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The association between speed of transition from initiation to subsequent use of cannabis and later problematic cannabis use, abuse and dependence

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Abstract

Aims—To test whether speed of transition from first use to subsequent use of cannabis is associated with likelihood of later cannabis dependence and other outcomes, and whether transition speed is attributable to genetic or environmental factors.

Design—Cross-sectional interview study

Setting—Australia

Participants—2239 twins and siblings who reported using cannabis at least twice (mean age at time of survey = 32.0, 95% CI 31.9–32.1, range 22–45).

Measurements—Time between first and subsequent cannabis use (within 1 week; within 3 months; between 3 months–12 months; more than 1 year later), later use of cannabis and symptoms of DSM-IV cannabis abuse/dependence. Multinomial regression analyses (comparison group: more than 1 year later) adjusted the association between speed of transition and the outcomes of cannabis daily use, abuse/dependence, and treatment-seeking after controlling for socio-demographic, childhood, mental health, peer and licit drug factors. Twin modelling

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estimated the proportion of variance in transition speed attributable to genetic (A), common environment (C) and unique environmental (E) factors.

Findings—Subsequent use of cannabis within one week of first use was associated with daily use (OR 2.64, 95% CI 1.75–3.99), abuse and/or dependence (OR 3.25, 95% CI 2.31–4.56) and treatment-seeking for cannabis problems (OR 1.89, 95% CI 1.03–3.46). Subsequent use within 3 months was associated with abuse and/or dependence (OR 1.61, 95% CI 1.18–2.19). The majority of the variation of the speed of transition was accounted for by unique environment factors (0.75).

Conclusions—Rapid transition from initiation to subsequent use of cannabis is associated with increased likelihood of subsequent daily cannabis use and abuse/dependence.

Introduction

Cannabis is the most commonly used illicit drug, with prevalence of lifetime use estimated at between 2.7% and 4.9% of the global population aged 15–64 years (1). Although many individuals use cannabis infrequently and without problematic consequences, globally an estimated 13.1 million individuals experience cannabis dependence, contributing 10.3% of the illicit drug use global burden of disease (2).

Existing research has identified a number of genetic and environmental factors associated with increased risks for cannabis dependence (3–12). However, a number of intermediate stages of use necessarily occur before an individual develops dependence. These include opportunity to use, initiation, repeated use and escalation to regular use, and genetic and environmental factors are differentially associated with progression through these stages (8,10,12–15).

Less is known about variation in progression through the stages of substance use. Research in this area focuses on speed of transition, including speed from initiation of use to: daily use (16); regular use (17); abuse or dependence (17–19). More research has focused on early onset of use, which can be used as an exemplar of the speed of transition literature by representing early onset of drug use as a faster rate of transition from non-use to initiation. This is associated with alcohol, tobacco and cannabis dependence (18,20–22), suggesting a relationship between rate of transition and later substance use outcomes. Given that there is thought to be a short period after substance use initiation for implementation of prevention interventions (23,24), the potential for speed of transitions to act as an early marker for later problems is a worthwhile avenue for exploration.

The relationship between transition speed and later drug-use outcomes is not straightforward. Those at risk of dependence may be expected to begin and continue on a faster trajectory through the stages of substance use, but research demonstrates those who progress faster from non-use to initiation often exhibit a slower progression to dependence than those who experience later initiation (18,25). Additionally, faster transition from initiation to regular use has not been consistently associated with later outcomes of dependence (17). Further research on a broader range of transitions is required to better understand the relationship between speed of transition and later outcomes, and to identify whether similar factors determine speed between each stage (13).

One previously unstudied transition is that from initiation (first use) to the subsequent (second) use of cannabis. Utilising cross-sectional data from a sample of Australian twins, this paper aims to:

1. Test whether speed of transition from initiation to subsequent use of cannabis is associated with increased likelihood of later daily cannabis use, abuse and/or dependence and cannabis related treatment seeking when accounting for the influence of socio-demographic, childhood, mental health, peer and licit drug factors that may be predictive of faster transitions in the subsequent use of cannabis
2. Determine the extent to which the speed of this transition is attributable to additive genetic, shared environmental or non-shared environmental factors.

