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Trends in the sequence of first alcohol, cannabis and cigarette use in Australia, 2001-2016

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Abstract

Background: Recent analyses of data from the US found that young people were increasingly engaging in cannabis use before alcohol and cigarettes. These shifts are important for public health, but it is not clear whether such trends extend beyond the US. The aim of this study is to examine whether and how the age and sequencing of initiation into alcohol, cannabis and cigarette use has changed in Australia since the early 2000s.

Methods: Data came from six waves of the Australian National Drug Strategy Household Survey, spanning 2001-2016. We used data from 18-21 year-olds (n=6,849) and examined trends in the age at first use for each of the three substances plus any changes in the order of initiation.

Results: The mean age of initiation increased steadily for all three substances (e.g. from 14.9 in 2001 to 16.4 in 2016 for alcohol), while the prevalence of any use declined. There were some changes in ordering of use. For example, in 2001, 62% of respondents who used both cigarettes and cannabis had first used cigarettes at an earlier age than cannabis, compared with 41% in 2016. Young people who used both alcohol and cannabis remained more likely to try alcohol before cannabis across the study period.

Conclusions: Our results partly replicated US findings, with differences potentially reflecting the substantially different environment around these substances in the US compared to Australia. The age of initiation for alcohol, cigarette and cannabis use in Australia has increased sharply over the past 15 years.

Keywords: Adolescent, Age of initiation, trends, alcohol, cigarettes, cannabis

1. Introduction

There have been major changes in youth substance use patterns in many countries over recent years. There is increasingly clear evidence that both cigarette and alcohol use have declined sharply since the early 2000s in high-income countries. For example, in the Australian National Drug Strategy Household Survey (NDSHS), past-year drinking for 12-17 year-olds fell from 46% to 18% and past year smoking from 8% to 3% between 2004 and 2016 (Australian Institute of Health and Welfare, 2017). Similar trends were found in the Australian School Survey on Alcohol and Drugs (ASSAD) (White and Williams, 2016). The most recent Health Behaviours in School-aged Children (HBSC) survey findings showed substantial declines in drinking for 15 year-olds in 26 out of the 34 participating countries, with overall declines in all five European regions they examine. Similarly, the European School Survey Project on Alcohol and Other Drugs (ESPAD) shows declines in adolescent smoking rates in 41 of 42 European countries. Similar trends have occurred in the US, Canada and New Zealand (Clark et al., 2013; de Looze et al., 2015; Johnston et al., 2013). While there have been broad declines in alcohol and cigarette use for teenagers in high income countries there remains some variation in patterns. For example, Kraus et al. (Kraus et al., 2018) highlight differences in the timing and magnitude of the alcohol trends, with steady declines in Northern Europe from 1999 onwards compared with smaller and more recent declines in other parts of Europe.

In contrast, trends in cannabis use have varied markedly between countries. The ESPAD survey finds marked variations in cannabis use by 15 year-olds across countries – for example the prevalence of lifetime use more than doubled in Poland between 1999 and 2015, while it fell by more than half in Ireland (Kraus and Nociar, 2016). In the US, cannabis use for teenagers has been relatively stable throughout the 2000s even while all other substance use declined (Arnett, 2018). In Australia, adolescent cannabis-use trends vary by data source

- in the NDSHS there was some evidence of a decline, while the ASSAD data showed stable rates between 2008 and 2014 (Australian Institute of Health and Welfare, 2017; White and Williams, 2016).

These trends may have influenced the age at which young substance users initiate various substances. There is substantial evidence that age of initiation into substance use is an important predictor of later outcomes. For example, a number of studies have shown that earlier initiation into drinking predicts later heavy drinking and alcohol-use disorders (Maggs and Schulenberg, 2005; McGue et al., 2001; Pitkanen et al., 2005). Similarly, early initiation into cannabis use has been linked to increase risk of later of psychosis (Stefanis et al., 2004) and poor academic outcomes (Ellickson et al., 2004), while early smoking predicts greater subsequent smoking levels (Sharapova et al., 2018). Thus, understanding whether ages of initiation have changed for these three substances given the recent trends in use has important implications for public health. The order in which adolescents initiate substance use is also important, especially given the predominance of 'gateway' approaches to prevention and policy in many settings (see Barry et al., 2016 for example). Researchers, mainly from North America, have established a normative sequence of substance use initiation, with young people typically initiating alcohol and cigarette use before trying cannabis or other illicit substances (Degenhardt et al., 2016). These patterns are not fixed across settings – for example, Degenhardt and colleagues showed substantial cross-national variation in the proportion of cannabis users who had not smoked cigarettes or drunk alcohol before trying cannabis (although across 17 countries, the highest prevalence of cannabis use before either tobacco or alcohol was 12% in South Africa) (Degenhardt et al., 2010). A recent study from the USA suggests that these sequences are not fixed over time either, finding substantial changes in substance use sequences over a 40-year period based on school survey data (Keyes et al., 2019). In particular, among young people who had used both cannabis and

