

Relationship between personality change and the onset and course of alcohol dependence in young adulthood

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ABSTRACT

Aims To examine the reciprocal effects between the onset and course of alcohol use disorder (AUD) and normative changes in personality traits of behavioral disinhibition and negative emotionality during the transition between adolescence and young adulthood. **Design** Longitudinal–epidemiological study assessing AUD and personality at ages 17 and 24 years. **Setting** Participants were recruited from the community and took part in a day-long, in-person assessment. **Participants** Male ($n = 1161$) and female ($n = 1022$) twins participating in the Minnesota Twin Family Study. **Measurements** The effects of onset (adolescent versus young adult) and course (persistent versus desistent) of AUD on change in personality traits of behavioral disinhibition and negative emotionality from ages 17 to 24 years. **Findings** Onset and course of AUD moderated personality change from ages 17 to 24 years. Adolescent onset AUD was associated with greater decreases in behavioral disinhibition. Those with an adolescent onset and persistent course failed to exhibit normative declines in negative emotionality. Desistence was associated with a ‘recovery’ towards psychological maturity in young adulthood, while persistence was associated with continued personality dysfunction. Personality traits at age 11 predicted onset and course of AUD, indicating personality differences were not due to active substance abuse. **Conclusions** Personality differences present prior to initiation of alcohol use increase risk for alcohol use disorder, but the course of alcohol use disorder affects the rate of personality change during emerging adulthood. Examining the reciprocal effects of personality and alcohol use disorder within a developmental context is necessary to improve understanding for theory and intervention.

Keywords Alcohol use disorder, behavioral disinhibition, development, negative emotionality, personality.

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INTRODUCTION

The developmental transition from adolescence to young adulthood entails important psychosocial and neurobiological changes [1–3]. Several theories suggest that alcohol use disorders (AUD; alcohol abuse and dependence) might suppress psychological growth during this period, preventing those who abuse alcohol early in life from reaching a degree of maturity necessary for successful adjustment in adulthood [1,2,4]. A lay description of such an effect might be that a person who begins to abuse alcohol at age 16 will continue to exhibit the psychological maturity of a 16-year-old until he or she desists from

active substance abuse. While interesting, there have been few empirical tests of such notions [4,5], or whether other mechanisms such as personality characteristics present prior to the onset of AUD might account more accurately for the link between AUD and psychological maturity.

Personality traits are important risk factors in etiological theories of AUDs [6–9]. Although the notion that AUDs reflect a unique configuration of personality traits (i.e. an ‘addictive personality’) [10] has largely been abandoned, the last 20 years of research has demonstrated that the traits of ‘behavioral disinhibition’ and ‘negative emotionality’ are associated with increased risk

for substance use disorders [11–14]. Behavioral disinhibition refers to the failure to inhibit one's behavioral impulses and includes traits such as impulsivity, sensation seeking, unconventionality and rebelliousness. Negative emotionality refers to one's tendency to experience psychological distress such as frequent negative emotions (sadness, fear, worry, anger), breaking down under stress, feelings of isolation and suspiciousness and interpersonal hostility. Several longitudinal studies have established prospective associations between substance use disorders and these personality traits assessed at as young as age 3 years [11, 15–19]. These prospective associations are stronger for behavioral disinhibition than negative emotionality and are consistent across gender and different substances, including alcohol, nicotine and illicit drugs.

Few studies, however, have examined reciprocal effects underlying the association between the onset and course of AUD and personality development [5]. Such an analysis must necessarily be informed by patterns of normative change. Most important for personality development is the 'maturity principle', a pattern of personality change that describes a normative trend towards increased self-control, risk avoidance and emotional stability over the life-course. This trend is evinced by normative declines in behavioral disinhibition and negative emotionality, with the most pronounced changes occurring during the transition from late adolescence to young adulthood [20–25]. One perspective on the maturity principle is that psychological maturity can be defined in terms of personality traits; that is, the ability to be planful, responsible, disciplined and to cope effectively with unpleasant emotions [26, 27]. AUD also exhibits normative patterns of onset, escalation and decline that are similar to the maturity principle. Specifically, AUD emerges in late adolescence, increases and peaks in prevalence during the transition from adolescence to young adulthood and then declines markedly by age 30 [28–31].

Interestingly, people who experience the greatest personality changes during the transition to adulthood are those who exhibit the most 'immature' personality styles in adolescence (i.e. high negative emotionality and behavioral disinhibition) [21, 22, 24]. One interpretation of this finding is that personality reflects an overall competence to manage age-appropriate developmental tasks successfully (e.g. academic achievement and peer relationships in adolescence; career development and intimate partner relationships in adulthood) [2, 26, 32]. Throughout the transition into adulthood, the complexity of such tasks increases while external supports are removed (parental home, structured school environment). As such, maintaining competence requires greater behavioral control and emotional stability. There-

fore, those with less mature personality styles in adolescence will experience a greater 'press' to catch up with their competent peers, resulting in greater declines in negative emotionality and behavioral disinhibition during the transition to adulthood [26]. People who continue to exhibit high negative emotionality and behavioral disinhibition relative to their peers, however, will struggle to manage the expanding roles and growing responsibilities of adulthood [26].

