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Cannabis use disorders among Australian adults: Results from the National Survey of Mental Health and Wellbeing.

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EXECUTIVE SUMMARY

The National Survey of Mental Health and Well-Being (NSMHWB) interviewed a representative sample of 10,641 Australians aged 18 years and older about symptoms of DSM-IV and ICD-10 mental health and substance use disorders, and disability and help-seeking associated with these disorders. It provided the first opportunity to examine the prevalence of cannabis use disorders in the adult Australian population.

This report presents data on the prevalence of cannabis use, the prevalence and correlates of DSM-IV cannabis use disorders, the DSM-IV dependence symptoms reported and health service utilisation among Australian adults. A limited comparison with ICD-10 cannabis use disorders is presented. The factor structures of DSM-IV and ICD-10 dependence symptoms and agreement between the two diagnostic systems in who is diagnosed with a disorder are also examined.

In the past 12 months, 7.1% of Australians had consumed cannabis on more than five occasions; it was the most commonly used illicit drug among Australians. Cannabis use predominated among males (10.1% vs 4.2% of females) and 18-24 year olds (19.8%, compared to 12% or less in older age groups).

During this time 2.3% of Australian adults, and 31.7% of cannabis users, were diagnosed with a DSM-IV cannabis use disorder. This was predominantly cannabis dependence (1.5% of the population and 21% of users) as opposed to abuse (0.8% of the population and 10.7% of users). Cannabis use disorders were the second most common diagnosed substance use disorder. As with use, disorders tended to predominate among males and young adults.

The most commonly reported DSM-IV dependence symptoms were: a persistent desire, or unsuccessful efforts to moderate use (36.6%) and withdrawal symptoms (29.7%). Users were typically only mildly dependent, meeting a mean of 1.3 out of the 7 dependence criteria.

A multivariate analysis of level of cannabis involvement (no cannabis use, non-dependent use, DSM-IV dependent use) identified a number of correlates of increased involvement. Demographic factors were: being male, being younger, being unemployed, not being in a married/defacto relationship and being Australian born (compared to being born in a non-English speaking country). Correlates indicative of a comorbidity between cannabis dependence and substance use or mental health factors were: being a current tobacco smoker, having a DSM-IV alcohol use disorder, illicit drug use involvement, and having higher neuroticism scores on the EPQ.

Those who met DSM-IV cannabis dependence criteria were approximately 3 times as likely as those without to have sought help from a health professional in the past 12 months for a mental health problem than those without. These figures were on a par with those diagnosed with alcohol dependence. However, given a number of factors were associated with level of cannabis involvement, the effect of these on the relationship between dependence and health service utilisation needs to be investigated.

As a comparison 1.7% of Australian adults and 23.6% of users were diagnosed with ICD-10 cannabis use disorders in the past 12 months. As with the DSM-IV diagnoses, dependence

was more common than harmful use, and disorders were more common among males and younger adults. The most commonly reported ICD-10 dependence symptoms were: difficulties controlling cannabis use (43.2%) and withdrawal symptoms (29.7%). Again, users clustered at the mild end of the dependence continuum, meeting an average of 1.3 out the 6 ICD-10 criteria.

Principal components analyses (PCA) of DSM-IV and ICD-10 dependence symptoms indicated that among the general Australian population, cannabis dependence symptoms formed a unidimensional syndrome with good internal consistency.

There was excellent agreement between the DSM-IV and ICD-10 diagnostic systems as to who was diagnosed with cannabis *dependence* (kappa=0.9) and severity of dependence (r=0.9). Agreement between the systems on the proportion of Australians with a cannabis use *disorder* was substantial, but slightly lower (kappa=0.7), largely because of the poor agreement between the DSM-IV abuse and ICD-10 harmful use diagnoses.

These results show that cannabis use disorders are the second most common form of substance use disorder in the Australian population, affecting approximately 300,000 adults. The significance of cannabis dependence needs further investigation, particularly its clinical relevance and its causal significance in the likelihood of developing adverse health outcomes. Cross-sectional surveys such as these thus need to be supplemented by longitudinal research and intervention studies.

1 INTRODUCTION

In Australia, the United States and New Zealand cannabis is a drug that is primarily used in late adolescence and early adulthood (see Hall, Johnston and Donnelly, 1999; World Health Organization, 1997a). It is typically used experimentally or intermittently and discontinued by the mid to late 20s (Bachman et al, 1997; Chen and Kandel, 1995). While only a minority proceed to long-term, regular use it is by far the most widely consumed illicit drug in the Western world. The 1998 Australian National Household Survey revealed that approximately 40% of Australians aged 14 years and over have tried cannabis and almost one in five (17%) have used it in the past year (Australian Institute of Health and Welfare, 1999).

Survey data indicate that the lifetime prevalence of cannabis use in Australia and the United States, particularly among adolescents, has increased throughout the 1990s, after a decline in the 1980s and early 1990s (Australian Institute of Health and Welfare, 1999; Johnston, O'Malley and Bachman, 1997; Lynskey et al, 1999; Makkai and McAllister, 1997; National Institute on Drug Abuse, 1996). However, the latest data from the 1998 Monitoring the Future Study suggest that among US adolescents, lifetime prevalence may again be on the decline (Johnston, O'Malley and Bachman, 1998). This trend is yet to be observed in Australia, where there was a marked increase in use among female adolescents between 1995 and 1998 (Australian Institute of Health and Welfare, 1999). While the prevalence of lifetime and recent use remained unchanged from the 1995 survey for 14-19 year old males (approximately 44% and 35% respectively), among females the lifetime prevalence increased from 24% in 1995 to 45% in 1998, and the proportion who had used in the last 12 months increased from 20% to 34% (Australian Institute of Health and Welfare, 1999).

Gender and age are consistently strong correlates of cannabis use. Males are more likely to have tried cannabis and to be more frequent users than females (e.g., Bachman et al, 1997; Donnelly and Hall, 1994; Kandel, 1984; Kandel, Chen, Warner, Kessler and Grant, 1997). Use also predominates among the younger age groups. Consumption increases in the late teens, peaks in the early twenties and subsequently declines (Bachman et al, 1997; Chen and Kandel, 1995; Kandel et al, 1997). Longitudinal data indicate approximately one tenth to a third of those who were using on a monthly or more frequent basis at around 20 years were doing so in their early 30s (Bachman et al, 1997; Kandel and Davies, 1992).

There has only been a limited examination of the relationship between cannabis use and other potential correlates such as education, ethnicity, socioeconomic status, marital status and attitudes to use. The significance of these correlates appears to differ according to whether the outcome measure is the initiation, continuation or cessation of use, although some of the variables that predict initiation also persist in their influence into adulthood (e.g., Chen and Kandel, 1998; Donnelly and Hall, 1994; Kandel, 1984). Research suggests a positive relationship between income and use, and reasons for use and level of involvement. The data are equivocal on the association between socioeconomic status and ethnicity, and cannabis use (see Hall, Johnston et al, 1999). Data collected from the Australian National Household Surveys between 1988 and 1995 suggests lifetime cannabis use may be elevated among those who are divorced or separated, those without children, Aboriginal and Torres Strait Islanders, those with more formal education and in higher paid jobs, and the unemployed (Makkai and McAllister, 1997). However, these patterns were not necessarily

evident when recent use was considered, and there was no adjustment for potential confounding with gender and age.

There is a vigorous debate in Australia and elsewhere about the appropriate legal status of cannabis, in which concerns about its health and psychological effects figure prominently. Foremost among these concerns is the dependence potential of cannabis, not only as an issue in itself, but as a factor that may increase the risks of other adverse health outcomes. The dependence potential of cannabis has long been a topic of debate that has served in the absence of research on the prevalence and nature of cannabis dependence symptoms.

While recent Australian research has examined this issue among long-term users (e.g., Swift, Copeland and Hall, 1998; Swift, Hall and Copeland, 1998, 1999; in press; Swift, Hall, Didcott and Reilly, 1998), there are no Australian population-based data on cannabis dependence. Major US surveys on the prevalence and correlates of mental health disorders have demonstrated that substance use disorders are among the most common of the mental disorders reported. Among those with substance use disorders, cannabis use disorders are the most prevalent after alcohol and tobacco use disorders.

1.1 Population Surveys of Alcohol and Other Drug Dependence

The Epidemiologic Catchment Area (ECA) study was conducted in five catchment areas in the USA in the early 1980s on a sample of 20000 adults. It used a standardised and validated clinical interview to elicit a history of psychiatric symptoms of 40 major psychiatric diagnoses, including DSM-III drug abuse and dependence (Robins and Regier, 1991). The most common disorders were phobia (lifetime - 14.3%, one-year - 8.8%) and alcohol use disorders (lifetime - 13.8%, one-year - 6.3%). Illicit drug abuse/dependence was the fifth most common disorder (lifetime – 6.2%, one-year – 2.5%) after generalised anxiety disorder (lifetime – 8.5%, one-year – 3.8%) and major depressive episode (lifetime – 6.4%, one-year – 3.7%). Cannabis was the most commonly used illicit drug, accounting for the bulk of illicit drug abuse and/or dependence cases. Of the 6.2% of respondents who received a lifetime drug abuse and/or dependence diagnosis, 4.4% met criteria for cannabis abuse and/or dependence, followed by 1.7% for stimulants, 1.2% for sedatives, and 0.7% for opioid drugs.

Two-thirds of those diagnosed with lifetime cannabis abuse/dependence in the ECA had used the drug in the past year, and 38% had reported active problems. Three fifths of those with a DSM-III diagnosis of illicit drug abuse/dependence met an approximation of DSM-III-R dependence. Comorbidity among psychiatric disorders was common (Anthony and Helzer, 1991). Hall, Solowij and Lemon (1994) used these data to estimate the prevalence of cannabis abuse and dependence. They estimated that 2.6% of the United States (US) population (3.2% of men and 2.0% of women) were cannabis dependent in 1982-1983.

Among the 1394 ECA respondents who had used cannabis for at least two weeks on a daily basis, 17.2% felt dependent, compared to 1.3% of those who never used at this level. The most common symptoms among daily smokers were: requiring larger amounts, or having psychological problems attributed to cannabis (both 20.6%), social problems attributed to cannabis (17%) and inability to reduce use (8.4%). Few reported health problems (4.6%) or withdrawal sickness (2.9%) (Anthony and Trinkoff, 1989). Only a minority of those who had a diagnosis of abuse and/or dependence on any drug (20% of men and 28% of women)

had mentioned this problem to a health professional, even though 60% to 70% had sought medical treatment in the previous month (Anthony and Helzer, 1991).

More recently (1990-92), the US National Comorbidity Survey (NCS) (Anthony, Warner and Kessler, 1994; Kessler et al, 1994; Warner, Kessler, Hughes, Anthony and Nelson, 1995) recruited a stratified, multi-stage area probability sample of 8098 non-institutionalised people from 48 coterminous states. This was supplemented by a representative sample of students housed on campus. The NCS collected information on the lifetime and 12 month prevalence of alcohol and other drug use and dependence. Cannabis dependence was measured with a modified version of the Composite International Diagnostic Interview (CIDI) (Cottler, Robins et al, 1991; Robins et al, 1988), a structured clinical interview which operationalised DSM-III-R and ICD-10 diagnoses.

Substance use disorders were again among the most prevalent of those reported. The most common disorders were major depression (lifetime – 17.1%, one-year – 10.3%) and alcohol dependence (lifetime – 14.1%, one-year – 7.2%). Simple and social phobias were the next most frequently reported diagnoses (lifetime –11.3% and 13.3% respectively). Overall, substance use disorders were the most prevalent lifetime disorder (26.6%; one-year – 11.3%), while anxiety disorders were the most prevalent in the last 12 months (17.2%). Comorbidity was common - 29% had experienced at least one other disorder in the last 12 months (Kessler et al, 1994).

Cannabis was the most commonly used illicit drug (46%), followed by cocaine (16%), other stimulants (15%), anxiolytics (13%), psychedelics (11%) and analgesics (10%). A lifetime diagnosis of cannabis dependence was the third most common type of substance dependence diagnosed (4.2%), after tobacco (24%) and alcohol dependence (14%). This estimate is very similar to that obtained in the ECA study, and placed its prevalence between panic disorder and generalised anxiety disorder.

