2 Cannabis use: Epidemiology and risk factors

2.1 Cannabis dependence: Definition

Although many people will try cannabis at some point during their lives, most people do not progress to chronic, long term use. Most will experiment sporadically with cannabis during adolescence and early adulthood and cease use once reaching their mid- to late-20s [29]. However, there is a proportion that will use cannabis more often, for a longer period of time, and develop cannabis dependence. It has been estimated that approximately one in ten people who use cannabis once will become dependent [2]. For those that have used several times, the risk of dependence is about one in five, and for daily users the risk is one in two. Those who are dependent on cannabis are at a greater risk of experiencing the harms associated with cannabis use. Dependent cannabis users report cognitive and motivational problems, interpersonal relationship problems, memory deficits, and financial difficulties, all of which they associate with their dependence [26].

In the past, cannabis dependence was considered mild or non-existent. Its slow clearance from the body did not elicit an obvious withdrawal state like heroin or alcohol. The discovery of the brain’s cannabinoid system led to research that clearly showed cannabis withdrawal in animals [27]. Surveys of cannabis users [29] and laboratory studies [29] revealed cannabis tolerance (i.e. requiring increasingly greater amounts of a drug to obtain the desired psychoactive effect) as well as withdrawal. The two major diagnostic instruments—the Diagnostic and Statistical Manual of Mental Disorders (DSM-IV) and the International Classification of Diseases (ICD-10) recognise these signs of dependence and specify diagnostic criteria for cannabis use disorders (see Boxes 2.1 & 2.2).
### Box 2.1: Diagnostic Criteria for cannabis use disorders

*Diagnostic and Statistical Manual of Mental Disorders, fourth edition, text revision*

**Cannabis Abuse:**

A. A maladaptive pattern of substance use leading to clinically significant impairment or distress, as manifested by at least one of the following, occurring within a 12-month period:

1. Recurrent cannabis use resulting in a failure to fulfil major role obligations at work, school, or home
2. Recurrent cannabis use in situations in which it is physically hazardous
3. Recurrent cannabis-related legal problems
4. Continued cannabis use despite having persistent or recurrent social or interpersonal problems caused or exacerbated by the effects of cannabis

B. The symptoms have never met the criteria for Cannabis Dependence

**Cannabis Dependence:**

A maladaptive pattern of cannabis use, leading to clinically significant impairment or distress, as manifested by at least three of the following occurring at any time in the same 12-month period:

1. Tolerance, as defined by either of the following:
   a. a need for markedly increased amounts of the substance to achieve intoxication or desired effect
   b. markedly diminished effect with continued use of the same amount of the substance
2. Withdrawal, as manifested by either of the following:
   a. the characteristic withdrawal syndrome for cannabis
   b. cannabis, or a cannabis-like substance is taken to relieve or avoid withdrawal symptoms
3. Cannabis is often taken in larger amounts or over a longer period than was intended
4. A persistent desire or unsuccessful efforts to cut down or control cannabis use
5. A great deal of time is spent in activities necessary to obtain cannabis, use cannabis, or recover from its effects
6. Important social, occupational, or recreational activities are given up or reduced because of cannabis use
7. Cannabis 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 cannabis

*From the Diagnostic and Statistical Manual of Mental Disorders, fourth edition, text revision* [30]
### Box 2.2: Diagnostic Criteria for cannabis use disorders

**ICD-10 Classification of Mental and Behavioural Disorders**

#### Cannabis Dependence Syndrome

Three or more of the following manifestations should have occurred 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 cannabis-taking behaviour in terms of its onset, termination, or levels of use, as evidenced by: cannabis 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 when cannabis use is reduced or ceased, as evidenced by the characteristic cannabis withdrawal syndrome, or by the use of cannabis or similar substances with the intention of relieving or avoiding withdrawal symptoms;

4. evidence of tolerance to the effects of cannabis, such that there is a need for significantly increased amounts of cannabis to achieve intoxication or the desired effect, or a markedly diminished effect with continued use of the same amount of cannabis;

5. preoccupation with cannabis use, as manifested by important alternative pleasures or interests being given up or reduced because of cannabis use; or a great deal of time being spent in activities necessary to obtain, take or recover from the effects of cannabis;

6. persistent substance use despite clear evidence of harmful consequences, as evidenced by continued use when the individual is actually aware, or may be expected to be aware, of the nature and extent of harm.

#### Harmful Cannabis Use

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

B. The nature of the harm should be clearly identifiable (and specified)

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

D. The disorder does not meet the criteria for any other mental or behavioural disorder related to the same drug in the same time period (except for acute intoxication).