Using a large, mixed-gender community sample, we examined the relationship between the onset and course of AUD and personality development (a proxy for psychological growth and maturity) during the transition from adolescence (age 17) to young adulthood (age 24). Specifically, previous research has shown that an adolescent onset of AUD (relative to a young adult onset) is associated with numerous psychosocial deficits [33, 34]. Additionally, a persistent course of AUD is associated with continued psychosocial deficits throughout young adulthood, while those who desist from AUD exhibit signs of recovery and normative functioning [33]. Therefore, we wanted to examine the distinct effects of an adolescent onset and persistent versus desistent course of AUD on personality development. Finally, to ensure the association between personality and AUD was not due solely to active substance abuse, we also examined the link between onset and course of AUD on personality traits assessed at age 11, prior to the initiation of alcohol use for most participants.

METHOD

Participants

The sample consisted of male and female twins participating in the Minnesota Twin Family Study (MTFS), a prospective study investigating the development of substance use disorders and related conditions [35, 36]. The MTFS includes two age cohorts, with participants entering the study at either age 11 or 17 years. Participants are given the opportunity to return for follow-up assessments every 3–4 years. Recruitment entailed locating all families that included a twin birth in Minnesota between 1972 and 1984 using publicly available birth records and databases. More than 90% of families were located successfully for each target birth year. Eligible families were required to live within a 1-day drive of our Minneapolis laboratories, with neither twin having an intellectual or physical disability that would preclude participation in the day-long, in-person assessment. Seventeen per cent of eligible families declined participation. Based on a survey completed by more than 80% of non-participating families, parents in the participating families differed only slightly in terms of socio-economic

status (0.25 years more education), but did not differ in terms of history of mental health problems or treatment. Consistent with the demographics of Minnesota for the target birth years, 96% of participants reported European American ancestry.

The MTF design includes assessments at target ages of 17, 20 and 24 years. Personality data were collected from participants at the age 17 [mean = 17.83 years, standard deviation (SD) = 0.69 years] and age 24 assessments (mean = 24.95 years, SD = 0.90 years). At the time of writing, all male twins and female twins from the older cohort had completed the age 24 follow-up assessment, while assessments for the female twins of the younger cohort were ongoing. As such, 2183 ($n_{\text{men}} = 1161$, $n_{\text{women}} = 1022$) participants had diagnostic data available for the age 24 assessment with retention rates for male and female twins from the older cohort of 91.8% and 93.3%, respectively. Analyses utilizing all male twins and female twins from the older cohort revealed minimal bias due to attrition (those not participating at age 24 exhibited slightly more symptoms of alcohol, nicotine, and cannabis abuse/dependence at age 17; Cohen's $d = 0.14$, 0.22 , and 0.12 , respectively).

Assessment

AUD

The Substance Abuse Module of the Composite International Diagnostic Interview [37,38] was used to assess symptoms of alcohol abuse and dependence according to DSM-III-R criteria (the diagnostic system in use at the time of the intake assessment). At age 17, the assessment was for life-time symptoms. For the age 20 and 24 assessments, participants reported on the time interval since their last assessment. Thus, twins who did not participate in the age 20 assessment were not necessarily lost to follow-up. All interviewers held at least a Bachelor's degree in psychology or a related discipline and received extensive training in psychiatric interviewing. All interviews were reviewed by a team of at least two clinical psychology graduate students who were required to meet consensus regarding the presence of all symptoms prior to assigning diagnoses. Kappa statistic for diagnostic reliability was >0.91 for AUD diagnoses. To balance sensitivity and specificity, the threshold for an AUD diagnosis was set at two symptoms (three symptoms are needed for a dependence diagnosis, but only one symptom is required for an abuse diagnosis). Abuse and dependence symptoms contributed equally to the symptom tally for an AUD diagnosis. Using this definition, the prevalence of an AUD was 12.7% and 24.1% at ages 17 and 24, respectively. To examine the effects of onset, persistence and desistence of AUD, participants were classified into four AUD groups: never onset (did not meet criteria at any age; $n = 1211$;

61.3%), early adult onset (criteria met at age 20 or 24; $n = 545$; 27.6%), adolescent onset and persistent course (criteria met at age 17 and age 24; $n = 149$; 7.5%), adolescent onset and desistent course (criteria met at age 17 and 0 symptoms at age 24; $n = 71$; 3.6%).

