The epidemiology of cannabis use and cannabis-related harm in Australia 1993–2007

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ABSTRACT

Aims To examine trends in patterns of cannabis use and related harm in the Australian population between 1993 and 2007. Design Analysis of prospectively collected data from: (1) the National Drug Strategy Household Survey (NDSHS) and Australian Secondary Student Alcohol and Drug Survey (ASSADS); (2) the National Hospital Morbidity Database (NHMD); and (3) the Alcohol and Other Drug Treatment Services National Minimum Dataset (AODTS-NMDS). Participants Australians aged 14 years and over from the general population; students aged 12–17 years; public and private hospital in-patients; public and private in-patients and out-patients attending for drug treatment. Measurement Prevalence of 12-month cannabis use among the general population and secondary students. Proportions in the general population by age group reporting: daily cannabis use; difficulties in controlling cannabis use; and heavy cannabis use on each occasion. Number of hospital and treatment presentations for cannabis-related problems. Findings Prevalence of past-year cannabis use has declined in the Australian population since the late 1990s. Among those reporting past-year use, daily use is prevalent among 40–49-year-olds, while heavy patterns of use are prevalent among 14–19-year-olds. Hospital presentations for cannabis-related problems reflect similar trends. Past-year cannabis use has decreased among the 10–19-year age group, but those who are daily users in this age group report using large quantities of cannabis. Conclusions Despite declines in the prevalence of cannabis use, continued public health campaigns warning of the harms associated with cannabis use are essential, aimed particularly at users who are already experiencing problems. The increasing demand for treatment for cannabis problems in Australia suggests the need for more accessible and more effective interventions for cannabis use disorders.

Keywords Cannabis, dependence, drug-related harms, drug-induced psychosis, hospital admissions, marijuana, monitoring systems.

INTRODUCTION

Cannabis is the most readily available and widely used illicit drug in Australia [1]. Sentinel groups of regular illicit drug users report that cannabis is very easy to obtain and relatively inexpensive [2,3], and one in six Australian adults from the 2007 National Drug Strategy Household Survey reported that they had the opportunity to use cannabis in the past 12 months [1].

Prevalence of past-year cannabis use in Australia (9.1%) is similar to the prevalence reported in other developed countries. According to the 2008 European Monitoring Centre for Drugs and Drug Addiction (EMCDDA) Annual Report [4], past-year cannabis use in Europe increased throughout the 1990s, but has subsequently stabilized in most countries. Although there is considerable variation across countries, the European average of past-year cannabis use among adults aged 15–64 years is estimated to be 6.8%. In the United States, past-month cannabis use among people aged 12 years and over has been stable since 2002 at around 6%, while it has decreased from 8.2% in 2002 to 6.7% in 2006.
among young people aged 12–17 years [5]. Past-year cannabis use in the United Kingdom also declined between 1998 and 2006/07 among adults aged 16–59 years (from 10.3% in 1998 to 8.2% in 2006/07) and among young people aged 16–24 years (from 28.2% in 1998 to 20.9% in 2006/07) [6,7].

There is now good evidence that daily or near-daily use by adolescents and young adults can lead to the development of cannabis dependence [8,9]. Regular use is also associated with an increased risk of psychosis and depression [10–14]; respiratory problems when smoked [15]; poorer educational and occupational outcomes among those smoking before the age of 16 years [16]; and the use of other illicit substances [17].

The proportion of adults using cannabis in the past year is often used as an indicator of the extent of cannabis use [18], but it does not convey any information about the frequency of use or the amount that is used typically. There is increasing recognition internationally that problematic cannabis use can be an important public health issue [4]. It is particularly important to examine trends in frequency and amount of use, because many of the documented cannabis-related harms are associated with regular cannabis use [9,17].

This paper presents current population data on the trends in cannabis use in Australia, with a focus on the extent of daily use and impaired control over use in the population. It also presents trends in cannabis-related harm as documented in routine morbidity and treatment data collections. While previous research has documented trends in the prevalence of cannabis use disorders in the United States using population survey data [19], there have been no analyses across routine data collections to assess trends in cannabis-related harms in other countries with high rates of cannabis use. This paper examines a range of routine data in order to assess problematic patterns in cannabis use and cannabis-related harms in Australia.