alcohol, the proportion who initiated alcohol consumption before cannabis fell from 69% in 1995 to 39% in 2016. Among those who had used both cannabis and cigarettes, the proportion who used cigarettes first fell from 75% to 39%. A second US study using a nationally representative household sample found similar shifts, with a significant increase in the proportion of young people who used cannabis before any other substance use between 2004 and 2014 (Fairman et al., 2018).

The degree to which these shifts are generalisable to young people outside of the US is questionable. The US has seen substantial liberalisation of cannabis laws since California first permitted medical marijuana in 1996, with legal or partially-legal markets operating in different forms in an increasing number of states (Leung et al., 2018). Nearly 30 US states now operate medical marijuana markets and, since 2012, nine states and the District of Columbia have legalised recreational cannabis markets (Carliner et al., 2017). In contrast, even medical marijuana remains illegal in some Australian jurisdictions, with very limited availability in others (Martin and Bonomo, 2016). There has been a gradual shift towards more liberal policies in Australia, with cultivation of marijuana for medical or scientific purposes legalised in 2015 (Martin and Bonomo, 2016), and a small jurisdiction legislating for legal recreational use from 2020 (Lowery, 2019). Even with these small steps towards a more liberal approach, the contrast between the US and Australia is stark.

Similarly, there are marked differences in alcohol regulation. For example, the US has a uniform minimum legal drinking age of 21 (World Health Organisation, 2014), compared with 18 in Australia. Australia has more restrictive cigarette policies, with higher taxes (ITC Project, 2014), tighter restrictions on point-of-sale and other marketing (e.g. Waddell et al., 2016) and mandatory plain packaging aimed explicitly at reducing the appeal of cigarettes to young people (Scollo et al., 2015). Point of sale marketing restrictions (2009-2012) and plain packaging (2012) were both implemented in Australia over the study period. These

substantial regulatory differences mean that the US findings reported by Keyes et al. (2019) may not apply in Australia.

In this study, we used national survey data from Australia between 2001 and 2016 to answer these questions for Australia. We had two main aims: 1) to describe trends in the age of initiation for alcohol, cigarettes and cannabis for young Australians over the study period, and 2) to examine whether the order of initiation across these three substances has changed.

2. Methods

2.1 Data

We used data from six waves of the National Drug Strategy Household Survey (NDSHS), which was conducted every three years between 2001 and 2016. The NDSHS is a large cross-sectional survey of alcohol and drug use in the Australian population. Response rates have been stable across the study period, varying between 46% in 2004 and 51% in 2010. The sample is geographically-stratified to provide sufficient respondent numbers across states and regions. Sample weights calculated by the data providers were used to adjust for age, sex and region to produce an overall sample that is broadly representative of Australians residing in private dwellings, excluding those unable to speak English. Data collection modes have changed across the study period, from a mixture of telephone, face-to-face and drop and collect[1] in 2001 to being entirely based on drop and collect from 2010 onwards. In 2004, the survey used multiple modes and differences in prevalence of lifetime use were estimated – they were minimal for alcohol (ranging from 94.0% to 95.8%), smoking (71.0% to 72.0%) and cannabis (31.9% to 35.2%), suggesting pooled analyses will produce reliable estimates (Roy Morgan Research, 2005). Sensitivity analyses were conducted adjusting for survey

[1] Drop and collect involves face to face recruitment of a respondent and subsequent self-completion of a printed questionnaire, which is collected 1-2 weeks after recruitment.

mode, with results unchanged. Full technical details of each survey wave are available in the published reports (e.g. (Australian Institute of Health and Welfare, 2002, 2005, 2009, 2011, 2014, 2017)). We focussed on respondents aged between 18 and 21 in each wave of the survey. This ensured that we were comparing ages of initiation across distinct cohorts (e.g. in wave 1 included respondents born between 1980 and 1983, in wave 2 between 1984 and 1987, etc.), and that initiation was recent enough for recall bias effects to be minimal. Our sample sizes varied between 892 (in 2016) and 1,448 (in 2001).