Personality

Negative emotionality and behavioral disinhibition were assessed at ages 17 and 24 using the 198-item version of the Multidimensional Personality Questionnaire (MPQ), a self-report questionnaire designed to comprehensively assess normal range personality [39]. The MPQ includes three higher-order factors: positive emotionality, negative emotionality and behavioral constraint. Positive emotionality (propensity to experience positive emotions, sociability and social dominance) was unrelated to AUD and failed to exhibit mean-level developmental change, and so was excluded from the analyses. Negative emotionality is a measure of the construct of the same name, while behavioral constraint measures the tendency to be planful and cautious, to avoid thrills and danger and to conform to social norms. Behavioral constraint scores were reversed for all analyses so that the scale reflected behavioral disinhibition. MPQ data were available for 90.6% and 89.2% of participants at the age 17 and 24 assessments, respectively, with 1626 ($n_{\text{men}} = 871$, $n_{\text{women}} = 755$) participants having MPQ data at both time-points.

To ensure that personality differences across groups at age 17 were not due solely to active substance abuse for the adolescent onset group, we also examined parent and teacher ratings of similar personality traits at age 11 for the twins from the younger cohort. The validity, reliability and psychometric structure of the parent and teacher ratings have been reported elsewhere [40,41]. The mean of the standardized parent and teacher ratings was used as the age 11 measures of negative emotionality and behavioral disinhibition ($n_{\text{men}} = 492$, $n_{\text{women}} = 325$). Only 4.3% of participants in the age 11 cohort reported ever drinking alcohol without their parents' permission at the intake assessment. Results were unchanged if these participants were excluded from the analysis.

Statistical analyses

For cross-sectional group comparisons, we report effect sizes (Cohen's d) and P -values from *post-hoc* tests using an AUD group factor as the predictor variable. The linear mixed model module of SPSS was used to adjust P -values for the twin observations and a Bonferroni correction was used in the *post-hoc* tests. HLM 6.08 [42] was used for analyses examining personality change from ages 17 to 24. Each model included three levels: observations at each time-point (level 1), nested within

individuals (level 2) and nested within twin pairs (level 3). The effects of age were examined in level 1 of the model, using the actual chronological age at which each participant completed the personality measures, as there was some heterogeneity in terms of when participants completed the age 17 (range 16.55–20.12 years; 3% were >19 years old) and age 24 assessments (range 22.63–29.30 years; 1.4% were <23 years old and approximately 10% were >26 years old). Sex and AUD status were then modeled at level 2 of the equation to predict variance in the level 1 age parameter; that is, individual differences in the rate of personality change. The variance components for the level 1 slope and all level 2 predictors were fixed, and we centered age at 17 so that the intercept estimates reflected trait scores at age 17. Interactions between sex and AUD group were also tested, but none were significant so we report results for models with main effects only.

RESULTS

Descriptive statistics

Table 1 provides the descriptive statistics for negative emotionality and behavioral disinhibition for the AUD groups at each age. We also report the effect size for the mean difference between ages 17 and 24 scores. Because a different informant and method was used for the age 11 observer rating, these scores cannot be compared to the ages 17 and 24 MPQ self-report scores in terms of change over time. All AUD groups exhibit significant declines from ages 17 to 24 for negative emotionality and behavioral disinhibition. The adolescent onset–desist group exhibited the greatest declines with large effects sizes for both traits. The never onset and adult onset groups exhibited comparable declines, with medium to large effects for negative emotionality and small to medium effects for behavioral disinhibition. Interestingly, the adolescent onset–persist group exhibited the least decline for negative emotionality (small to medium effect), but a medium to large decline in behavioral disinhibition.

Cross-sectional comparisons

For both traits, the adult onset group scored significantly higher than the never onset group at each age with a small effect for negative emotionality ($d = 0.21$ – 0.28) and a medium effect for behavioral disinhibition ($d = 0.43$ – 0.58). For both traits, the adolescent onset–desist group scored significantly higher than the never onset group at age 11 and 17 ($d = 0.43$ – 0.57), but the groups were no longer significantly different at age 24 ($d < 0.18$). The adolescent onset–desist group was not significantly different from the adult onset group at any age for negative emotionality (although $d = 0.34$ at age

11), and the two groups did not differ on behavioral disinhibition at ages 11 and 17. At age 24, however, the adult onset group scored significantly higher than the adolescent onset–desist group on behavioral disinhibition. The adolescent onset–persist group scored significantly higher than the never onset (medium to large effects; $d = 0.55$ – 1.00) and adult onset (small to medium effects; $d = 0.26$ – 0.59) groups at each age for both negative emotionality and behavioral disinhibition. Notably, group differences increased with age for negative emotionality, but declined with age for behavioral disinhibition. The two adolescent onset groups did not differ on negative emotionality at ages 11 and 17, but at age 24 the persist group scored significantly higher than the desist group. For behavioral disinhibition, the persist group scored significantly higher than the desist group at each age ($d = 0.35$ – 0.65). Differences between the adolescent onset–persist and –desist groups were greatest at age 24 for both negative emotionality and behavioral disinhibition.

