The impact of cohort substance use upon likelihood of transitioning through stages of alcohol and cannabis use and use disorder: Findings from the Australian National Survey on Mental Health and Well-Being

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Abstract

Background: We used population-level Australian data to estimate prevalence, age of onset and speed of transitions across stages of alcohol and cannabis use, abuse and dependence, and remission from disorder, and consider the potential impacts that an individual's age cohort's level of substance use predicted transitions into and out of substance use.

Methods: Data on use, DSM-IV use disorders, and remission from these disorders were collected from participants (n=8463) in the 2007 Australian National Survey of Mental Health and Wellbeing using the Composite International Diagnostic Interview.

Results: Lifetime prevalence (95% confidence interval) of alcohol use, regular use, abuse and dependence were 94.1% (93.3-94.8%), 64.5% (62.9-66.2%), 18.7% (17.4-19.9%) and 4.0% (3.4-4.6%). Lifetime prevalence (standard error) of cannabis use, abuse and dependence were 19.8% (18.6-20.9%), 4.4% (3.8-5.0%) and 1.9% (1.5-2.4%). Among those with the disorder, rates of remission from cannabis abuse, alcohol abuse, cannabis dependence and alcohol dependence were 90.5% (87.4-93.6%), 86.2% (83.8-88.7%), 79.6% (71.1-88.1%) and 53.8% (46.6-61.0%). Increases in the estimated proportion of people in the respondent's age cohort who used alcohol/cannabis as of a given age were significantly associated with most transitions from use through to remission beginning at the same age.

Conclusions: Clear associations were documented between cohort-level prevalence of substance use and personal risk of subsequent transitions of from use to greater substance involvement. This relationship remained significant over and above associations involving the individual's age of initiation. These findings have important implications for our understanding of the causal pathways into and out of problematic substance use.

Keywords: alcohol; cannabis; abuse; dependence; remission; cohort

Introduction

Increased understanding of the natural history of substance use disorders and transitions through the stages (initiation, transition to and remission from problems) is necessary to better identify prevention and treatment opportunities, targets, and optimal timing. Research on the trajectories of use has been carried out but has most often considered only the transition between use and dependence [e.g. 1,2] or focused on specific populations (e.g. young adults and people seeking treatment [3-5]).

The general population studies that have explored the natural history of substance use show that commonly-identified social contextual risk factors have a differential role according to transition stage [2,6-10]. For example, substance use is highly linked to social and peer-level variables [11] and there is evidence to suggest that the extent to which behaviour is normative may be associated with adverse outcomes [12,13].

Previous studies have consistently reported chronological age, historical period (“secular influences”) and birth cohort effects associated with differences in substance use and related problems [14-17]. Even the well-documented gender differences in substance use and disorders have been found to be associated with age, period and cohort effects [18-20]. Many studies have documented age related differences in substance use and related problems and these differences are usually attributed at least in part to developmental and maturational factors especially when cross-sectional comparisons are made across a sample comprised of a broad age range of a population [21-23]. However, individuals are also strongly influenced by the broader social contextual period effects.

Substance use-related period influences, including both risk and protective factors (e.g. substance use norms, enforcement of sanctions, substance availability, and perceptions of risk), have varied widely across geographical locations and in different time periods in history. Birth cohort effects more focally include the shared social and environmental

influences on the individuals born at particular times as they mature as a group, experiencing the extant period effects including changes in the period effects over time. There are complex issues involved in distinguishing period and cohort effects [24,25], and while there is evidence of both influences, research has shown that substance use behaviours are especially related to cohort effects [17,20,26], which may filter or modify period effects and perhaps exert other social and peer influences. It may also be that cohort effects vary at different ages and stages of use.

Using data from a national study of Australian adults sampled across all cohorts in the population, the aims of the present study were to estimate the prevalence, age of onset and speed of transitioning across stages of alcohol and cannabis use, abuse and dependence, and remission from abuse and dependence in the Australian population, and to determine the impact that an individual's age cohort's level of substance use has on transitioning between these stages. We hypothesised that involvement in to, and out of, all stages of involvement with alcohol is largely impacted by the prevalence of its' use among similarly aged peers such that risk of transitioning to all stages increases with prevalence of cohort use.

