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The association between psychosis and problematic drug use among Australian adults: Findings from the National Survey of Mental Health and Well-Being

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The association between psychosis and problematic drug use among Australian adults: Findings from the National Survey of Mental Health and Well-Being

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This is the fourth in a series of linked NDARC Technical Reports on various aspects of the National Survey of Mental Health and Well-being (NSMHWB). This survey was a major collaborative effort between numerous Australian academics and institutions. It was funded by the Mental Health Branch of the Commonwealth Department of Health and Aged Care. Fieldwork was conducted by the Australian Bureau of Statistics in 1997. It provides the first data on the prevalence and correlates of common mental health and substance use disorders among a representative sample of more than 10,000 Australians aged 18 years and over.

Each of these Technical Reports addresses separate issues related to findings on substance use disorders among Australian adults.

The list of Technical Reports on this topic published to date are:

Hall, W., Teesson, M., Lynskey, M. & Degenhardt, L. (1998). The prevalence in the past year of substance use and ICD-10 substance use disorders in Australian adults: Findings from the National Survey of Mental Health and Well-being (Technical Report No. 63).

Swift, W., Hall, W. & Teesson, M. (1999). Cannabis use disorders among Australian adults: Results from the National Survey of Mental Health and Wellbeing (Technical Report No. 78).

Degenhardt, L., & Hall, W. (1999). The relationship between tobacco use, substance use disorders and mental disorders: Results from the National Survey of Mental Health and Well-Being (Technical Report No. 80).

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EXECUTIVE SUMMARY

Psychotic disorders, such as schizophrenia and schizoaffective disorders, have a lower prevalence than other forms of mental illness, yet they impose a disproportionate personal and public health burden. One issue that has received considerable attention in recent years has been substance use among persons with psychotic disorders. There is a considerable amount of clinical research that reveals high rates of substance use and substance use disorders among this population. However, while clinical evidence suggests cause for concern, clinical samples may be prone to selection biases, and causal theories have rarely been tested.

There has been some population-level research conducted in the US. The Epidemiological Catchment Area (ECA) study, a study of representative samples of adults across 5 US sites, found elevated rates of schizophrenia among persons with alcohol and other drug use disorders. There has also been an analysis using ECA data of the relationship between drug use and having a "self-reported psychotic experience" (experiencing at least one psychotic symptom). Daily cannabis use and meeting criteria for a DSM-III alcohol use disorder were significant predictors of reporting at least one psychotic symptom during the follow-up year.

While these findings provided important population-level information concerning the risks of experiencing at least one psychotic symptom that are associated with drug use, there remains a number of issues to address. First, do the associations observed among North American populations exist in other countries? Second, is there a relationship between problematic drug use and severity of psychotic disorder? Finally, are any associations due to the confounding effects of demographic characteristics or other mental health problems?

The aims of the present paper were: a) to provide Australian estimates of the population-level association between psychotic symptoms and substance use; b) to examine patterns of association between substance use and likely cases of psychosis in the Australian general population; c) to examine the prevalence of problematic use *among* users according to psychosis case status; and d) to examine the association between problematic substance use and increasing scores on a psychosis screener using multivariate ordinal logistic regression (OLR), taking into account the effects of demographics, mental health, and the fact that the use of multiple drug types would be likely. OLR is a regression technique that takes into account the ordering of an ordered categorical outcome variable (in this case, number of psychotic symptoms). OLR produces an estimate of the average change in the odds for each additional point along the ordered scale (here, for each additional psychotic symptom reported).

The data used was obtained from the National Survey of Mental Health and Well-Being (NSMHWB), a stratified multistage probability sample survey of persons aged 18 years and older in the Australian population. A subset of the sample was used, comprising persons under the age of 50 years (n=6,722), because drug use and psychosis are both rare in older adults.

The psychosis screener (PS) was developed for use in the NSMHWB, and assesses the presence of characteristic psychotic symptoms. Univariate associations between "case" status on the screener and a number of drug use variables were examined: use of tobacco; use and DSM-IV abuse or dependence upon alcohol, cannabis, sedatives, stimulants and opiates; and frequency of alcohol and cannabis use. The conditional prevalence (prevalence among users) was estimated for DSM-IV alcohol and cannabis

abuse and dependence, as well as for other drug use disorders (abuse or dependence on sedatives, stimulants or opiates). All prevalence estimates were weighted to conform to independent population estimates, and balanced repeated replicate weights were used to account for the survey design. Odds ratios and their 95% confidence intervals were estimated using unweighted data. A series of OLRs was carried out, in which demographic variables, mental health variables, and finally drug use variables, were entered. The significant mental health and drug use variables were retained in the final OLR model.