AUD group differences in personality change from ages 17 to 24 years

Figures 1 and 2 display the means for the AUD groups at ages 17 and 24 years for negative emotionality and behavioral disinhibition, respectively. Results of the HLM analyses for negative emotionality are reported in Table 2. The intercept refers to the model predicted mean value at age 17 for members of the two groups being compared. Age refers to the units of change in negative emotionality per year between the ages 17 and 24 assessments for the reference group in the comparison (i.e. the first group listed). Sex and AUD group status were entered as predictors of individual differences in the rate of change. Sex is coded 0 for female and 1 for male. Because the overall sample trajectory was a decrease in negative emotionality, the positive values for the effect of sex on the age effect indicate that men change at a slower rate than women. AUD group is coded 0 for the first group and 1 for the second group listed in the comparison. Positive values again indicate the second group in the comparison changes at a slower rate than the first group. For example, in the first comparison between the never versus adult onset groups, men in the adult onset group had a rate of change of $-1.33 + 0.20 + 0.23 = -0.90$ units per year between the ages 17 and 24 assessments.

For comparisons between the never onset and AUD groups, there was a significant sex effect such that men declined at a slower rate than women. The adult onset group declined at a significantly slower rate than the never onset group. The adolescent onset–desist group exhibited a similar rate of decline to that of the never onset and adult onset groups. The adolescent

Table 1 Descriptive statistics, cross-sectional comparisons, and mean-level change from ages 17 to 24 of negative emotionality and behavioral disinhibition among alcohol use disorder groups.

	Never (a) (n = 1211)	Adult onset (b) (n = 545)	Adolescent onset-desist (c) (n = 71)	Adolescent onset-persist (d) (n = 149)	Cohen's <i>d</i> for cross-sectional comparisons ($M_2 - M_1 / SD$)				
					a versus b	a versus c	a versus d	b versus c	b versus d
Negative emotionality									
Age 11 observer rating									
Mean	48.7	50.7	54.7	55.0	0.21**	0.51*	0.57***	0.38**	0.02
SD	9.1	9.4	13.7	12.7					
Age 17 MPQ									
Mean	87.7	91.4	93.5	95.4	0.28***	0.43***	0.55***	0.16	0.29**
SD	13.5	13.1	13.7	14.6					
Age 24 MPQ									
Mean	80.1	83.3	82.2	89.9	0.25***	0.17	0.74***	-0.08	0.49**
SD	13.1	13.4	12.8	13.5					
Mean diff. ages 24-17 years									
Cohen's <i>d</i>	-0.57***	-0.61***	-0.85***	-0.39***					
Behavioral disinhibition									
Age 11 observer rating									
Mean	48.3	52.3	53.6	58.2	0.43***	0.56***	1.00***	0.14	0.59**
SD	8.9	9.5	10.1	10.7					
Age 17 MPQ									
Mean	48.6	56.2	58.3	64.3	0.52***	0.57***	1.00***	0.13	0.53***
SD	15.1	14.3	18.5	16.2					
Age 24 MPQ									
Mean	43.0	51.5	45.4	55.1	0.58***	0.15	0.86***	-0.39**	0.26***
SD	14.9	14.6	16.6	13.4					
Mean diff. ages 24-17 years									
Cohen's <i>d</i>	-0.37***	-0.33***	-0.73***	-0.62***					

* $P < 0.05$; ** $P < 0.01$; *** $P < 0.001$. The observer rating and self-report measures are on different metrics and so cannot be compared across time. Age 11 variables were only available for twins of the younger cohort so that sample sizes for the age 11 comparisons are much smaller than the ages 17 and 24 comparisons: never onset ($n = 500$), adult onset ($n = 270$), adolescent onset-desist ($n = 33$) and adolescent onset-persist ($n = 77$). Values for personality change are standardized mean differences or Cohen's $d = (M_1 - M_2) / SD$; small effect $d = 0.20$, medium effect $d = 0.50$, large effect $d = 0.80$. MPQ: Multidimensional Personality Questionnaire; SD: standard deviation.

Figure 1 The graphs depict the mean negative emotionality scores for the no onset, adult onset, adolescent onset–desist and adolescent onset–persist alcohol dependence groups at ages 17 and 24 years. Negative emotionality scores are in a T-score metric (mean = 50, standard deviation = 10) standardized to the age 17 data. Adol: adolescent