*From the International Classification of Diseases, tenth revision, Classification of Mental and Behavioural Disorders, World Health Organization, 1993*
2.2 Prevalence and patterns of use

Of the illicit substances in Australia, cannabis is the most widely used in the world; the United Nations Office on Drugs and Crime (UNODC) estimated that almost 160 million people worldwide used cannabis in 2005 [16]. This far outweighs the number of users of all other illicit substances put together (Figure 2.1). When comparing the use of cannabis, amphetamines, opiates and cocaine in Australia in 2004 [31] it is apparent that the proportion of Australians who reported using cannabis at least once in 2004 (11.3%) is about three times that of the world proportion in 2005 (3.8%).

Figure 2.1: Percent of people aged 15–64, who used these illicit drugs at least once in 2005 (United Nations Office on Drugs and Crime, 2007) or aged 14 and over in Australia in 2004 (AIHW, 2005)

In the United States of America (USA), the United Kingdom (UK) and Australia, the past-year prevalence of cannabis use may have declined slightly in recent years, although there are some methodological issues that may have contributed to the apparent decline. For example, in Australia, interviews are now conducted over the telephone, whereas they were previously conducted face-to-face. Both Aquilino [32] and Gfroerer and Hughes [33] found substantially lower rates of illicit drug use in a telephone interview format when compared to a face-to-face format.

From the first surveys in the 1970s, the use of cannabis in Australia increased steadily until at least 1998. Even with the recent decline in use, it remains the most widely used illicit drug in Australia. According to the most recent National Drug Strategy Household Survey, approximately one-third of Australians have tried cannabis, and about one in ten have used it in the past year [31]. Cannabis use is most prevalent among those aged in their 20s, and is more commonly used by males than females.
Use of cannabis has fallen since an apparent peak in 1998 [34]. The rise in lifetime use in Figure 2.2 can be explained by about 1 in 15 cannabis users ceasing use each year.

2.3 Risk factors for cannabis use and dependence

2.3.1 Reasons for cannabis use

The subjective effects of cannabis typically include; an initial non-specific sensory “buzz” or “rush”, euphoria and relaxation, labile mood (especially inexplicable mirth), altered sensory perceptions (usually perceived as enhanced), an increased focus on imagination and a reduced focus on the self. Most users find these effects pleasant, while a minority become disturbed, particularly if they interpret the sensory and cognitive alterations as pathologic. The effects are dependent upon both the route of administration and dose. The initial “buzz” seems more common with smoking and is probably due to the faster transfer of cannabinoids to the brain. High doses or lack of experience are usually implicated in producing negative effects, particularly those including disturbing sensory alterations or feelings of depersonalisation. A number of other acute effects such as drowsiness and increased appetite are less likely to be reasons for recreational use.

Gaining an understanding of the reasons why people use cannabis, or their motives for use, may help inform prevention and intervention programs [35]. Research into reasons for cannabis use has typically used two methods: collecting self-generated reasons for use using open-ended questions, or asking about specific reasons for use using the Marijuana Motives Measure (MMM) [36]. The MMM is a measure derived from the 20 item
Alcohol Motives Measure \cite{37} by adding five statements concerning the consciousness enhancing qualities of cannabis to that measure and altering the wording by substituting “use marijuana” for “drink”. Items are endorsed by frequency, from “Almost never/never” to “Almost always/always”. The MMM groups motives to use cannabis into five categories; enhancement (the positive effects of cannabis—to ‘get high’), coping (dealing with negative moods, such as depression and anxiety), social (facilitating socialisation), conformity (group identification/peer pressure) and expansion (cognitive and perceptual enhancement).

A study of American university students found that, of those who had used cannabis during their lifetime, enhancement and social motives were most commonly endorsed; conformity motives were the least common motives reported \cite{36}. Using multiple regression analysis, it was found that enhancement and coping significantly predicted cannabis use in the past six months with coping being a better predictor for females. Social motives predicted cannabis use problems.

A study using a sample of adolescents and young adults found that among males, enhancement motives were associated with higher frequency of cannabis use, and among females, expansion motives were associated with both higher frequency of use and cannabis dependence \cite{38}. Symptoms of anxiety and depression did not significantly predict frequency of cannabis use in this study, but in males borderline personality scores predicted dependence. This suggests that self medication of depression and anxiety is not the main determinant of frequency of cannabis use in adolescents and young adults.