Methods

Sample

From Australian Twin Registry members born between 1972–1979, 3348 MZ and DZ twins and 476 of their siblings completed a drug misuse study (see (26) for a recruitment outline). Of the complete cohort sample, 2601 (68.5%) reported lifetime use of cannabis. The subset of the sample selected for the analyses in this paper were the 2239 participants (mean age at time of survey = 32.0, 95% CI 31.9–32.1, range 22–45) who had reported using cannabis at least twice in their lives (58.6% of the entire sample, 86.1% of lifetime cannabis users). Of this subset 58.7% were female.

Assessment

Participants were assessed through computer-assisted telephone interviews, and were provided with a respondent booklet so answers would be unidentifiable to anyone overhearing. The interview collected information on socio-demographics, childhood experiences, substance use and common mental health disorders including conduct disorder, assessed using the SSAGA-II interview (27). The SSAGA is a validated measure of mental health that uses DSM-IV criteria, and includes alcohol and other drug abuse and dependence.

Measures

Transition speed—Those who reported using cannabis more than once were asked: “how soon after you first tried marijuana did you try it again?” Data were recorded categorically, and responses were further collapsed for analysis into the following categories: within 1 week (19.8%), within 3 months (but not including those who transitioned within 1 week) (37.7%), between 3 months–12 months (21.7%), more than 1 year later (20.8%).

Lifetime cannabis involvement

Daily use of cannabis: In the subsample used in this analysis 16.6% self-reported using cannabis daily during their period of heaviest use.

Cannabis abuse and/or dependence: In the subsample used in this analysis 27.9% reported cannabis abuse and/or dependence. Participants were classified as meeting DSM-IV criteria

for lifetime cannabis abuse if they reported one or more of the following: often using cannabis in a situation where they might get hurt; arrested more than twice within a 12 month period as a result of their cannabis use; cannabis use having caused difficulty with work, study or household responsibilities; cannabis having caused social and interpersonal problems more than 3 times within a 12 month period.

Participants were classified as meeting lifetime criteria for DSM-IV cannabis dependence if they reported 3 or more of the following symptoms occurring within the same 12 month period: using cannabis a greater number of times/greater amount than was intended, tolerance, wanting to cut down/stop use, spending so much time obtaining/using/recovering from the effects of cannabis that the participant had little time for anything else, reducing important activities as a result of cannabis use, continuing use despite it worsening health/emotional problems. Withdrawal was not included as it was not part of DSM-IV criteria for cannabis dependence.

Cannabis related treatment seeking: In the subsample used in this analysis 6% self-reported having discussed cannabis related problems with a professional. Participants were able to endorse seeking treatment from multiple sources: Psychiatrist (N=45), General Practitioner or other medical doctor (N=80), Psychologist (N=42), another mental health professional (N=61), member of the clergy (N=7) or another source (N= 9).

Covariates

Early cannabis onset: Individuals reporting lifetime cannabis use were asked the age at which they first used cannabis. In line with existing literature (26,28,29), those who were aged 16 and under when cannabis was first used were classified as having early onset of cannabis use. Additionally a series of sensitivity tests were conducted to test the effect of different early onset cut-off points (<13, <14, <15 and <17), which showed that selecting 16 as the cut-off had no effect on the results of the analyses (full results available upon request). Mean age of cannabis onset in the analytical sample was 17.46 (SD 2.99) with a range of 6–34 years.

Education: Participants were asked to report the highest level of education they had obtained, and for analysis respondents were classified by whether or not their highest level of education was post-secondary/higher education.

Parental characteristics: *Parental alcohol problems* were determined through participant self-report of their mother or father's problems with health/family/job/police/other as a result of drinking, or their mother or father drinking excessively. Specifically, participants were asked "Did drinking ever cause [your biological father/mother] to have problems with health, family, job or police, or other problems?" and "Did you ever feel that [your biological father/mother] were excessive drinkers?" Responding yes to either of these questions constituted being a case for parental alcohol problems.