A total of 99 persons screened positively for psychosis (a weighted prevalence rate of 1.2% in this age group, 18 to 49 years). Regular tobacco use was much more common among persons screening positively, with 60% reporting such use, compared to 27% of non-cases. A greater proportion of cases reported regular alcohol or cannabis use. Cases were much more likely than non-cases to meet criteria for DSM-IV alcohol (24% vs. 8%) and cannabis (16% vs. 3%) use disorders. Similar patterns were observed for other drug use, with cases significantly more likely to report the use of these drugs, as well as meet criteria for abuse or dependence.

An examination of the prevalence of use disorders among users of these substances revealed that among those who reported alcohol or cannabis use, cases were much more likely than non-cases to report *dependent* use (25% of cases who were alcohol users versus 7% of non-cases; 41% vs. 21% for cannabis).

The OLR revealed that the association between problematic substance use and psychotic symptoms was not due to the effects of demographic variables, a measure of personality, or other mental health problems. Regular tobacco use (OR = 1.43; 95%CI 1.23, 1.66), cannabis dependence (OR = 2.00; 95%CI 1.40, 2.85), alcohol dependence (OR = 1.49, 95%CI 1.16, 1.91), and opiate abuse (OR 6.54; 95%CI 1.34, 31.81) were each significant predictors of increased numbers of psychotic symptoms.

Hence, the confounding variables considered here did not explain the relationship between problematic substance use and psychotic symptoms.Given the cross-sectional nature of the data from the NSMHWB, however, it is not possible to distinguish between other competing explanations for the associations observed here. On the basis of the evidence currently available, it seems likely that the use of drugs such as cannabis may exacerbate the symptoms of those with psychotic illnesses. Controlled outcome studies of substance abuse treatment for persons with psychosis could examine whether cessation of drug use predicts improvement in symptoms.

There are a number of implications of the present study. First, the mental health risks of problematic substance use need to be disseminated to persons who are at risk of psychotic illness, to persons who have already been diagnosed with a psychotic illness, and to persons who are heavy substance users. In particular, the risks of exacerbation of, or relapse to mental health problems need to be highlighted.

Second, more attention needs to be given to the *physical* health risks of heavy or problematic substance use by persons with psychotic illnesses, particularly given the high rates of tobacco and cannabis smoking. Heavy alcohol users also face increased risks of cognitive impairment and physical disease.

Finally, the use of alcohol, cannabis, sedatives, opiates and stimulants may interfere with medication, reduce treatment compliance, reduce housing stability and increase the burden upon treatment services and the family. Work is needed to address problematic substance use among persons with psychotic disorders.

1 INTRODUCTION

Psychotic disorders, such as schizophrenia and schizoaffective disorders, are disorders that may be characterised by symptoms such as bizarre delusions, auditory hallucinations, and delusions of persecution (American Psychiatric Association, 1993). Such disorders often run a chronic or recurrent course, cause considerable disability to the individual, and adversely affect a sufferer's family and the community (Keith et al., 1991). They have a lower prevalence than other forms of mental illness such as depression and anxiety disorders (Keith, Regier, & Rae, 1991), yet they impose a considerable personal and public health burden because of their impact on sufferers and their families. The economic cost of psychotic disorders such as schizophrenia has been estimated as similar to that of all cancers combined (Hall, Goldstein, Andrews, & et al., 1985).

One issue that has received considerable attention in recent years has been substance use among persons with psychotic disorders. Clinical research has revealed high rates of substance use, and of more concern, high rates of tobacco use (Glassman, 1993; Goff, Henderson, & Amico, 1992; Masterson & O'Shea, 1984) and *problematic use* (abuse or dependence) of alcohol (Dixon, Haas, Weiden, Sweeney, & Frances, 1991; Drake, Osher, & Wallach, 1989; Drake & Wallach, 1989; Fowler, Carr, Carter, & Lewin, 1998), cannabis (Dixon et al., 1991; Drake & Wallach, 1989; Fowler et al., 1998), and other illicit drugs (Dixon et al., 1991; Drake & Wallach, 1989; Fowler et al., 1998; Mueser, Bellack, & Blanchard, 1992)

In such research, problematic substance use has been associated with symptom worsening or relapse (Carey, Carey, & Meisler, 1991), homelessness or housing instability (Drake et al., 1991), poor compliance with medication (Pristach & Smith, 1990), increased burden upon the sufferer's family (Clark, 1994), and increased treatment costs (Bartels et al., 1993). In addition, problematic substance use is a health concern in and of itself because of the physiological and psychological harms that may result from chronic drug use.