Similarly, in another sample of American college students cannabis use was predicted by enhancement motives \cite{39}, replicating the above study \cite{38}. Cannabis-related problems were related to both impulsivity and using cannabis to cope with negative mood.

Another recent study found that all MMM factors except for conformity predicted frequency of cannabis use, with enhancement motives having the strongest relationship, replicating the earlier work \cite{40}. This study also found that cannabis users with higher levels of anxiety sensitivity than their peers were more likely to use cannabis due to the perception that it may reduce, or manage, negative emotional distress. Cannabis users with high levels of anxiety sensitivity are more likely to experience serious symptoms of anxiety, such as panic attacks \cite{41}. If those who are prone to anxiety tend to use cannabis to alleviate unpleasant sensations, their risk of experiencing symptoms of anxiety may be compounded by their cannabis use over the long-term, leading to a cycle of worsening anxiety \cite{40}\cite{42}. Buckner et al. \cite{44} found a similar pattern of associations between motives and cannabis use, but noted that problems attributed to cannabis were more closely related to social anxiety and obsessive–compulsive behaviours than anxiety sensitivity. It should be noted that reports of increased anxiety when cannabis users are observed have not been replicated when users self-report and are not directly observed \cite{43}.

Comeau and colleagues \cite{45} sampled a younger population than most other researchers, with a mean age of just over fifteen years. As only those who acknowledged use of a substance completed the relevant measures of motivation, it was not possible to test associations between motives and usage. Anxiety sensitivity scores were associated with endorsing conformity motives for cannabis use. As this study used an instrument that did not assess expansion motives, the results should be interpreted with some caution.
One criticism of the MMM is that it has been adapted from a measure of alcohol use motives, and although cannabis-specific motives were added, these may not capture all the motives that are unique to cannabis. Recently, Lee and colleagues [46] examined self-generated reasons for cannabis use in 634 students about to enter college. Nineteen distinct motives for cannabis use were identified: enjoyment; conformity; experimentation; social enhancement; boredom; relaxation; coping; availability; perceived low risk; altered perception; activity enhancement; rebellion; alcohol intoxication; food enhancement; anxiety reduction; image enhancement; celebration; medical use; and habit. The first six of these reasons for cannabis use were the most highly endorsed, in descending order. Using multiple regression, it was found that experimentation was associated with less use and problems, whereas habit was associated with more frequent use and coping was associated with more problems [46].

It is apparent that the motives for using cannabis are numerous and vary widely between users. This should alert us to the complexity of the effects of cannabis. Such an insight may help to understand the sometimes contradictory findings to be reviewed.
<table>
<thead>
<tr>
<th>Study</th>
<th>Sample</th>
<th>Cannabis use measure</th>
<th>Motives measure</th>
<th>Most commonly endorsed reasons</th>
<th>Recent cannabis use</th>
<th>Predictors of use</th>
<th>Cannabis frequency</th>
<th>Cannabis problems</th>
<th>Cannabis dependence</th>
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</thead>
<tbody>
<tr>
<td>Simons et al.</td>
<td>161 American university students</td>
<td>Cannabis use in the past six months</td>
<td>MMM</td>
<td>Enhancement and social</td>
<td>Enhancement and coping (coping stronger for females)</td>
<td>Social and conformity</td>
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<td>(1998)</td>
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<tr>
<td>Comeau, Stewart &amp; Loba (2001)</td>
<td>508 Canadian secondary students</td>
<td>Ever used</td>
<td>TMMQ</td>
<td>Enhancement and social</td>
<td>Enhancement and social</td>
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<tr>
<td>Chabrol et al.</td>
<td>212 French adolescents and young adults</td>
<td>Cannabis use in the past six months</td>
<td>MMM</td>
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<td>Expansion (females)</td>
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<td>Simons et al.</td>
<td>309 American university students</td>
<td>Cannabis use in past 12 months</td>
<td>MMM</td>
<td>Enhancement and coping motives</td>
<td>Enhancement and coping motives</td>
<td>Coping motives</td>
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<td>(2005)</td>
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<tr>
<td>Buckner et al., (2007)</td>
<td>159 American university students</td>
<td>Ever used cannabis</td>
<td>MMM</td>
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<tr>
<td>Lee, Neighbors &amp; Woods, (2007)</td>
<td>634 American students entering college</td>
<td>Ever used cannabis</td>
<td>Open ended</td>
<td>Experiment, enhancement</td>
<td>Habit, enhancement, expansion, enjoyment and sex</td>
<td>Coping, habit, enjoyment, expansion, enhancement and experiment (–)</td>
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</table>
Among the studies using the MMM as an assessment of motives to use cannabis, it is clear that enhancement and expansion motives are related to cannabis use and social and coping motives are related to problems attributed to cannabis. Simons et al. [39] reported that motives increasing the frequency of cannabis use might indirectly lead to cannabis-related problems, since frequency of cannabis use was related to both motives to use cannabis and cannabis use problems. In the same study, cannabis problems were directly predicted by using cannabis to cope with negative mood.