Parental drug problems were determined through participant self-report of their mother or father's problems with health/family/job/police/other as a result of drug use, or the participant reporting they felt their mother or father had a problem with drugs. Specifically,

participants were asked “Did using drugs ever cause [your biological father/mother] to have problems with health, family, job or police, or other problems?” and “Did you ever feel that [your biological father/mother] had a problem with drugs?” Responding yes to either of these questions constituted being a case for parental drug problems.

Parental conflict was determined by participant responses to the questions “how often did your parents fight or argue in front of you” and “how much conflict and tension was there between your parents”. Both questions focused on the period when the participant was aged 6–13. Participants reporting parents ‘sometimes’ or ‘always’ fought or argued, or reporting ‘a lot’ or ‘some’ conflict/tension were coded as experiencing high parental conflict.

Childhood sexual abuse: Participants who self-reported being forced into sexual intercourse or any other forms of sexual activity before age 18 were classified as having experienced childhood sexual abuse.

Conduct disorder: Participants were coded as meeting criteria for conduct disorder if they reported at least 3 of the 15 DSM-IV criteria occurring within the same 12-month period, prior to age 18.

Depressed mood before cannabis onset: Participants were classified as having experienced depressed mood if they had reported feeling depressed/down/low ‘most of the day’ and ‘nearly every day’, or feeling a lot less interested in or able to enjoy most things ‘most of the day’ and ‘nearly every day’ for at least two weeks in their lifetime before the onset of cannabis use.

Peer use: The extent of substance misuse amongst high school peers was measured through self-report questions asking whether ‘hardly any’, ‘some’, ‘half’, ‘three quarters’ or ‘almost all’ the students who were in their grade in high-school used illegal drugs whilst of school age. Participants were categorised as being exposed to high levels of illicit drug use during high school if they reported that at least three quarters of their peers had been using cannabis.

Regular alcohol use before cannabis onset: Age of onset of regular alcohol use (once a month for 6 months or longer) and age of cannabis onset were used to determine whether regular alcohol use occurred before onset of cannabis use.

Regular tobacco use before cannabis onset: The age of onset of regular tobacco use (at least once a week for at least two months) and age of cannabis onset were used to determine whether regular tobacco use occurred before onset of cannabis use.

Statistical analysis

Epidemiological analyses were conducted in SAS statistical software version 9.3 for Windows (SAS Institute Inc) and Stata statistical software version 11 (StataCorp, College Station TX, 2009). χ^2 tests and phi coefficients assessed the association between the speed of transition from initiation to subsequent use of cannabis and lifetime cannabis daily use, abuse and/or dependence and treatment seeking. All associations were deemed significant at

the $P < 0.05$ level. Multinomial logistic regression analysis (reference category: subsequent use more than a year after initiation) determined the association between the speed of transition from initiation to subsequent use of cannabis and the outcomes daily cannabis use, abuse/dependence, and treatment-seeking for cannabis use problems after adjustment for socio-demographic, childhood, mental health, peer and licit drug factors. Covariates were included in the models if they were significantly associated with both the exposure and outcome variables through χ^2 tests (analyses not reported). To correct for the non-independence of observations Huber-White analysis for clustered data was implemented in STATA to provide robust standard errors. Post hoc comparisons across the varying speeds of transition were conducted using Wald chi-square tests.

Twin modelling was conducted using OpenMX (30) for the statistical software R (31). As there were low numbers of concordant twins univariate analyses used raw ordinal data and full-information maximum-likelihood (FIML) estimation, which makes use of twin pairs where data from a co-twin is unavailable. Composition of the twin sample is described in Table 1. Model-fitting was conducted using a step-wise approach. A liability-threshold model including an adjustment for twin sex and estimating co-twin correlations was fitted to the data set and used to test assumptions regarding the equality of thresholds within and between monozygotic (MZ) and dizygotic (DZ) twin groups. Based on these results, a univariate variance components model was fitted, partitioning the variance attributable to additive genetic (A), shared environmental (C), and unique environmental (E) factors. Difference in model fit was assessed via the likelihood-ratio χ^2 test and examination of the Akaike Information Criterion (AIC) and Bayesian Information Criterion (BIC).