A different pattern emerged when *conditional* prevalence was estimated – that is, the proportion of people who had used each drug who met criteria for dependence. The conditional lifetime prevalence of cannabis dependence among users (9%), which was exceeded by nicotine (32%), heroin (23%), cocaine (17%), alcohol (15%) and stimulant (11%) dependence (Anthony, Warner and Kessler, 1994).

While the estimated prevalence of cannabis dependence was higher than the ECA figure, the differences in the studies' sampling and diagnostic methods may partly account for this finding. As with use, dependence predominated among men and younger age groups. Thus, 12% of male compared to 2% of female cannabis users were dependent, as were 15% of 15-24 year old users compared to only 3% of users aged 45 years or older.

1.2 Study Aims

This report presents detailed data on DSM-IV cannabis use disorders diagnosed in a sample of among 10641 Australian adults surveyed in the National Survey of Mental Health and Wellbeing (NSMHWB). The NSMHWB is the first epidemiological study of the prevalence of DSM-IV mental disorders in the Australian adult population. It provides the first nationally representative data on the prevalence of substance use disorders and substance-related problems in the general community. It thus provides the first opportunity to

examine the epidemiology of cannabis use disorders in Australia. This report contains a limited comparative examination of the prevalence and characteristics ICD-10 cannabis use disorders. More general data on the survey findings, including the prevalence of ICD-10 substance use disorders, are reported elsewhere (Andrews et al, 1999; Australian Bureau of Statistics, 1998; Hall et al, 1998; in press).

The aim of this report is to provide an outline of the prevalence and characteristics of cannabis users and those who meet criteria for cannabis use disorders in the Australian adult population. Specifically, the data have been analysed to address the following questions:

1 What proportion of the Australian population have used cannabis in the past 12 months and what are their characteristics?

2 What proportion of the Australian population met standardised DSM-IV criteria for cannabis abuse and dependence in the past 12 months?

3 What proportion of current users met DSM-IV criteria for cannabis abuse and dependence?

4 What are the most commonly reported DSM-IV cannabis dependence symptoms?

5 What are the correlates of the level of cannabis involvement?

6 Do people diagnosed with cannabis dependence use health services?

7 What is the factor structure of DSM-IV cannabis dependence symptoms in the general population?

8 How do the DSM-IV and ICD-10 diagnoses of cannabis use disorders compare – that is, (i) how similar is their prevalence, (ii) how similar is the factor structure of DSM-IV and ICD-10 cannabis dependence, and (iii) what is the level of agreement between the two systems of diagnosis in which people are diagnosed as cannabis dependent?

2 METHODS

2.1 Sampling

These data were collected from a stratified, multistage probability sample of the Australian population aged 18 years and older. The overall response rate was 78%, representing 10,641 participants. The data were weighted according to the inverse probability of an individual being selected for interview. A more detailed discussion of the NSMHWB sampling design and its implementation has been reported elsewhere (Australian Bureau of Statistics, 1998).

2.2 The Interview

The interview schedule included established measures of known reliability and validity to assess a number of domains. These were: demographics, disability, neuroticism, mental disorders, childhood adversity and suicidal ideation, disability related to main mental health and physical health problem, health service utilisation, perceived health needs, days out of role for all positive diagnoses, and general psychological morbidity (see Hall et al, 1998).

Mental disorders were assessed by a modified version of the Composite International Diagnostic Interview (CIDI) (World Health Organization, 1997b), which was adapted for the NSMHWB to yield information on: substance use disorders (abuse/harmful use and dependence), affective disorders, and anxiety disorders. All CIDI modules produced diagnoses according to ICD-10 and DSM-IV classifications. The interview was restricted to symptoms in the last 12 months to maximise symptom recall.

2.2.1 Assessment of Alcohol and Other Drug Use

Respondents were asked separate questions about their use of alcoholic beverages and the following drugs: cannabis (marijuana & hashish), stimulants (amphetamines, ecstasy, speed and other stimulants which can be obtained by medical prescription including, dexedrine, preludin and ritalin), sedatives (barbiturates and tranquillisers and other sedatives which can be obtained by medical prescription including, ativan, librium, megaton, normison, rohypnol, serepax, valium, xanax) and opioids (heroin and opium as well as other opioids and analgesics which can be obtained on medical prescription including, codeine, doloxene, methadone, morphine, percodan and pethidine).

The questions asked about the use of drugs such as marijuana and the "extramedical use" of prescribed drugs such as benzodiazepines. They asked whether drugs and medicines had been used "in larger amounts than was prescribed or for a longer period than was prescribed" or used "more than five times when they were not prescribed for you, to get high, to relax, or to make you feel better, more active, or alert". While the format of the questions was consistent with the approach used in the NCS (Anthony et al, 1994), the requirement that a drug had to have been used more than fives times in order for a person to be classed as a user of that drug, was consistent with the approach used in the ECA (Robins and Regier, 1991). Additional questions covered age of onset of use, frequency and recency of use of each of the four drug groups. These questions were a subset of those that were used in the NCS. They were selected to reflect the most widely used extramedical drugs among Australian adults, as indicated in the Australian National Drug Strategy Household surveys (National Drug Strategy, 1996).

NSMHWB questions on the use of alcoholic beverages followed a similar format, although respondents were asked if they had consumed at least 12 standard drinks (10g of alcohol) in the last 12 months. In addition, they were asked if they currently smoked tobacco, if they smoked at least once a day, and if they had ever smoked regularly (that is, at least once a day).

The interviewee was given a detailed verbal description of each drug group and lists of drugs in each class. The interviewer read the questions and recorded the participants' responses on a laptop computer. This use of a computer to record answers in real-time differed from the ECA and NCS, which used pencil and paper. Studies have since shown excellent agreement between responses recorded via pencil and paper and those recorded via laptop computer (Peters, Clarke & Carrol, 1999).

2.2.2 Diagnostic Assessment of Substance Use Disorders

The assessment of substance use disorders was undertaken whenever a respondent reported: using prescribed drugs and medicines in larger amounts than was prescribed, or for a longer period than was prescribed, or extramedical use of drugs more than five times in the last 12 months, or when they reported consuming 12 or more drinks in total, and more than three drinks on any one occasion, in the past year. The requirement of more than five occasions was based on the assumption that even as few as six occasions might be sufficient for development of a substance use disorder, and that substance use disorders would be extremely rare among persons who had used the drug less than five times.

The CIDI diagnostic assessment of substance use disorders for the NSMHWB was based on DSM-IV and ICD-10 criteria that were translated into standardised survey questions for administration by a trained lay interviewer. The CIDI is the most widely used interview in large epidemiological studies (Robins & Regier, 1991; Kessler et al., 1994). CIDI assessments for substance use disorders have been shown to have excellent inter-rater reliability in large international field trials (Cottler et al., 1991; Wittchen et al., 1991) and the test-retest reliability has been shown to be good (Andrews & Peters, 1998; Cottler et al., 1991; Rubio-Stipec et al., submitted; Semler et al., 1987; Wacker et al., 1990; Wittchen et al., 1989; Wittchen et al., 1991).

The validity of the CIDI has been further supported by the broad agreement between the findings of the ECA and the NCS which used improved diagnostic interview schedules and various other methodological refinements (Kessler et al, 1994). Thus, while community epidemiological surveys may not provide perfect estimates of the prevalence of mental disorders in the community they provide a reasonably valid portrait of the pattern of disorders in the community. This represents an enormous improvement on previous knowledge of the epidemiology of substance use disorders derived from clinical populations. In this report, we present prevalence estimates based on DSM-IV criteria for abuse and dependence and ICD-10 harmful use and dependence, in the last 12 months. For each system, the two categories are mutually exclusive so that a person meeting criteria for dependence cannot also be categorised as having abuse/harmful use. A description of the criteria for DSM-IV and ICD-10 substance use disorders is presented in Appendices 1a and 1b.

2.3 Procedure

Fieldwork was conducted by the Australian Bureau of Statistics (ABS) in 1997. Trained survey interviewers met with each designated respondent to administer the interview. The interviewers were given 24-hour access to a trained psychiatrist to deal with any concerns that arose in the course of the interview. All interviewer procedures were predetermined and all inputs and scoring outputs were standardised. Responses were recorded directly onto laptop computer by the interviewer.

2.4 Analyses and estimation procedures

(i) Prevalence estimates: This report presents weighted population estimates of the 12-month prevalence of cannabis use, and the 12-month prevalence of DSM-IV and ICD-10 cannabis use disorders. In the case of prevalence of use, the numerator consists of the estimated number of persons who have had more than five occasions of cannabis use in the last 12 months, and the denominator is the total study population. Each population prevalence estimate for cannabis use disorders has the total study population for the denominator. The numerator is the estimated number of persons who qualify for the DSM-IV or ICD-10 diagnosis of a substance use disorder in the last 12 months. In addition, weighted estimates were provided of the proportion of cannabis users in the survey who met criteria for a substance use disorder in the last 12 months. Prevalence estimates from the survey were derived using a complex estimation procedure, which ensures that they conform to independent population estimates by State, part of state, age and sex. Standard errors of estimates were calculated using methods recommended by the Australian Bureau of Statistics (Australian Bureau of Statistics, 1998). All prevalence estimates were produced using SPSS for Windows (6.1.4) (SPSS, 1993)

(ii) Correlates of cannabis involvement: The association between level of cannabis involvement and a number of demographic, substance use and mental health correlates was assessed at univariate and multivariate levels. Variables were chosen on the basis of previous research. For the initial univariate analyses, chi square tests were used to assess for significant differences in the distribution of outcome and predictor variables when predictor variables were categorical. ANOVAs were used when predictor variables were continuous. Multivariate adjustment for potential confounding between predictor variables was conducted using ordinal logistic regression. This allows regression of each predictor on the three categories of level of cannabis involvement, taking into account the natural ordering of the levels of outcome. All analyses were conducted on unweighted data using Intercooled Stata 5.0 for Windows (1997)[1]. Predictor variables were added in blocks: demographic variables, followed by substance use variables and finally mental health variables. Variables were eliminated on the basis of Wald chi-square tests, and successive models were checked using the likelihood ratio test (Hosmer and Lemeshow, 1989).

(iii) Factor structure of dependence symptoms: Principal components analysis (PCA) was used to investigate whether the DSM-IV and ICD-10 measures of cannabis dependence comprised unidimensional scales, as proposed by Edwards and colleagues (Edwards, Arif and Hodgson 1981). PCA was used as a data reduction technique to define linear

[1] At the time of printing, sampling replicates were unavailable. These would have allowed for an assessment of the effects of sampling on the outcome of the multivariate analyses. The analyses conducted in this report use unweighted data and do not adjust for the effects of sampling procedures.

combinations of the dependence criteria in such a way as to maximise the amount of variance "explained" in the original variables (Hair et al, 1995). Principal components were retained on the basis of an examination of the scree plot, and if they had an eigenvalue of 1 or more (Hair et al, 1995). In addition, Cronbach's alpha (Cronbach, 1951), a measure of internal consistency reliability, was calculated for each measure of cannabis dependence. If these are unidimensional scales the value of alpha should be 0.70 or greater (Streiner and Norman, 1995). The analyses of the items were conducted using tetrachoric correlation matrices entered into the Factor module of SYSTAT Version 6 (SYSTAT, 1994a, 1994b). Tetrachoric matrices were used as the items in these scales were binary - that is, the criteria were present or absent.

(iv) Assessing agreement between DSM-IV and ICD-10: Cohen's kappa (Cohen, 1960) was used to assess agreement between DSM-IV and ICD-10 cannabis dependence and disorder diagnoses in terms of whether or not a cannabis user met a diagnosis. According to Feinstein (1985), kappa values of 0-.20 indicate slight agreement, .21-.40 fair, .41-.60 moderate, .61-.80 substantial and .81-1.0 almost perfect concordance. Agreement between DSM-IV abuse and ICD-10 harmful use diagnoses, which had a low prevalence, was assessed using Yule's Y statistic (Yule, 1912), which is robust against low/high base rates (see Spitznagel and Helzer, 1985; Stewart and Rey, 1988). Pearson product moment correlations assessed agreement on dependence severity (i.e., the number of dependence criteria met) among cannabis users.