METHOD

Data on drug use

Household survey data

We analysed data from the National Drug Strategy Household Survey (NDSHS) from 1993 to 2007. These data are collected triennially, with approximately 24 000 respondents participating (and a response rate of 49.3%) in 2007. A multi-stage stratified sampling methodology is employed each year, in which the sample is stratified by geographic region, with oversampling of the smaller jurisdictions. The methodology is designed to provide a close-to-random sample to obtain data on drug and alcohol use in the Australian population over 14 years of age. The NDSHS is designed to be representative of the Australian population. However, the resulting samples required weighting to correct for imbalances arising in the design and execution of the sampling. More detailed descriptions of the sampling methodology are available elsewhere [1,20–24].

Prevalence and frequency of past-year cannabis use are presented by 10-year birth cohort. In addition, we examined responses to questions about attempts to reduce or cease cannabis use, and the amount of cannabis used on each occasion from their first collection in 2001.

Secondary school students’ survey data

Data from the Australian School Students Alcohol and Drug Survey (ASSADS) are presented from 1996 to 2005. ASSADS is conducted triennially on a sample of approximately 20 000 students aged 12–17 years (the response rate in 2005 was 63%) [25–28]. Students are sampled randomly from government-run, Catholic and independent secondary schools in all states and territories. A two-stage stratified random sampling methodology is used; the first stratification occurs at the education sector level, to ensure representativeness across sectors, and the second occurs within schools at the student level. Although intended to be representative of all adolescents attending high school, some bias may be introduced through student absence on the survey day. Further detail about the methodology is available elsewhere [28]. Prevalence of past-year cannabis use was used.

Data on drug-related harms

Hospital separations

Data from the National Hospital Morbidity Database (NHMD) are presented from 1993 to 2007. The NHMD is a collection of records for all admitted patients separated from almost all public and private hospitals in Australia. A few private hospitals do not contribute to this collection; however, this is not likely to impact greatly on the representativeness of the NHMD. In 2006/07 there were 7.6 million separations from Australian hospitals [a hospital separation is defined as an episode of care for an admitted patient, which may refer to a total hospital stay (from admission to discharge), or a portion of a hospital stay beginning or ending in a change of type of care] [29]. The NHMD is coded according to a clinically modified version of the International Classification of Diseases and Related Problems (ICD) version 10 [30]. Hospital separations for principal diagnoses of cannabis-induced psychosis and cannabis-related problems (including presentations for dependence, toxicity and use disorders)
were analysed by 10-year age group. Further details on the data and coding protocols used in this paper may be found elsewhere [31,32].

Treatment data

Data from the Alcohol and Other Drug Treatment Service National Minimum Dataset (AODTS-NMDS) are presented for the period 2003–07. These data represent closed treatment episodes for people with problems related to alcohol and other drugs provided in all publicly funded government and non-government treatment agencies across Australia that provide specialist alcohol and drug treatment services (excluding opioid maintenance pharmacotherapy clients, whose characteristics are monitored using other data sets) [33]. A treatment episode is considered closed when one of the following applies: a treatment plan is completed; there has been no contact with a client for 3 months; the principal drug of concern, main treatment type or delivery setting has changed; or treatment has ceased for other reasons (e.g. incarceration, death or cessation of treatment against advice). Episodes include both in-patient and out-patient treatment. Data are presented by 10-year birth cohort for episodes where cannabis was identified as the primary drug of concern. These data do not cover treatment in for-profit treatment services which in Australia, unlike the United States, are relatively small in number and are likely to account for a minority of treatment episodes. In 2006/07, there were 140,475 closed treatment episodes reported in Australia, and 31,980 (22.8%) of these episodes were for cannabis [34].

Data analysis

Descriptive statistics were used for all data sources. Statistical analyses were conducted using SPSS for Windows, release 15.0 [35] and SAS for Windows, release 9.1.3 [36].

Numbers of cannabis-related hospital separations per million people in the total population were calculated for each 10-year age group using the Australian Bureau of Statistics (ABS) estimates of the population as at 30 June for each corresponding year.