Method

Sample

Data from the Confidentialised Unit Record File of the 2007 National Survey of Mental Health and Well-Being (NSMHWB) were obtained from the Australian Bureau of Statistics. The 2007 NSMHWB was conducted by trained Australian Bureau of Statistics interviewers between August and December 2007. The aim of the survey was to provide reliable estimates of mental disorders at a national level. The 2007 NSMHWB sample of 17,352 dwellings was selected using a stratified, multistage area probability sample of people aged

16-85 years in private dwellings across all Australian states and territories excluding very remote areas. The area-based selection ensured that all sections of the population living in private dwellings within the geographical scope of the survey were represented. Non-private dwellings (hospitals, nursing homes, prisons, hotels) were not sampled. After removal of households with no in-scope respondents, and vacant, under construction or derelict dwellings, the effective sample size was reduced to 14,805 dwellings. All interviews were conducted in English, meaning that non-English speakers were excluded from the sample. However, those persons unable to answer themselves but who otherwise fell within the survey's scope are represented in statistical outputs through inclusion in the population benchmarks used for weighting, a standard approach implemented by the Australian Bureau of Statistics [27]. Each interview was conducted in person using computer assisted interviewing and took approximately 90 minutes to complete.

There were 8841 participants aged 16 and over (8463 participants when limited to those aged 18 years and over, of which 50.4% (standard error = 0.8) were female), with a response rate of 60%. Due to the lower than expected response rate (it was expected that a 75% response rate would be achieved), extensive non-response analyses were undertaken to assess the reliability of the survey estimates. A purposive sample of fully non-responding households in two metropolitan areas, Sydney and Perth, was followed up with a short-form interview, to gain a qualitative assessment of non-response bias. The study indicated the impact of non-response to be small at the aggregate level, but possible underestimation of the prevalence of mental disorders may exist for men, young people and those residing in Perth. The final sample represented an estimated population count of 16,015,300 Australian adults. Further information about the procedure and instrument is published elsewhere [28].

The 2007 NSMHWB used the World Mental Health Survey Initiative version of the Composite International Diagnostic Interview Version 3.0 (WMH-CIDI 3.0) [29]. This interview has undergone extensive methodological development and testing and has been

used in household surveys in at least 28 countries around the world. This instrument collects both diagnostic information on a broad range of mental disorders and information on risk factors, impacts, patterns and treatment of mental disorders. There were some modifications made to the WMH-CIDI to tailor the survey to the Australian context.

All analyses were based on weighted data, accounting for stratification and clustering. The application of the weights ensured the data were representative of the national population. Person weights and replicate weights generated by the Australian Bureau of Statistics were obtained from the Confidentialised Unit Record File [30].

Assessment of Alcohol and Cannabis Use Disorders

The WMH-CIDI produces diagnostic information according to the American Psychiatric Association's Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition (DSM-IV) [31]. The WMH-CIDI uses a lifetime time frame. Diagnoses were derived using standard WMH-CIDI diagnostic algorithms and the lifetime DSM-IV diagnosis criteria are used in the current report.

In order to minimise unnecessary respondent burden, questions regarding alcohol use disorders were asked of all people who, in the year they drank most, drank alcohol at least three days per week or consumed at least three standard (10 g) alcoholic drinks per drinking day. Questions about cannabis use disorders were asked of those who had used cannabis at least five times in their lifetime. These questions were asked of 5522 alcohol and 1639 cannabis users (N=5444 for alcohol and N=1606 for cannabis when limited to 18 years or older).

Data Analysis

We looked at the age of onset and speed of transition between stages. For alcohol, these stages were use (first time drank a standard alcoholic drink), regular use (drank alcohol on

at least three days per week; or at least three standard alcoholic drinks per drinking day in the year they drank most), DSM-IV abuse without dependence and DSM-IV dependence. For cannabis, they were age of onset among people who used more than five times in their life, DSM-IV abuse without dependence, and DSM-IV dependence. We also assessed remission from dependence and from abuse *without* dependence, where remission was defined as the absence of all disorder related symptoms for more than 12 months prior to the interview.

