RESEARCH REPORT

Alcohol, cannabis and tobacco use among Australians: a comparison of their associations with other drug use and use disorders, affective and anxiety disorders, and psychosis

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Abstract

Aim. To compare relationships between alcohol, cannabis and tobacco and indicators of mental health problems in the general population. Method. A survey of a nationally representative sample of 10 641 Australian adults (the National Survey of Mental Health and Well-Being (NSMHWB)) provided data on alcohol, cannabis and tobacco use and mental health (DSM-IV anxiety disorders, affective disorders, other substance use disorders and screening positively for psychosis). Findings. Alcohol showed a “J-shaped” relationship with DSM-IV affective and anxiety disorders: alcohol users had lower rates of these problems than non-users of alcohol, while those meeting criteria for alcohol dependence had the highest rates. Tobacco and cannabis use were both associated with increased rates of all mental health problems examined. However, after controlling for demographics, neuroticism and other drug use, cannabis was not associated with anxiety or affective disorders. Alcohol dependence and tobacco use remained associated with both of these indicators of mental health. All three types of drug use were associated with higher rates of other substance use problems, with cannabis having the strongest association. Conclusions. The use of alcohol, tobacco and cannabis are associated with different patterns of co-morbidity in the general population.

Introduction

Alcohol, tobacco and cannabis are among the most commonly used psychoactive substances in the western world. While many users do so without experiencing any problems related to their use, some do develop problems. The predominant classification of substance use problems (abuse and dependence) in psychiatry has been redefined through successive versions of the American Psychiatric Association’s Diagnostic and Statistical Manual of Mental Disorders.¹ The concept of “co-morbidity” between substance use problems and other mental health problems has emerged as an area of importance over the past few decades. Co-morbidity refers commonly to the overlap of two or more psychiatric disorders,² but recent work has distinguished between two types of co-morbidity.

Homotypic co-morbidity refers to the co-occurrence of disorders within a diagnostic grouping, such as two different substance use disorders (e.g. cannabis and alcohol). Heterotypic co-morbidity refers to the co-occurrence of two disorders from different diagnostic groupings, such as a substance use disorder with an anxiety disorder. The aim of this study is to compare the patterns of co-morbidity of alcohol, cannabis and tobacco with other mental health problems (heterotypic co-morbidity), and with other drug use and drug use disorders (homotypic co-morbidity).

There are good reasons to examine links between drug use and mental health. First, the co-occurrence of mental health problems with substance use disorders raises important questions about the aetiology of mental and substance use disorders. Secondly, if it is the case that substance use and misuse are associated with other mental health problems, this has implications for service provision: if a person with a substance use problem is likely to have other mental health problems, then someone presenting for treatment for a substance use problem may also require treatment for mental health problems and vice versa.

What do we know about the co-morbidity of alcohol, cannabis and tobacco use with other mental health problems?

There has been a considerable amount of research conducted on the relationship between substance use and other mental health problems. In general, the evidence to date suggests that people who are problematic users of one substance are more likely to have a range of other mental health problems and other substance use problems.\(^4,5\)

However, there appears to have been less direct comparison of the relationships of different drugs with other mental health problems. This comparative approach has previously been used to compare drugs’ dependence liability,\(^6\) as well as the relative risks of a range of physical health problems.\(^7\) Previous epidemiological surveys such as the Epidemiological Catchment Area study and the National Co-morbidity Survey have been analysed for patterns of co-morbidity between the use of individual substances, taken one at a time, and mental health,\(^8-10\) but a direct comparison of relationships between cannabis, alcohol and tobacco and mental health does not appear to have been conducted to date in the same population sample.

Explaining co-morbidity

Substance use disorders and mental disorders may be associated because one is the cause of the other. For example, substance use could cause mental disorders, or mental disorders could lead to substance use problems in attempts at self-medication. There may also be no causal relationship between substance use and mental health problems; rather, they may share common risk factors.\(^11,12\) Research suggests that genetic factors increase the risk of substance use disorders\(^13-19\) and it may be that these factors are common across different drug types. This is supported by evidence showing that nicotine and alcohol dependence are affected by common genetic and environmental vulnerabilities.\(^17\)

Multiple drug problems might be influenced by a common neurophysiological trait, given that different drugs act upon similar brain loci and upon the same neurotransmitter systems.\(^20,21\)

There is also some evidence that there are common causes of substance use disorders and mental disorders (i.e. for heterotypic co-morbidity). For example, research has suggested that common genetic factors increase the risk of alcohol dependence and anxiety and affective symptoms,\(^22\) as well as nicotine dependence and major depression.\(^23\) Shared environmental factors may also increase the likelihood of both alcohol dependence and major depression among women.\(^22\)

There is also a high degree of similarity between the social, demographic and environmental factors associated with substance use and mental health problems, factors such as social disadvantage, parental psychiatric illness and family dysfunction.\(^24-26\)

Any examination of relationships between substance use and mental health must take these potentially confounding factors into account. The present study will accordingly examine some potential common factors that may explain the co-occurrence of cannabis, alcohol and tobacco use and mental health problems. These potential common factors include demographic characteristics of users and the personality trait of neuroticism.