3 RESULTS

3.1 Prevalence of 12-month cannabis use

Nearly one in ten Australians (7.1%) had consumed cannabis on more than five occasions in the preceding 12 months. Table 1 illustrates the demographic characteristics of cannabis users and compares them to "non-users" (i.e., those who had used no more than five times), and to the total sample. Consistent with the literature, gender and age were strong correlates of cannabis use. Cannabis use predominated among males, with more than twice as many males as females reporting use in the last year (10.1% vs. 4.2%). Use peaked among 18-24 year olds (19.8%), was somewhat less in those aged 25-34 years (12.4%) and thereafter declined rapidly, with no use among those aged 65 years or older. Consumption also appeared to be associated with being unemployed (25.6%) and having never married (18.1%). Not being in the labour force (97.4%) and being born in a non-English speaking country (97.0%) were associated with non-use. Although there was a strong association between being widowed (99.9%) and non-use, the small number of persons comprising this category makes this estimate unreliable.

3.1.1 Patterns of cannabis use

Patterns of cannabis use during the previous 12 months are displayed in Table 2. Not surprisingly, cannabis was almost exclusively smoked (99.1%). The majority of cannabis users (83.3%) reported that they had been using at least monthly during their most frequent period of use in the last year. Approximately two thirds (64.9%) said they had used at least weekly during this period, and one third (34.5%) said their most frequent use was on an almost daily basis. There was a slight tendency for males to report more frequent use than females. This use frequency had typically commenced more than a year ago (89.8%), especially for men (93.3% vs. 81.7% of women). Most had last used this frequently within the last 6 months, with 45% currently using at this level. Only a minority (6.8%) of users had last consumed cannabis more than 6 months ago.

Table 1: Weighted prevalence (%) (±SE) of the demographic characteristics of cannabis users, non-users and the total sample.

	Cannabis user* (n=722)	Non-user* (n=9919)	Total sample (n=10 641)
Gender			
Male	10.1 (0.3)	89.9 (0.6)	49.2 (0.3)
Female	4.2 (0.2)	95.8 (0.7)	50.8 (0.3)
Age			
18-24	19.8 (1.0)	80.2 (1.6)	13.5 (0.2)
25-34	12.4 (0.6)	87.6 (1.2)	21.1 (0.3)
35-44	7.2 (0.5)	92.8 (1.3)	21.0 (0.3)
45-54	1.5 (0.3)	98.5 (1.4)	17.5 (0.3)
55-64	0.3 (0.1)+	99.7 (1.9)	11.6 (0.2)
65+	0 (-)	100 (-)	15.4 (0.2)
Country of birth			
Australia	7.9 (0.3)	92.1 (0.4)	74.8 (0.3)
Overseas/ES	7.0 (0.7)	93.0 (1.9)	11.3 (0.2)
Overseas/NESB	3.0 (0.4)	97.0 (1.6)	13.8 (0.2)
Education			
Secondary incomplete	6.7 (0.4)	93.3 (0.9)	33.4 (0.3)
Completed secondary	8.8 (0.6)	91.2 (1.4)	15.9 (0.2)
Post-secondary	6.8 (0.3)	93.2 (0.6)	50.7 (0.3)
Employment			
Employed full-time	8.2 (0.3)	91.8 (0.7)	45.4 (0.3)
Employed part-time	8.0 (0.6)	92.0 (1.3)	17.9 (0.3)
Unemployed	25.6 (2.2)	74.4 (3.4)	4.2 (0.2)
Not in labour force	2.6 (0.3)	97.4 (0.9)	32.5 (0.3)
Marital status			
Married/defacto	4.1 (0.2)	95.9 (0.5)	65.1 (0.3)
Divorced/separated	7.0 (0.9)	93.0 (2.2)	8.1 (0.2)
Widowed	0.1 (>0.08)+	99.9 (3.1)	5.6 (0.2)
Never married	18.1 (0.7)	81.9 (1.2)	21.2 (0.3)
Geographic location			
Urban	7.4 (0.2)	92.6 (0.4)	72.6 (0.3)
Rural	6.4 (0.4)	93.6 (1.1)	27.4 (0.3)

*Cannabis use: used cannabis on more than 5 occasions in the last 12 months; non-use: used cannabis 5 or less times.

+ Unreliable estimate because too few cases

Table 2: Weighted prevalence of cannabis use patterns among cannabis users in the last year (%) (±SE).

	Total n=722	Males n=468	Females n=254
Route of use			
Smoke	99.1 (2.5)	99.5 (3.4)	98.2 (5.6)
other	0.9 (0.3)*	0.5 (0.3)*	1.8 (0.8)*
Most frequent use			
< monthly	16.7 (1.3)	14.3 (1.5)	22.3 (3.1)
1-3 days/month	18.4 (1.4)	18.4 (1.7)	18.3 (2.7)
1-2 days/week	18.4 (1.4)	18.4 (1.7)	18.2 (2.7)
3-4 days/week	12.0 (1.2)	12.6 (1.5)	10.7 (2.1)
almost daily	34.5 (1.8)	36.3 (2.3)	30.4 (3.5)
Onset of most frequent use			
>1 year ago	89.8 (2.5)	93.3 (3.3)	81.7 (5.2)
within last year	10.2 (1.1)	6.7 (1.1)	18.3 (2.7)
Recency of most frequent use+			
< last 2 weeks	45.0 (2.1)	48.7 (2.6)	36.3 (3.9)
2 wks – <1 mth ago	13.8 (1.3)	13.5 (1.6)	14.4 (2.5)
1 mth - <6 mths ago	27.8 (1.7)	25.8 (2.0)	32.4 (3.8)
6 mths - <1 yr ago	9.8 (1.1)	8.5 (1.2)	12.7 (2.4)
in last 12 mths	3.7 (0.7)	3.5 (0.8)	4.1 (1.3)*
Recency of any use+			
< last 2 weeks	59.7 (2.2)	63.4 (2.9)	51.1 (4.3)
2 wks – <1 mth ago	12.9 (1.2)	12.5 (1.5)	13.9 (2.4)
1 mth - <6 mths ago	20.6 (1.4)	17.9 (1.7)	27.2 (3.4)
6 mths - <1 yr ago	5.2 (0.8)	4.9 (0.9)	5.8 (1.5)
in last 12 mths	1.6 (0.4)	1.4 (0.5)*	2.0 (0.9)*

+ Small amount of missing data as respondents answered they had last used more than 1 year ago: n=37 and n=8 for last 2 questions

* Unreliable estimate because too few cases

3.2 Prevalence of DSM-IV cannabis use disorder: cannabis abuse and cannabis dependence

Table 3 illustrates the proportions of the total sample, and of cannabis users, who had qualified for a DSM-IV cannabis use disorder in the last 12 months, by age and gender. Cannabis accounted for more drug use disorders (excluding alcohol) than any other drug. Thus, while 2.9% met criteria for a substance use disorder in the last 12 months, approximately 1 in 50 (2.3%) Australians had a cannabis use disorder. This was predominantly comprised of those with DSM-IV cannabis dependence (1.5%). Among cannabis users, the conditional prevalence was higher: one third (31%) had a cannabis use

disorder, with 21% meeting criteria for dependence and 11% for abuse. As with cannabis use, cannabis use disorders were most common among males, and 18-34 year olds. There were no cannabis use disorders among those aged 55 years or older.

Of the substance use disorders, the prevalence of cannabis use disorders was exceeded only by that of alcohol use disorders (6.0%). Less than one percent of Australians were diagnosed with sedative (0.5%), stimulant or opioid (both 0.3%) use disorders in the last year. Among those who were classified as substance users (i.e., had used drugs more than 5 times, or consumed at least 12 drinks, in the last year), the pattern of disorders was quite different. The most prevalent disorder was a stimulant use disorder (36.4% of stimulant users). Cannabis use disorders had the second highest conditional prevalence (31.7% of cannabis users), followed by opioids (27.0% of opioid users) and sedatives (24.7% of sedative users). The conditional prevalence of alcohol use disorders was comparatively low (8.3% of drinkers). As with the ECA and NCS, substance use disorders were a common form of disorder among Australian adults. One in twelve (8.4%) Australians were diagnosed with an alcohol or other drug use disorder, while 6.7% and 5.7% were diagnosed with affective and anxiety disorders, respectively.

Table 3: Weighted prevalence (%) (±SE) of 12 month DSM-IV cannabis abuse, dependence and use disorder in the total sample and among 12 month users, by sex and age.

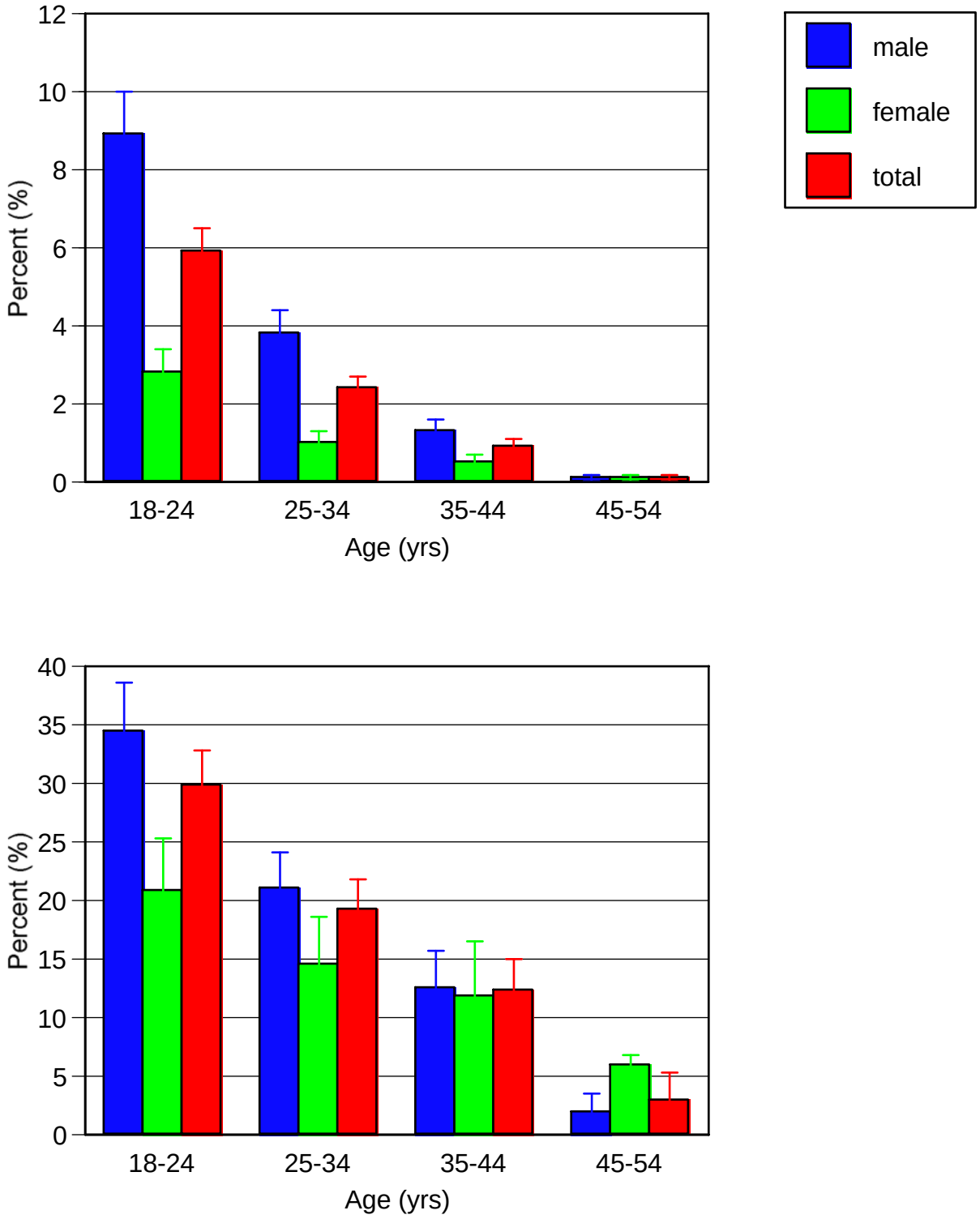
	Total (n=10 641)			Users (n=722)		
	Abuse	Dependence	Disorder	Abuse	Dependence	Disorder
Male	1.3 (0.2)	2.3 (0.2)	3.6 (0.2)	12.9 (1.5)	23.0 (3.4)	35.9 (2.3)
Female	0.2 (0.05)*	0.7 (0.1)	0.9 (0.1)	5.5 (1.5)	16.4 (2.6)	21.8 (3.0)
18-24	2.1 (0.4)	5.9 (0.6)	8.0 (0.7)	10.4 (1.8)	29.8 (3.0)	40.3 (3.4)
25-34	1.6 (1.3)	2.4 (0.3)	3.9 (0.4)	12.7 (2.0)	19.2 (2.6)	31.9 (3.1)
35-44	0.6 (0.2)	0.9 (0.2)	1.4 (0.2)	7.8 (2.1)	12.3 (2.7)	20.1 (3.4)
45-54	0.2 (0.1)*	<0.1(>0.08)*	0.2 (0.1)*	10.8 (5.3)*	2.9 (2.4)*	13.7 (5.9)*
55-64	0	0	0	0	0	0
Total	0.8 (0.08)	1.5 (0.1)	2.3 (0.1)	10.7 (1.1)	21.0 (1.4)	31.7 (1.7)

* Unreliable estimate because too few cases

3.3 DSM-IV cannabis dependence

The gender and age breakdown of those with DSM-IV cannabis dependence is presented in Figure 1, among the total sample and cannabis users. These data largely reflect the findings reported in the previous tables. Dependence predominated among males and younger participants, with no dependence diagnosis met by those aged 55 years or older.