Overall, it appears that cannabis users commonly cite enhancement of their activities and improved social relations as the primary motivations for continued use. Using cannabis to cope with negative mental states seems to be the most common motive associated with problems attributed to cannabis, with social and conformity motivations also contributing.

### 2.3.2 Reasons for cannabis use among those with existing mental health disorders

Reasons for cannabis use among those with a mental health problem are important in defining the causal relationship between the two, given that those with a mental health disorder are two to three times more likely to have a concurrent substance abuse problem [47]. Cannabis, like many other drugs, can exacerbate existing mental health problems, and it may be that those with a mental health disorder are particularly sensitive to the negative effects of cannabis [48]. While it has often been asserted that psychoactive recreational drugs are taken by those with mental health disorders to diminish the symptoms of the disorder [49] or the side effects of medication, it is disputed whether the anxiolytic or euphoric effects of such drugs are any more potent in those with mental health disorders [49][cf. 50]. However, those with mental health disorders are disproportionately likely to have common risk factors for recreational drug use such as unemployment, boredom, poverty and deviant social networks. Casual cannabis use by those with mental health disorders may be motivated by similar reasons to those reported by the general population.

Both research studies [51][52][53][54][55] and reviews [56][57] of the expressed reasons for cannabis use among those experiencing psychoses indicate that their reasons, while very similar to those of non-psychotic respondents, give more weight to reducing dysphoria, boredom and of course specific psychotic symptoms. Those abusing cannabis, as judged by the criteria of Drake et al. [48] were more likely to cite self-medication as a reason.

### 2.3.3 Awareness of the risks of cannabis use

The mental health risks of using cannabis are usually acknowledged by those with [52] and without [56] mental health problems, whether they are cannabis users or not. However, the perception of such risks varies greatly from complete ignorance or denial to risk perception far beyond what is warranted by the available evidence. While some individuals may be deterred from using cannabis by increased perception of risk [58], attempting to persuasively inflate such perceptions may have no effect in the population [60]. It appears that unless the cannabis user decides that the benefits of using are outweighed by the perceived or expected costs, he or she will continue to use.
2.3.4 Conclusion

Cannabis, like other recreational drugs, seems to be used for its perceived positive effects. The evidence from both those with mental health disorders and the general population suggests that using cannabis to manage negative mental states and facilitate social interaction is associated with problems. Both higher frequencies and negative consequences of cannabis use are associated with such use. However, the persistence of cannabis use in these cases speaks strongly for the importance of the positive effects to the user.

2.4 Other risk factors

A recent review of high quality studies assessing the relationship between cannabis and mental health found the following factors to be associated with the onset of cannabis use: being male; prior or concurrent tobacco and alcohol use; having poor parental relationships; and having peers who use cannabis [61]. These factors are all consistent with an Australian study of a large birth cohort [62].

A number of negative outcomes such as poor academic achievement, criminal activity, violent behaviour and conduct disorders are also associated with cannabis and other drug use. Problem Behavior Theory [63] has been one attempt to integrate this broad association of behavioural problems within a framework that emphasises the interaction of the individual and environment rather than simply identifying environmental factors that may influence behaviour. For every example of cannabis use leading to an undesirable outcome, there are typically many similar cases in which such an outcome did not eventuate. Discovering why both sorts of outcomes occur is central to understanding these associations.

Beyond the immediate mental health risks to the user of cannabis, it is also important to consider risks posed through prenatal use of cannabis to the unborn child. A recent systematic review of the neurodevelopmental consequences of prenatal exposure to toxins found that those exposed to cannabis prenatally were at an increased risk of having problems maintaining attention later in life [281]. There is also some evidence that prenatal cannabis exposure is related to experiencing depression and anxiety in childhood and adolescence [282][283]. Other research has found that cannabis use during pregnancy increases the likelihood of cannabis use among offspring at the age of 14 [284]. A recent Australian review in the area pointed out that associations found between prenatal cannabis use and subsequent adverse cognitive, behavioural and psychiatric outcomes may be confounded by unmeasured genetic and environmental factors [285].