All analyses were carried out using SAS Version 9.4. Life-table (actuarial) estimates of the survival functions for age of onset and remission were produced using the SAS PROC LIFETEST procedure and are reported as weighted prevalence (95% confidence interval). The associations of cohort-level lifetime prevalence of use as of given ages controlling for basic socio-demographics with these transitions were assessed using discrete-time survival models in SAS PROC SURVEYLOGISTIC with person-year the unit of analysis and a logistic link function [32]. We defined a contextual variable to represent the level of alcohol/cannabis use in an individuals' birth cohort to estimate the effect of changes in use over time. An individual's birth cohort was based on their year of birth +/- 5 years, which created 11-year wide cohorts centred around each year of birth. The cohort widths were reduced for those aged between 18 and 22 years to, as close as possible, ensure symmetry around birth year; total band width was of size two for 18-year olds (18-19), three for 19-year olds (18-20), five for 20-year olds (18-22), seven for 21-year olds (18-24) and nine for 22-year olds (18-26). Cohorts were top-coded for those aged 65 or older. The predictor variable was the estimated proportion of people (/10) in the individual's birth cohort who had used the specific substance (either alcohol or cannabis) by the prior person year. In order to capture only the most prominent changes in cohort use, cohort use prevalence was set to zero for person years below the age of 12 and top-coded for 30 years and over.

Predictor variables were sex, age of person year (<=14, 15-17, 18-20, 21-24, 25-29 and 30+ for all use/use disorder models and <=18, 19-20, 21-22, 23-24, 25-29, 30-39 and 40+ for remission from alcohol abuse or dependence), time-varying education level (student, low,

low/medium, medium/high or high), age of commencing use (except for modelling commencement of use) defined as early youth, mid-teens or adulthood and speed of transition from use to abuse or dependence defined as early, mid or late tertiles (only for remission from alcohol abuse or dependence). Low education is defined as having completed 11 years or less, low/medium as completion of 12 years, medium/high as 13-15 years and high as 16 or more years.

Results

Prevalence of use, use disorders and remission

Lifetime prevalence estimates for alcohol and cannabis use and use disorders are shown in Table 1. Prevalence of alcohol use, regular use, abuse and dependence of alcohol were 94.1%, 64.5%, 18.7% and 4.0%, respectively. One in five (19.8%) had used cannabis more than five times during their lifetime; 1.9% had been dependent upon cannabis.

Once conditioned on use, a higher percentage of cannabis users compared to alcohol users developed abuse (22.2% versus 19.9%) and dependence (9.8% versus 4.2%). Those with cannabis use disorders also had a higher prevalence of remission than people with alcohol use disorders; for example, 79.6% of people with lifetime cannabis dependence had remitted by the time of interview, compared to just over half (53.8%) of people with alcohol dependence.

Table 1 about here

Age of onset distributions

Figure 1 shows the cumulative age of onset (AOO) curves for onset of alcohol and cannabis use, abuse, dependence, remission from abuse and remission from dependence. The onset of use for both alcohol and cannabis largely occurred by age 19 (75th percentile for both

alcohol and cannabis). Onset of cannabis abuse and dependence typically occurred at earlier ages than for alcohol abuse and dependence; for example, the 75th percentile for cannabis abuse onset was 21 years, compared to 25 years for alcohol abuse.

Remission AOO curves also showed that remission from cannabis abuse and dependence occurred at earlier ages than for remission from alcohol use disorders. For example, the 75th percentile for remission of alcohol dependence was age 40, compared to 31 years for cannabis dependence. Cumulative AOO curves among those that reached each stage, and remission AOO curves among those with the disorder, are shown in the Appendix (**Figure S1 and S2**, respectively).

Figure 1 about here

AOO curves for alcohol and cannabis use, in selected birth cohorts, are shown in Figure 2. The median age of onset of alcohol and cannabis use both decreased for alcohol and cannabis use in more recent cohorts, and particularly for cannabis use, overall levels of use reached much higher levels in more recent cohorts, with the exception that those in the 1989 cohort (which includes those born in '88 and '89) had lower levels of cannabis use compared to the 1979, 1969 and 1959 cohorts (all +/- 5 years) by the age of 19.

Figure 2 about here

Time to transition across stages of involvement with alcohol and cannabis use

Figure 3 shows the cumulative curves for time between stages for alcohol and cannabis. For alcohol, the transition from initial use to regular use showed the fastest transition speed, with more than half of all individuals who become regular users doing so within three years of initial use. The time lag between onset of use to disorder was longer for alcohol than cannabis: for alcohol dependence for example, 75% of alcohol dependence cases had developed 15 years after onset of use; for cannabis dependence, 75% of cases had begun six years after onset of use.

The time from onset to remission of either abuse or dependence was similar within alcohol and cannabis. For example, around 75% of cases of alcohol abuse and alcohol dependence had remitted by 13 years after onset of the disorder, and 75% of cannabis abuse and cannabis dependence had remitted by 9 years after onset of the disorder.