Proportions reporting past-year cannabis use in each 10-year cohort from the National Drug Strategy Household Survey were calculated using weights provided by the Australian Institute of Health and Welfare for each database. Confidence intervals around these proportions were calculated using re-scaled weight variables as follows. Given that the weights provided scale the data to equal the population count (rather than sample size), these need to be re-scaled for purposes of statistical error estimation. The re-scaled weights were determined using the following calculation:

\[
\text{Rescaled weight factor} = \frac{\text{Original weight factor} \times \text{Total expanded size}}{\text{Total sample size} \times \text{population count}}
\]

Logistic regression models were employed to analyse the following:

1. Associations between age group and daily cannabis use among past-year cannabis users in the 2007 survey.
2. Changes over time in the prevalence of indicators of problematic cannabis use (difficulty controlling use and heavy use) between 2004 and 2007.
3. Associations between (i) age group and difficulty controlling use and (ii) age group and heavy use in the 2007 survey.

Looking at changes over time, the model controlled for survey year and age group, as well as the interaction between these two variables. The interaction term was not significant, and was removed from the final model.

RESULTS

Population-level use

The overall proportion reporting past-year use in general population surveys remained relatively stable over the five survey periods (from 1993 to 2004) at around 11–13%, with the exception of 1998, when 18% reported past-year cannabis use. There was a significant decrease in the prevalence of past-year use in 2007 (from 11% in 2004 to 9%) [1] (Fig. 1). The proportion of school students reporting past-year use has declined markedly over the past decade, halving from 32% in 1996 to 14% in 2005 (Fig. 2). Age-related trends show that past-year use was most common among those respondents born between 1970 and 1979 in the earlier surveys and later in the period, among those born between 1980 and 1989 (Fig. 3). There has been a significant decrease in past-year use between 2004 and 2007 among those respondents born between 1960 and 1969 and those born between 1970 and 1979. Past-year cannabis use remains most prevalent among the more recent birth cohorts (i.e. 1980–89 and 1970–79).

Figure 4a shows past-year cannabis use by 10-year age groups, to provide a point of comparison with Fig. 4b, demonstrating levels of daily use among past-year users. In the 2007 survey, daily use was most common among cannabis users aged 40–49 years [18.8% 95% confidence interval (CI) 14.4–22.8], and this age group was nearly twice as likely to report daily use [odds ratio (OR) 1.9, 95% CI 1.01–3.7] than the 14–19-year age group (Fig. 4b). There were no other significant differences between age groups and daily cannabis use.
Two indicators of dependence are impaired control over use and heavy patterns of use [37] and overall, controlling for age, there has been no change in the proportion of daily users reporting difficulties controlling cannabis use between 2004 and 2007. Similarly, controlling for survey year, there were no differences across age groups in proportions reporting impaired control (Fig. 5a). The proportion of daily users reporting use of more than 10 cones or joints per day (defined as ‘heavy use’) has not changed between 2004 and 2007. However, daily users aged 10–19 years were significantly more likely to report heavy use than those aged 30–39 (OR 2.3, 95% CI 1.2–4.7) and 40–49 years (OR 2.5, 95% CI 1.2–5.4) (Fig. 5b).

Harm at the population level

Hospital separations with a principal diagnosis of cannabis-induced psychosis (Fig. 6a) and cannabis-related problems (e.g. dependence and use disorders) (Fig. 6b) were most prominent among the 20–29-year age group, and have increased among both the older age groups. This is consistent with trends in past-year use (Fig. 3) and with indicators of problematic use (Fig. 5).

The number of drug treatment episodes in Australia for a primary cannabis problem increased from 23 826 in 2001/02 to 31 449 in 2006/07 [38]. Treatment episodes for cannabis problems were most common among the younger birth cohorts (i.e. 1970–79 and 1980–89) over time (Fig. 6c), and increases were evident among both groups. This is consistent with the higher proportion of younger age groups reporting heavy use (Fig. 5b). Figure 6d,e shows drug treatment data by referral source (law enforcement and non-law enforcement). Law enforcement referrals were highest among the younger birth cohorts. Non-law enforcement referrals show a similar trend (Fig. 6e). Cannabis treatment episodes accounted for a marginally higher proportion of all drug treatment episodes between 2001/02 (21–95% CI 20.8–21.3) and 2005/06 (24.6–95% CI 24.3–24.8). There was a small decrease in this proportion in 2006/07 (22–95% CI 21.8–22.2) [38].