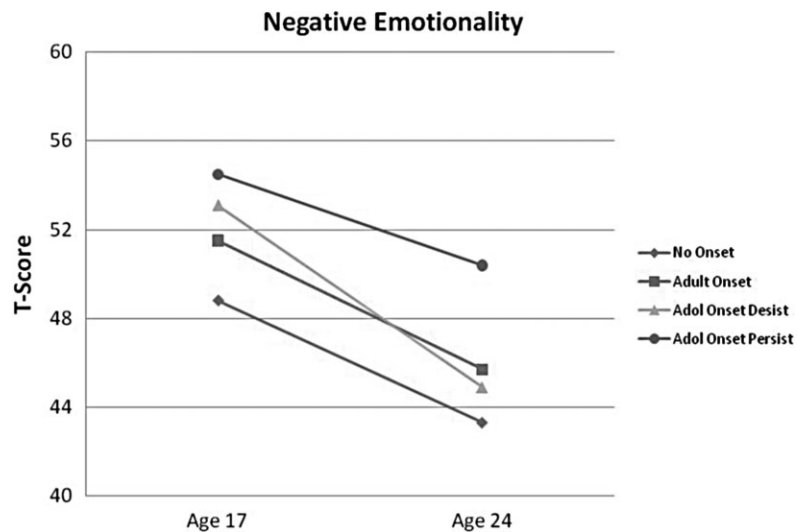
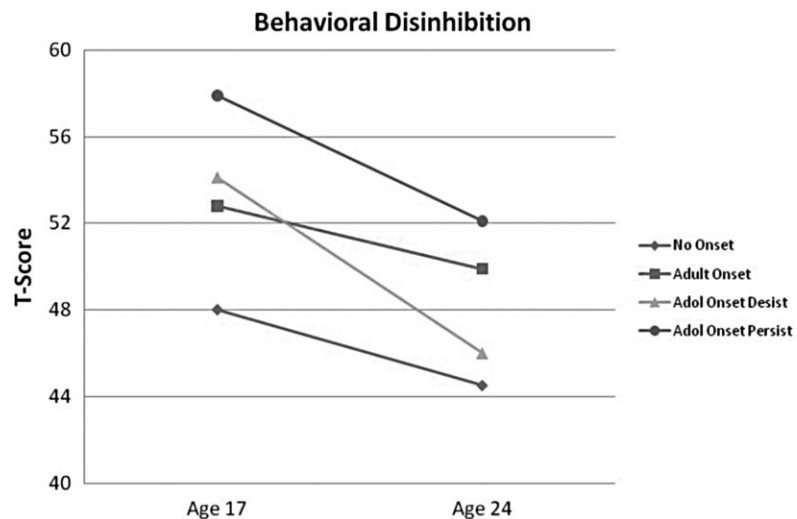


Figure 2 The graphs depict the mean behavioral disinhibition scores for the no onset, adult onset, adolescent onset–desist and adolescent onset–persist alcohol dependence groups at ages 17 and 24 years. Behavioral disinhibition scores are in a T-score metric (mean = 50, standard deviation = 10) standardized to the age 17 data. Adol: adolescent



onset–persist group exhibited the least decline in negative emotionality with a significantly slower rate of change than all the other groups.

The results of the HLM for the AUD groups on behavioral disinhibition are reported in Table 3. For all comparisons, men declined at a slower rate than women. The adult onset and adolescent onset–persist groups declined at a significantly slower rate than the never onset group. The adolescent onset–desist group exhibited a significantly greater rate of decline than the adult onset and adolescent onset–persist groups (and the never onset group, but this difference was not statistically significant). The adult onset and adolescent onset–persist groups exhibited comparable rates of decline.

DISCUSSION

Behavioral disinhibition and negative emotionality are well-established risk factors for AUD. However, few

studies have examined the reciprocal processes underlying the link between AUD and personality during the transition from adolescence to young adulthood when there are substantial normative declines on these traits. We were especially interested in the association between onset (adolescent versus young adult) and course (persistent versus desistent) of AUD and these normative declines. For example, would an adolescent onset and persistent course stunt personality change toward growth and maturity, or would there be evidence of a developmental ‘press’, such that those with an adolescent onset of AUD would exhibit greater change in order to ‘catch-up’ to their non-AUD peers?

In terms of AUD affecting personality, we continued to detect normative declines in behavioral disinhibition and negative emotionality, despite active AUD for many participants. However, the amount of change was moderated by the course of AUD and the particular personality trait. For behavioral disinhibition, adolescent onset AUD was

Table 2 Results of multi-level modeling of change in negative emotionality from age 17 to 24 and alcohol use disorder (AUD) group contrasts.