If we can compare directly different drug types for their relationships with mental health prob-
problems, we can begin to understand whether involvement with any drug is a marker of poor mental health in general, or if different drugs have a different pattern of relationships with other mental health problems.

Aims
The present study aims to examine relationships between alcohol, tobacco and cannabis use, and other drug use and mental health in a nationally representative sample of Australians aged 18 years and over. The sampling means that we can be confident that the results found are representative of the Australian community in general. The survey assessed participants using standardized diagnostic criteria that have been shown to be reliable and valid. The aims of the present study were as follows:

1. To compare the relationships between the level of involvement with use of alcohol, tobacco and cannabis, and the following indices of mental wellbeing:
   
   (a) other drug use and DSM-IV drug use disorders;
   (b) DSM-IV affective disorders;
   (c) DSM-IV anxiety disorders;
   (d) screening positively for psychosis.

2. To examine whether any relationships between alcohol, tobacco and cannabis and mental health are explained by other factors such as demographic characteristics and neuroticism.

Method
The NSMHWB sample was a representative sample of 10,641 residents in private dwellings across all States and Territories in Australia, conducted by the Australian Bureau of Statistics (ABS) in 1997. The sampling design of the NSMHWB has been discussed in greater detail previously. Trained survey interviewers met with each designated respondent to administer the interview. The interviewers were given 24-hour access to a psychiatrist to deal with any concerns that arose in the course of the interview. The interviewer read the questions and recorded responses on a laptop computer. This method of administration has been shown to have excellent agreement with paper-and-pencil recorded responses.

Questioning was restricted to symptoms in the last 12 months. Mental disorders were assessed by a modified version of the CIDI, which yielded diagnoses of ICD-10 and DSM-IV disorders. The validity and reliability of the CIDI have been discussed elsewhere.

Assessment of alcohol, cannabis and other drug use, abuse and dependence
All people were asked whether they currently used tobacco. Respondents were asked if they had consumed at least 12 standard drinks (10 g alcohol) within the past 12 months. All those who reported such use, and who had consumed more than three standard drinks on one occasion, were assessed for symptoms of DSM-IV alcohol abuse and dependence.

People were asked if they had used a number of drug types (selected to reflect the most widely used extramedical drugs among Australian adults) more than five times in the past 12 months. All those who reported such use were assessed for symptoms of DSM-IV abuse and dependence. The drug groups were: cannabis (marijuana and hashish); stimulants: amphetamines, ecstasy, speed and other stimulants which can be obtained by medical prescription including, dexamphetamine, priludin and ritalin; sedatives: barbiturates and tranquillizers and other sedatives which can be obtained by medical prescription including, ativan, librium, megoat, normison, rohypnol, serepax, valium, xanax; and opioids such as heroin and opium as well as other opioids and analgesics which can be obtained on medical prescription, including codeine, doloxene, medadone, morphine, percocan and pethidine.

In the present paper, involvement with cannabis use was categorized as a four-level variable: fewer than six occasions of use in the past 12 months (termed “no use”), more frequent use without meeting criteria for DSM-IV abuse or dependence (“cannabis use”), DSM-IV cannabis abuse and DSM-IV cannabis dependence. A four-level alcohol use variable was also created: no alcohol use in the past 12 months, alcohol use without meeting criteria for a DSM-IV disorder, meeting criteria for DSM-IV alcohol abuse and meeting criteria for DSM-IV alcohol dependence. All people were asked if they currently
smoked. Because nicotine abuse and dependence were not assessed, tobacco use was categorized as “use” or “no current use”. It is likely that the majority of people who reported current tobacco use would have been nicotine dependent, since previous research has estimated that 55–87% of current tobacco users are nicotine-dependent.\textsuperscript{35,36}

**Diagnostic assessment of anxiety disorders**

If respondents reported that they had an unusually strong fear or avoidance of a range of social situations in the past 12 months, they were assessed for DSM-IV social phobia. All people were asked if they had had an unusually strong fear or avoidance of situations, such as being outside home alone or on a bus. If so, they were assessed for symptoms of DSM-IV agoraphobia. All people were asked if they had had attacks of fear in which they felt anxious, frightened or very uneasy, which did not occur in a life-threatening situation and which was unexpected; if so, they were assessed for symptoms of DSM-IV panic disorder. All people were asked if they had had a period of at least 1 month in the past year when they felt generally anxious or worried, and if so, they were asked about symptoms of DSM-IV generalized anxiety disorder.