During the period 1998–2007, the number of national cannabis arrests remained relatively stable at approximately 55,000 per year [39].

DISCUSSION

Past-year cannabis use declined significantly overall in the Australian population between 2004 and 2007, with age-related trends showing a significant decrease among Australians born between 1960 and 1969 and 1970 and 1979. However, daily use among past-year cannabis users remains prevalent among substantial minorities (between 10 and 20%) of each age group. The oldest age group [40–49] was significantly more likely to report daily use compared to the youngest age group [14–19]. While there were no significant differences in the proportion of daily users reporting impaired control of use between 2004 and 2007, nor between age groups, prevalence remained relatively high in 2007 (between 44 and 63%). In contrast to daily use, heavy patterns of cannabis
use were significantly higher among the youngest age group compared to the older users (30–49 years of age).

The occurrence of population indicators of cannabis-related harm examined in this paper has increased steadily over time. There have been increasing numbers of hospital presentations for problems associated with cannabis use and treatment presentations for cannabis dependence, particularly among the older age groups.

These data are consistent with the survey data showing marked increases in daily use among older cannabis users.

There are a number of hypotheses that may explain the observed age-related patterns of cannabis use and cannabis-related harm. First, the increased regular and problematic cannabis use among the older age groups may reflect the development of dependence among those...
who initiated use at a young age during the 1990s. On this hypothesis, as lighter users in the older birth cohorts have discontinued their use, regular users have remained. This hypothesis is consistent with a downward trend during the 1990s in the age of cannabis initiation in Australia [40], and other evidence that early initiation into cannabis predicts problematic cannabis use later in life [41].

Secondly, birth cohort effects in cannabis use may have interacted with increased availability of cheaper and possibly more potent cannabis products. Clements [42] analysed trend data in cannabis price in Australia, and reported that prices had declined over time. He hypothesized that the decline in price reflected increased efficiency among Australian cannabis producers in producing cannabis products using hydroponic indoor cultivation over the past few decades, a trend that has been reported globally [43]. There is evidence from a number of countries that average cannabis potency has increased over the last decade [44–46]. Increased access to cheaper and possibly more potent cannabis in Australia might explain why (i) older users are more likely to remain regular users; and (ii) the apparent increase in the proportion of younger users who become regular users, despite a decline in overall numbers of younger Australians using cannabis. While this is an interesting possibility, there are currently no data available to evaluate this hypothesis. Research investigating the relationship between cannabis potency and cannabis dependence would be an important addition to the literature.

Finally, the apparent decline in hospital presentations among the younger age group may be attributable to the fact that this group of daily users was significantly more likely to report heavy patterns of use. These patterns may be more indicative of acute short-term cannabis-related harms (such as intoxication and drug-induced psychosis)

Figure 6 Indicators of cannabis-related harms in Australia. (a) Cannabis-induced psychosis hospital separations by age. (b) Cannabis-related hospital separations by age. NB: Cannabis-related separations include those for dependence, cannabis toxicity and cannabis use disorders. (c) Numbers of drug treatment episodes by cohort. (d) Number of law enforcement referrals to treatment. (e) Number of non-law enforcement referrals to treatment. Source: (a) and (b) National Hospital Morbidity Database; (c), (d) and (e) National Minimum Dataset. NB: Numbers under (c) represent total number of treatment episodes across all drug types, numbers under (d) and (e) represent total numbers of law enforcement and non-law enforcement referrals across all drug types.
rather than longer-term harms (such as dependence) requiring hospitalization.

Cannabis-related arrests have remained relatively stable over the study period, suggesting that there have been minimal changes in the intensity of enforcement of cannabis-related offences in Australia. This is supported by the absence of any change in the proportion of people being coerced legally into treatment for cannabis problems. These data suggest that the increase in the number of treatment presentations for cannabis is not driven solely by increased use of the courts to coerce cannabis users into treatment in Australia, as some have argued has been the case in the United States [47].

**Implications for preventing and reducing cannabis-related harm**

These findings have several important implications. The decreases in past-year cannabis use are significant, and prevention efforts in this regard should continue. With regard to high-risk patterns of use there are a number of issues for consideration. First, programmes designed to prevent the uptake of regular, heavy cannabis use among young people should be trialled and evaluated in an attempt to reduce the prevalence of use further, particularly among this group.