Figure 3 about here

Predictors of transition between stages

Table 2 shows the results from multivariable discrete-time survival analyses investigating predictors of transitions between stages for both alcohol and cannabis, where the outcome modelled is the likelihood of transitioning to use or from use to use disorder in a given year. Men were more likely to start using alcohol and cannabis, and to transition to abuse and dependence of these substances after starting use. An individual's AOO of alcohol use was also significantly associated with the onset of both abuse and dependence, while AOO of cannabis use was only significantly associated with risk of dependence.

More consistent associations were observed between the percentage of an individual's age cohort who had already started using alcohol or cannabis, and the likelihood of that individual transitioning to use and dependence for both alcohol and cannabis, as well as to abuse for alcohol. Most notable was the large cohort effect for transitioning to dependence, where each 10% increase of people in an individual's age cohort having commenced use by the previous person year was associated with an increase of 76% and 157% in the adjusted odds of transitioning from use to dependence, for alcohol and cannabis, respectively.

Predictors of remission from abuse and dependence

Table 3 shows the results from multivariable discrete-time survival analyses investigating predictors of remission from alcohol and cannabis use disorders. The two variables related to risk of remitting in any given year were gender for cannabis, and levels of use in an

individual's age cohort for remission from abuse for cannabis and abuse and dependence for alcohol. Men were less likely than women to remit from abuse or dependence for cannabis. Interestingly, the higher the level of use in an individual's age cohort, the higher the likelihood that a person who had developed alcohol abuse or dependence or cannabis abuse, was to remit from these disorders.

Discussion

The aim of the present study was to examine prevalence and transitions between alcohol and cannabis use, disorder, and remission in a nationally representative Australian sample, with a specific focus on the extent to which substance use of an individual's age cohort predicted risk of these transitions.

Most Australian adults are estimated to engage in lifetime alcohol use, with two-thirds reporting a lifetime history of regular use, and over one-fifth meeting criteria for an alcohol use disorder. Lower rates of lifetime use and disorder were observed for cannabis, but among those using, the prevalence of use disorders was higher for cannabis, and the speed of transition to use disorders was faster for people using cannabis than it was for people using alcohol. Onset of use and use disorders typically occurred between mid-teens and early 20s and there was a trend for declining AOO in more recent birth cohorts consistent with recent reviews of this evidence [33,34].

In line with existing research [35], transition time from cannabis use to use disorder was generally half the time of that from alcohol use to use disorder. Also, people who transitioned to cannabis use disorders were more likely to later remit from these disorders, and to do so at an earlier age, than people with alcohol use disorders. These findings align with previous research showing higher rates of remission from lifetime cannabis dependence versus alcohol dependence, attributed to social pressures surrounding legality

of cannabis, and greater environmental cues for consumption with alcohol, as well as other physical, psychological and social consequences of use [36].

The key focus of this paper was to consider whether there was any impact of the substance use context in an individual's age peers. We found that there clearly is. The higher the level of use in an individual's age cohort, the greater the likelihood of an individual starting use in the following year and, if use had begun, the greater the likelihood of transitioning to disorder, for both alcohol and cannabis. Further, this variable was a strong predictor of remission from alcohol and cannabis abuse and alcohol dependence, in that the more people in an individual's age cohort who were using those substances, the greater the likelihood of remitting from use disorder.

These findings speak strongly to the social context in which substance use occurs. One of the most consistent findings around substance use is that substance use of one's peers predicts a greater likelihood of involvement with substance use for an individual [37]. Here, we have further shown that this is a generalised pattern whereby it is not only substance use among one's friends, but in one's peer cohort more generally. This may be through multiple mechanisms, including impacts on perceived norms related to substance use [38], as well as increasing opportunities to use substances [39]. As substance use increases and the onset of disorder becomes more about the cohort as a whole, persons transitioning to disorders may be less problematic or use disorder prone at the individual level and, as a result, remit from those disorders at a higher rate. These findings also provide data that suggest that the level of risk for developing problems with substance use (and likelihood of remission of problems once they begin) is not static, but affected by other variables, in this case the extent to which substance use is occurring among one's age peers.