2.2 Measures

The key measures were consistently asked across all survey waves. Respondents were asked whether they had ever used each of the three substances (Have you ever smoked a full cigarette? Have you ever had a full serve of alcohol e.g. a glass of wine, a whole nip of spirits, a glass of beer, etc? Have you ever used marijuana/cannabis?). Those who responded 'yes' were then asked what age they were when they first smoked a full cigarette/had a full serve of alcohol/used marijuana or cannabis. Respondents answered in whole years, meaning it is not always possible to determine which substance was used first (e.g. if they first used alcohol and cannabis at age 16).

Based on responses to these questions, variables were derived classifying respondents who had used multiple substances into two categories based on the order in which they used them. For example, respondents who had used both alcohol and cannabis were classified into two groups: 1) used alcohol before cannabis and 2) first used cannabis before alcohol or in the same year. A detailed presentation of the overall substance order responses is provided in supplementary material – around one-fifth to one-quarter of respondents reported initiating multiple substances in the same year. In general, the trends observed do not seem to be heavily influenced by the proportion of people initiating two substances in the same year –

these proportions are relatively stable over time (see Table S1). Respondents with ties were grouped with the less common substance-use pathway in all cases (e.g. if alcohol was used before cigarettes by the majority of the sample, then respondents who initiated both in the same year were combined with those who used cigarettes first). Respondents who reported initiating substance use but did not provide an age of first use were excluded (n=37 (0.6%) for alcohol, 11 for cannabis (0.4%), 27 (0.8%) for cigarettes).

2.3 Analysis

Data were initially presented descriptively. The significance of time trends was tested using simple linear (for mean age of initiation) and logistic (for order of initiation) regression models. In the linear regression models the outcome variable was age of initiation, while in the logistic regression models the outcomes for each of the three substance use combinations were: alcohol before cannabis (with ties and cannabis first in the reference category), cigarettes before cannabis (with ties and cannabis first in the reference category) and alcohol before cigarettes (ties and cigarettes first in the reference category). All analyses were conducted on weighted data with appropriate adjustments for the complex survey design using Stata's 'svy' package.

3. Results

Figure 1 shows the distribution of age of initiation for the entire population of 18-21 year-olds for the three substances over the six survey waves. For all three substances there has been substantial delaying of initiation over time. For cigarettes and cannabis the prevalence of any use by the age of 21 declined markedly, while for alcohol the declines in prevalence were smaller.

FIGURE 1 HERE

Table 1 shows the mean age of first use amongst young people who had initiated use for each of the three substances. It shows that the mean age of initiation for young people who had tried cigarettes by the age of 18-21 increased from 14.4 (95% CI 14.2, 14.6) in 2001 to 16.3 (95%CI 16.6, 17.1) in 2016.

TABLE 1 HERE

The trends in age of initiation were significant for all three substances, with estimated annual increases of 0.09 years, 0.14 years and 0.11 years per year for alcohol, cigarettes and cannabis respectively. The remainder of the analyses in this paper focus on the order of initiation among respondents who used multiple substances. It is worth noting that multiple substance use has declined substantially over time. In 2001, 67.1% (95% CI 64.1%, 70.0%) reported using at least two of alcohol, cigarettes and cannabis. This had declined to 38.9% (95% CI 35.3%, 42.8%) in 2016.

Among young people who had used multiple substances, we looked at the order in which they initiated alcohol, cigarettes and cannabis. Table 2 shows the proportion of people who used both substances who reported initiating alcohol before cannabis, cigarettes before cannabis and alcohol before cigarettes. It is worth noting that only respondents who used more than one substance were included in each of the columns below, while the trends in overall age of initiation presented above included everyone who had used each of the substances.

