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

Lindsey A. Hines[1], Katherine I. Morley[1], John Strang[1], Arpana Agrawal[2], Elliot C. Nelson[2], Dixie Statham[3], Nicholas G. Martin[4] & Michael T. Lynskey[1]

Addictions Department, Institute of Psychiatry, Psychology and Neuroscience, King's College London, London, UK,[1] Department of Psychiatry, Washington University School of Medicine, St Louis, MO USA,[2] School of Social Sciences, University of the Sunshine Coast, Queensland Australia[3] and QIMR Berghofer Medical Research Institute, Brisbane, Queensland, Australia[4]

ABSTRACT

Aims   To test whether speed of transition from initiation 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**   A total of 2239 twins and siblings who reported using cannabis at least twice [mean age at time of survey = 32.0, 95% confidence interval (CI) = 31.9 – 32.1, range = 22–45]. **Measurements**   Time between initiation and subsequent cannabis use (within 1 week; within 3 months; between 3 and 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 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 1 week of initiation was associated with daily use [odds ratio (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.

Keywords   Cannabis, cannabis abuse, cannabis dependence, initiation, subsequent use, transitions, twin study.

INTRODUCTION

Cannabis is the most commonly used illicit drug, with prevalence of life-time 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 occur necessarily before an individual develops dependence. These include opportunity to use, initiation, repeated use and escalation to regular use, and genetic and environmental factors are associated differentially 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]; and 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 transition 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 that 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 associated consistently with later outcomes of dependence [17]. Further research on a broader range of transitions is required to understand more clearly 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. Utilizing 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 and 1979, 3348 monozygotic (MZ) and dizygotic (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 life-time 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% confidence interval (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 life-time 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 that 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 Semi-Structured Assessment for the Genetics of Alcoholism (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 and 12 months (21.7%) and more than 1 year later (20.8%).

Life-time 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 life-time 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; and cannabis having caused social and interpersonal problems more than three times within a 12-month period.

Participants were classified as meeting life-time criteria for DSM-IV cannabis dependence if they reported three 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 and 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 life-time 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 [standard deviation (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 that 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 years. 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 three 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 great deal less interested in or able to enjoy most things 'most of the day' and 'nearly every day' for at least 2 weeks in their life-time before the onset of cannabis use.

Peer use

The extent of substance misuse among 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 while of school age. Participants were categorized 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 2 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., Cary, NC, USA) and Stata statistical software version 11 (StataCorp, College Station TX, USA, 2009). χ^2 tests and phi coefficients assessed the association between the speed of transition from initiation to subsequent use of cannabis and life-time 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 associated significantly 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 χ^2 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 stepwise 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 MZ and 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

Associations between speed of transition and daily use, abuse/dependence and treatment-seeking

Speed of transition was associated significantly 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 1 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.

Demographic, childhood and peer use associations with transition speed

Significant differences were observed between the different transition speed groups for almost all 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 associated significantly with transition speed.

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

Table 1 Speed of transition from initiation 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
MZ twin 1	73	145	83	94
n = 395	18.5%	36.7%	21.0%	23.8%
MZ twin 2	99	147	90	93
n = 429	23.1%	34.3%	20.9%	21.7%
DZ twin 1	101	235	126	113
n = 575	17.6%	40.9%	21.9%	19.6%
DZ twin 2	127	219	113	111
n = 570	22.3%	38.4%	19.8%	19.5%

DZ = dizygotic; MZ = monozygotic.

Table 2 Association between speed of transition from initiation to subsequent cannabis use and cannabis-related outcomes.

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	45	67	134	126	0.17	<0.0001
n = 372	9.7%	13.8%	15.9%	28.4%		
Abuse and/or dependence	82	100	238	204	0.22	<0.0001
n = 624	17.6%	20.5%	28.2%	46.0%		
Treatment-seeking	19	21				<0.0001
n = 132	45	47	0.10	10.6%		

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
Mean age at cannabis initiation	17.60 (SD = 2.95)	17.94 (SD = 3.16)	17.24 (SD = 2.89)	17.23 (SD = 2.98)	0.20	0.1009
Gender: female	297	289	489	239	0.06	0.0230
n =1314	63.9%	59.3%	57.9%	53.9%		
Education: any high school	98	131	207	159	0.11	<0.0001
n = 595	21.1%	26.9%	24.5%	35.9%		
Parental alcohol problems	137	118	225	147	0.07	0.0082
n = 627	30.0%	24.6%	27.1%	34.3%		
Parental drug problems	19	21	36	30	0.05	0.1528
n = 106	4.2%	4.4%	4.3%	6.9%		
Parental conflict	202	176	321	185	0.05	0.0925
n = 884	45.3%	38.1%	41.0%	44.6%		
Experienced sexual abuse before age 18	53	40	80	59	0.06	0.0504
n = 232	11.4%	8.2%	9.5%	13.4%		
Conduct disorder	35	46	106	98	0.15	<0.0001
n = 285	7.5%	9.4%	12.6%	22.1%		
Depressed mood before cannabis onset	29	51	73	46	0.05	0.0778
n = 199	6.2%	10.5%	8.7%	10.4%		
Peer use: more than ¾ of high school peers used cannabis	38	28	87	56	0.08	0.0020
n = 209	8.2%	5.7%	10.3%	12.6%		
Early cannabis onset: 16 and under	178	173	380	198	0.08	0.0016
n = 929	38.3%	35.5%	45.0%	44.7%		
Regular nicotine use before cannabis onset	80	96	151	123	0.10	<0.0001
n = 450	17.2%	19.7%	17.9%	27.8%		
Regular alcohol use before cannabis onset	165	182	256	127	0.07	0.0077
n = 730	35.5%	37.4%	30.3%	28.7%		

drug factors, those whose second use of cannabis was within a week were at increased odds of meeting criteria for abuse/dependence [odds ratio (OR) = 3.25, 95% confidence interval (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).

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

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	1.00
	3 months to 1 year, n = 487	1.49* (1.00–2.21)	1.43 (0.95–2.17)	1.21 (0.87–1.67)	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)	1.83*** (1.37–2.46)	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)	3.99*** (2.92–5.44)	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 of 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)		Not included in model	
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)	

*$P < 0.05$; **$P < 0.01$; ***$P < 0.001$. [a]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.

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/later 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) and (2) transition 3 months–1 year, with those in the early-onset group having an increase in likelihood of daily use (OR = 2.55, 915% CI = 1.04–6.27) and treatment-seeking (OR = 8.38, 95% CI = 1.35–2.1).

Modelling additive genetic, shared and non-shared environmental influences on speed of transition between initiation 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 that 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 among those with later cannabis onset, suggesting that 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 have 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 non-use to initiation attributed to additive genetic effects

Table 5 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.

Model	Proportion of variance			−2 log likelihood	df	AIC	BIC
	A	*C*	*E*				
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

AIC = Akaike information criterion; BIC = Bayesian information criterion. Model is adjusted for sex. A = additive genetic factors; C = common environmental factors; E = specific environmental factors.

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 influenced predominately by environmental factors, demonstrating the importance of utilizing a stage-sequential approach in order to understand fully 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] and 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 been found previously 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 and future research

First, 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 was 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 underestimation of the effect of this transition. Fifthly, while probably representative of base population [47], the prevalence of life-time 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 been observed previously in the 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 probably 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 1 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 due predominately 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.

Declaration of interests

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