waterman, 2018; Wennberg & Bohman 2002).

2. Method

2.1. Participants and Procedure

Participants were drawn from the Longitudinal Study of Australian Children (LSAC; Australian Institute of Family Studies, 2015). The LSAC is a nationally representative study of two Australian age cohorts: an older cohort (labeled K) born 1999–2000 and a younger cohort (labeled B) born 2003–2004. The first wave of data collection for both cohorts was conducted 2004–2005 and follow-up waves have occurred every 2 years. The study was approved by the Australian Institute of Family Studies Ethics Committee and each family provided written informed consent before participating. LSAC data can be requested from the Australian Institute of Family Studies (<http://growingupinaustralia.gov.au/data/dataaccessmenu.html>).

In the present analyses, childhood temperament predictors and demographic covariates were obtained from the LSAC data collected when children were 4–5 years old. Adolescent substance use outcomes were obtained from the LSAC data collected when children were 12–17 years old. We excluded children if childhood temperament predictors or demographic covariates were missing at the 4–5 year old time-point or if adolescent substance use outcomes were missing at all time-points from 12–17 years old. We included a total of 5,362 children in the present analyses: 2,358 from Cohort B and 3,004 from Cohort K. Descriptive statistics for the included children are provided in Table 2.

There were 1,269 children who did not provide data on substance use at any time-point in adolescence, but data was available on their temperament and demographic covariates in childhood. When compared to the included children with full data, these excluded children without follow-up data were more likely to be indigenous ($\phi = .09, p < .001$), to live with only one parent ($\phi = .13, p < .001$), and to have at least one parent who smoked cigarettes ($\phi = .10, p < .001$), but there was no difference in the gender ratio ($\phi = .01, p = .51$) or the proportion who had at least one parent with alcohol problems ($\phi = -.001, p = .96$). Additionally, these excluded children were higher in reactivity ($d = .18, p < .001$) and lower in persistence ($d = -.13, p < .001$), their parents had less income ($d = -.24, p < .001$) and fewer years of education ($d = -.37, p < .001$), and they lived in lower SES neighborhoods ($d = -.17, p < .001$), but there was no difference in child sociability ($d = -.04, p = .17$).

2.2. Measures

2.2.1. Child temperament.—When children were 4–5 years old, parents completed a 12-item measure of their child's sociability, reactivity, and persistence, with four Likert-type items for each trait drawn from the Short Temperament Scale for Children (STSC; Sanson, Smart, Prior, Oberklaid, & Pedlow, 1994). The sociability items were selected from the sociability subscale (e.g., “This child will go up to strange children and join in their play”), the reactivity² items were selected from the inflexibility subscale (e.g., “When this child is angry about something, it is difficult to sidetrack him/her”), and the persistence items were selected from the persistence subscale (e.g., “This child stays with an activity for a long

²The items selected from the inflexibility subscale primarily focused on anger, irritability, and frustration, so this construct might also be called irritable reactivity.

time”). All items had six response options (1 = “Almost never”, 2 = “Not often”, 3 = “Variable, usually does not”, 4 = “Variable, usually does”, 5 = “Frequently”, 6 = “Almost always”).

2.2.2. Adolescent Substance Use.—Adolescents completed a series of self-report questions about drinking alcohol, smoking cigarettes, trying marijuana, and trying other drugs up to three times between the ages of 12–17 years old. Because these questions addressed sensitive topics, they were administered in private via an Audio Computer-Assisted Self-Interview (ACASI), so that neither the interviewer nor parents would know the child’s responses. The present analyses focused on whether the adolescents reported ever having used these substances: “Have you ever had even part of an alcoholic drink?” [alcohol], “Have you ever smoked even part of a cigarette? [cigarettes]”, “Have you ever tried marijuana (cannabis, hash, grass, dope, weed, mull, yarndi, ganga, pot, a bong, a joint)? [marijuana]”, “Have you ever tried other drugs (e. g. speed, ecstasy, LSD, ice, cocaine, heroin)?” [other drugs]. For marijuana and other drugs, the response options were “Yes” or “No.” For alcohol and cigarettes, there were additional response options to indicate the amount of use, which were collapsed into Yes and No for these analyses. For cigarettes, any reported use, including “just a few puffs” was coded as Yes. Consistent with recommended methods for reporting alcohol use (e.g., Center for Behavioral Health Statistics and Quality, 2017), both “No” and “just a few sips” of alcohol were coded as No, while “fewer than 10 alcoholic drinks in my life” and “10 or more alcoholic drinks in my life” were coded as Yes. In some cases, adolescents did not respond as to whether they had ever used these substances, but did respond “Yes” to a follow-up question asking if they had used these substances in the last 12 months. In these cases, adolescents were coded as Yes for ever having used.