Figure 1: Weighted prevalence (%) (±SE) of 12 month DSM-IV cannabis dependence in the total sample (n=10,641) (top) and among 12 month users (n=722) (below), by sex and age. (NB: Estimates for those aged 45-54, and all females aged 25+, may be unreliable because of small sample sizes)



3.3.1 Symptoms of dependence

Table 4 illustrates the dependence symptoms reported by cannabis users. The most frequently reported symptom in the last year was one or more unsuccessful efforts to quit cannabis use (36.7%). Contrary to its perceived rarity, cannabis withdrawal or use for withdrawal relief was the second most commonly reported symptom among users (29.7%). Approximately one in five reported tolerance (22.1%) and using more cannabis than intended (19%). Few had experienced the remaining symptoms. These results indicate that among this general population sample, symptoms indicative of a compulsion to use and physical dependence were most common, with few reporting that cannabis use had caused them problems in their daily lives (e.g., low prevalence for symptoms 5 to 7). Men and women were largely identical in their rank ordering of symptoms. Users had experienced an average of 1.3 (SD=1.6, range=0-7) of the 7 dependence symptoms in the last year, at the mild end of the severity continuum. There were no gender differences in severity of dependence (means of 1.3 criteria for male and female), or in the likelihood of reporting each of the individual criteria.

Table 4: Weighted prevalence of DSM-IV symptoms (%) (±SE) among cannabis users, by gender.

	Total N=722	Male n=468	Female n=254
1. Tolerance	22.1 (1.5)	22.8 (1.9)	20.3 (2.9)
1. Withdrawal/ withdrawal relief	29.7 (1.7)	31.2 (2.1)	26.2 (3.3)
2. Cannabis used in larger amounts or for longer than intended	19.0 (1.4)	19.2 (1.8)	18.5 (2.7)
3. Persistent desire/unsuccessful efforts to control use	36.6 (1.8)	37.0 (2.3)	35.5 (3.7)
4. Great deal of time spent in obtaining, using and recovering	9.2 (1.1)	10.2 (1.4)	6.9 (1.7)
5. Important activities given up or reduced	2.2 (0.5)	2.1 (0.6)*	2.5 (1.0)*
6. Continued use despite knowledge of physical or psychological problem	8.8 (1.0)	10.4 (1.4)	5.0 (1.4)*

* Unreliable estimate because too few cases

Table 5 presents the contrast in DSM-IV symptom prevalence between those with and without a DSM-IV cannabis dependence diagnosis. Not surprisingly, those who were not dependent had a lower prevalence on all criteria. The physical dependence symptoms of

withdrawal and tolerance were strong discriminators between the groups, being experienced by the majority of dependent users (88.8% and 72.6%, respectively). The majority of dependent users had also made unsuccessful efforts to control their use (86.9%), compared to only one in five (23.2%) non-dependent users. The only criterion that did not appear to have reasonable discrimination between was neglecting or reducing important activities (Criterion 7), which less than one in ten users had reported. Dependent users met an average of 4.1 symptoms in the last year, compared to 0.5 symptoms among non-dependent users ($t_{187.3}$=-38.3, p<0.001).

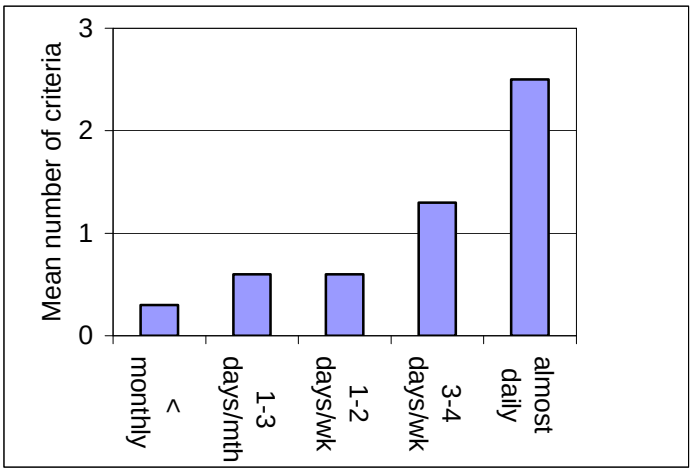
Table 5: Weighted prevalence of DSM-IV symptoms (%) (±SE) among cannabis users, by DSM-IV dependence diagnosis.

	Total	Non-dependent	Dependent
	N=722	n=572	n=150
1. Tolerance	22.1 (1.5)	8.6 (1.2)	72.6 (6.1)
2. Withdrawal/ withdrawal relief	29.7 (1.7)	14.0 (1.4)	88.8 (6.6)
3. Cannabis used in larger amounts or for longer than intended	19.0 (1.4)	7.3 (1.1)	62.8 (5.8)
4. Persistent desire/unsuccessful efforts to control use	36.6 (1.8)	23.2 (1.8)	86.9 (6.6)
5. Great deal of time spent in obtaining, using and recovering	9.2 (1.1)	0.4 (0.2)*	42.5 (5.0)
6. Important activities given up or reduced	2.2 (0.5)	0.2 (0.1)*	9.9 (2.4)
7. Continued use despite knowledge of physical or psychological problem	8.8 (1.0)	1.3 (0.4)*	37.0 (4.7)

* Unreliable estimate because too few cases

A crude dose-response relationship between frequency of cannabis use and severity of dependence was assessed by a linear regression. The "most frequent use categories" presented in Table 2 (reference: use less than monthly) were regressed on the number of symptoms experienced in the last year (range: 0-7). While the overall analysis was significant ($F_{4,717}$=84.1, p<0.0001), there was not a linear dose-response trend (see Figure 2). Using cannabis "3-4 days a week" (β=1.1, SE=0.2, T=5.7, p<0.0001) and "almost daily":(β=2.2, SE=0.2, T=14.4, p<0.0001) were most clearly linked to severity of dependence, as would be expected.

Figure 2: Average number of DSM-IV criteria met in last year among cannabis users, by most frequent use.



3.3.2 Factor structure of DSM-IV cannabis dependence

Principal components analysis (PCA) was used to investigate whether the DSM-IV measure of cannabis dependence comprised a unidimensional scale, as proposed by Edwards and colleagues (Edwards et al, 1981). The results of the PCA are displayed in Table 6. There was good evidence that the DSM-IV criteria, as measured by the CIDI-Auto, represented a unidimensional operationalisation of the cannabis dependence syndrome in this population-based sample. All criteria had substantial, significant positive loadings on the first principal component (≥0.76), which in total accounted for approximately two thirds of the total variance (65.7%). Since no other PC had an eigenvalue greater than 1 no rotation was performed. The value of Cronbach's alpha for the scale was 0.75, which is indicative of good internal consistency and supportive of unidimensionality.

Table 6: Principal components analysis of DSM-IV cannabis dependence criteria, showing the single solution for the principal component (PC) with an eigenvalue greater than 1 (n=722).

DSM-IV Criterion	Loading
1. Tolerance	0.78
2. Withdrawal/withdrawal relief	0.88
3. Cannabis used in larger amounts or for longer than intended	0.77
4. Persistent desire/unsuccessful efforts to control use	0.76
5. Great deal of time spent in obtaining, using and recovering	0.87
6. Important activities given up or reduced	0.76
7. Continued use despite knowledge of physical or psychological problems	0.84
Eigenvalue	4.6
% variance	65.7

3.4 Correlates of the level of cannabis involvement

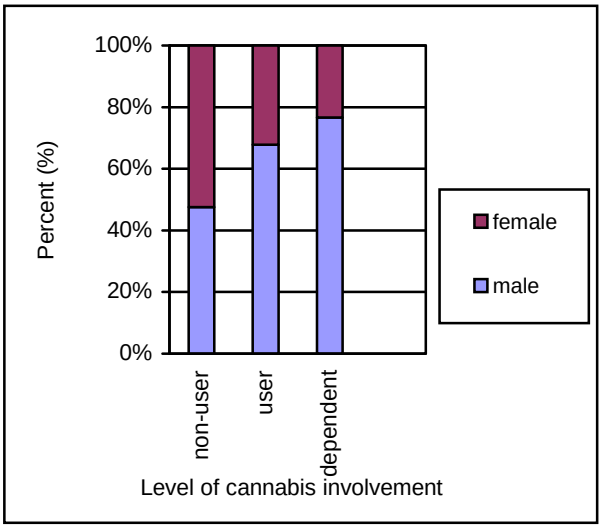
The sample were divided into three categories on the basis of their level of cannabis involvement in the last year: non-users (92.9% of the sample), non-DSM-IV-dependent cannabis users (although they may have received an abuse diagnosis) (5.6%) and DSM-IV dependent cannabis users (1.5%). A number of potential demographic, drug use and mental health correlates of cannabis involvement were assessed. This section outlines the univariate relationship between each of these variables and level of cannabis involvement. Tables outlining the prevalence, standard error and significance of the relationship between these correlates and outcome are presented in Appendices 2a and 2b. Graphical representations of these data are presented in the body of the text, below.

3.4.1 Demographic correlates

All variables were significantly related to level of involvement (see Appendix 2a) with the exception of geographic location, indicating that urban or rural residence was not associated with degree of use. Thus, each of the categories describing level of cannabis use comprised approximately three quarters urban and one quarter rural participants (χ^2, 2df=3.6, p=0.17).

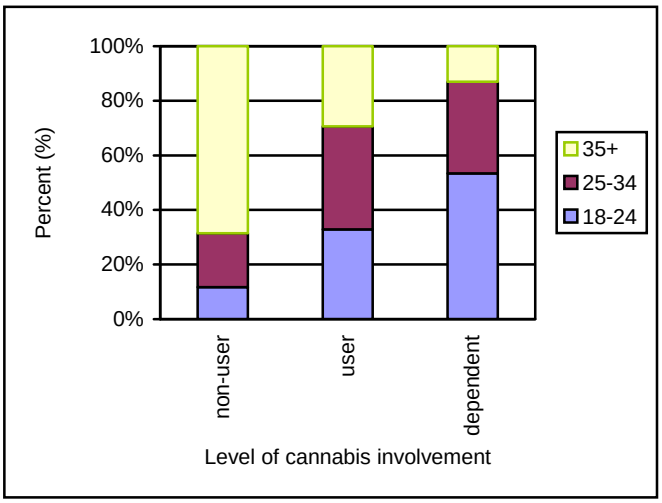
The proportion of males in each category increased as the level of involvement intensified, such that three quarters (76.6%) of those who were DSM-IV dependent were male, compared to approximately half (47.6%) of non-users, and two-thirds (67.8%) of non-dependent users (Figure 3).