This suggests that any intervention that reduced the overall level of substance use within a cohort would also reduce individual-level risk for transitioning into greater levels of involvement with substance use. Educational settings provide ready access and easy delivery of interventions to young people, but there are problems with the quality of studies

of school-based prevention [11] and many studies only report on changes in attitudes and knowledge [40,41]; these also do not include young people who have left school, a group at higher risk of substance use [37]. There are structural-level interventions with good evidence of a much greater preventive impact upon substance use [42]. For example, limiting outlets where alcohol may be sold can reduce young people's access to alcohol [43]; increasing alcohol taxation or alcohol price also reduces alcohol consumption [44,45]. Raising the age at which alcohol purchase is legal has also been shown to reduce alcohol-related motor vehicle accidents, alcohol-related hospitalisations and mortality [44,45].

While the current study identifies the effect of cohort involvement measures on risk of transitioning to higher stages of the same substance, it would also be of interest to investigate the impact of cross-substance use. Do disorders of different substances tend to occur at the same ages or over time? Do cohort involvement measures predict across substances? Such findings would provide further insight of the patterns and influences of poly-substance use and use disorders.

Previous research has shown a differential role of sociodemographic risk factors in transitioning across the stages of alcohol use and use disorder [6-8,10]. These findings were reflected in the current study for both alcohol and cannabis to the extent that being male and lower educational attainment predicted onset of use, and transition from use to regular use and abuse. Men were also less likely to report lifetime remission from cannabis abuse and dependence; this has previously been suggested to reflect a higher likelihood of greater physical, psychological and social consequences of substance use among women and their faster progression to treatment [36,46]. Models for alcohol use transitions were run for the transitions of use to regular use, regular use to abuse without prior dependence, and regular use to dependence, similarly to those in Table 2 (see **Appendix Table S1**). Individuals' age of onset was significantly associated with all transitions, lower education and being male were associated with increased risk of transitioning from use to regular use

and regular use to abuse, and the prevalence of use among one's peers was positively significantly associated with transitions from regular use to use disorders.

Although treatment provision was not factored into these analyses, separate analyses have suggested that treatment rates for substance use disorders were very low [47], and there is considerable scope to improve the reach of effective early intervention and continuing care throughout the journey to remission, and for targeted intervention within the comparably brief time window between onset of use and use disorder, particularly for cannabis.

Limitations

This study provided detail regarding the prevalence and timing of various stages across the full trajectory of both alcohol and cannabis use, with clinically valid diagnoses and inclusion of contextual predictors not previously accounted for within the literature. It should be noted that data on age of onset for each stage were obtained via retrospective self-report and may be subject to 'forward telescoping', whereby participants are more likely to report events as closer to the point of interview than is accurate [48,49]. Large upticks in the cohort curves presented in Figure 2, relative to surrounding years, are likely representative of such memory bias. However, this literature does not suggest that the order of recalled events will be altered.

The peer networks that individuals from the same birth cohort directly interact with will vary. It was not clear with the current dataset how to capture the prevalence of use among an individual's true peer group. The estimates presented here are likely lower-bound estimates of the effect sizes that would have been obtained if we had completely accurate data on peer groups.

The illegality and potential stigmatism surrounding substance use may have meant respondents under-reported their true level of involvement with substances. While this may influence the overall prevalence levels, we have no reason to suspect this would vary by

cohort or age. If the true level of substance use is in fact higher, cohort use may have an even larger effect on risk of transitioning than is observed here.

Due to the small counts in certain models, it was necessary to use large age-categories such as the person-year age grouping of 40+ years, which combines different age groups including middle-aged adults and seniors and may obscure putative specific effects in the elderly. Conditional relationships may also exist between the age-related variables (age of onset, person year and education) though interactive terms were not explicitly modelled.

Changes to the national schooling structure over time means there is likely variation in the education completion thresholds across cohort groups, as well as at the institution and geographic location levels. Information relating to schooling was not captured in enough detail that would allow for reliable cohort-specific education categories. Therefore, the significance of this variable may in part capture the age of an individual.

Conclusion

We documented clear associations between the substance use of an individual's age cohort and an individual's personal risk of transitioning to greater involvement with that substance. This relationship remained a significant predictor of transitioning into and out of problematic substance use, over and above that individual's age of initiation and speed of transition into substance use. These findings have important implications for our understanding of the causal pathways into and out of problematic substance use.