2.2.3. Covariates.—We controlled for ten socio-demographic variables that might be related to child temperament and/or adolescent substance use: cohort, child gender, child indigenous status, child age at temperament assessment, whether there were 1 or 2 parents in the home, highest parent income, highest parent education, neighborhood SES, either parent cigarette use, and either parent alcohol problems. The LSAC defined parent alcohol problems as heavy daily average alcohol consumption (>4 drinks for men, >2 for women) or frequent binge drinking (2 to 3 times a month or more of 7+ drinks in a sitting for men, 5+ for women).

2.3. Statistical Approach

We used Cox proportional hazards regression models to predict adolescent substance use initiation for four types of substances (cigarettes, alcohol, marijuana, and other drugs) from three child temperament traits (sociability, reactivity, and persistence) controlling for demographic covariates. All predictors were standardized before being entered. The three temperament predictors were examined in three separate models and then all together in one simultaneous model. Time to first reported use of a particular substance was coded in years since birth. Participants who never reported using a particular substance were censored at the last available time-point that they reported not having used that substance. In addition to examining the four substance use outcomes separately, we also recoded the outcomes into

three new variables: Illicit Substance Use (use of Marijuana or Other Drugs), Substance Use Besides Alcohol (use of Cigarettes, Marijuana, or Other Drugs), and Any Substance Use (use of Alcohol, Cigarettes, Marijuana, or Other Drugs).

3. Results

At 12–13 years old, 5% of children reported any substance use initiation (see Table 3). This was divided equally with 2% of children reporting alcohol use initiation, 2% for cigarettes, and 2% for marijuana. Reported initiation of using other drugs use at 12–13 years old was much lower, at 0.08% of children. Over the course of adolescence, self-reported substance use initiation increased substantially with 68% of children reporting any substance use initiation by 16–17 years old. In contrast to the equal split between alcohol, cigarettes, and marijuana at 12–13 years old, at 16–17 years old alcohol was the predominant substance. In general, approximately a third of children 16–17 years old reported only alcohol use initiation and no other substances (36%), a third reported alcohol use initiation as well as other substances (30%), and a third reported that they had never used any substances at all (32%). In contrast, about 2.6% of children 16–17 years old reported having used a substance, but never having used alcohol.

3.1. Sociability

Higher parent-reported sociability at 4 or 5 years old was associated with significantly higher risk of adolescent substance use initiation for all substances, controlling for demographic covariates (see Table 4). For each 1 standard deviation increase in childhood sociability, risk of substance use initiation increased by 6% for Alcohol, 11% for Cigarettes, 11% for Marijuana, 30% for Other Drugs, 12% for Illicit Substances (marijuana or other drugs), 10% for any substance besides alcohol, and 6% for any substance at all. These associations with sociability were unchanged when reactivity and persistence were further controlled for in the model.

3.2. Reactivity

Higher parent-reported reactivity at 4 or 5 years old was associated with significantly higher risk of adolescent substance use initiation for many substances, controlling for demographic covariates (see Table 4). For each 1 standard deviation increase in childhood reactivity, risk of substance use initiation increased by 13% for Cigarettes, 11% for Marijuana, 11% for Illicit Substances (marijuana or other drugs), 11% for any substance besides alcohol, and 8% for any substance at all. Substance use initiation for Alcohol or Other Drugs was not associated with reactivity. These associations with reactivity were unchanged when sociability and persistence were further controlled for in the model.

3.3. Persistence

Higher parent-reported persistence at 4 or 5 years old was associated with significantly lower risk of adolescent substance use initiation for some substances, controlling for demographic covariates (see Table 4). For each 1 standard deviation increase in childhood persistence, risk of substance use initiation decreased by 12% for Cigarettes, 10% for any substance besides alcohol, and 5% for any substance at all. Substance use initiation for

Alcohol, Marijuana, Other Drugs, or Illicit Substances was not associated with persistence. These associations with persistence were mostly unchanged when sociability and reactivity were further controlled for in the model, except for use of any substance at all, which became non-significant.