Figure 3: Relationship between gender by level of cannabis involvement



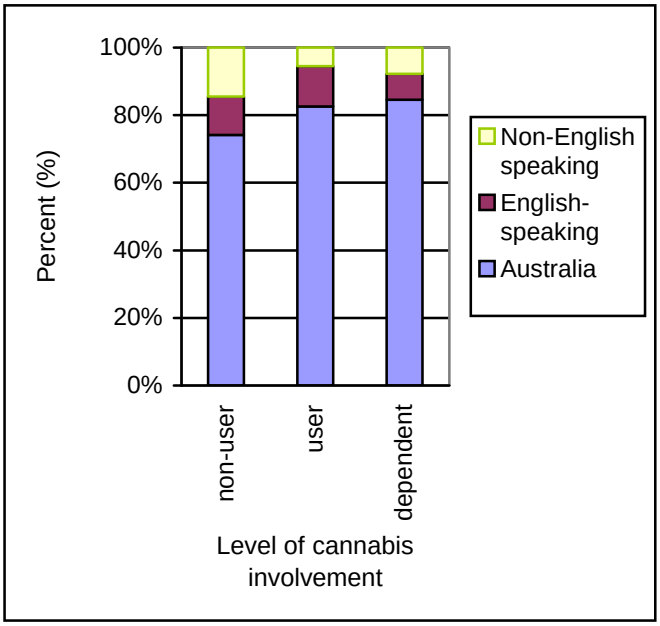
Age data were collapsed into three categories (18-24, 25-34 and 35+) as small cell sizes among those aged over 35 years produced unreliable estimates (see Figure 4). Those aged 18-24 years were more likely to be more involved with cannabis use and half of those who were dependent (53.4%) were 18-24 years of age. Those aged 25-34 were more prevalent among users (37.7% of non-dependent users and 33.6% of dependent users). Those aged 35 years and older were predominantly non-users.

Figure 4: Relationship between age and level of cannabis involvement



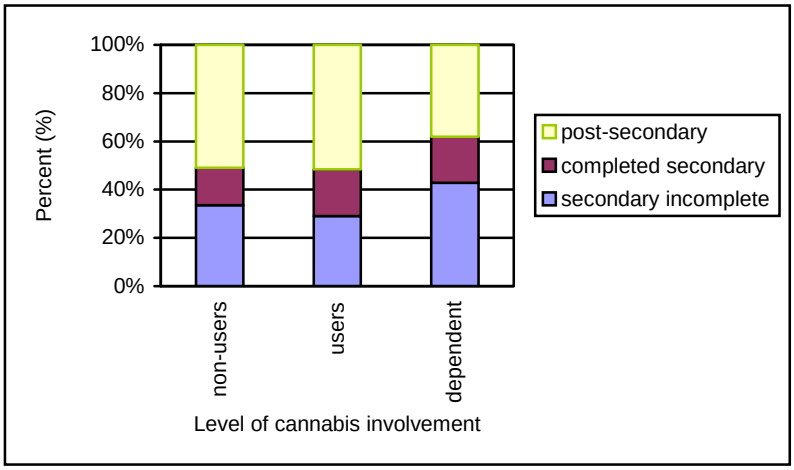
The proportion of Australian-born participants increased with level of cannabis involvement– while three quarters of non-users were Australian-born (74.2%), this increased to 84.6% among those who were dependent (Figure 5). In contrast, the proportions of overseas-born participants decreased, such that approximately 8% of dependent users were born overseas compared to 11-15% of non-users. This was particularly marked among those from non-English speaking countries.

Figure 5: Relationship between country of birth and level of cannabis involvement



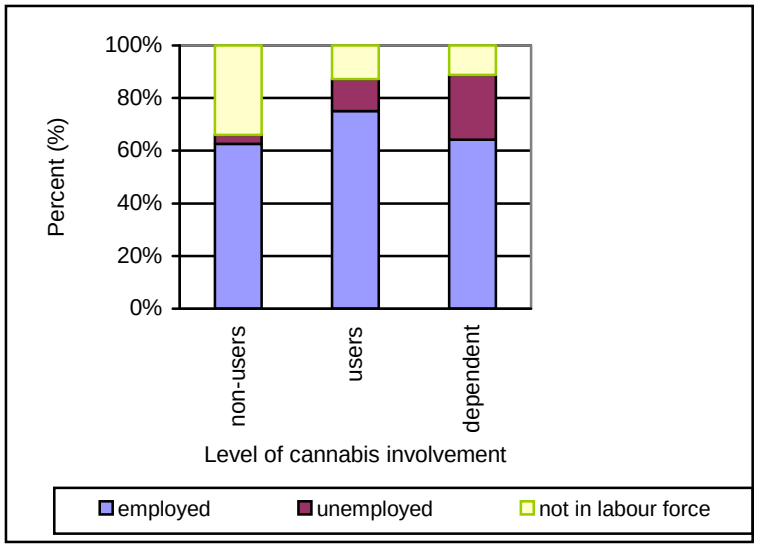
There was no clear relationship between education and cannabis use (Figure 6). Those who had not completed secondary school were a little less likely to have used cannabis (29%) compared to those who had not (34%), but more likely to be diagnosed as cannabis dependent (43%). There was no relationship between cannabis use and having completed secondary education. Among those who had post-secondary education, there was little difference in the proportions of people who had and had not used (51-52%), and a lower level of cannabis dependence (38%).

Figure 6: Relationship between education and level of cannabis involvement



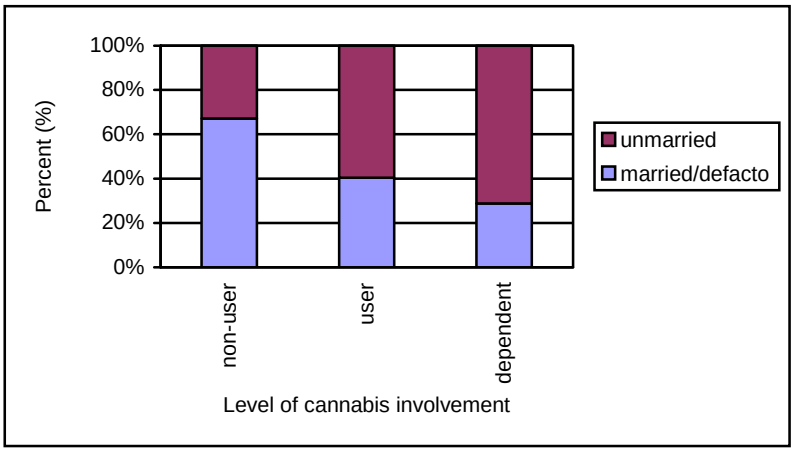
There was a relationship between being unemployed and having cannabis-related problems (Figure 7). Unemployed persons comprised one quarter of those with cannabis dependence compared to only 3% of those who did not use. An opposite, but less marked, trend was apparent among those not in the labour force, who were predominantly non-users. This relationship probably reflects the preponderance of older, retired participants among those outside the labour force. Those who were employed were equally represented among non-users (62.6%) and dependent users (64.2%), and slightly greater over-represented among non-dependent users (74.9%).

Figure 7: Relationship between employment status and level of cannabis involvement



As with age, the marital status categories were collapsed because of small cell sizes (married/defacto, vs. separated/divorced/widowed/never married). There was a clear relationship between level of involvement and not being married. Unmarried persons comprised 71.2% of those who were cannabis dependent compared to 32.8% of non-users (Figure 8). This was largely due to the influence of those who had never been married, who comprised the largest proportion of the second category. Widowed respondents were predominantly non-users, and there was no obvious relationship between being divorced/separated and level of cannabis involvement, but caution needs to be exercised because of the smaller size of these groups. The opposite trend was apparent among those who were married or in a defacto relationship; they comprised two thirds of the non-user category (67.2%) 40.4% of non-dependent users and only 28.8% of dependent users.

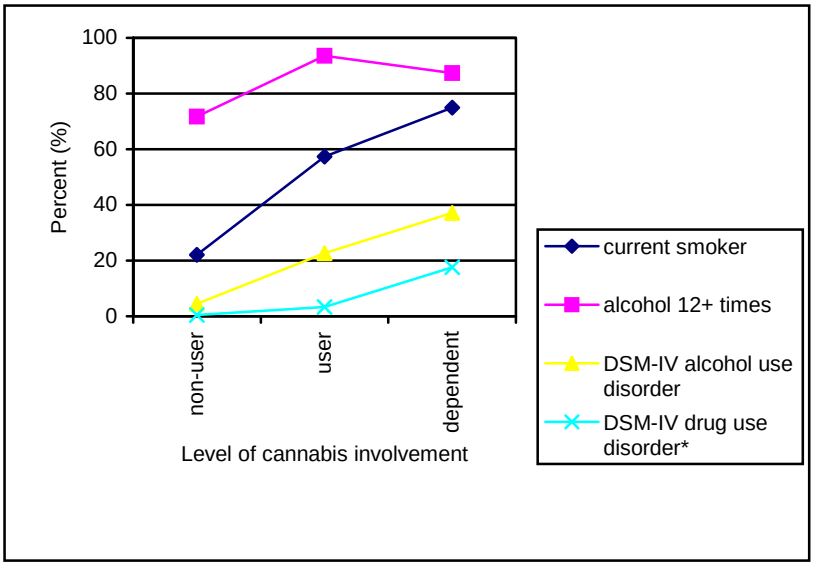
Figure 8: Relationship between marital status and level of cannabis involvement



3.4.2 Substance use and mental health correlates

This section describes the univariate relationships between substance use and mental health correlates and level of cannabis involvement. Figure 9 displays the relationship between substance use correlates and level of cannabis involvement (see also Appendix 2b). There was a positive relationship between being a current smoker and increased involvement with cannabis. A similar pattern was evident for those with a DSM-IV alcohol use disorder and a DSM-IV stimulant, opioid or sedative use disorder, although the proportions of those with these disorders was much lower. There was a more ambiguous relationship between alcohol consumption and cannabis use. While there was a greater proportion of alcohol drinkers among cannabis users than non-users (93.6% of non-dependent users and 87.4% of dependent users, compared to 71.7% of non-users), there was a slight decrease in the proportion of dependent cannabis users who were drinkers compared to non-dependent users.

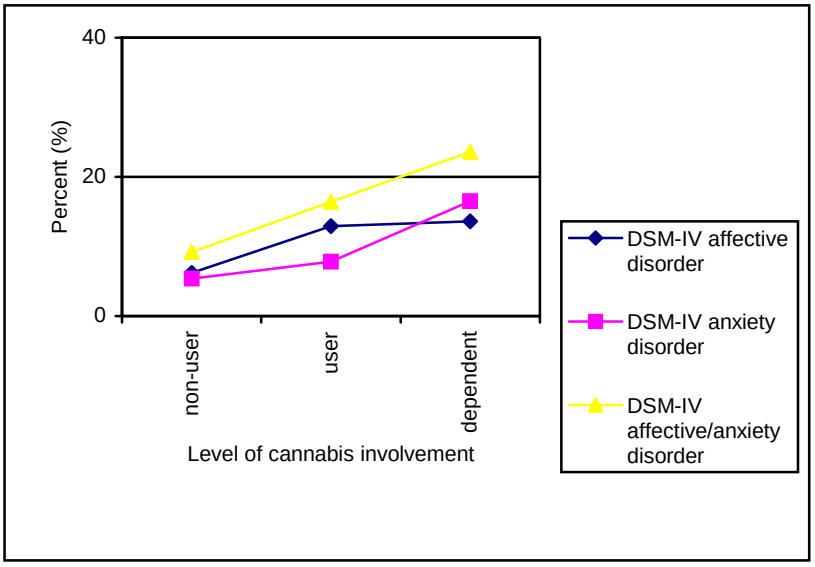
Figure 9: Relationship between substance use and level of cannabis involvement



* DSM-IV drug use disorder comprised a stimulant, opioid or sedative use disorder

Figure 10 displays the relationship between having a DSM-IV affective and anxiety disorder, and level of cannabis involvement. As for substance use, respondents with these disorders were over-represented among cannabis users. There did not appear to be a strong linear relationship between the presence of an affective disorder and level of cannabis involvement across all three categories, with little difference between non-dependent and dependent cannabis users. However, there was a linear relationship between having an anxiety disorder, and either an anxiety or affective disorder, and level of cannabis involvement. There was also a linear relationship between the score on the Eysenck Personality Questionnaire (EPQ) (Eysenck et al, 1985), a measure of neuroticism, and intensity of cannabis use. Dependent users had higher average scores than non-dependent users (4.1 vs. 3.1), who in turn had a higher score than non-users (2.5).