There was a slight increase in the proportion of respondents using alcohol before cannabis over the study period, peaking at 77% in 2013 from 62% in 2001. There was a corresponding decline in the proportion using cannabis before alcohol (Table S1). The proportion of respondents who first tried cigarettes before they tried cannabis fell substantially, such that less than half of 18-21-year-olds in 2016 who had used both cigarettes

and cannabis used cigarettes at an earlier age than cannabis. In contrast, the proportion of respondents who tried cannabis at a younger age than cigarettes increased from 13% in 2001 to 30% in 2016 (Table S1). Finally, in 2001, around one-third of 18-21-year-olds who had both smoked cigarettes and drunk alcohol first used alcohol at an earlier age than they first smoked cigarettes. By 2016, this had increased to more than half, while the proportion using tobacco before alcohol fell from 40% to 18% (Table S1). These changes were all statistically significant in our logistic regression models.

4. Discussion

The data presented here provide clear evidence that there has been a marked increase in the age of initiation into substance use for young people in Australia in the past fifteen years. The average age of first use of cannabis, alcohol and cigarettes for 18-21-year-olds increased by more than twelve months between 2001 and 2016. These increases come during a period of declining prevalence – in other words in 2016 there are fewer young adults using each of the three substances (especially cigarettes and cannabis) than there were in 2001 *and* those that are using started later. These findings add further support to the evidence that we are seeing large-scale shifts in substance use behaviours among young people in Australia (Livingston, 2014) and much of the high income world (de Looze et al., 2015; Kraus et al., 2018). These findings suggest the potential for longer-term health and social benefits given the evidence linking early initiation into substance use with a variety of negative outcomes including later substance use disorders, mental health issues and a range of negative social outcomes (Englund et al., 2008; Grant and Dawson, 1997; Stefanis et al., 2004).

There have also been shifts in the ordering of substance use among young people who use multiple substances. In 2001, 62% of 18-21-year-olds who had used both cigarettes and cannabis first used cigarettes at an earlier age than cannabis, compared with just 41% in

2016. In this respect, our results are broadly similar to Keyes et al.'s (Keyes et al., 2019), who found that the proportion of young people who used cigarettes before cannabis fell below half in the US in recent years. A similar pattern was evident when comparing alcohol and cigarette initiation. These findings add support to earlier work noting that normative sequences of substance use over the life course were not fixed (Degenhardt et al., 2010). In that study, cross-national data showed substantial variation in initiation sequences across countries, while our work (along with Keyes et al.'s US study) show that the normative pathways can change over time even within countries. We did not replicate Keyes et al.'s findings when looking at alcohol and cannabis, finding an increase in the proportion of people who tried alcohol before cannabis over our study period. This difference likely reflects the significant differences in cannabis regulation and availability between Australia (where cannabis regulations were actually tightened over the study period (Ritter and Sotade, 2017)) and the US (where cannabis has become substantially more available over the study period as states increasingly legalise recreational or medical cannabis markets (Carliner et al., 2017).

It should be noted that the growing prevalence of e-cigarette use in Australia (Yong et al., 2014) may have influenced trends in cigarette use, although data on e-cigarettes in Australia are poor, making the magnitude of any effects unclear. The study has a range of other limitations. We rely on self-report for measures of both consumption and age of initiation. Recall bias is likely to be a particular concern for questions asking about someone's initiation (Engels et al., 1997; Sartor et al., 2011) – we have limited our sample to relatively young adults to try to reduce the extent of this bias and have selected respondents of the same age from each survey wave so that the extent of bias should at least be comparable over time. Other limitations relate to the changes in survey mode over time, although our previous work has shown that survey estimates of alcohol consumption broadly

track more objective measures (Livingston and Dietze, 2016), giving us some confidence that mode effects are minimal.

Our study has shown that the prevalence of use of cigarettes, alcohol and cannabis has declined markedly for young people in Australia and that the age of initiation among people who do use these three substances has increased steadily. Among people who use multiple substances, we found some changes in ordering of use, with cigarette use declining as the first substance used. This reflects significant declines in the population prevalence of cigarette use in Australia, following a long series of increasingly restrictive regulatory measures being implemented (e.g. increasing bans on smoking in public settings, increased taxes, plain packaging). This has been accompanied by substantial changes in public attitudes to smoking, a process Chapman and Freeman dub 'denormalisation' (Chapman and Freeman, 2008). For alcohol, the drivers of the declines and delays remain unclear (Pennay et al., 2015), although some studies point to changing attitudes towards alcohol (Livingston and Callinan, 2017) and changes in parenting practices as potential mechanisms (Vashishtha et al., In press (accepted 28/8/2019)). Even with the declines in alcohol consumption that have occurred, alcohol has emerged as the primary drug of initiation for young people, suggesting an ongoing need to focus prevention efforts on alcohol consumption by adolescents.