AUD group contrast	Level-1 parameters		Level-2 predictors of age parameter	
	Intercept (SE)	Age (SE)	Sex (SE)	AUD group (SE)
Never versus adult onset	90.45*** (0.41)	-1.33*** (0.07)	0.20* (0.09)	0.23* (0.09)
Never versus adolescent onset–desist	89.75*** (0.47)	-1.31*** (0.07)	0.25* (0.10)	0.01 (0.17)
Never versus adolescent onset–persist	90.23*** (0.47)	-1.33*** (0.07)	0.26* (0.10)	0.65*** (0.16)
Adult onset versus adolescent onset–desist	92.96*** (0.63)	-1.24*** (0.14)	0.14 (0.15)	-0.23 (0.19)
Adult onset versus adolescent onset–persist	93.42*** (0.62)	-1.31*** (0.15)	0.19 (0.17)	0.54** (0.17)
Adolescent onset desist versus adolescent onset–persist	96.28*** (1.15)	-1.85*** (0.23)	0.42 (0.29)	0.62* (0.24)

* $P < 0.05$; ** $P < 0.01$; *** $P < 0.001$. The intercept refers to the predicted mean value at age 17 for negative emotionality for individuals in the group comparison (e.g. never versus adult onset). Age refers to the units of change per year between ages 17 and 24 for individuals in the group comparison. Sex and AUD group effects account for a portion of the age parameter effect with female coded 0 and male coded 1. AUD group is coded 0 for the first group and coded 1 for the second group listed in the row. For example, for the never versus adult onset comparison, a male with an adult onset AUD would have a model-estimated age effect of $-1.33 + 0.20 + 0.23 = -0.90$ units per year. SE: standard error.

Table 3 Results of multi-level modeling of change in behavioral disinhibition from age 17 to 24 and alcohol use disorder (AUD) group contrasts.

AUD group contrast	Level-1 parameters		Level-2 predictors of Age parameter	
	Intercept (SE)	Age (SE)	Sex (SE)	AUD group (SE)
Never versus adult onset	51.95*** (0.46)	-0.93*** (0.07)	0.60*** (0.10)	0.41*** (0.10)
Never versus adolescent onset–desist	50.35*** (0.53)	-0.84*** (0.08)	0.60*** (0.11)	-0.41 (0.22)
Never versus adolescent onset–persist	51.46*** (0.53)	-0.88*** (0.07)	0.56*** (0.11)	0.36* (0.15)
Adult onset versus adolescent onset–desist	57.51*** (0.71)	-1.13*** (0.17)	0.93*** (0.17)	-0.83** (0.23)
Adult onset versus adolescent onset–persist	58.81*** (0.67)	-1.67*** (0.16)	0.88*** (0.17)	-0.06 (0.15)
Adolescent onset desist versus adolescent onset–persist	64.06*** (1.29)	-2.40*** (0.30)	0.85** (0.30)	0.79** (0.27)

* $P < 0.05$; ** $P < 0.01$; *** $P < 0.001$. The intercept refers to the predicted mean value at age 17 of behavioral disinhibition for individuals in the group comparison (e.g. never versus adult onset). Age refers to the units of change per year between ages 17 and 24 for individuals in the group comparison. Sex and AUD group effects account for a portion of the age parameter effect with female coded 0 and male coded 1. AUD group is coded 0 for the first group and coded 1 for the second group listed in the row. For example, for the never versus adult onset comparison, a male with an adult onset AUD would have a model-estimated age effect of $-0.93 + 0.60 + 0.41 = +0.08$ units per year. SE: standard error.

associated with greater declines, consistent with a developmental press model. For negative emotionality, there was an interaction between onset and course such that, among people with an adolescent onset, those who desisted exhibited greater declines while those who persisted exhibited fewer declines relative to their non-AUD peers. This suggests that persistent AUD may lead to 'canalization' [43]; that is, a narrowing of potential developmental trajectories that helps to maintain a deviant personality structure and AUD. In contrast, desistence from AUD suggests a recovery such that movement towards growth and maturity is accelerated to match levels reached by their non-AUD peers. These different patterns of effects could be due to the nature of the most salient developmental tasks during the transition from adolescence to adulthood. For example, these tasks may relate more to behavioral control (what one does) than emotional stability (how one feels).

In terms of personality affecting the onset and course of AUD, another interesting finding was that the course

of AUD was clearly distinguished by age 11 personality traits; that is, characteristics present prior to the initiation of alcohol use. First, these findings rule out the possibility that the personality differences we observed at age 17 and 24 were due solely to active alcohol abuse (personality differences between the no onset and adult onset group at age 17 also rule out this possibility). Secondly, it suggests that important individual differences factors that contribute both to an adolescent onset and a persistent course of AUD are present in childhood. Also, there was a clear ordering of personality differences reflective of the severity of later AUD (no onset < adult onset < adolescent onset–desist < adolescent onset–persist). Consistent with previous studies [33], behavioral disinhibition is especially predictive. For example, even among those with adolescent onset AUD, behavioral disinhibition at ages 11 and 17 discriminated those who would persist versus desist by age 24. Thus, personality characteristics that precede both initiation and problem use are not only key risk factors for the onset and

persistence of AUD, but also probably index important etiological processes.