People who reported they had been bothered by recurrent unpleasant and persistent thoughts in the past 12 months were assessed for DSM-IV obsessive-compulsive disorder. Finally, all people were asked if they had ever experienced a range of extremely stressful or upsetting events (such as being in combat, being sexually assaulted); those who had were assessed for DSM-IV post-traumatic stress disorder.

**Diagnostic assessment of affective disorders**

All people were asked if they had had a period of at least 2 weeks in the past 12 months when they had felt sad or depressed, or had lost interest in most things. Those who had were assessed for DSM-IV major depression. All people were asked if they had had a period of at least 2 years where they felt sad or depressed most days, without having an interruption of such feelings for 2 months. Those who reported this, and for whom the period had extended into the past year, were assessed for DSM-IV dysthymia. People were assessed for DSM-IV bipolar I and II disorders if they reported a period of at least 4 days where they were so happy or excited that they got into trouble or friends/family were concerned.

**Psychosis screener**

The psychosis screener comprised seven items; the first six items covered the following features of psychotic disorders: delusions of control, thought interference and passivity; delusions of reference or persecution; and grandiose delusions. The final item assessed whether a respondent had ever received a diagnosis of schizophrenia. Scores on the screener ranged from zero to a maximum of six. An analysis of the effectiveness of this screener in detecting cases of schizophrenia or schizoaffective disorders has been carried out, using a sample of people from an inpatient psychiatric setting, and a sample of people from a variety of mental health services [unpublished analyses; contact the authors of this paper for further details]. This analysis indicated that scores of three or more discriminated adequately between cases and non-cases of schizophrenia or schizoaffective disorder.

**Measures**

Demographic variables included gender; age (18–24 years, compared to 25–34, 35+); education (completed less than secondary education; compared to completed secondary education, completed post-secondary education); marital status (currently married/de facto; compared to separated/divorced/widowed/never married); employment status (employed full-time/part-time; compared to unemployed/not in the labour force). Scores on the neuroticism scale of the Eysenck Personality Questionnaire (EPQ) were also included.\textsuperscript{37}

**Data analysis**

Prevalence estimates were weighted to conform to independent population estimates by State, part of State, age and sex. In addition, balanced repeated replicate weights were used to account for the complex survey sampling design. Prevalence estimates and their standard errors were calculated using SUDAAN Version 7.5.3.\textsuperscript{38}
Multiple regressions

Multiple logistic regressions were carried out for each dichotomous outcome variable (e.g. presence/absence of a DSM-IV affective disorder). All analyses were carried out using STATA 5.0 for Windows. Bivariate regressions were carried out first, in which only alcohol, cannabis or tobacco use variables were included. This was followed by a series of multiple logistic regression analyses in which the following sets of variables were added in the regression model at each subsequent step:

1. Demographic variables.
2. Other drug use: stimulant, sedative or opiate use in the past 12 months.
3. EPQ Neuroticism score.

Results

Alcohol was the most widely used substance, with two-thirds of Australian adults (68%) reporting they had used alcohol in the past year without meeting criteria for a use disorder, and a further 6% meeting criteria for alcohol abuse (1.9%) or dependence (4.1%). One-quarter (25%) of Australian adults reported current tobacco use. One in 20 people (5%) reported cannabis use more than five times in the past year without meeting criteria for a use disorder, while 2.2% met criteria for cannabis abuse (0.7%) or dependence (1.5%) in the past year.

Sedative/stimulant/opiate use and use disorders

Table 1 shows the prevalence of the use of sedatives, stimulants or opiates within the past 12 months, according to the level of involvement with cannabis, alcohol and tobacco. In all figures presented, tobacco use has been placed in the “use” category, as nicotine dependence was not formally assessed. None the less, it is likely that a significant proportion of people who reported using tobacco would have met criteria for nicotine dependence.

Cannabis use of all levels was associated with a higher prevalence of use of sedatives, stimulants or opiates (cannabis use 14%, cannabis

Table 1. Bivariate and adjusted odds ratios (OR) and 95% confidence intervals (95%CI) for other drug use according to alcohol, cannabis and tobacco use