Figure 10: Relationship between mental health and level of cannabis involvement



3.4.3 Multivariate assessment of correlates of cannabis involvement

Because of relationships between the correlates of cannabis use, univariate analyses do not adequately represent the relationship between these correlates and level of cannabis involvement. Multivariate analyses are required to understand them.

A multivariate ordinal logistic regression was accordingly conducted to take advantage of the natural ordering of outcome categories and to permit adjustment to be made for relationships between predictor variables. Variables which were significant at the univariate level (all but geographic location) were entered into the model in blocks. Demographic variables were entered first: age, gender, educational level, employment status, marital status and country of birth. These were followed by substance use variables: current smoking and drinking status, number of illicit drugs consumed in last year, and presence of a DSM-IV alcohol use, or stimulant/sedative/opioid use, disorder. Finally, mental health variables were entered: presence of DSM-IV affective and anxiety disorders, and score on the Eysenck Personality Questionnaire (EPQ-12). Individual predictor variables were deleted from the model if the corresponding Wald chi square was not significant ($p<0.05$), while the impact of the addition and subtraction of variables between models was assessed using the Likelihood Ratio Test.

The final model (χ^2, 12df=1449.4, $p<0.001$; pseudo $R^2=0.24$) (see Table 7) included: age, gender, country of birth, employment status, marital status, smoking status, presence of a DSM-IV alcohol use disorder, number of illicit drugs consumed in the last year and EPQ score. This model indicated that females were less likely than males to be heavily involved in cannabis use after adjusting for all other variables in the model. Persons aged 25 years or older showed less involvement than those aged 18-24 years. Compared to those who were employed, those who were unemployed had a higher risk of problematic cannabis use, while those who were outside the labour force had a lower risk. Those who were married or in a

defacto relationship showed less involvement than those who were divorced, separated, widowed or never married. Persons born in non-English speaking countries were less likely than Australian-born persons to become heavily involved in cannabis use. Being a current smoker and having a DSM-IV alcohol use disorder were both associated with increased levels of cannabis use. Involvement with cannabis also intensified with the number of other illicit drugs consumed. Finally, there was a positive relationship between the score on the EPQ and intensity of cannabis use. Interaction terms expressing the relationship between gender and age, gender and (licit and illicit) substance use, and gender and mental health were added to the final main effects model but were not significant.

Table 7: Ordinal logistic regression of demographic, substance use and mental health variables on level of cannabis involvement (n=10, 641).

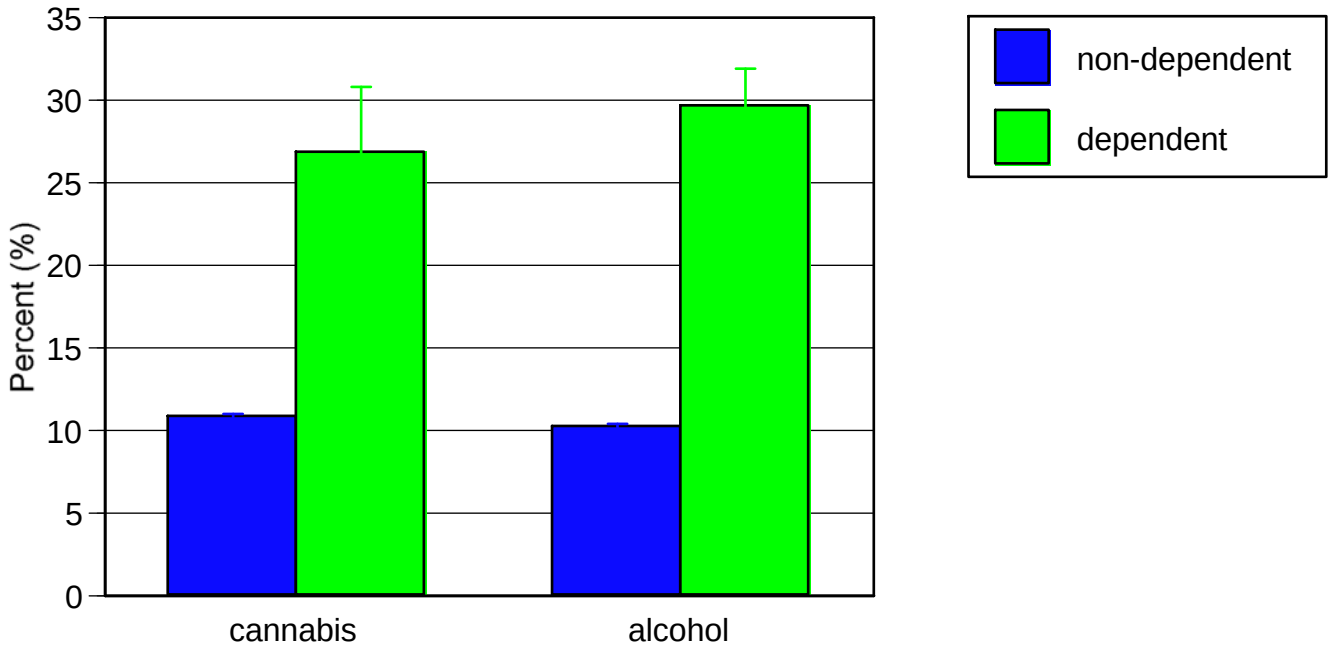
	Coefficient	SE	Z	P
Gender	-0.85	0.09	-9.2	<0.001
Age				
25-34	-0.42	0.11	-3.7	<0.001
35+	-1.55	0.12	-13.3	<0.001
Employment status				
Unemployed	0.84	0.14	6.2	<0.001
Not in labour force	-0.51	0.12	-4.2	<0.001
Marital status				
Not married/defacto	0.46	0.09	5.0	<0.001
Country of birth				
Overseas, ESB	0.16	0.13	1.2	0.23
Overseas, NESB	-0.73	0.18	-3.9	<0.001
Tobacco smoking status				
Current smoker	0.68	0.10	6.7	<0.001
DSM-IV alcohol use disorder	0.80	0.11	7.0	<0.001
Number of illicit drugs used	0.63	0.05	12.6	<0.001
EPQ-12 score	0.06	0.02	3.8	<0.001

Reference categories: Gender=male; age=18-24yrs; employment status=employed; marital status=married/defacto; country of birth=Australia; smoking status=non-smoker; DSM-IV alcohol use disorder=absent

3.5 Health service utilisation

Those with a DSM-IV cannabis dependence diagnosis were 3.3 times more likely than those without to have sought assistance for a mental health problem from a health professional in the past 12 months (26.8% versus 10.8% of non-users/non-dependent users; 95%CI=2.3, 4.7; χ^2, 1df=50.2, p<0.001). Again, a similar pattern was evident for alcohol (29.6% of alcohol-dependent persons had sought help compared to 10.2% of non-drinkers/non-dependent drinkers; unadjusted OR=3.9; 95%CI=3.1,4.8; χ^2, 1df=189.4, p<0.001) (see Figure 11).

Figure 11: Weighted proportion (%) (±SE) of those with DSM-IV alcohol or cannabis dependence who had consulted a health professional about their mental health in the last 12 months, compared to those who were not dependent (i.e., non-users and non-dependent users).



3.6 Prevalence of ICD-10 cannabis use disorder: harmful cannabis use and cannabis dependence

Table 8 shows the proportions of the total sample and cannabis users who qualified for an ICD-10 cannabis use disorder in the last 12 months, by age and gender. According to ICD-10, approximately 1 in 50 (1.7%) Australians had a cannabis use disorder, predominantly ICD-10 cannabis dependence (1.6%). Among cannabis users, one quarter (23.6%) had a cannabis use disorder in this time, with 22% meeting criteria for dependence and only 1.5% for harmful use. While both nosologies diagnosed few people with the residual categories of abuse (DSM-IV) or harmful use (ICD-10), this was particularly marked for the ICD-10 criteria: so few people were diagnosed with harmful use, all prevalence estimates for this diagnosis are unreliable. This largely explains the discrepancy in the prevalence of cannabis use disorders between the two diagnostic systems. As with DSM-IV disorders, ICD-10 disorders were most common among males, and 18-34 year olds. Again, there were no cannabis use disorders among those aged 55 years or older.

Table 8: Weighted prevalence (%) (±SE) of 12 month ICD-10 cannabis harmful use, dependence and use disorder in the total sample and among 12 month users, by sex and age.

	Total (n=10 641)			Users (n=722)		
	Harmful Use*	Dependence	Disorder	Harmful Use*	Dependence	Disorder
Male	0.2 (0.07)	2.4 (0.2)	2.6 (0.2)	1.6 (0.5)	24.2 (1.9)	25.7 (2.0)
Female	0.1 (0.06)	0.7 (0.1)	0.8 (0.1)	1.3 (0.7)	17.4 (2.6)	18.7 (2.8)
18-24	0.2 (0.1)	5.8 (0.6)	6.0 (0.6)	0.9 (0.5)	29.5 (3.0)	30.4 (3.0)
25-34	0.2 (0.08)	2.7 (0.3)	2.9 (0.3)	1.9 (0.8)	21.9 (2.8)	23.7 (2.8)
35-44	0.1 (0.05)	0.9 (0.2)	1.0 (0.2)	1.6 (0.9)	12.7 (2.7)	14.3 (2.9)
45-54	0.1 (0.07)	0.1 (0.06)*	0.2 (0.1)*	3.9 (2.9)	7.8 (4.5)*	11.7 (5.6)*
55-64	0	0	0	0	0	0
Total	0.1 (0.03)	1.6 (0.1)	1.7 (0.1)	1.5 (0.4)	22.1.(1.5)	23.6 (1.5)

* Unreliable estimate/treat with caution

Table 9 illustrates the ICD-10 dependence symptoms reported by cannabis users. The most frequently reported symptom in the last year was difficulties controlling use (43.2%), followed by cannabis withdrawal (29.7%) and tolerance (22.1%). Approximately one in ten reported a compulsion to use (13.5%), neglect of other interests and activities (10.1%) and continued use despite significant problems (8.8%). Men and women were identical in their rank ordering of symptoms. Users had experienced an average of 1.3 (SD=1.6, range=0-6) symptoms in the last year, again at the mild end of the severity continuum. There were no gender differences in severity of dependence (means of 1.3 criteria for male and 1.2 for female), or in the likelihood of reporting each of the individual criteria. Among those who could estimate age of symptom onset and recency, the median duration of ICD-10 cannabis dependence was 3 years (range: 1-24 years).

Table 9: Weighted ICD-10 symptom prevalence (%) (±SE) among cannabis users, by gender.

	Total	Male	Female
	N=722	n=468	n=254
1. Strong desire/compulsion to use	13.5 (1.2)	13.7 (1.5)	13.2 (2.3)
2. Difficulties controlling cannabis use	43.2 (2.0)	43.6 (2.4)	42.3 (4.0)
3. Withdrawal/withdrawal relief	29.7 (1.7)	31.2 (2.1)	26.2 (3.3)
4. Tolerance	22.1 (1.5)	22.8 (1.9)	20.3 (2.9)
5. Neglect of alternative interests because of cannabis use	10.1 (1.1)	11.2 (1.4)	7.5 (1.7)
6. Continued use despite significant problems	8.8 (1.0)	10.4 (1.4)	5.0 (1.4)*

* Unreliable estimate because too few cases

Table 10 displays ICD-10 symptom prevalence among those with and without an ICD-10 dependence diagnosis. As for DSM-IV, there was good discrimination between groups, extending to all six criteria. In particular, physical dependence symptoms and a compulsion to use were experienced by the majority of dependent users. Those with an ICD-10 dependence diagnosis reported an average of 3.9 symptoms, compared to 0.6 symptoms among non-dependent users ($t_{194.7}$= -35.2, $p<0.001$).

Table 10: Weighted ICD-10 symptom prevalence (%) (±SE) among cannabis users, by dependence diagnosis.