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Table 1: Prevalence of levels of involvement with alcohol and cannabis use, Australia

	Alcohol			Cannabis ⁶		
	N	Weighted prevalence (%)	95% CI	N	Weighted prevalence (%)	95% CI
<i>Prevalence^{1,2}</i>						
Use	8463	94.1	93.3-94.8	8,463	19.8	18.6-20.9
Regular use ^{4,5}	8463	64.5	62.9-66.2			
Abuse	8463	18.7	17.4-19.9	8,463	4.4	3.8-5.0
Dependence	8463	4.0	3.4-4.6	8,463	1.9	1.5-2.4
Remission from abuse	8463	16.1	14.9-17.3	8,463	4.0	3.4-4.6
Remission from dependence	8463	2.1	1.7-2.6	8,463	1.5	1.2-1.9
<i>Conditional prevalence³</i>						
Regular use ⁴ use	7945	68.6	66.9-70.3			
Abuse use	7945	19.9	18.5-21.2	1,606	22.2	19.3-25.0
Dependence use	7945	4.2	3.7-4.8	1,606	9.8	7.5-12.2
Remission from abuse LT abuse W/O dependence	1464	86.2	83.8-88.7	340	90.5	87.4-93.6
Remission from dependence LT dependence	342	53.8	46.6-61.0	144	79.6	71.1-88.1

1. Lifetime.

2. Excludes people aged under 18 at the time of interview.

3. Inclusion in the denominator is conditional on persons having met a certain level of alcohol involvement e.g. 'Regular use | use' is regular use among persons who had ever used alcohol.

4. Regular use of cannabis was not assessed.

5. Prevalence of lifetime abuse with or without dependence was 22.1(0.6) for alcohol and 6.1(0.3) for cannabis.

6. Cannabis use defined as having used more than 5 times in lifetime.

CI, confidence interval; LT, lifetime; SE, standard error; W/O, without.

Figure 1: Age of onset of alcohol use, regular use, use disorder, and remission, and cannabis use, use disorder and remission, Australia; Y-axis scales range from 0-100% for alcohol and 0-21% for cannabis

Among those making this transition...	Age-of-onset, percentile				
	5	25	50	75	95
Alcohol use	10	15	17	19	24

Among those making this transition...	Age-of-onset, percentile				
	5	25	50	75	95
Cannabis use	14	16	18	19	25

Alcohol regular use	15	17	19	19	28	Cannabis abuse	15	17	19	21	31
Alcohol abuse	16	19	20	25	39	Cannabis dependence	15	18	20	23	36
Alcohol dependence	16	19	21	29	48	Remission from cannabis abuse	19	22	25	30	41
Remission from alcohol abuse	21	24	29	38	53	Remission from cannabis dependence	20	22	26	31	37
Remission from alcohol dependence	21	24	31	40	54						

Figure 2: Age of onset curve for alcohol and cannabis use among selected birth cohorts, Australia

Figure 3: Transition times between alcohol use, regular use, use disorder and remission, and cannabis use, use disorder and remission, Australia

Table 2: Multivariate predictors of transitions to alcohol and cannabis use and use disorder, Australia