4. Discussion

The present research indicates that children rated as being higher on sociability at 4–5 years old were at higher risk of substance use initiation in adolescence. Additionally, children higher in reactivity were at higher risk of cigarette or marijuana use initiation, but not alcohol or other drugs, and children higher in persistence had a lower risk of cigarette use initiation, but not alcohol, marijuana, or other drugs. These results support our hypotheses that higher sociability, higher reactivity, and lower persistence in childhood would predict higher risk of substance use initiation in adolescence and parallels studies of adult personality and substance use. Of note, these effects of temperament were found over a period spanning up to a decade and after accounting for major risk factors for the onset of substance use, such as gender, parent substance use, family SES and neighborhood SES. These analyses demonstrate that individual differences in temperament precede and predict substance use initiation. This finding suggests that associations between temperament/personality and substance use are not entirely a result of substance use systematically altering personality (MacLean et al., 2011)

There are many potential mechanisms that might be responsible for the observed associations between temperament and substance use initiation. People higher on sociability, for example, tend to have a larger social network (Asendorf & Wilpers, 1998), which may increase exposure to other substance users. This exposure might increase the risk of substance use initiation via social influence or at least would make it easier for adolescents to obtain controlled substances. Alternatively, sociability is closely related to sensation-seeking and people higher in sensation-seeking are typically more eager to experiment with new substances. For reactivity, one possible mechanism is that substances are used as a coping mechanism. Reactivity is associated with more intense negative emotional responses and greater risk of many mental disorders (e.g., Lewis & Olsson, 2011; Smart & Sanson, 2005). Adolescents high in reactivity might turn to various substances to help cope with those issues. However, it is not entirely clear why higher reactivity was not associated with risk of alcohol use initiation. Perhaps alcohol use commonly occurred in large social gatherings that adolescents high in reactivity were too anxious to attend. It is also not clear why higher persistence was only associated with decreased risk of smoking initiation. However, the Australian government has engaged in a vigorous antismoking campaign, educating people about the negative effects of smoking on health with graphic images (Intergovernmental Committee on Drugs, 2012), and higher adult conscientiousness is consistently associated with avoiding unhealthy behaviors (e.g., Bogg & Roberts, 2004). Perhaps adolescents higher in persistence avoid smoking as clearly unhealthy, but are more ambivalent about the health impact of other substances.

This research demonstrates that temperament in early childhood is associated with risk of substance use initiation in adolescence. Thus, it is possible that by routinely assessing child

temperament, along with other factors, could potentially increase the accuracy of predictions about children's risk of later substance use. This approach would enable more precisely targeted interventions that focus resources on the children at greatest risk. Additionally, knowledge of which temperament traits are associated with which substance use outcomes could be used to aid in improving interventions to reduce adolescent use of specific substances. Recent research has demonstrated the effectiveness of personality-targeted substance use interventions conducted in adolescence (see Conrod, 2016; Edalati & Conrod, 2019). Earlier interventions administered in pre-adolescence and targeted based on child temperament may be even more effective at reducing adolescent substance use initiation.

4.1. Strengths

Previous research on child temperament and adolescent substance use initiation has produced mixed results, sometimes finding significant associations (e.g., Dick et al., 2013) and other times not (e.g., Hentges, Shaw, & Wang, 2018). However, these prior studies each investigated a disparate array of temperament traits and substance use outcomes, which may in part explain the conflicting results. This research employed a more comprehensive design by examining a set of three commonly-investigated child temperament traits that are precursors to the FFM, the most widely accepted adult personality model. Additionally, this research examined four different substance use outcomes, both separately and in various combinations. This research also used a very large, nationally representative data-set that may facilitate more reliable results than smaller studies.

4.2. Limitations

This research was conducted on a national representative sample of Australian children and, therefore, it is unclear to what degree the results generalize to other countries. Additionally, attrition analyses indicated that there were significant demographic and temperamental differences between those children who participated in the adolescent follow-up waves and those who did not. Those who did not participate were more likely to come from relatively disadvantaged backgrounds, which may limit the generalizability of these results. Furthermore, our assessment of substance use initiation was based on the adolescent's self-report and even though every effort was made to ensure that the responses would be private, it is still possible that the self-reports of substance use may not be entirely accurate. The temperament measures were based on parent reports of their own child's temperament and may be somewhat biased. It is of note, however, that theoretically meaningful associations emerged between assessments given by different informants (i.e., parent-reported temperament and adolescent-reported substance use). Finally, the effect sizes observed in these analyses are not large; the significant hazard ratios ranged from 1.06 to 1.30. For hazard ratios with a standardized continuous predictor Cohen's (1988) standard conventions for effect size convert to: small = 1.14, medium = 1.47, large = 1.90 (Azuerro, 2016). Substance use initiation is a complex behavior with many risk factors besides temperament and thus any individual factor, such as temperament, is unlikely to have a large effect. Furthermore, even small effects can have broad impact in terms of public health, particularly in regard to substance use in a vulnerable population.