<table>
<thead>
<tr>
<th>Sedative, stimulant or opiate use</th>
<th>Prevalence</th>
<th>OR</th>
<th>95%CI</th>
<th>Adjusted OR</th>
<th>Adjusted 95%CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>No alcohol use</td>
<td>2.8 (0.4)</td>
<td>1.00</td>
<td>—</td>
<td>1.00</td>
<td>—</td>
</tr>
<tr>
<td>Alcohol use</td>
<td>3.0 (0.4)</td>
<td>1.23</td>
<td>0.94, 1.60</td>
<td>1.29</td>
<td>0.97, 1.71</td>
</tr>
<tr>
<td>Alcohol abuse</td>
<td>10.9 (2.8)</td>
<td>4.13</td>
<td>2.41, 7.10</td>
<td>2.55</td>
<td>1.41, 4.57</td>
</tr>
<tr>
<td>Alcohol dependence</td>
<td>15.3 (3.2)</td>
<td>7.26</td>
<td>5.15, 10.26</td>
<td>3.06</td>
<td>2.07, 4.57</td>
</tr>
<tr>
<td>No cannabis use</td>
<td>2.6 (0.2)</td>
<td>1.00</td>
<td>—</td>
<td>1.00</td>
<td>—</td>
</tr>
<tr>
<td>Cannabis use</td>
<td>14.4 (2.2)</td>
<td>5.81</td>
<td>4.37, 7.69</td>
<td>4.38</td>
<td>3.18, 6.04</td>
</tr>
<tr>
<td>Cannabis abuse</td>
<td>12.4 (4.1)</td>
<td>5.35</td>
<td>2.72, 10.49</td>
<td>3.22</td>
<td>1.55, 6.75</td>
</tr>
<tr>
<td>Cannabis dependence</td>
<td>26.8 (9.0)</td>
<td>11.32</td>
<td>7.61, 16.79</td>
<td>6.75</td>
<td>4.25, 10.70</td>
</tr>
<tr>
<td>No tobacco use</td>
<td>2.8 (0.2)</td>
<td>1.00</td>
<td>—</td>
<td>1.00</td>
<td>—</td>
</tr>
<tr>
<td>Tobacco use</td>
<td>6.1 (0.5)</td>
<td>2.27</td>
<td>1.84, 2.78</td>
<td>1.21</td>
<td>0.95, 1.53</td>
</tr>
</tbody>
</table>

Sedative, stimulant, opiate use disorder

| No alcohol use                                   | 0.7 (0.3)  | 1.00| —      | 1.00        | —             |
| Alcohol use                                      | 0.6 (0.1)  | 0.74| 0.44, 1.24 | 0.77        | 0.44, 1.34    |
| Alcohol abuse                                    | 2.2 (1.3)  | 2.90| 1.00, 8.50 | 1.20        | 0.37, 3.86    |
| Alcohol dependence                               | 7.3 (2.3)  | 9.96| 5.70, 17.37 | 2.73        | 1.41, 5.26    |
| No cannabis use                                   | 0.5 (0.1)  | 1.00| —      | 1.00        | —             |
| Cannabis use                                     | 3.1 (1.1)  | 5.58| 3.14, 9.98 | 3.10        | 1.63, 5.90    |
| Cannabis abuse                                   | 4.1 (3.2)  | 7.27| 2.22, 23.76 | 3.10        | 0.84, 10.91   |
| Cannabis dependence                              | 17.6 (6.7) | 34.52| 20.49, 56.83 | 14.00       | 7.38, 26.74   |
| No tobacco use                                    | 0.4 (0.1)  | 1.00| —      | 1.00        | —             |
| Tobacco use                                       | 2.4 (0.4)  | 4.69| 3.10, 7.09 | 1.90        | 1.24, 3.19    |

1 Adjusted for age, gender, educational attainment, marital status, employment status and neuroticism.
abuse 12%, cannabis dependence 27%) than non-users (3%), with odds ratios ranging from 5.4 to 11.3 (Table 1). The association with alcohol use was less strong (Table 1). Alcohol use (without disorder) was not associated with an increased likelihood of using sedatives, stimulants or opiates. Those meeting criteria for alcohol abuse or dependence were more likely than users/non-users to report use of these other drug types (ORs 4.1, 7.3, respectively). Tobacco use was associated with a doubling of the odds of having used these other drug types (6% vs. 3%, OR 2.3; Table 1).

A similar pattern emerged when considering other drug use disorders. Cannabis use (regardless of the level of involvement) was strongly associated with problematic drug use (Table 1). By far the strongest marker of other drug use disorders was cannabis dependence, which was associated with a 34.5 times greater likelihood of meeting criteria for another drug use disorder (compared to non-users of cannabis). Those who were alcohol dependent were 10 times more likely to meet criteria for another drug use disorder than non-drinkers (Table 1). The other alcohol use groups (use and abuse) did not differ significantly form non-users of alcohol in the likelihood of meeting criteria for another drug use disorder. Tobacco use, in contrast, was a significant marker of increased risk of meeting criteria for another drug use disorder, with increased odds relative to non-users of 4.7 (95% CI 3.1, 7.1).

Table 1 also shows the odds ratios produced after accounting for other factors that may have explained the higher rates of other drug use among cannabis, alcohol and tobacco users. After adjusting for these other factors, tobacco use was no longer associated with an increased likelihood of using sedatives, stimulants or opiates (OR 1.2, 95% CI 0.95, 1.53). In contrast, all levels of cannabis involvement remained associated with an increased likelihood of using these other drug types in multivariate analysis, with adjusted odds ratios of between 3.2 and 6.8 (Table 1). Alcohol abuse and alcohol dependence also remained associated other drug use: those meeting criteria for alcohol abuse or dependence were still around three times more likely than non-users to report using at least one of these other drug types.