There are a number of factors that mean that research with *clinical* populations may not reveal an accurate picture of the association between substance use and psychotic illness in the *general* population. Clinical samples may be subject to a number of biases. The first – *Berkson's bias* – refers to the fact that a person has two disorders at a given point in time means that they are more likely to receive treatment simply because there are two separate disorders for which they might seek help (Berkson, 1946). The second reason has been called a *clinical bias* (Galbaud Du Fort, Newman, & Bland, 1993). This refers to the fact that persons who have two disorders may be more likely to seek treatment *because* they have two disorders. Third, *referral biases* may exist, whereby some persons will be referred for treatment because of other factors, such as a family history of psychopathology (Caron & Rutter, 1991). In representative general population samples these biases do not exist, and observed patterns reflect general relationships between mental health problems.

Additionally, much of the research on this issue is based on relatively small samples, which means that there is a limited ability to examine the effects of confounding factors on the relationship between drug use problems and psychosis, for example, age or other mental health problems.

Nonetheless, there has been some examination of the population-level association between psychosis and drug use problems in the general population. For example, the US Epidemiological Catchment

Area (ECA) study was carried out in the mid 1980s, and assessed the prevalence of DSM-III mental disorders in representative samples from 5 sites across the US (Robins & Regier, 1991). The ECA estimated that the rate of schizophrenia was 3.4 times higher among those with a DSM-III alcohol use disorder (Helzer, Burnam, & McEvoy, 1991), and 5.9 times higher among those with a DSM-III drug use disorder (Anthony & Helzer, 1991). There has also been an analysis using the ECA data of the relationship between drug use and having a "self-reported psychotic experience" (Tien & Anthony, 1990). In this study, a "case" was a person who reported experiencing at least one psychotic symptom (from 12 Diagnostic Interview Schedule (DIS) items) within a follow up year. Only persons under the age of 50 years were included, due to low rates of drug use among older persons, and the increased likelihood that older persons would have organic mental disorders. An age-matched sample of cases (n = 477) and controls (n = 1818) were compared in a series of logistic regressions that controlled for baseline mental health problems (such as depression), as well as demographic factors; the drug use variables that were significant were retained in the model. From these multivariate analyses, daily cannabis use (RR = 2.0, 95%CI 1.25, 3.12) and a DSM-III alcohol use disorder (RR = 7.9, 95%CI 1.99, 31.41) were found to be significant predictors of reporting at least one psychotic symptom during the follow-up year.

Although this study provided important US population-level information on the relationship between substance use and reporting at least one psychotic symptom, a number of issues remain to be addressed. First, do the associations observed among the North American general population exist in other countries?

Second, is it the case that persons who are likely to meet criteria for psychotic disorders are more liable to having substance use problems when they use drugs? This issue may be examined by examining the *conditional prevalence* of substance use disorders among users. The conditional prevalence of substance use disorders gives an indication of how many persons who report any use of a substance also report problematic use. In the present case, if persons likely to have a psychotic disorder were more liable to developing problematic substance use, then the conditional prevalence estimate for these persons would be higher than it would be for those unlikely to have psychotic disorders.

Third, is there a relationship between problematic drug use and severity of psychotic disorder? In other words, are some drug use patterns associated with reporting an *increasing* number of psychotic symptoms? Finally, is any association due to the effects of demographic characteristics, personality, or other mental health problems?

One way to examine the association between substance use and the number of reported psychotic symptoms is to use ordinal logistic regression (OLR). OLR is a regression technique that takes into account the ordering of an ordered categorical outcome variable (in this case, number of psychotic symptoms)(Bender & Grouven, 1997). While more common analytic methods such as logistic regression produce estimates of the size of the odds ratio for a dichotomous outcome variable, simply classifying an ordered scale into a dichotomous variable would mean losing information about the intervals along the scale; the alternative would be to carry out a series of logistic regressions in which the dichotomous outcome variable was classified according to the different cut-points of the scale. OLR produces an estimate of the average change in the odds for each additional point along the ordered scale (here, for each additional psychotic symptom reported), which means that one odds ratio statistic can be used.