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References

Arnett, J.J., 2018. Getting better all the time: Trends in risk behavior among American adolescents since 1990. Arch. Scientific Psych. 6, 87-95.

Australian Institute of Health and Welfare, 2002. 2001 National Drug Strategy Household Survey - First Results. AIHW, Canberra.

Australian Institute of Health and Welfare, 2005. National Drug Strategy Household Survey - First Results. AIHW, Canberra.

Australian Institute of Health and Welfare, 2009. 2007 National Drug Strategy Household Survey - Detailed Findings. AIHW, Canberra.

Australian Institute of Health and Welfare, 2011. 2010 National Drug Strategy Household Survey - Detailed Report. AIHW, Canberra.

Australian Institute of Health and Welfare, 2014. 2013 National Drug Strategy Household Survey - Detailed Report. AIHW, Canberra.

Australian Institute of Health and Welfare, 2017. 2016 National Drug Strategy Household Survey - Detailed Report. AIHW, Canberra.

Barry, A.E., King, J., Sears, C., Harville, C., Bondoc, I., Joseph, K., 2016. Prioritizing alcohol prevention: Establishing alcohol as the gateway drug and linking age of first drink with illicit drug use. J. Sch. Health 86, 31-38.

Carliner, H., Brown, Q.L., Sarvet, A.L., Hasin, D.S., 2017. Cannabis use, attitudes, and legal status in the US: a review. Prev. Med. 104, 13-23.

Chapman, S., Freeman, B., 2008. Markers of the denormalisation of smoking and the tobacco industry. Tob. Control 17, 25-31.

Clark, T.C., Fleming, T., Bullen, P., Denny, S., Crengle, S., Dyson, B., Fortune, S., Lucassen, M., Peiris-John, R., Robinson, E., Rossen, F., Sheridan, J., Teevale, T., Utter, J., 2013. Youth'12 Overview: The health and wellbeing of New Zealand secondary school students in 2012. The University of Auckland, Auckland, New Zealand.

de Looze, M., Raaijmakers, Q., ter Bogt, T., Bendtsen, P., Farhat, T., Ferreira, M., Godeau, E., Kuntsche, E., Molcho, M., Pförtner, T.-K., 2015. Decreases in adolescent weekly alcohol use in Europe and North America: evidence from 28 countries from 2002 to 2010. Eur. J. Pub. Health 25, 69-72.

Degenhardt, L., Dierker, L., Chiu, W.T., Medina-Mora, M.E., Neumark, Y., Sampson, N., Alonso, J., Angermeyer, M., Anthony, J.C., Bruffaerts, R., de Girolamo, G., de Graaf, R., Gureje, O., Karam, A.N., Kostyuchenko, S., Lee, S., Lépine, J.-P., Levinson, D., Nakamura, Y., Posada-Villa, J., Stein, D., Wells, J.E., Kessler, R.C., 2010. Evaluating the drug use "gateway" theory using cross-national data: Consistency and associations of the order of initiation of drug use among participants in the WHO World Mental Health Surveys. Drug Alcohol Depend. 108, 84-97.

Degenhardt, L., Stockings, E., Patton, G., Hall, W.D., Lynskey, M., 2016. The increasing global health priority of substance use in young people. Lancet Psych. 3, 251-264.

Ellickson, P.L., Tucker, J.S., Klein, D.J., Saner, H., 2004. Antecedents and outcomes of marijuana use initiation during adolescence. Prev. Med. 39, 976-984.

Engels, R.C., Knibbe, R.A., Drop, M.J., 1997. Inconsistencies in adolescents' self-reports of initiation of alcohol and tobacco use. Addict. Behav. 22, 613-623.

Englund, M.M., Egeland, B., Oliva, E.M., Collins, W.A., 2008. Childhood and adolescent predictors of heavy drinking and alcohol use disorders in early adulthood: a longitudinal developmental analysis. Addiction 103, 23-35.

Fairman, B.J., Furr-Holden, C.D., Johnson, R.M., 2018. When Marijuana Is Used before Cigarettes or Alcohol: Demographic Predictors and Associations with Heavy Use, Cannabis Use Disorder, and Other Drug-related Outcomes. Prev. Sci. 20, 225-233.