While the strength of these relationships was significantly reduced in all cases, the relative patterns changed very little after controlling for demographics and neuroticism (Table 1). Those who were cannabis-dependent still had the highest odds compared to non-users of meeting criteria for other drug use disorders (OR = 14.0). Those meeting criteria for alcohol dependence (OR 2.7) and tobacco users (OR 1.9) still had increased odds; cannabis use (OR 3.1) was still associated with meeting criteria for another drug use disorder. Although the odds ratio for cannabis abuse was no longer significant, this may have been due to the small sample size and corresponding lack of precision of the estimates (OR 3.1, 95% CI 0.8, 10.9).

Affective and anxiety disorders
Table 2 shows the prevalence of DSM-IV affective and anxiety disorders according to alcohol use, cannabis use and tobacco use, and the odds ratios of these disorders among users compared to non-users. The prevalence of affective disorders was increased among those who met criteria for alcohol dependence, compared to non-drinkers. Alcohol-dependent people were 4.5 times more likely to meet criteria for an affective disorder than non-drinkers (24% vs. 7%, respectively). In contrast, however, those who reported drinking without meeting criteria for an alcohol use disorder had a significantly lower rate of affective disorders compared to non-drinkers (5.5% vs. 7.3%). Those meeting criteria for alcohol abuse (6%) did not differ from non-drinkers in the proportion who met criteria for an affective disorder. In comparison, cannabis use of all levels was associated with higher rates of affective disorders, with odds ratios of between 2.2 and 2.9 compared to non-users (Table 2). Tobacco use was also associated with a doubling of the likelihood of meeting criteria for an affective disorder (OR 2.2).

A similar pattern was observed for anxiety disorders. Alcohol dependence and cannabis dependence were associated with similarly increased risks of anxiety disorder (OR 4.4 and 4.3, respectively), while tobacco use was associated with a 2.4 times greater chance of meeting criteria for an anxiety disorder (Table 2). Alcohol users who did not meet criteria for an alcohol use disorder were less likely to have an anxiety disorder than non-drinkers (4.5% vs. 6.5% respectively), while those meeting criteria for alcohol abuse did not have a significantly
Table 2. Bivariate and adjusted odds ratios (OR) and 95% confidence intervals (95%CI) of DSM-IV affective and anxiety disorders according to alcohol, tobacco and cannabis use