4.3. Future Directions

This research demonstrates the association between child temperament and adolescent substance use initiation. Future research is needed to investigate the specific mediating mechanisms by which this association occurs. For instance, as discussed above, the association could potentially be mediated via affiliation with deviant peers (e.g., Dick et al., 2013; Eiden et al., 2016) or via mental health issues (e.g., Burk et al., 2011). Additionally, future research is also needed to investigate the degree to which environmental factors in childhood might moderate the association between child temperament and adolescent substance use. The most frequently suggested moderating environmental factor is parenting style (e.g., Hentges et al., 2018; Rioux, Castellanos-Ryan, Parent, Vitaro, et al., 2016). There are multiple theories about the interaction of temperament and parenting style on various negative outcomes in adolescence (e.g., Belsky, 2005; Monroe & Simons, 1991) and future research should investigate them in relation to substance use. Finally, these analyses focused on the specific behavior of using substances. It would be worthwhile in future research to examine other important outcomes, such as substance use disorders, physical health consequences of substance use, and criminal convictions for using or possessing substances.

4.4. Conclusions

These analyses find that child temperament at 4–5 years old is associated with substance use initiation by age 12 to 17. These results clarify previous inconsistent findings by utilizing multiple substance use outcomes, a broad set of temperament traits closely linked to the adult FFM, and a very large sample size. This research demonstrates the importance of considering individual differences in temperament and personality when assessing risk of future substance use initiation and when designing interventions to reduce substance use initiation.

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Highlights:

- More sociable children are at higher risk of any type of substance use initiation in adolescence.
- More reactive children are at higher risk of initiating cigarette or marijuana use in adolescence
- More persistent children are at lower risk of initiating cigarette use in adolescence

Table 1

Prior Empirical Studies on Child Temperament and Adolescent Substance Use

Article	N	Result
Dick et al., 2013	b:4,318 g:4,091	<ul style="list-style-type: none"> • Sociability (Activity, Approach) related to higher Alc. use for g&b • Emotional Difficulties (Intensity, Emotionality) related to lower Alc. use for g&b
Martel et al., 2009	674	<ul style="list-style-type: none"> • Reactive Control (planful, neat, persistent) related to lower substance use • Negative Emotionality (rapid mood shifts) not related to substance use • Resiliency (eager, curious, vital, energetic) not related to substance use
Masse & Tremblay, 1997	656	<ul style="list-style-type: none"> • Novelty Seeking (Activity) related to higher use of Alc., Cig., and Other Drugs • Harm Avoidance (worries, afraid, cries easily) related to lower use of Alc., Cig., and Other Drugs • Reward Dependence (helps clean, stops quarrels) not related to use of Alc., Cig., or Other Drugs
Wong et al., 2006	514	<ul style="list-style-type: none"> • Resiliency (energetic, vital, lively, curious) related to lower Alc. use, but not Illicit Drug use • Behavioral Control (deliberates before acting) related to lower use of Alc. and Illicit Drugs
Buil et al., 2017	411	<ul style="list-style-type: none"> • Approach (Behavioral Disinhibition) not related to use of Alc. or Other Drugs • Negative Reactivity (frustration, fear, discomfort) not related to use of Alc. or Other Drugs • Attention (Task Persistence) not related to use of Alc. or Other Drugs
Armstrong et al., 2013	374	<ul style="list-style-type: none"> • Disinhibition (Activity, Approach) not related to Alc. Use
Burk et al., 2011	362	<ul style="list-style-type: none"> • Disinhibition (Activity, Approach) not related to Alc. Use • Negative Affect (Anger, Fear, Sadness) not related to Alc. use
Henges et al., 2018	310	<ul style="list-style-type: none"> • Impulsivity (low Inhibitory Control) not related to substance use
Eiden et al., 2016	227	<ul style="list-style-type: none"> • Self-regulation (Effortful Control) not related to Alc. or Mar. use
Rioux et al., 2016	209	<ul style="list-style-type: none"> • Impulsivity (Behavioral Activation) not related to Alc. Use • Inhibitory Control (Effortful Control) not related to Alc. Use
Williams et al., 2010	137	<ul style="list-style-type: none"> • Behavioral Inhibition (slow to approach or vocalize) not related to substance use
Block et al., 1988	g:54 b:51	<ul style="list-style-type: none"> • Ego-Undercontrol (unable to delay gratification) related to higher Mar. and Hard Drug use for g&b • Ego-Resiliency (exploring, energetic, lively) related to lower Mar. and Hard Drug use for g, not b