Results

1. Associations between speed of transition and subsequent daily use, abuse/dependence and treatment seeking

Speed of transition was significantly associated with each of the three cannabis use outcomes ($P < 0.0001$ for all outcomes, see Table 2). Those whose second use of cannabis was within one week of initiation had the highest rate of daily cannabis use (28.4%), abuse and/or dependence (46.0%), or cannabis-related treatment seeking (10.6%). For all outcomes the proportion that would go on to develop problems decreased approximately linearly across the groups.

2. Demographic, childhood and peer use associations with transition speed

Significant differences were observed between the different transition speed groups for almost all of the socio-demographic, childhood, mental health, peer and licit drug factors tested in this analysis (see Table 3). Parental drug problems, parental conflict and depressed mood before cannabis onset were not significantly associated with transition speed.

3. Multinomial logistic regression of the outcomes associated with transition speed

After controlling for early onset of cannabis use, socio-demographic, childhood, mental health, peer and licit drug factors, those whose second use of cannabis was within a week were at increased odds of meeting criteria for abuse/dependence (OR 3.25, 95% CI 2.31–

4.56), reporting daily use (OR 2.64, 95% CI 1.75–3.99) and treatment seeking (OR 1.89, 95% CI 1.03–3.46) (see Table 4). Those whose subsequent use of cannabis was within 3 months of initiation were just under twice as likely to develop abuse and/or dependence (OR 1.61, 95% CI 1.18–2.19).

4. Post-Hoc analysis of age of onset

Stratifying the analysis by early or later onset revealed differences in the association between transition speed and all later outcomes, which remained after adjustment for the other covariates. For the association between transitions within a week and daily use, those with earlier onset had an increase in likelihood of 1.83 (95% CI 1.05–3.17) compared to 4.32 (95% CI 2.27–8.21) for those with later onset.

For the association between transitions within a week and abuse/dependence, those with earlier onset had an increase in likelihood of 2.14 (95% CI 1.33–3.42) compared to 4.86 (95% CI 2.97–7.94) for those with later onset. For the association between transitions within a week and later treatment seeking, those with earlier onset had an increase in likelihood of 1.63 (95% CI 0.72–3.70) compared to 2.19 (95% CI 0.92–5.17) for those with later onset.

There was a significant interaction between early/late cannabis onset and 1) transition within a week, with those in the early onset group having a decrease in likelihood of abuse and/or dependence of 0.50 (95% CI 0.26–0.94), 2) transition 3 months–1 year, with those in the early onset group having an increase in likelihood of daily use (OR 2.55, 91% CI 1.04–6.27) and treatment seeking (OR 8.38, 95% CI 1.35–52.1).

5. Modelling additive genetic, shared and non-shared environmental influences on speed of transition between first and subsequent cannabis use

Data on speed of transition from initiation to subsequent use of cannabis for twin modelling was available for 824 MZ twins and 1145 DZ twins (see Table 1 for full information). Tetrachoric correlations were similar for MZ (0.27) and DZ (0.23) pairs. A univariate variance component twin model was fitted, with thresholds equated within and between zygosity groups as initial analyses did not identify any significant differences ($P = 0.17$). The estimate for additive genetic influences for the full model was small (0.002, 95% CI 1.446372e-09–0.35), and could be dropped from the model without a significant loss of fit ($P = 1$). A model specifying only environmental influences (C and E) provided the best fit, with moderate shared environmental influences (0.25, 95% CI 0.15–0.34) and large unique environmental influences (0.75, 95% CI 0.66–0.84) on the variation in speed of this transition (see table 5).