While the study had notable strengths, including a large, community-based sample and prospective design, it has several limitations. One is that our sample is not racially or ethnically diverse, thereby limiting generalizability. Secondly, we had only two time-points of personality data to examine change, for which few definitive conclusions can be drawn regarding the timing and processes of change. A third limitation is that while we often refer to psychological growth and maturity and psychosocial functioning, we have relied solely on self-reported personality as indirect proxies for these constructs. Finally, we did not examine specific variables such as leaving the rearing home, entering into educational training or an occupation or romantic relationships that might mediate the broad changes we identified in personality traits [2,5,20].

To conclude, both AUD and personality traits exhibit normative patterns of change and stability, and their reciprocal effects can only be understood in the context of normal development. Clearly, the onset and persistence of AUDs has substantial impact on the lives of people who experience them. Future studies that continue to examine the interplay between normative personality development and the onset and persistence of AUD will yield important insights into personality theory and intervention for substance use disorders.

Declarations of interest

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References

- Baumrind D., Moselle K. A. A developmental perspective on adolescent drug abuse. *Adv Alcohol Subst Abuse* 1985; **4**: 41–67.
- Brown S., McGue M., Maggs J., Schulenberg J., Hingson R., Swartzwelder S. *et al.* A developmental perspective on alcohol and youths 16 to 20 years of age. *Pediatrics* 2008; **121**: S290–S310.
- Spear L. P. The adolescent brain and age-related behavioral manifestations. *Neurosci Biobehav Rev* 2000; **24**: 417–63.
- Chassin L., Dmitrieva J., Modecki K., Steinberg L., Cauffman E., Piquero A. R. *et al.* Does adolescent alcohol and marijuana use predict suppressed growth in psychosocial maturity among male juvenile offenders? *Psychol Addict Behav* 2010; **24**: 48–60.
- Littlefield A. K., Sher K. J., Wood P. K. Is 'maturing out' of problematic alcohol involvement related to personality change? *J Abnorm Psychol* 2009; **118**: 360–74.
- Cloninger C. R. Neurogenetic adaptive mechanisms in alcoholism. *Science* 1987; **236**: 410–6.
- Sher K. J. *Children of Alcoholics: A Critical Appraisal of Theory and Research*. Chicago: University of Chicago Press; 1994.
- Tarter R. E. Are there inherited behavioral traits that predispose to substance abuse. *J Consult Clin Psychol* 1988; **56**: 189–96.
- Zucker R. A., Gomberg E. S. L. Etiology of alcoholism reconsidered: the case for a biopsychosocial process. *Am Psychol* 1986; **41**: 783–93.
- Nathan P. The addictive personality is the behavior of the addict. *J Consult Clin Psychol* 1988; **56**: 183–8.
- Elkins I. J., King S. M., McGue M., Iacono W. G. Personality traits and the development of nicotine, alcohol, and illicit drug disorders: prospective links from adolescence to young adulthood. *J Abnorm Psychol* 2006; **115**: 26–39.
- Krueger R. F., Caspi A., Moffitt T. E., Silva P. A., McGee R. Personality traits are differentially linked to mental disorders: a multitrait–multidiagnosis study of an adolescent birth cohort. *J Abnorm Psychol* 1996; **105**: 299–312.
- Labouvie E. W., McGee C. R. Relation of personality to alcohol and drug use in adolescence. *J Consult Clin Psychol* 1986; **54**: 289–93.
- McGue M., Slutske W. S., Iacono W. G. Personality and substance use disorders: II. Alcoholism versus drug use disorders. *J Consult Clin Psychol* 1999; **67**: 394–404.
- Caspi A., Moffitt T. E., Newman D. L., Silva P. A. Behavioral observations at age 3 years predict adult psychiatric disorders: longitudinal evidence from a birth cohort. *Arch Gen Psychiatry* 1996; **52**: 1033–9.
- Cloninger C. R., Sigvardsson S., Bohman M. Childhood personality predicts alcohol abuse in young adults. *Alcohol Clin Exp Res* 1988; **12**: 494–505.
- Krueger R. F. Personality traits in late adolescence predict mental disorders in early adulthood: a prospective-epidemiological study. *J Personal* 1999; **67**: 39–65.
- Sher K. J., Bartholow B. D., Wood M. D. Personality and substance use disorders: a prospective study. *J Consult Clin Psychol* 2000; **68**: 818–29.
- Wong M. M., Nigg J. T., Zucker R. A., Puttler L. I., Fitzgerald H. E., Jester J. M. *et al.* Behavioral control and resiliency in the onset of alcohol and illicit drug use: a prospective study from preschool to adolescence. *Child Dev* 2006; **77**: 1016–33.
- Caspi A., Roberts B. W., Shiner R. L. Personality development: stability and change. *Annu Rev Psychol* 2005; **56**: 453–84.
- Blonigen D. M., Carlson M. D., Hicks B. M., Krueger R. F., Iacono W. G. Stability and change in personality traits from late adolescence to early adulthood: a longitudinal twin study. *J Personal* 2008; **76**: 229–66.
- Donnellan M. B., Conger R. D., Burzette R. G. Personality development from late adolescence to young adulthood: differential stability, normative maturity, and evidence for the maturity–stability hypothesis. *J Personal* 2007; **75**: 237–63.
- McGue M., Bacon S., Lykken D. T. Personality stability and change in early adulthood: a behavioral genetic analysis. *Dev Psychol* 1993; **29**: 96–109.