	Commencing use		Use to abuse (w/o prior dependence)		Use to dependence	
	OR	(95% CI)	OR	(95% CI)	OR	(95% CI)
Alcohol	N=8,463		N=7,945		N=7,945	
Individual's age of commencing alcohol use³						
Early youth	-	-	2.63*	(2.09-3.31)	3.21*	(2.10-4.91)
Mid-teens	-	-	1.37*	(1.07-1.76)	1.71*	(1.06-2.75)
Adulthood	-	-	1.00	-	1.00	-
$\chi^2_2[p]$	-	-	79.55**	[<0.001]	38.29**	[<0.001]
Male	1.63*	(1.50-1.77)	2.78*	(2.40-3.23)	1.64*	(1.24-2.16)
$\chi^2_1[p]$	133.29**	[<0.001]	187.69**	[<0.001]	12.67**	[<0.001]
Percentage of individual's age cohort already using⁵	1.34*	(1.30-1.39)	1.37*	(1.30-1.45)	1.76*	(1.51-2.05)
$\chi^2_1[p]$	328.90**	[<0.001]	135.30**	[<0.001]	53.95**	[<0.001]
Education⁶						
Student	1.53	(0.96-2.45)	2.02*	(1.39-2.93)	0.66	(0.31-1.40)
Low	1.25	(0.81-1.90)	1.88*	(1.39-2.56)	0.76	(0.38-1.52)
Low/Med	0.69	(0.46-1.06)	1.52*	(1.03-2.24)	0.65	(0.33-1.29)
Med/High	1.18	(0.76-1.83)	1.76*	(1.27-2.44)	0.75	(0.39-1.44)
High	1.00	-	1.00	-	1.00	-
$\chi^2_4[p]$	37.91**	[<0.001]	18.07**	[0.001]	2.07	[0.723]
Cannabis	N=8,463		N=1,599		N=1,604	
Individual's age of commencing cannabis use⁴						
Early youth	-	-	0.61*	(0.37-1.00)	1.06	(0.58-1.95)
Mid-teens	-	-	0.71	(0.42-1.22)	0.59	(0.33-1.06)
Adulthood	-	-	1.00	-	1.00	-
$\chi^2_2[p]$	-	-	3.97	[0.137]	8.74**	[0.013]
Male	1.94*	(1.70-2.21)	1.55*	(1.20-2.00)	1.69*	(1.03-2.78)
$\chi^2_1[p]$	102.81**	[<0.001]	12.04**	[0.001]	4.49**	[0.034]
Percentage of individual's age cohort engaged in use⁵	2.09*	(1.88-2.33)	1.17	(0.95-1.44)	2.57*	(1.60-4.13)
$\chi^2_1[p]$	182.19**	[<0.001]	2.25	[0.134]	15.75**	[<0.001]
Education⁶						
Student	2.36*	(1.66-3.36)	1.94	(0.97-3.89)	1.24	(0.32-4.77)
Low	1.42	(0.95-2.10)	2.20*	(1.19-4.08)	1.43	(0.42-4.86)
Low/Med	1.35	(0.87-2.08)	0.84	(0.37-1.91)	1.44	(0.39-5.37)
Med/High	0.97	(0.63-1.49)	1.56	(0.80-3.05)	1.28	(0.35-4.72)
High	1.00	-	1.00	-	1.00	-
$\chi^2_4[p]$	61.09**	[<0.001]	13.54**	[0.009]	0.56	[0.967]

Person-years were defined from six years of age for alcohol and thirteen years of age for cannabis in modelling commencement of use.

1. N = The total unweighted number of respondents included in model, conditioning on initial stage.
2. Model also controlled for age person year (not shown in table) - groups were <= 14, 15-17, 18-20, 21-24, 25-29, and 30+.
3. *Individual's age of commencing alcohol use* is split into tertiles among all those who ever used alcohol. The earliest (early youth) tertile is age <=15, the 2nd tertile (mid-teens) age 16-17 and the 3rd tertile (adulthood) aged 18+.
4. *Individual's age of commencing cannabis use* is split into tertiles among those who ever used cannabis. The first tertile (early youth) is age <=16, the 2nd tertile (mid-teens) 17-18 and the last (adulthood) 19+.
5. %/(10) of +/-5-yr cohort used by prior person year. e.g. For an individual born in 1975 the cohort would be persons born between 1970 and 1980. An OR of 1.5 for commencement of use would be interpreted as an increase of 50% in the odds of commencing use with an increase of 10% of people in the age cohort who had commenced use by the previous person year (controlling for all other variables in the model).

6. Low education is defined as completed 11 or less years, low/med is completed 12 years, medium 13-15 years and high 16 or more years. Individuals with a missing age of onset were excluded from the model (N=4 for cannabis abuse and N=2 for cannabis dependence).
*/** - significant at the 0.05 level, two-sided test; CI, confidence interval; OR, odds ratio.

Table 3: Multivariate predictors of remission from DSM-IV alcohol and cannabis use disorders, Australia