Discussion

The key finding of this paper was the significant association between speed of transition from initiation to subsequent use of cannabis and later likelihood of daily cannabis use, cannabis abuse/dependence and cannabis related treatment seeking. This association remained after controlling for potential confounders. The unique environment accounted for most (0.75) of the variance in the speed of transition from initiation of cannabis to subsequent use, and measured risk factors including conduct disorder, education, and regular

use of nicotine before cannabis initiation were associated with a more rapid transition to subsequent use. Given the absence of prior research on this transition these findings provide an original and intriguing contribution to the literature.

Previous research has found earlier use is associated with later problematic drug use/dependence (18,21,22,32–34), and by studying the novel transition from initiation to subsequent use this paper has established that the association between speed of transition and later negative outcomes remains after controlling for factors that would be expected to predispose individuals towards cannabis use problems. Stratifying analyses by onset showed the association between transition speed and all studied outcomes was stronger amongst those with later cannabis onset, suggesting transition speed is indicative of later problems even beyond the high-risk period of early adolescence. This highlights the importance of accounting for age when applying a stage-sequential approach to the study of substance use (13).

Additive genetic effects has no influence on variation in the speed of this transition, which is in contrast to findings of moderate heritability for other transitions (5,26,28,35). Similarly the speed of other specific transitions has been found to be moderately heritable, with 0.30 (95% CI 0.15–0.46) of the rate of transition from nonuse to initiation attributed to additive genetic effects and similar findings observed for the rate of transition from initiation to first dependence symptom (0.36, 95% CI 0.19–0.44) and first dependence symptom to the development of dependence (0.37, 95% CI 0.00–0.58) (36). In contrast, our findings show the speed of transition from initiation to subsequent use of cannabis is predominately influenced by environmental factors, demonstrating the importance of utilizing a stage-sequential approach in order to fully understand how genetic and environmental factors vary throughout substance use.

Significant differences were observed between transition speed groups for measured environmental risk factors. Studies of the speed of other transitions have identified similar environmental risk factors including childhood sexual abuse (37,38), parental substance abuse (37), peer use of substances (39,40), parental substance dependence (41), conduct disorder (41–44). The majority of the variance in the speed of the transition from initiation to subsequent use was attributable to the unique environment, which can represent measurement error in the analysis. However, we speculate that availability, which has previously been found to account for variation in drug use progression (45), is likely to form part of the environmental factors at play in the speed of transition from initiation to subsequent use. Further exploration is needed to understand the determinants of speed of transition from initiation to subsequent use.

Limitations & Future Research

Firstly, these data were based on retrospective self-report which introduces the possibility of recall bias. Secondly, the measure of transition speed was comprised of relatively wide categories. Thirdly, there were a low number of twin pairs concordant for speed of transition from initiation to subsequent use, which was overcome through the use of raw data for the twin modelling. Ordinal analysis can result in lower power, and may result in an underestimate of the true liability correlation (46). Fourthly, the study lacked temporal

information on a number of covariates within the analysis, and including these variables in the analysis represents a cautious approach to adjustment for confounding variables which may lead to under-estimation of the effect of this transition. Fifthly, whilst likely representative of base population (47) the prevalence of lifetime cannabis use in this sample is relatively high at 68.2%, which may limit generalizability.

It is unknown whether these findings will translate to alcohol and nicotine use or to other illicit drugs, given that differences have previously been observed in rate of transition to cannabis disorder compared to nicotine or alcohol dependence (18), but the results of the current study suggest that study of this transition across drug classes is warranted.

Implications

We suggest that faster transition from initiation to subsequent use is unlikely to have a traditional causal relationship with cannabis dependence. The association likely reflects a combination of individual and contextual factors, such as availability, that surround the rapid escalation. If replicated in prospective research, these findings may have practical utility for clinical practice, with the prospect of translation into a clinically useful marker with which to identify individuals likely to benefit from intervention. These findings have also highlighted the utility of studying different transitions in substance use to disentangle the complex aetiology of drug use disorders (13).