Note. g = girls, b = boys, Alc. = alcohol, Cig. = cigarettes, Mar. = marijuana

Table 2

Descriptive Statistics and Temperament Scores at 4/5 years old

	Both Cohorts	Cohort K	Cohort B
Number of children	5,362	3,004	2,358
Female children	48.45%	48.83%	47.96%
Indigenous children	2.13%	2.23%	1.99%
One parent families	11.36%	12.35%	10.09%
Parent cigarette use	28.52%	31.79%	24.34%
Parent alcohol problems	29.07%	29.56%	28.46%
Child age	4.79(0.22)	4.77(0.22)	4.81(0.23)
Parent income per week (Log ₁₀)	3.01(0.29)	2.94(0.28)	3.09(0.28)
Parent income per week (raw)	AU\$1,023	AU\$871	AU\$1,230
Parent education (Years)	15.82(2.36)	15.58(2.42)	16.12(2.24)
Neighborhood SES (SEIFA-IRSD)	1,016(57.8)	1,014(57.1)	1,020(58.6)
Sociability	3.84(1.19)	3.85(1.23)	3.83(1.14)
Reactivity	2.60(0.88)	2.66(0.91)	2.53(0.84)
Persistence	3.93(0.90)	3.94(0.93)	3.91(0.85)

Note. Values represent a count, percent, or mean(standard deviation). SEIFA-IRSD = Australian Socio-Economic Indexes for Areas – Index of Relative Socioeconomic Disadvantage (Pink, 2006).

Table 3

Reported Substance Use Initiation Percentages by Age

	Age in Years		
	12/13	14/15	16/17
Alcohol Use	1.78%	15.23%	65.36%
Cigarette Use	2.25%	11.03%	26.54%
Marijuana Use	1.95%	6.71%	20.85%
Other Drug Use	0.08%	0.62%	3.77%
Illicit Substance Use	1.98%	6.78%	21.11%
Substance Use Besides Alcohol	3.82%	13.51%	32.30%
Any Substance Use	5.01%	21.31%	67.97%

Note. Illicit substances are marijuana or other drugs, not including cigarettes or alcohol.

Table 4

Child Temperament Traits and Risk of Adolescent Substance Use Initiation

Substance	Trait	Separate Effects Models	Simultaneous Effects Model
Alcohol	Sociability	1.06[1.01, 1.12], .013	1.07[1.02, 1.12], .009
	Reactivity	1.04[0.99, 1.09], .110	1.05[1.00, 1.10], .070
	Persistence	0.99[0.94, 1.04], .767	1.00[0.95, 1.06], .853
Cigarettes	Sociability	1.11[1.04, 1.19], .002	1.12[1.04, 1.20], .002
	Reactivity	1.13[1.05, 1.20], .001	1.12[1.04, 1.20], .001
	Persistence	0.88[0.83, 0.95], <.001	0.91[0.85, 0.97], .005
Marijuana	Sociability	1.11[1.03, 1.20], .005	1.12[1.04, 1.21], .003
	Reactivity	1.11[1.03, 1.19], .008	1.11[1.03, 1.20], .007
	Persistence	0.93[0.87, 1.01], .073	0.96[0.89, 1.03], .268
Other Drugs	Sociability	1.30[1.06, 1.59], .011	1.29[1.05, 1.59], .014
	Reactivity	0.97[0.80, 1.18], .748	0.98[0.81, 1.19], .868
	Persistence	0.92[0.75, 1.11], .375	0.93[0.77, 1.13], .462
Illicit Substances	Sociability	1.12[1.04, 1.21], .003	1.13[1.05, 1.22], .002
	Reactivity	1.11[1.03, 1.19], .008	1.11[1.03, 1.20], .006
	Persistence	0.94[0.87, 1.01], .083	0.96[0.89, 1.04], .302
Substances Besides Alcohol	Sociability	1.10[1.03, 1.17], .002	1.10[1.04, 1.18], .002
	Reactivity	1.11[1.05, 1.18], <.001	1.11[1.05, 1.18], .001
	Persistence	0.90[0.85, 0.96], .001	0.93[0.87, 0.98], .013
Any Substance	Sociability	1.06[1.01, 1.11], .013	1.07[1.02, 1.12], .008
	Reactivity	1.08[1.03, 1.13], .001	1.08[1.03, 1.13], .002
	Persistence	0.95[0.91, 1.00], .048	0.97[0.93, 1.02], .225

Note. Values represent standardized hazard ratios [95% confidence interval], *p*-value. Models control for demographic covariates. Bolded values are statistically significant $\alpha = .05$. Illicit substances are marijuana or other drugs, not including cigarettes or alcohol.