Grant, B.F., Dawson, D.A., 1997. Age at onset of alcohol use and its association with DSM-IV alcohol abuse and dependence: results from the national longitudinal alcohol epidemiologic survey. J. Subst. Abuse 9, 103-110.

ITC Project, 2014. Tobacco Price and Taxation: ITC Cross-Country Comparison Report. University of Waterloo, Waterloo, Canada.

Johnston, L., O'Malley, P., Bachman, J.G., Schulenberg, J., 2013. Monitoring the Future - National Survey Results on Drug Use, 1975-2012: Volume 1 Secondary School Students. Institute for Social Research, University of Michigan, Ann Arbor.

Keyes, K.M., Rutherford, C., Miech, R., 2019. Historical trends in the grade of onset and sequence of cigarette, alcohol, and marijuana use among adolescents from 1976–2016: Implications for “Gateway” patterns in adolescence. Drug Alcohol. Depend. 194, 51-58.

Kraus, L., Nociar, A., 2016. ESPAD report 2015: results from the European school survey project on alcohol and other drugs. European Monitoring Centre for Drugs and Drug Addiction.

Kraus, L., Seitz, N.-N., Piontek, D., Molinaro, S., Siciliano, V., Guttormsson, U., Arpa, S., Monshouwer, K., Leifman, H., Vicente, J., Griffiths, P., Clancy, L., Feijão, F., Florescu, S., Lambrecht, P., Nociar, A., Raitasalo, K., Spilka, S., Vyshinskiy, K., Hibell, B., 2018. 'Are The Times A-Changin'? Trends in adolescent substance use in Europe. Addiction 113, 1317-1332.

Leung, J., Chiu, C.Y.V., Stjepanović, D., Hall, W., 2018. Has the Legalisation of Medical and Recreational Cannabis Use in the USA Affected the Prevalence of Cannabis Use and Cannabis Use Disorders? Curr. Addict. Rep. 5, 403-417.

Livingston, M., 2014. Trends in non-drinking among Australian adolescents. Addiction 109, 922-929.

Livingston, M., Callinan, S., 2017. Changing Attitudes to Alcohol in Australia. J. Stud. Alcohol Drugs 78, 844-852.

Livingston, M., Dietze, P., 2016. National survey data can be used to measure trends in population alcohol consumption in Australia. Aust. NZ J. Public Health 40, 233-235.

Lowery, T., 2019. ACT legalises personal cannabis use, becoming first Australian jurisdiction to do so. https://www.abc.net.au/news/2019-09-25/act-first-jurisdiction-to-legalise-personal-cannabis-use/11530104. (Accessed 30/10/2019).

Maggs, J.L., Schulenberg, J.E., 2005. Initiation and course of alcohol consumption among adolescents and young adults, Recent developments in alcoholism. Springer, pp. 29-47.

Martin, J.H., Bonomo, Y.A., 2016. Medicinal cannabis in Australia: the missing links. Med. J. Aust. 204, 371-373.

McGue, M., Iacono, W.G., Legrand, L.N., Malone, S., Elkins, I., 2001. Origins and Consequences of Age at First Drink. I. Associations With Substance-Use Disorders, Disinhibitory Behavior and Psychopathology, and P3 Amplitude. Alcohol. Clin. Exp. Res. 25, 1156-1165.

Pennay, A., Livingston, M., MacLean, S., 2015. Young people are drinking less: It is time to find out why. Drug Alcohol Rev. 34, 115-118.

Pitkanen, T., Lyyra, A.-L., Pulkkinen, L., 2005. Age of onset of drinking and the use of alcohol in adulthood: a follow-up study from age 8-42 for females and males. Addiction 100, 652-661.

Ritter, A., Sotade, O., 2017. Explaining the declining rates of past year cannabis use in Australia: A first pass. Drug Alcohol Rev. 36, 602-608.

Roy Morgan Research, 2005. National Drug Strategy Household Survey 2004 - Technical Report. Roy Morgan Research, Melbourne.

Sartor, C.E., Bucholz, K.K., Nelson, E.C., Madden, P.A.F., Lynskey, M.T., Heath, A.C., 2011. Reporting Bias in the Association Between Age at First Alcohol Use and Heavy Episodic Drinking. Alcohol. Clin. Exp. Res. 35, 1418-1425.