Conclusions

Those whose subsequent use is within one week have the greatest likelihood of future cannabis use problems. The novel demonstration that the speed of transition from initiation to subsequent cannabis use is predictive of later cannabis outcomes is striking, and is of potentially major importance to understanding of the development of cannabis dependence and problems. Given that the variance in the speed of this transition is predominately due to unique environmental factors, it may be that speed of the transition from initiation to subsequent use acts as a proxy measure of a number of the contextual factors that contribute to the development of addiction.

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Table 1Speed of transition from 1st to subsequent use of cannabis by zygosity for twin analysis sample

Twin sample	Within a week N = 400	Within 3 months N = 746	3 months to 1 year N = 412	More than a year N = 411
<i>MZ twin 1</i> <i>N = 395</i>	73 18.5%	145 36.7%	83 21.0%	94 23.8%
<i>MZ twin 2</i> <i>N = 429</i>	99 23.1%	147 34.3%	90 20.9%	93 21.7%
<i>DZ twin 1</i> <i>N = 575</i>	101 17.6%	235 40.9%	126 21.9%	113 19.6%
<i>DZ twin 2</i> <i>N = 570</i>	127 22.3%	219 38.4%	113 19.8%	111 19.5%

Association between speed of transition from initiation to subsequent cannabis use and cannabis-related outcomes

Table 2

Variable	More than a year N = 465	3 months to 1 year N = 487	Within 3 months N = 844	Within a week N = 443	Phi	P value
Daily use N = 372	45 9.7%	67 13.8%	134 15.9%	126 28.4%	0.17	<0.0001
Abuse and/or Dependence N = 624	82 17.6%	100 20.5%	238 28.2%	204 46.0%	0.22	<0.0001
Treatment seeking N = 132	19 4.1%	21 4.3%	45 5.3%	47 10.6%	0.10	<0.0001

Table 3

Associations between speed of transition from initiation to subsequent cannabis use and socio-demographic, childhood, mental health, peer and licit drug factors

Variable	More than a year N = 465	3 months to 1 year N = 487	Within 3 months N = 844	Within a week N = 443	Phi	P value
<i>Mean age at cannabis initiation</i>	17.60 (sd 2.95)	17.94 (sd 3.16)	17.24 (sd 2.89)	17.23 (sd 2.98)	0.20	0.1009
<i>Gender – Female N = 1314</i>	297 63.9%	289 59.3%	489 57.9%	239 53.9%	0.06	0.0230
<i>Education -Any high school N = 595</i>	98 21.1%	131 26.9%	207 24.5%	159 35.9%	0.11	<0.0001
<i>Parental alcohol problems N = 627</i>	137 30.0%	118 24.6%	225 27.1%	147 34.3%	0.07	0.0082
<i>Parental drug problems N = 106</i>	19 4.2%	21 4.4%	36 4.3%	30 6.9%	0.05	0.1528
<i>Parental conflict N = 884</i>	202 45.3%	176 38.1%	321 41.0%	185 44.6%	0.05	0.0925
<i>Experienced sexual abuse before age 18 N = 232</i>	53 11.4%	40 8.2%	80 9.5%	59 13.4%	0.06	0.0504
<i>Conduct disorder N = 285</i>	35 7.5%	46 9.4%	106 12.6%	98 22.1%	0.15	<0.0001
<i>Depressed mood before cannabis onset N = 199</i>	29 6.2%	51 10.5%	73 8.7%	46 10.4%	0.05	0.0778
<i>Peer use – More than ¼ hs peers used cannabis N = 209</i>	38 8.2%	28 5.7%	87 10.3%	56 12.6%	0.08	0.0020
<i>Early cannabis onset - 16 and under N = 929</i>	178 38.3%	173 35.5%	380 45.0%	198 44.7%	0.08	0.0016
<i>Regular nicotine use before cannabis onset N = 450</i>	80 17.2%	96 19.7%	151 17.9%	123 27.8%	0.10	<0.0001
<i>Regular alcohol use before cannabis onset N = 730</i>	165 35.5%	182 37.4%	256 30.3%	127 28.7%	0.07	0.0077