	Total	Non-dependent	Dependent
	N=722	n=565	n=157
1. Strong desire/compulsion to use	13.5 (1.2)	2.3 (0.6)	53.0 (4.3)
2. Difficulties controlling cannabis use	43.2 (2.0)	28.6 (1.9)	94.7 (6.5)
3. Withdrawal/withdrawal relief	29.7 (1.7)	12.4 (1.4)	90.5 (6.5)
4. Tolerance	22.1 (1.5)	8.4 (1.2)	70.1 (5.8)
5. Neglect of alternative interests because of cannabis use	10.1 (1.1)	0.5 (0.3)*	43.9 (4.9)
6. Continued use despite significant problems	8.8 (1.0)	1.2 (0.4)*	35.4 (4.5)*

* Unreliable estimate because too few cases

3.6.1 Factor structure of ICD-10 cannabis dependence

The results of the PCA are displayed in Table 11. As for the DSM-IV criteria, there was good evidence that the ICD-10 criteria formed a unidimensional cannabis dependence syndrome in this sample. Again, all criteria had significant positive loadings on the first principal component (≥0.79), which accounted for 71% of the total variance. Since no other PC had an eigenvalue greater than 1 no rotation was performed. The value of Cronbach's alpha for the scale was 0.77, again indicative of good internal consistency and supportive of unidimensionality.

Table 11: Principal components analysis of ICD-10 cannabis dependence criteria, showing the single solution for the principal component (PC) with an eigenvalue greater than 1 (n=722).

ICD-10 Criterion	Loading
1. Strong desire/compulsion to use	0.86
2. Difficulties controlling cannabis use	0.85
3. Withdrawal/withdrawal relief	0.88
4. Tolerance	0.79
5. Neglect of alternative interests because of cannabis use	0.87
6. Continued use despite significant problems	0.80
Eigenvalue	4.3
% variance	71.0

3.7 Agreement between DSM-IV and ICD-10 classifications of cannabis use disorders

There was excellent concordance between DSM-IV and ICD-10 cannabis dependence measured by the CIDI-Auto, expressed as the proportion of cannabis users who qualified for a diagnosis (kappa=0.9). This was reflected in the almost perfect agreement between the systems in terms of the severity of cannabis dependence, or number of criteria experienced (r=0.97). In contrast, there was only modest agreement between DSM-IV abuse and ICD-10 harmful use diagnoses (Y=0.4), which is consistent with the international literature and the differences in the content of the two diagnostic categories. While there was substantial agreement between the systems in terms of the proportion of users diagnosed with a cannabis use disorder (either dependence or abuse/harmful use) (kappa=0.7), this agreement for any cannabis use disorder was probably constrained by the lack of concordance between the categories of abuse (DSM-IV) and harmful use (ICD-10).

4 DISCUSSION

The NSMHWB provides the first population-based data on the prevalence and correlates of cannabis use disorders in Australia. Consistent with the international epidemiological literature, this report shows that cannabis use disorders are the most common form of substance use disorders among Australian adults after alcohol use disorders.

Nearly one in ten (7.1%) Australians aged 18 years and older had used cannabis more than five times in the last year. Consistent with the previous literature on demographic correlates of use, consumption was highest among males and young adults.

Approximately one in fifty adults (2.3%) had a DSM-IV cannabis use disorder. Cannabis dependence was about twice as prevalent as cannabis abuse, with 1.5% of Australians and 21% of current cannabis users diagnosed as dependent. By comparison, 0.8% of the total population and 10.7% of users met criteria for a cannabis abuse diagnosis. A cannabis use disorder was the second most common substance use disorder – among the total population it was exceeded only be alcohol use disorders (6%). Among those who had used each of the substances assessed, cannabis ranked second only stimulant use disorders (36.4%) in the proportion who met criteria for dependence. Similar figures were obtained using ICD-10 criteria, with 1.7% of Australians and one in four (23.6%) cannabis users with an ICD-10 cannabis use disorder. Again, this largely comprised cannabis dependence, with few receiving the residual diagnosis of harmful use. Dependence predominated among males and young adults, although the gender difference was less pronounced after accounting for initial differences in prevalence of use.

The 12-month prevalence of DSM-IV cannabis dependence in this sample (1.5%) was slightly lower than the DSM-III estimate calculated from the ECA (2.6%) (Hall et al, 1994). Twelve month estimates have not been reported for the NCS. The estimates of cannabis use disorders obtained in this study may not be directly comparable to those reported in the ECA and the NCS, due to some differences in sampling methodologies, the time frame assessed (lifetime versus 12 month prevalence) and criteria used to measure disorders (DSM-III, DSM-III-R and DSM-IV). Nevertheless, in all three studies cannabis use disorders were by far the most common illicit substance use disorders, ranking second only to alcohol. Similarly, there were consistent age and gender differentials – with disorders predominating among males and younger adults.

There has been considerable speculation about the existence and nature of a cannabis dependence syndrome, largely due to persistent beliefs that physical dependence symptoms are pre-eminent markers of dependence. However, changing notions of dependence, embodied in the alcohol and drug dependence syndromes (Edwards, Arif and Hodgson, 1981; Edwards and Gross, 1976), and reflected in the DSM and ICD-10 diagnostic nosologies, consider the condition a clinically meaningful cluster of physical, cognitive and behavioural symptoms. Tolerance and cannabis withdrawal has been reported among general population and long-term using samples (e.g., Anthony and Trinkoff, 1989; Stephens, Roffman and Simpson, 1993; Swift, Hall, Didcott et al, 1998; Swift et al, in press; Weller and Halikas, 1982), and observed in humans in laboratory experiments (e.g., Georgotas and Zeidenberg, 1979; Jones and Benowitz, 1976; Jones et al, 1981). Withdrawal has also been precipitated in laboratory animals using the cannabinoid antagonist

SR141716A (e.g., Aceto et al, 1995; Rubino et al, 1998; Tsou, Patrick and Walder, 1995). However, compared to the withdrawal syndrome precipitated by the antagonist, the process may be milder and more prolonged under the usual conditions of human use (Swan, 1995; Wiesbeck et al, 1996). Cannabis withdrawal may also be less pronounced than that commonly observed with drugs such as alcohol and the opiates.

Among this sample, symptoms of withdrawal/withdrawal relief and tolerance were the second and third most common symptoms of DSM-IV and ICD-10 dependence. The most common DSM-IV symptom was a desire to stop or unsuccessful attempts to moderate use. In a similar vein, difficulty controlling use was the most commonly reported ICD-10 symptom. Symptoms indicating a great deal of time spent using or recovering from use (DSM-IV), the neglect of other activities in favour of use (DSM-IV), and continued use despite problems (DSM-IV and ICD-10), were infrequently reported (<10%) in this general population sample. It is likely that different patterns of symptoms will be reported in different populations of users. For example, withdrawal was the most commonly endorsed criterion among a clinical sample of users participating in a randomised controlled of brief interventions for cannabis (Copeland, Swift and Rees, 1999), while in a non-clinical sample of long-term users, the most prevalent symptom was continued use despite problems (Swift et al, 1997).

There have been few attempts to identify criteria associated with levels of dependence severity. Proposed DSM-IV criteria measuring withdrawal (Carroll et al, 1994; Morgenstern et al, 1994) and persistent desire to cut down (Morgenstern et al, 1994) have been linked to more severe levels of dependence, while continuing cannabis use despite problems has linked to mild severity (Carroll et al, 1994; Morgenstern et al, 1994). In this sample, there was typically a great difference in symptom prevalence between those who did and did not receive a dependence diagnosis (Tables 5, 10). Our data are consistent with previously reported findings in showing that those who were dependent reported a higher rate of withdrawal and difficulties cutting down than those who were not dependent. There was less discrepancy between these groups on continued use despite problems. Continued research is required to determine the importance of these symptoms in various groups of cannabis users, and their implications (e.g., see Nelson et al, 1999). The almost universal endorsement of withdrawal (97%) among the clinical sample mentioned above (Copeland, Swift and Rees, 1999), for example, suggests it may have clinical implications for heavy users.

There has also been little research on the hypothesis that unidimensionality, one of the major hypotheses of the drug dependence syndrome, is applicable to cannabis dependence (Edwards et al, 1981). Unidimensionality is a psychometric concept which implies that all the elements of a syndrome are substantially intercorrelated and that the pattern of correlations indicates a single underlying factor (Nunnally, 1967). If there is a single underlying dimension for all drug classes, this increases the validity of the drug dependence syndrome. One implication of this may be that treatment components can be transported among drug classes because there is a universal core domain called "dependence" (Chick, 1980).

Data generally support the coherence of a drug dependence syndrome for alcohol, opiates, cocaine, stimulants and sedatives, although there is less compelling evidence that

hallucinogen dependence conforms to the syndrome concept (e.g., Feingold and Rounsaville, 1995; Hasin, Grant, Harford et al, 1988; Kosten et al, 1987; Morgenstern et al, 1994; Newcomb, 1992; Rounsaville et al, 1993). However, some researchers have identified multiple dimensions for alcohol (e.g., Caetano, 1990; Chick, 1980; Muthén, Grant and Hasin, 1993; Muthén, Hasin and Wisnicki, 1993), opiates (Phillips et al, 1987) and nicotine (Johnson, Breslau and Anthony, 1996) dependence.

Limited research has indicated reasonable coherence among cannabis dependence symptoms among restricted samples (typically general clinical and/or psychiatric samples, many of whom were polydrug users and among whom the prevalence of cannabis use and dependence may have been low). In these studies cannabis dependence tended to be the least coherent among the major drug classes (e.g., Feingold and Rounsaville, 1995; Hasin et al, 1988; Morgenstern et al, 1994; Rounsaville et al, 1993). The unidimensionality of NSMHWB dependence data is generally consistent with these findings. However, recent data on two samples of long-term Australian cannabis users failed to identify a single dimension (Swift et al, 1997; 1998). Discrepancies in these findings may be due to a number of factors, including: changing criterion sets and the use of different dependence measures, potential differences in the ease of operationalising each criterion, sample selection issues and the use of different analytic techniques. Different factor models may emerge for different population subgroups (Muthén, Grant et al, 1993), which may have clinical implications for aetiology, treatment response and prognosis (Johnson, Breslau and Anthony, 1996). Further research employing a comparison of analytic methods should help to provide a better understanding of the factor structure of cannabis dependence.

A small body of literature provides reasonable evidence that cannabis and other substance dependence symptoms form unidimensional scales, which constitute a continuum of severity (Feingold and Rounsaville, 1995a; Kosten et al, 1987; Langenbucher, Morgenstern and Miller, 1995; Morgenstern et al, 1994; Nelson et al, 1999; Newcomb, 1992; Woody, Cottler and Cacciola, 1993). Other research suggests this continuum is less well characterised for cannabis dependence than opiates and cocaine. Users in this study clustered at the mild end of the continuum of dependence severity, experiencing an average of only 1.3 out of the 7 DSM-IV symptoms in the last year. Other research has also reported such positively skewed distributions of cannabis dependence symptoms (Feingold and Rounsaville, 1995; Kosten et al, 1987; Woody et al, 1993). Dependence severity has been linked to frequency and chronicity of cannabis consumption and the number of cannabis-related problems experienced (Langenbucher et al, 1995, Woody et al, 1993). To date, the cannabis treatment literature has not explicitly examined the predictive validity of cannabis dependence (e.g., in predicting future use or ability to stop), or its potential association with treatment goals or type of intervention.

Substance disorders are among the most difficult to examine cross-culturally, with diagnosis complicated by the use of different drugs and routes of use, and varying perceptions of problems and symptom interpretation (Robins, 1990). Given the lack of a specific biological marker to determine the prevalence of substance use disorders, diagnosis relies on observable symptoms designated by nosological systems such as the DSM-IV and ICD-10 (Cottler and Compton, 1993). While these systems have increasingly converged in their conceptual bases for dependence diagnoses, they retain slightly different operationalisations of the syndrome, and have each undergone revisions of their criterion sets. One of the ways

in which the validity of the dependence syndrome, which underlies the systems, is assessed is by examining concordance among the systems. That is, do different methods of measuring dependence reflect a similar underlying domain? An examination of these issues is important if consensus is to be achieved on the components and characteristics of the dependence syndrome. Such consensus would also enhance research into the more fundamental processes underlying the development and maintenance of this disorder.