Scollo, M., Bayly, M., Wakefield, M., 2015. Plain packaging: a logical progression for tobacco control in one of the world's ‘darkest markets’. Tob. Control 24, ii3-ii8.

Sharapova, S., Reyes-Guzman, C., Singh, T., Phillips, E., Marynak, K.L., Agaku, I., 2018. Age of tobacco use initiation and association with current use and nicotine dependence among US middle and high school students, 2014–2016. Tob. Control, tobaccocontrol-2018-054593.

Stefanis, N.C., Delespaul, P., Henquet, C., Bakoula, C., Stefanis, C.N., Van Os, J., 2004. Early adolescent cannabis exposure and positive and negative dimensions of psychosis. Addiction 99, 1333-1341.

Vashishtha, R., Livingston, M., Pennay, A., Dietze, P., MacLean, S., Holmes, J., Herring, R., Caluzzi, G., Lubman, D.I., In press (accepted 28/8/2019). Why is adolescent drinking declining? A systematic review and narrative synthesis. Addict. Res. Theory.

White, V., Williams, T., 2016. Australian secondary school students' use of tobacco, alcohol, and over-the-counter and illicit substances in 2014. Cancer Council Victoria, Melbourne, Victoria.

World Health Organisation, 2014. Global Status Report on Alcohol and Health, 2014 Edition. WHO, Geneva, Switzerland.

Yong, H.-H., Borland, R., Balmford, J., McNeill, A., Hitchman, S., Driezen, P., Thompson, M.E., Fong, G.T., Cummings, K.M., 2014. Trends in e-cigarette awareness, trial, and use under the different regulatory environments of Australia and the United Kingdom. Nicotine Tob. Res. 17, 1203-1211.

Table 1 – Mean age at first use for alcohol, cigarettes and cannabis, respondents aged 18-21, 2001-2016.

	Mean age at first use		
	Alcohol (n=6,126)	Cigarettes (n=3,369)	Cannabis (n=2,893)
2001	14.9 (14.8, 15.0)	14.4 (14.2, 14.6)	15.5 (15.3, 15.6)
2004	15.2 (15.1, 15.4)	14.8 (14.6, 15.0)	15.7 (15.6, 15.9)
2007	15.3 (15.1, 15.4)	15.1 (14.8, 15.3)	16.0 (15.7, 16.2)
2010	15.6 (15.4, 15.7)	15.5 (15.3, 15.8)	16.5 (16.2, 16.7)
2013	16.0 (15.8, 16.1)	16.0 (15.8, 16.3)	16.8 (16.6, 17.1)
2016	16.4 (16.2, 16.5)	16.3 (16.0, 16.5)	16.9 (16.6, 17.1)
Trend parameter[a] (95% CI)	0.09 (0.08, 0.10)*	0.14 (0.12, 0.15)*	0.11 (0.09, 0.13)*

[a] the trend parameter represents the estimated annual change in the age of initiation between 2001 and 2016

* $p<0.01$

Table 2 – Prevalence of different substance use initiation orders, 18-21-year-old respondents who had used multiple substances, 2001-2016

	Alcohol before cannabis	Cigarettes before cannabis	Alcohol before cigarettes
2001	62.0% (57.8%, 66.1%)	61.8% (57.4%, 66.0%)	36.2% (32.7%, 40.0%)
2004	66.7% (62.2%, 70.9%)	61.1% (56.1%, 65.9%)	39.9% (35.8%, 44.2%)
2007	69.8% (64.2%, 74.8%)	54.9% (48.3%, 61.4%)	46.2% (40.7%, 51.8%)
2010	75.9% (71.1%, 80.1%)	51.4% (45.3%, 57.5%)	53.0% (48.1%, 57.9%)
2013	76.9% (70.8%, 82.0%)	54.0% (46.2%, 61.6%)	58.4% (52.4%,64.1%)
2016	68.6% (62.1%, 74.4%)	41.1% (33.6%, 49.2%)	55.0% (48.3%, 61.6%)
Odds ratio for year[a]	1.03 (1.01, 1.06)*	0.95 (0.93, 0.97)*	1.07 (1.05, 1.08)*

[a] the trend parameter represents the estimated annual change in odds of a respondent initiating in the order examined in each model

* $p<0.01$