Table 4

Odds ratios (95% Confidence intervals) between speed of transition from initiation to subsequent cannabis use, covariates and later cannabis outcomes from multinomial logistic regression

Outcome	Daily use ^a N = 372 Odds Ratio (95% Confidence Interval)		Abuse and/or Dependence N = 624 Odds Ratio (95% Confidence Interval)		Treatment-seeking ^a N = 132 Odds Ratio (95% Confidence Interval)	
	Univariate model	Adjusted model	Univariate model	Adjusted model	Univariate model	Adjusted model
Speed of transition to subsequent use	More than a year N = 465	1.00	1.00	1.00	1.00	1.00
	- 3 months to 1 year N = 487	1.49 [*] (1.00 – 2.21)	1.43 (0.95 – 2.17)	1.19 (0.85 – 1.68)	1.06 (0.58 – 1.94)	1.03 (0.55 – 1.90)
	- Within 3 months N = 844	1.76 [*] (1.23 – 2.52)	1.44 (0.99 – 2.11)	1.61 ^{**} (1.18 – 2.19)	1.32 (0.76 – 2.28)	1.05 (0.60 – 1.84)
	Within a week N = 443	3.71 ^{***} (2.55 – 5.39)	2.64 ^{***} (1.75 – 3.99)	3.25 ^{***} (2.31 – 4.56)	2.79 ^{***} (1.60 – 4.85)	1.89 [*] (1.03 – 3.46)
Covariates						
Gender – Female N = 1314	0.54 ^{***} (0.41 – 0.71)		0.47 ^{***} (0.37 – 0.59)		0.60 ^{**} (0.40 – 0.92)	
Education – Any high school N = 595	1.47 [*] (1.12 – 1.93)		1.23 (0.97 – 1.55)		1.41 (0.98 – 2.03)	
Parental alcohol problems N = 627	1.20 (0.90 – 1.60)		1.15 (0.90 – 1.47)		1.46 (0.97 – 2.17)	
Conduct disorder N = 285	2.67 ^{***} (1.95 – 3.65)		2.55 ^{***} (1.89 – 3.45)		2.50 ^{***} (1.61 – 3.90)	
Peer use – More than ¾ high school peers used cannabis N = 209	1.14 (0.76 – 1.70)		0.93 (0.65 – 1.31)		1.42 (0.82 – 2.46)	
Early cannabis onset – 16 and under N = 929	2.00 ^{***} (1.50 – 2.66)		2.21 ^{***} (1.72 – 2.84)		1.68 [*] (1.05 – 2.70)	
Regular nicotine use before cannabis onset N = 450	1.59 ^{**} (1.16 – 2.17)		1.44 ^{**} (1.10 – 1.87)		<i>Not included in model</i>	
Regular alcohol use before cannabis onset N = 730	0.51 ^{***} (0.36 – 0.74)		0.60 ^{***} (0.45 – 0.80)		0.60 (0.34 – 1.09)	
Experienced sexual abuse before age 18 N = 232	1.99 ^{***} (1.34 – 2.95)		2.00 ^{***} (1.41 – 2.85)		2.03 ^{**} (1.18 – 3.48)	

* P < 0.05

** P < 0.01

For these outcomes the groups “3 months to 1 year”, and “within 3 months” were not found to be significantly different to each other in post-hoc tests_p

100%^a

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Twice ACE model fitting results and variance components point estimates with 95% confidence intervals for speed of transition from initiation to subsequent use of cannabis.

Table 5

Model	Proportion of variance			<i>E</i>	<i>-2 log likelihood</i>	<i>df</i>	<i>AIC</i>	<i>BIC</i>
	<i>A</i>	<i>C</i>						
Full ACE model	0.0002 (5.801395e-08 – 0.35)	0.25 (2.7711648e-10 – 0.34)		0.75 (0.63 – 0.84)	5268.96	1963	1342.96	-9004.02
CE submodel	-	0.25 (0.15 – 0.34)		0.75 (0.66 – 0.85)	5268.96	1964	1340.96	-9011.30

Model is adjusted for sex.