	Predictors of remission among people who had met criteria for DSM-IV alcohol...				Predictors of remission among people who had met criteria for DSM-IV cannabis...			
	...abuse ¹		...dependence ¹		...abuse ¹		...dependence ¹	
	OR	(95% CI)	OR	(95% CI)	OR	(95% CI)	OR	(95% CI)
<i>Individual's age of commencing use</i> ²								
Early youth	0.75*	(0.57-0.99)	0.63	(0.32-1.24)	0.82	(0.57-1.17)	1.09	(0.65-1.84)
Mid-teens	0.86	(0.66-1.12)	0.69	(0.34-1.43)	1.15	(0.80-1.66)	1.29	(0.63-2.63)
Adulthood	1.00	-	1.00	-	1.00	-	1.00	-
$\chi^2_2 [p]$	4.78	[0.091]	1.89	[0.389]	5.03	[0.081]	0.52	[0.772]
<i>Male</i>	0.92	(0.74-1.14)	0.67	(0.45-1.02)	0.51*	(0.36-0.71)	0.44*	(0.26-0.75)
$\chi^2_1 [p]$	0.62	[0.433]	3.60	[0.058]	16.10**	[<0.001]	9.54**	[0.002]
<i>Individual's speed to transition from use to disorder</i> ³								
Early	1.02	(0.81-1.27)	0.95	(0.56-1.62)	1.28	(0.87-1.87)	2.23*	(1.28-3.91)
Mid	0.75	(0.55-1.02)	0.70	(0.40-1.22)	1.18	(0.79-1.75)	1.69	(0.97-2.94)
Late	1.00	-	1.00	-	1.00	-	1.00	-
$\chi^2_2 [p]$	5.23	[0.073]	2.09	[0.351]	1.68	[0.432]	9.70**	[0.008]
<i>Percentage of individual's age cohort already engaged in use</i> ⁴	2.88*	(2.08-4.00)	9.02*	(1.96-41.44)	1.72*	(1.26-2.34)	1.53	(0.99-2.37)
$\chi^2_1 [p]$	41.90**	[<0.001]	8.32**	[0.004]	12.41**	[<0.001]	3.8	[0.051]
<i>Education level</i> ⁵								
Student	0.58	(0.31-1.07)	2.21	(0.42-11.77)	0.59	(0.24-1.50)	1.15	(0.30-4.49)
Low	0.82	(0.60-1.13)	0.76	(0.37-1.56)	0.67	(0.38-1.18)	0.74	(0.38-1.44)
Low/Med	0.87	(0.60-1.25)	0.84	(0.33-2.17)	0.96	(0.54-1.72)	1.72	(0.80-3.70)
Med/High	0.85	(0.61-1.18)	0.78	(0.39-1.58)	0.85	(0.52-1.40)	1.42	(0.69-2.91)
High	1.00	-	1.00	-	1.00	-	1.00	-
$\chi^2_4 [p]$	3.58	[0.465]	2.85	[0.584]	3.26	[0.516]	6.88	[0.143]

Person-years were defined from six years of age for alcohol and thirteen years of age for cannabis in modelling commencement of use.

1. Models also controlled for age person year (not shown in table) with age groups ≤ 18, 19-20, 21-22, 23-24, 25-29, 30-39, and 40+.

2. *Individual's age of commencing alcohol use* is split into tertiles among all those who ever used alcohol. The earliest (early youth) tertile is age ≤15, the 2nd tertile (mid-teens) age 16-17 and the 3rd tertile (adulthood) aged 18+.

Individual's age of commencing cannabis use is split into tertiles among those who ever used cannabis. The first tertile (early youth) is age ≤16, the 2nd tertile (mid-teens) 17-18 and the last (adulthood) 19+.

3. *Individual's speed of transition from alcohol use to disorder* is split into tertiles. When predicting remission from abuse, tertiles were calculated for transition from use to abuse: the fastest at 0-4 years, the middle tertile 5-8 years and late transitions were 9+ years. Among those who transition from use to dependence when predicting remission from dependence the early tertile is 0-4 years from use to dependence, mid is 5-11 years and late is 12+ years.

Individual's speed of transition from cannabis use to disorder is split into tertiles. When predicting remission from abuse, tertiles were calculated for transition from use to abuse: the fastest at 0-1 years, the middle tertile 2-3 years and late transitions were 4+ years. Among those who transition from use to dependence when predicting remission from dependence the early tertile is 0-2 years from use to dependence, mid is 3-5 years and late is 6+ years.

4. %(/10) of +/-5-yr cohort used by prior person year. e.g. For an individual born in 1975 the cohort would be persons born between 1970 and 1980. An OR of 1.5 for commencement of use would be interpreted as an increase of 50% in the odds of commencing use with an increase of 10% of people in the age cohort who had commenced use by the previous person year (controlling for all other variables in the model).

5. Low education is defined as completed 11 or less years, low/med is completed 12 years, medium 13-15 years and high 16 or more years.

Where the reported time since last disorder problem was <2 years but the exact age of remission was not reported, age of remission could not be evaluated and these individuals were excluded from the models (N=86 remission from alcohol abuse, N=21 remission from alcohol dependence, N=19 remission from cannabis abuse and N=5 remission from cannabis dependence).

*/** - significant at the 0.05 level, two-sided test; DSM-IV, Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition.

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