<table>
<thead>
<tr>
<th>DSM-IV affective disorder</th>
<th>Prevalence</th>
<th>OR</th>
<th>95%CI</th>
<th>Adjusted OR¹</th>
<th>Adjusted 95%CI¹</th>
</tr>
</thead>
<tbody>
<tr>
<td>No alcohol use</td>
<td>7.3 (0.4)</td>
<td>1.00</td>
<td>—</td>
<td>1.00</td>
<td>—</td>
</tr>
<tr>
<td>Alcohol use</td>
<td>5.5 (0.3)</td>
<td>0.82</td>
<td>0.70, 0.97</td>
<td>0.98</td>
<td>0.81, 1.19</td>
</tr>
<tr>
<td>Alcohol abuse</td>
<td>6.1 (2.0)</td>
<td>0.90</td>
<td>0.50, 1.60</td>
<td>0.64</td>
<td>0.34, 1.21</td>
</tr>
<tr>
<td>Alcohol dependence</td>
<td>24.0 (4.0)</td>
<td>4.47</td>
<td>3.48, 5.74</td>
<td>1.98</td>
<td>1.45, 2.72</td>
</tr>
<tr>
<td>No cannabis use</td>
<td>6.2 (0.3)</td>
<td>1.00</td>
<td>—</td>
<td>1.00</td>
<td>—</td>
</tr>
<tr>
<td>Cannabis use</td>
<td>12.1 (2.7)</td>
<td>2.24</td>
<td>1.73, 2.91</td>
<td>1.30</td>
<td>0.94, 1.79</td>
</tr>
<tr>
<td>Cannabis abuse</td>
<td>18.6 (5.3)</td>
<td>2.88</td>
<td>1.61, 5.17</td>
<td>1.46</td>
<td>0.73, 2.90</td>
</tr>
<tr>
<td>Cannabis dependence</td>
<td>13.6 (2.6)</td>
<td>2.85</td>
<td>1.86, 4.35</td>
<td>0.91</td>
<td>0.54, 1.54</td>
</tr>
<tr>
<td>No tobacco use</td>
<td>5.4 (0.4)</td>
<td>1.00</td>
<td>—</td>
<td>1.00</td>
<td>—</td>
</tr>
<tr>
<td>Tobacco use</td>
<td>10.9 (0.8)</td>
<td>2.20</td>
<td>1.90, 2.54</td>
<td>1.48</td>
<td>1.24, 1.76</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>DSM-IV anxiety disorder</th>
<th>Prevalence</th>
<th>OR</th>
<th>95%CI</th>
<th>Adjusted OR¹</th>
<th>Adjusted 95%CI¹</th>
</tr>
</thead>
<tbody>
<tr>
<td>No alcohol use</td>
<td>6.5 (0.5)</td>
<td>1.00</td>
<td>—</td>
<td>1.00</td>
<td>—</td>
</tr>
<tr>
<td>Alcohol use</td>
<td>4.5 (0.4)</td>
<td>0.78</td>
<td>0.65, 0.93</td>
<td>1.01</td>
<td>0.81, 1.25</td>
</tr>
<tr>
<td>Alcohol abuse</td>
<td>4.9 (1.9)</td>
<td>0.73</td>
<td>0.37, 1.44</td>
<td>0.49</td>
<td>0.23, 1.05</td>
</tr>
<tr>
<td>Alcohol dependence</td>
<td>19.5 (2.7)</td>
<td>4.42</td>
<td>3.39, 5.75</td>
<td>1.85</td>
<td>1.31, 2.62</td>
</tr>
<tr>
<td>No cannabis use</td>
<td>5.4 (0.3)</td>
<td>1.00</td>
<td>—</td>
<td>1.00</td>
<td>—</td>
</tr>
<tr>
<td>Cannabis use</td>
<td>8.0 (1.2)</td>
<td>1.78</td>
<td>1.31, 2.41</td>
<td>0.87</td>
<td>0.59, 1.27</td>
</tr>
<tr>
<td>Cannabis abuse</td>
<td>6.4 (2.8)</td>
<td>1.10</td>
<td>0.44, 2.73</td>
<td>0.37</td>
<td>0.13, 1.04</td>
</tr>
<tr>
<td>Cannabis dependence</td>
<td>16.5 (2.6)</td>
<td>4.30</td>
<td>2.88, 6.40</td>
<td>1.41</td>
<td>0.84, 2.39</td>
</tr>
<tr>
<td>No tobacco use</td>
<td>4.5 (0.3)</td>
<td>1.00</td>
<td>—</td>
<td>1.00</td>
<td>—</td>
</tr>
<tr>
<td>Tobacco use</td>
<td>9.3 (0.8)</td>
<td>2.42</td>
<td>2.07, 2.83</td>
<td>1.66</td>
<td>1.36, 2.01</td>
</tr>
</tbody>
</table>

¹Adjusted for age, gender, educational attainment, marital status, employment status and neuroticism.

different risk of meeting criteria for an anxiety disorder compared to non-drinkers (Table 2).

These patterns changed markedly after multiple regression analysis (Table 2). No level of cannabis use was associated with an increased risk of meeting criteria for an affective disorder after the effects of demographics, other drug use and neuroticism were considered. The significant univariate association disappeared after controlling for tobacco, alcohol and cannabis and other drug use. In contrast, alcohol dependence and tobacco use remained associated with a higher likelihood of meeting criteria for an affective disorder. Alcohol dependent people were still twice as likely to meet criteria for an affective disorder (OR 2.0), while tobacco users were still 1.5 times as likely. As can be seen in Table 2, cannabis use was not associated with anxiety disorders after multiple regressions. This relationship disappeared after including alcohol, tobacco and other drug use in the analysis. Alcohol use and abuse were also not significantly associated with anxiety disorders. In contrast, alcohol dependence and tobacco use remained significant markers of anxiety disorders (OR 1.9 and 1.7, respectively).

Psychosis

Table 3 shows the association between screening positively on the psychosis screen and alcohol, cannabis and tobacco use. As can be seen in the univariate odds ratios, cannabis use of any level, alcohol dependence and tobacco use were all associated with significantly increased odds of screening positively for psychosis (Table 3). Those meeting criteria for alcohol dependence were 6.4 times more likely than non-drinkers to screen positively, while tobacco users were 4.7 times more likely. Cannabis dependence was associated with an 11-fold higher odds of screening positively for psychosis compared to non-users (OR 10.8). Alcohol use and abuse were not associated with increased risks of screening positively for psychosis compared to non-use of alcohol.
Table 3. Bivariate and adjusted odds ratios (OR) and confidence intervals (95%CI) of screening positively for psychosis according to alcohol, tobacco and cannabis use