Psychometric theory dictates that if the DSM and ICD have a common conceptual underpinning, and if the underlying concept of dependence is valid, then different instruments designed to operationalise dependence should agree on case identification, regardless of whether they are fully or semi-structured. A small number of studies indicate there is variable, but generally good, concordance between the DSM and ICD-10 operationalisations of the *dependence* syndrome for many drug classes. The evidence for the validity of a cannabis dependence syndrome is more equivocal. Some studies have reported good to excellent agreement within and across DSM and ICD classification systems, using different instruments and in a variety of geographic locations (e.g., Hasin, Grant et al, 1997; Rapaport et al, 1993; Rounsaville et al, 1993). Other studies have appeared more discordant in their findings (e.g., Compton, Cottler et al, 1996a, 1996b; Cottler, Robins et al, 1991). Even in the studies in which good agreement was exhibited, agreement coefficients were lower for cannabis than other drug classes. In all these studies, for all drug classes, there was poor agreement between the DSM and ICD-10 operationalisations of *abuse and harmful use*, primarily reflecting conceptual differences in these diagnostic categories between the 2 systems.

The data from the NSMHWB indicate that when measured using an automated version of the CIDI, excellent concordance was achieved between the DSM-IV and ICD-10 diagnoses of cannabis *dependence* in an Australian general population sample. That is, both systems appeared to measure the same underlying construct. This finding is strengthened by the strong positive correlations between the number of DSM-IV and ICD-10 dependence symptoms met – that is, a person who was severely dependent according to one system was also likely to be severely dependent on the other. Consistent with international research, there was poor agreement among the *abuse and harmful use* categories. It is also possible that the very low prevalence of abuse/harmful use and the attendant large standard errors may have constrained the assessment of validity, although Yule's Y statistic is more robust in these circumstances.

A novel feature of this research was an exploratory investigation of the correlates of level of cannabis involvement among Australian adults. Previous population-based research has not examined predictors of cannabis dependence, but correlates of continued cannabis involvement and frequent use, which could increase the likelihood of dependence. The multivariate analyses of this sample support existing literature on the influence of age and gender on cannabis use (e.g., Bachman et al, 1997; Chen and Kandel, 1995; Donnelly and Hall, 1994; Kandel, 1984; Kandel et al, 1997). Thus, after adjusting for other variables, males were more likely to be heavily involved in cannabis use than females, as were those aged 18-24 years of age. Other demographic correlates of involvement suggested that being unemployed, and not living in a married/defacto relationship increased the risk of cannabis dependence, while being outside the labour force and being born in a non-English speaking

country were protective. There is little research examining the relationship between cannabis use and these variables, so these findings needs to be replicated.

Consistent with the literature on comorbidity, these findings illustrate the likely co-occurrence of cannabis dependence and other drug use. Thus, those who were more heavily involved in cannabis use were more likely to be current tobacco smokers, to be alcohol dependent and to have used a greater number of illicit drugs in the last year than those who were less involved in cannabis use. The personality trait of neuroticism was also associated with greater involvement, over-riding the effects of whether a person had an anxiety or affective disorder. High levels of trait neuroticism have previously been shown to be associated with more frequent alcohol (e.g., Prescott, Neale, Corey and Kendler, 1997; Rankin, Stockwell and Hodgson, 1982), tobacco (Kendler et al, 1999) and cannabis (Sieber and Angst, 1990; Wells and Stacey, 1976) use, and anxiety and depression (Kendler et al, 1992). Thus, those with this personality style may be predisposed to engaging in frequent substance use, and developing anxiety or depressive disorders. In general, those with comorbid disorders have been shown to experience greater disability and poorer outcomes than those with a single disorder (Kessler, 1995).

The health utilisation data suggested that those with cannabis dependence were approximately three times as likely as those without to have had a recent mental health consultation. However, the above analyses indicate the need to control for other potential correlates of help-seeking, such as concurrent substance use or comorbid disorders. This suggests that people presenting to services who meet a cannabis dependence diagnosis may have a complex clinical picture that needs careful assessment.

Some have argued that cannabis dependence has few clinical implications, being no worse than caffeine or television dependence. Among a general population sample such as this, in which most users reported few symptoms, a large proportion may not require or seek professional intervention (Anthony and Helzer, 1991). Nevertheless, some users do seek help for cannabis-related problems, and find it extremely difficult to control their use (Budney et al, 1998; Copeland, Rees and Swift, 1999; Stephens et al, 1993), indicating that, as for other drugs, its effects are not completely benign and should not be trivialised. A key challenge is to identify when, and with whom, to provide what sort of intervention (e.g., see Allsop, 1990; Hall and Teesson, in press; Jarvis, 1994; Mraczek and Haggerty, 1994; Rounsaville and Kleber, 1985).

Conclusions

Data from the first study on the prevalence of substance use and mental health disorders among Australian adults revealed that cannabis use disorders were the most common form of illicit drug use diagnoses. Cannabis dependence comprised the bulk of disorder diagnoses. Contrary to common perceptions of cannabis dependence, withdrawal symptoms were the most commonly reported criterion. While, on average, users clustered at the mild end of the continuum of dependence severity, cannabis dependence was significantly associated with several demographic, substance use and mental health variables. DSM-IV and ICD-10 cannabis dependence appeared to be unidimensional syndromes, and there was good agreement between these systems in diagnosing dependence, but not abuse. The

significance of cannabis dependence needs further investigation, particularly its clinical relevance and its causal significance in the likelihood of developing adverse health outcomes. Cross-sectional surveys such as these thus need to be supplemented by longitudinal research and intervention studies.

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Appendix 1a: DSM-IV substance use disorders
(American Psychiatric Association, 1994)

DSM-IV abuse
A maladaptive pattern of substance use leading to clinically significant impairment or distress. It requires the presence of at least one of the following in a 12 month period:

1 recurrent substance use resulting in a failure to fulfill major role obligations at work, school or home

2 recurrent substance use in situations in which it is physically hazardous

3 recurrent substance-related legal problems

4 continued substance use despite persistent or recurrent social or interpersonal problems caused or exacerbated by use

The person has not met the criteria for substance dependence for this substance.

DSM-IV dependence
a maladaptive pattern of substance use that leads to clinically significant impairment or distress. It requires the presence of at least three out of seven of the following criteria in the same 12 month period:

1 tolerance defined by either a need for markedly increased amounts of the substance to achieve intoxication or desired effect, markedly diminished effect with continued use of the same amount of the substance*

2 withdrawal, manifested by a characteristic withdrawal syndrome or the use of the same (or a closely related) substance to relieve or avoid withdrawal symptoms*

3 the substance is often taken in larger amounts or over a longer period than was intended

4 there is a persistent desire or unsuccessful efforts to cut down or control substance use

5 a great deal of time is spent in activities necessary to obtain the substance, or recover from its effects

6 important social, occupational, or recreational activities are given up or reduced because of substance use

7 the substance use is continued despite knowledge of having a persistent or recurrent physical or psychological problem that is likely to have been caused or exacerbated by the substancetolerance,

- does not consider cannabis tolerance or withdrawal necessary or sufficient: can use specifiers of "with physiological dependence" (tolerance or withdrawal present) or "without physiological dependence" (neither present).

Appendix 1b: ICD-10 substance use disorders
(World Health Organization, 1993).

ICD-10 harmful use

1 There must be clear evidence that the substance use was responsible for (or substantially contributed to) physical or psychological harm, including impaired judgment or dysfunctional behaviour, which may lead to disability or have adverse consequences for interpersonal relationships

2 The nature of the harm should be clearly identifiable

3 The pattern of use has persisted for at least one month or has occurred repeatedly within a 12 month period

4 The person does not meet criteria for dependence or other substance use disorders (except for acute intoxication) for the same drug over the same time period

ICD-10 dependence
Three or more of the following occurring together for at least one month, or if persisting for periods of less than one month, should have occurred together repeatedly within a 12-month period:

1 a strong desire or sense of compulsion to take the substance

2 impaired capacity to control the use of a substance, in terms of onset, termination, or levels of use, as evidenced by: the substance being often taken in larger amounts or over a longer period than intended, or by a persistent desire or unsuccessful efforts to reduce or control substance use

3 a physiological withdrawal state as evidenced in the characteristic withdrawal syndrome, or by use of the same (or closely related) substance to relieve or avoid withdrawal symptoms

4 tolerance

5 preoccupation with substance use, manifested by neglect of alternative pleasures, or by a great deal of time spent in activities necessary to obtain, take, or recover from the effects of the substance

6 persisting substance use despite clear evidence of harmful consequences

Appendix 2a: Demographic correlates of level of cannabis involvement (%) (±SE).

	Non-users* (n=9919) % who were…	Non-dependent users* (n=572) % who were…	DSM-IV dependent users* (n=150) % who were…
Gender (χ^2, 2df=126.5, p<0.0001)			
Male	47.6 (0.3)	67.8 (2.6)	76.6 (6.2)
Female	52.4 (0.4)	32.2 (2.0)	23.4 (3.7)
Age (χ^2, 10df=747.5, p<0.0001)			
18-24	11.7 (0.2)	32.9 (2.0)	53.4 (5.4)
25-34	19.8 (0.3)	37.7 (2.1)	33.6 (4.5)
35+	68.5 (0.4)	29.4 (1.9)	13.0 (2.8)
Country of birth (χ^2, 4df=36.3, p<0.0001)			
Australia	74.2 (0.3)	82.5 (2.9)	84.6 (6.5)
Overseas/ES	11.4 (0.2)	11.9 (1.3)	7.6 (2.1)
Overseas/NESB	14.5 (0.2)	5.5 (0.9)	7.8 (2.1)
Education (χ^2, 4df=16.0, p=0.003)			
Secondary incomplete	33.5 (0.3)	29.0 (1.9)	42.8 (5.0)
Completed secondary	15.6 (0.2)	19.4 (1.6)	19.1 (3.3)
Post-secondary	50.9 (0.4)	51.6 (2.4)	38.1 (4.8)
Employment (χ^2, 6df=350.9, p<0.0001)			
Employed	62.6 (0.4)	74.9 (2.7)	64.2 (5.9)
Unemployed	3.3 (0.1)	12.2 (1.3)	24.7 (3.8)
Not in labour force	34.0 (0.3)	12.8 (1.4)	11.2 (2.6)
Marital status (χ^2, 6df=539.1, p<0.0001)			
Married/defacto	67.2 (0.4)	40.4 (2.1)	28.8 (4.1)
Divorced/separated/widowed/never married	32.8 (0.3)	59.6 (2.5)	71.2 (6.1)
Geographic location (χ^2, 2df=3.6, p=0.17)			
Urban	72.4 (0.3)	75.4 (2.8)	75.8 (6.2)
Rural	27.6 (0.3)	24.6 (1.8)	24.2 (3.7)

*Cannabis use: used cannabis more than 5 times in the last 12 months; non-use: used 5 times or less

Appendix 2b: Substance use and mental health correlates of level of cannabis involvement (±SE).

	Non-users* (n=9919) % who were…	Non-dependent users* (n=572) % who were…	DSM-IV dependent users (n=150) % who were…
Tobacco (χ^2, 4df=590.9, p<0.0001) (%) Current use	22.1 (0.3)	57.3 (3.3)	75.0 (6.1)
Alcohol (χ^2, 2df=149.3, p<0.0001) (%) 12+ times	71.7 (0.3)	93.6 (3.0)	87.4 (6.6)
DSM-IV Alcohol use disorder (%) (χ^2, 2df=570.9, p<0.0001)	4.5 (0.2)	22.7 (1.7)	37.1 (4.8)
Number of illicit drugs+ used ($F_{1,721}$=35.2, p<0.0001) Mean (SD)	1.0 (<0.01)	1.8 (<0.01)	2.5 (<0.01)
DSM4 Stimulant, opioid or sedative use (%) disorder (χ^2, 2df=423.7, p<0.0001)	0.5 (0.07)	3.3 (0.7)	17.6 (3.2)
DSM4 affective disorder (%) (χ^2, 2df=73.0, p<0.0001)	6.2 (0.2)	12.9 (1.4)	13.6 (2.9)
DSM4 anxiety disorder (%) (χ^2, 2df=79.7, p<0.0001)	5.4 (0.2)	7.8 (1.1)	16.5 (3.1)
DSM4 affective/anxiety disorder (%) (χ^2, 2df=100.1, p<0.0001)	9.2 (0.2)	16.4 (1.5)	23.6 (3.7)
EPQ Score ($F_{1,721}$=18.7, p<0.0001) Mean (SD)	2.5 (<0.01)	3.1 (<0.01)	4.1 (<0.01)

* Cannabis use: used cannabis more than 5 times in the last 12 months; non-use: used 5 times or less
+: Stimulants, sedatives or opioids