24. Roberts B. W., Caspi A., Moffitt T. E. The kids are alright: growth and stability in personality development from adolescence to adulthood. *J Pers Soc Psychol* 2001; **81**: 670–83.
25. Roberts B. W., Walton K. E., Viechtbauer W. Patterns of mean-level change in personality traits across the life-course: a meta-analysis of longitudinal studies. *Psychol Bull* 2006; **132**: 1–25.
26. Johnson W., Hicks B. M., McGue M., Iacono W. G. Most of the girls are alright but some aren't: personality trajectory classes from age 14 to 24 and some associations with outcomes. *J Pers Soc Psychol* 2007; **93**: 266–84.
27. Steinberg L., Cauffman E. Maturity of judgement in adolescence: psychosocial factors in adolescent decision making. *Law Hum Behav* 1996; **20**: 249–72.
28. Chassin L., Flora D. B., King K. M. Trajectories of alcohol and drug use and dependence from adolescence to adulthood: the effects of familial alcoholism and personality. *J Abnorm Psychol* 2004; **113**: 483–98.
29. Johnston L. D., O'Malley P. M., Bachman J. G. *National Survey Results on Drug Use from the Monitoring the Future Study, 1975–2001, I. Secondary School Students*. Rockville, MD: National Institute on Drug Abuse; 2001.
30. Johnstone B. M., Leino E. V., Ager C. R., Ferrer H., Fillmore K. M. Determinants of life-course variation in the frequency of alcohol consumption: meta-analysis of studies from the Collaborative Alcohol-Related Longitudinal Project. *J Stud Alcohol* 1996; **57**: 494–506.
31. Kessler R. C., Berglund P., Demler O., Jin R., Merikangas K. R., Walters E. E. Lifetime prevalence and age-of onset distributions of *DSM-IV* disorders in the National Comorbidity Survey Replication. *Arch Gen Psychiatry* 2005; **62**: 593–602.
32. Masten A. S., Coatsworth J. D., Neemann J., Gest S. D., Tellegen A., Garmezy N. The structure and coherence of competence from childhood through adolescence. *Child Dev* 1995; **66**: 1635–59.
33. Hicks B. M., Iacono W. G., McGue M. Consequences of an adolescent onset and persistent course of alcohol dependence in men: adolescent risk factors and adult outcomes. *Alcohol Clin Exp Res* 2010; **34**: 819–33.
34. Clark D. B., Kirisci L., Tarter R. E. Adolescent versus adult onset and the development of substance use disorder in males. *Drug Alcohol Depend* 1998; **49**: 115–21.
35. Iacono W. G., Carlson S. R., Taylor J., Elkins I. J., McGue M. Behavioral disinhibition and the development of substance use disorders: findings from the Minnesota Twin Family Study. *Dev Psychopathol* 1999; **11**: 869–900.
36. Iacono W. G., McGue M., Krueger R. F. Minnesota center for twin and family research. *Twin Res Hum Genet* 2007; **9**: 978–84.
37. Robins L. M., Baber T., Cottler L. B. *Composite International Diagnostic Interview: Expanded Substance Abuse Module*. St Louis: Authors; 1987.
38. Robins L. M., Wing J., Wittchen H. U., Helzer J. E., Babor T. F., Burke J. et al. The Composite International Diagnostic Interview: an epidemiologic instrument suitable for use in conjunction with different diagnostic systems and in different cultures. *Arch Gen Psychiatry* 1988; **45**: 1069–77.
39. Patrick C. J., Curtin J. J., Tellegen A. Development and validation of a brief form of the Multidimensional Personality Questionnaire. *Psychol Assess* 2002; **14**: 150–63.
40. Cukrowicz K. C., Taylor J., Schatschneider C., Iacono W. G. Personality differences in children and adolescents with attention-deficit/hyperactivity disorder, conduct disorder, and controls. *J Child Psychol Psychiatry* 2006; **47**: 151–9.
41. Tackett J. L., Krueger R. F., Iacono W. G., McGue M. Personality in middle childhood: a hierarchical structure and longitudinal connections with personality in late adolescence. *J Res Pers* 2008; **42**: 1456–62.
42. Raudenbush S. W., Bryck A. S., Congdon R. *HLM 6 for Windows*. Lincolnwood, IL: Scientific Software International, Inc; 2004.
43. Waddington C. H. *The Strategy of the Genes: A Discussion of Some Aspects of Theoretical Biology*. London: Allen & Unwin; 1957.