Secondly, the increasing international demand for treatment for cannabis dependence has drawn attention to the need for clinical research to develop more effective interventions for cannabis-related problems. A recent Cochrane review [48] and meta-analysis [49] retrieved only seven randomized control studies of interventions that included motivational enhancement therapy (MET) [50–51], cognitive behavioural therapy (CBT) [52,53] and CBT with contingency management. All three forms of therapy reduced cannabis-related problems and cannabis use, but achieved only modest rates of abstinence [51–54]. Clearly, more research is required to investigate how to engage people in treatment programmes for cannabis, to determine the optimal treatment length, and how to sustain reductions in cannabis use and related problems after treatment. Research on trials of adjunctive pharmacotherapies would also be useful, as well as service delivery models to make self-help interventions more accessible (e.g. web-based interventions).

Thirdly, the development of strategies to encourage problem cannabis users to seek help at an earlier stage is also required. Only a minority of problem cannabis users seek treatment [55], and their treatment seeking is often driven by mental health problems rather than cannabis dependence per se [56]. This may reflect a lack of information in the community about the availability of treatment programmes for cannabis dependence. It may also reflect a lack of recognition of the harms related to regular cannabis use. Earlier engagement will require comprehensive educational campaigns about the short- and long-term risks of cannabis use (mental health problems, respiratory health effects and dependence) and available treatments.

Finally, these routine data provide useful information on trends in cannabis use and related harms in Australia. It is important to maintain and use these routine data collections to monitor these trends, and to maximize their value by ensuring that the methods used in their collection, reporting and analysis are consistent and reliable over time.

**Limitations**

One limitation of the NDSHS data is that methods of data collection and response rates have changed over time with increased use of telephone-assisted interviews in recent surveys. This seems unlikely to account for the complex pattern of changes in cannabis use between birth cohorts over time. For example, the decline in reported cannabis use in the younger cohorts is consistent with that observed in the ASSADS school surveys, which have surveyed secondary school students using the same sampling methods and questions over time.

The NHMD data also has some limitations. First, the recording of cannabis-related separations depends on the extent to which a drug use history is taken at the time of initial assessment. In addition, mental health and drug use service delivery may have changed over the period of study, and increases in cannabis-related separations may be attributable to changes in hospital admission thresholds, bed availability or coding of principal diagnoses. Despite these limitations, the trends in hospital presentations are consistent with the survey data on patterns of cannabis use and treatment for cannabis problems.

The NHMD has been developed to record trends in hospital separations using recording practices that have been consistent over time and jurisdiction, with health professionals in each jurisdiction using a common National Health Data Dictionary [57] to ensure coding consistency and comparability. A comprehensive compliance evaluation of the NHMD reported that the quality of principal diagnosis data at a national level ‘is considered to be very good’ [58].

Response rates for the NDSHS also need to be acknowledged as a potential limitation. Rates have fluctuated between 56% in 1998 and 49.3% in 2007 (with an increase from 45.6% in 2004), which might account for the declining prevalence in past-year cannabis use. However, there have been increases in reported levels of other drug use such as ecstasy and methamphetamine, suggesting that any impact of the change in response...
rates is unlikely to be a simple explanation of the trends in cannabis use observed in this paper.

CONCLUSIONS

Cannabis is readily available and cheap in Australia, and continues to be the most widely used illicit drug in this country. The prevalence of past-year use has declined among Australian adults, and there has been a particularly marked decrease among secondary students. These trends are consistent with other international surveys showing a decrease in cannabis use among young people [4]. Those young Australian adults who use cannabis daily, however, appear to be more likely to use larger amounts of cannabis on each occasion. It is also of concern that 63% of young daily users reported difficulties controlling their use. Public health messages about the risks of cannabis use and the availability of treatment for cannabis dependence need to be complemented with strategies to reduce the quantity and frequency of cannabis use among people who are already experiencing cannabis-related problems. Research is needed to develop: (i) strategies that encourage users to seek help more quickly; and (ii) more effective ways in helping people who develop cannabis-related problems to desist from using.

Declarations of interest

None.

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References