<table>
<thead>
<tr>
<th></th>
<th>Prevalence</th>
<th>OR</th>
<th>95%CI</th>
<th>Adjusted OR</th>
<th>Adjusted 95%CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>No alcohol use</td>
<td>0.7 (0.2)</td>
<td>1.00</td>
<td>—</td>
<td>1.00</td>
<td>—</td>
</tr>
<tr>
<td>Alcohol use</td>
<td>0.8 (0.1)</td>
<td>1.06</td>
<td>0.67, 1.68</td>
<td>1.22</td>
<td>0.74, 2.01</td>
</tr>
<tr>
<td>Alcohol abuse</td>
<td>1.8 (1.3)</td>
<td>2.55</td>
<td>0.88, 7.39</td>
<td>1.46</td>
<td>0.47, 4.50</td>
</tr>
<tr>
<td>Alcohol dependence</td>
<td>4.3 (1.3)</td>
<td>6.37</td>
<td>3.59, 11.34</td>
<td>1.70</td>
<td>0.87, 3.30</td>
</tr>
<tr>
<td>No cannabis use</td>
<td>0.7 (0.1)</td>
<td>1.00</td>
<td>—</td>
<td>1.00</td>
<td>—</td>
</tr>
<tr>
<td>Cannabis use</td>
<td>2.4 (0.7)</td>
<td>3.56</td>
<td>2.05, 6.23</td>
<td>1.45</td>
<td>0.77, 2.70</td>
</tr>
<tr>
<td>Cannabis abuse</td>
<td>3.9 (2.8)</td>
<td>4.64</td>
<td>1.43, 14.98</td>
<td>1.76</td>
<td>0.50, 6.17</td>
</tr>
<tr>
<td>Cannabis dependence</td>
<td>6.8 (3.2)</td>
<td>10.80</td>
<td>5.91, 19.89</td>
<td>2.84</td>
<td>1.37, 5.90</td>
</tr>
<tr>
<td>No tobacco use</td>
<td>0.5 (0.1)</td>
<td>1.00</td>
<td>—</td>
<td>1.00</td>
<td>—</td>
</tr>
<tr>
<td>Tobacco use</td>
<td>2.3 (0.4)</td>
<td>4.65</td>
<td>3.19, 6.75</td>
<td>2.47</td>
<td>1.63, 3.74</td>
</tr>
</tbody>
</table>

1Adjusted for age, gender, educational attainment, marital status, employment status and neuroticism.

Table 4. Patterns of association between alcohol, tobacco and cannabis use, and other mental health problems after adjusting for demographics and neuroticism

<table>
<thead>
<tr>
<th>Alcoholic</th>
<th>Cannabis</th>
</tr>
</thead>
<tbody>
<tr>
<td>U</td>
<td>A</td>
</tr>
<tr>
<td>Other drug use</td>
<td>x</td>
</tr>
<tr>
<td>Other drug use disorders</td>
<td>x</td>
</tr>
<tr>
<td>Affective disorders</td>
<td>x</td>
</tr>
<tr>
<td>Anxiety disorders</td>
<td>x</td>
</tr>
<tr>
<td>Screening positively for psychosis</td>
<td>x</td>
</tr>
</tbody>
</table>

x = no significant association remained; ✓ = a significant association remained; U = use without meeting criteria for DSM-IV abuse or dependence; A = DSM-IV abuse; and D = DSM-IV dependence.

Discussion

In this study, we have compared the co-morbidity of alcohol, cannabis and tobacco with other mental health problems. Homotypic co-morbidity was considered through examining sedative, stimulant or opiate abuse/dependence; while heterotypic co-morbidity was considered in examining anxiety disorders, affective disorders, and psychosis.

Homotypic co-morbidity—other drug use and abuse/dependence

When each drug was considered separately, alcohol, cannabis and tobacco use were all associated with an increased likelihood of using all other drug types considered here. They were also all associated with the problematic use of other drug types. Among Australian adults, dependent cannabis use was the strongest marker for other drug abuse or dependence (see Degenhardt, Hall & Lynskey 40 for greater discussion of cannabis use and other substance use). Cannabis abuse and use were also strongly associated with other drug use and drug use problems. While relation-
Patternsof co-morbidity of alcohol, tobacco and cannabis use were not reported in this paper, previous work has explored these relationships.\textsuperscript{40,41}

In almost all cases, this association was not explained by the covariates examined. It did not appear to be the case that the higher rates of drug use problems simply reflected demographic differences between groups, or that it reflected the use of multiple drug types. Nevertheless, it must be noted that there are covariates that have not been included in the present analyses, including genetic factors, which may play a role in increasing the likelihood of drug use and problematic drug use. For more comprehensive discussions of the implications of these findings, see previous reports on each of the three separate drug types.\textsuperscript{40–42}

It is difficult to distinguish between a number of possible explanations for this observed association using cross-sectional data. The first possibility is that there is no causal relationship between all these indicators of substance use, but that other common factors not considered here are responsible for the association. These might be environmental factors: for example, people with higher numbers of risk factors such as poor parental relationships have been found to be more likely to use all drug types.\textsuperscript{43,44} These might also be genetic factors: genetic vulnerabilities have been implicated as increasing the likelihood of alcohol dependence,\textsuperscript{14,45} cannabis dependence,\textsuperscript{46} nicotine dependence\textsuperscript{16} and cocaine dependence.\textsuperscript{18} It is possible that these vulnerabilities may be shared by different drug types, as has been found for nicotine and alcohol dependence.\textsuperscript{17}

A second possibility is that there is a causal connection between the use of one drug type, and increased likelihood of another. Recent longitudinal evidence, for example, has suggested that even after controlling for a wide range of known risk factors for illicit drug use, cannabis use was still associated with an increased risk of progression to illicit drug use.\textsuperscript{47} Nevertheless, much research supports a more general view of substance use as an element of a developmental pathway, in which multiple risk factors increase the likelihood of drug use in general, similar to the developmental pathway thought to typify childhood psychopathology.\textsuperscript{48} Early drug use, for example, has been found to increase the likelihood that adolescents will subsequently associate with delinquent peers and move out of home; these factors subsequently increase the likelihood of poor psychosocial outcomes in early adult life.\textsuperscript{49} One of these outcomes may be continued or escalated substance use.\textsuperscript{50}

Regardless of the reasons for the findings of the present report, however, one thing is clear: tobacco, alcohol and cannabis use are all associated with higher risks of drug use in general. This finding has implications for the physical and mental health of users. It also has implications for treatment, since it is likely that people in treatment for one drug type are likely to be problematic users of a range of drug types.

\textbf{Heterotypic co-morbidity—affective and anxiety disorders}

On a univariate level, cannabis use of all levels was associated with increased rates of anxiety and affective disorders. Tobacco use was associated with a higher rate of anxiety and affective disorders. In contrast, while alcohol dependence was strongly associated with an increased likelihood of both mental health problems, alcohol abuse was not associated with different rates of anxiety and affective disorders relative to non-users. Furthermore, alcohol use (without disorder) was associated with lower rates of anxiety and affective disorders. This “J-curve” between alcohol use and psychological wellbeing has been reported in other community samples.\textsuperscript{51,52}

These patterns changed significantly after considering demographics, the use of multiple drug types and neuroticism (see also Table 4). No level of cannabis use was associated with affective or anxiety disorders after these analyses; in particular, it was after including drug use variables together in analyses that cannabis use was no longer significantly associated with anxiety or affective disorders (see Degenhardt, Hall & Lynskey\textsuperscript{53} for further discussions of these findings). In contrast, alcohol dependence and tobacco use remained markers for an increased likelihood of anxiety and affective disorders.

The relationships found in the Australian population between tobacco use, and anxiety and depression, highlight a continued need for effective treatments for people who wish to stop smoking and who also have mental health problems such as depression, which have been shown to lower the chance of successfully quitting smoking.\textsuperscript{54}
There has been concern over the possibility that cannabis use, particularly among young people, is in some way related causally to depression. The present report found that this relationship did not appear to hold in the Australian adult population. Instead, the association arose because cannabis users were also more likely to meet criteria for an alcohol use disorder, smoke tobacco and use other drug types, all of which were associated with higher rates of mental health problems. The present findings suggest that it may be more appropriate to direct attention to the use of these other drug types when considering concomitant mental health problems.

**Heterotypic co-morbidity—psychosis**

Alcohol, tobacco and cannabis use were all associated with higher chances of screening positively for psychosis, as assessed by a short screening questionnaire for psychotic symptoms. Cannabis dependence was the most strongly associated on a univariate level.

After conducting multiple regressions, only cannabis dependence and tobacco use remained correlated with screening positively for psychosis (see Table 4). The strength of the association was similar for both tobacco use and cannabis dependence (odds ratios of 2.5 and 2.8, respectively). This association needs to be communicated to people at risk of psychotic illness, to people who have already been diagnosed with a psychotic illness, and to people who are heavy substance users. The possible risks of exacerbation of, or relapse to mental health problems, also need to be highlighted.

**Conclusions**

In this general population sample, the strongest markers of homotypic co-morbidity were alcohol dependence and any involvement with cannabis use, with cannabis dependence being the strongest marker overall.

The strongest marker of anxiety and affective disorders was alcohol dependence; tobacco use was a moderate marker of increased risk for both disorders. Cannabis use was not significantly associated with affective and anxiety disorders after adjusting for demographics, neuroticism and other drug use. Cannabis dependence was the strongest correlate of screening positively for psychosis, and after multiple regressions were carried out only cannabis dependence and tobacco use remained associated significantly with screening positively for psychosis.

These findings suggest that the use of different drug types is differentially associated with a range of other mental health problems. These results suggest that different factors are responsible for the co-morbidity between the use of different substances and separate mental health problems. These differential risks need to be taken into account in treatment. Further research is required to examine the reasons for these associations.

**References**


39. STATA Corporation (1997) Intercooled STATA for Windows 5.0 (College Station, Texas, STATA Corporation).