1.1 AIMS

Given the lack of Australian population-level data on this issue, and the issues that remained to be examined concerning the severity of psychosis, there were several major aims of the present paper:

1. To provide an estimate of the population prevalence of psychosis among young persons in Australia;
2. To examine Australian population patterns of association between likely cases of psychosis and the following drug use patterns:
    a. use of alcohol, cannabis, sedatives, stimulants and opiates;
    b. regular use of tobacco, alcohol and cannabis; and
    c. DSM-IV abuse or dependence on alcohol, cannabis, sedatives, stimulants and opiates;
3. To examine the conditional prevalence of substance use disorders according to psychosis "case" status;
4. To examine the relationship between increasing numbers of psychotic symptoms and problematic drug use, taking into account the effects of demographics, personality and other mental health problems.

2 METHOD

The NSMHWB sample was a stratified multistage probability sample of 10641 persons aged 18 years and older in the Australian population. The fieldwork and interviews were carried out by the Australian Bureau of Statistics (ABS) in 1997. The sample excluded special dwellings (hospitals, nursing homes, hostels etc.), and dwellings in remote and sparsely populated areas of Australia. Dwellings were selected using random stratified multistage area sampling, so that each person in all States and Territories had a known chance of participation. One person aged at least 18 years was randomly selected from each dwelling and asked to participate. Approximately 13,6000 private dwellings were approached, with a final sample size of 10,641 persons, giving a response rate of 78%.

In the present analyses, only a subset of the survey data was used - that on persons under the age of 50 years. This was for two reasons: psychotic disorders and drug use are more common among younger persons (Keith et al., 1991), while organic mental disorders are more common among older persons (George, Landerman, Blazer, & Anthony, 1991); and this would make it consistent with previous US population research (Tien & Anthony, 1990). The sample used in the analysis comprised 6,722 persons.

In the survey, respondents were asked about symptoms in the last 12 months to minimise the uncertainty about recall of symptoms over longer periods. Mental disorders were assessed by a modified version of the Composite International Diagnostic Interview (CIDI) (World Health Organisation, 1993), which yielded diagnoses of DSM-IV disorders. The substance use disorders assessed were: alcohol abuse and dependence, as well as abuse and dependence on four drug classes: opiates, cannabis, stimulants, and sedatives. Affective disorders assessed were: major depressive disorder, dysthymia, bipolar I disorder, bipolar II disorder. Anxiety disorders assessed were: panic disorder, agoraphobia, social phobia, generalised anxiety disorder, obsessive-compulsive disorder, and post-traumatic stress disorder.

All persons were asked whether they currently used tobacco and if they were current users, they were asked if their use was regular (daily). Respondents were assessed for alcohol use disorders if they had consumed at least 12 standard (10g of alcohol) drinks in the last 12 months. If respondents reported using cannabis, stimulants, sedative or opiates more than five times in the past 12 months, they were assessed for a use disorder.

2.1 PSYCHOSIS SCREENER

The psychosis screener (PS) was developed for use in the NSMHWB. The PS used elements of the CIDI to assess the presence of characteristic psychotic symptoms. It comprised 7 items (See Appendix), three of which (1a, 2a, 3a) were asked only if the respondent endorsed a previous question (1, 2, 3 respectively). The first 6 items covered the following features of psychotic disorders: delusions of control, thought interference and passivity (Question 1 and 1a); delusions of reference or persecution (Question 2 and 2a); and grandiose delusions (Question 3 and 3a). The final item (Question 4) 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 persons from an inpatient psychiatric setting, and a sample of persons from a variety of mental health

services[1]. This analysis indicated that scores of three or more discriminate adequately between cases and non-cases of schizophrenia or schizoaffective disorder.

Table 1: Questions included in the psychosis screener

1. In the past 12 months, have you felt that you thoughts were being directly interfered with or controlled by another person?
1a. Did it come about in a way that many people would find hard to believe, for instance, through telepathy?
2. In the past 12 months, have you had a feeling that people were too interested in you?
2a. In the past 12 months, have you had a feeling that things were arranged so as to have a special meaning for you, or even that harm might come to you?
3. Do you have any special powers that most people lack?
3a. Do you belong to a group of people who also have these special powers?
4. Has a doctor ever told you that you may have schizophrenia?

2.2 ANALYSES

Univariate associations between "case" status and a number of drug use variables were examined. The first group of these were substance use variables. Persons were considered to have used alcohol in the past 12 months if they reported drinking 12 or more standard drinks; and they were coded as having used other drugs (cannabis, sedatives, stimulants or opiates) if they reported using such drugs more than 5 times within the past 12 months. The second group of variables were the frequency of drug use: daily use was examined in the case of alcohol and tobacco, and at least weekly use in the case of cannabis. The third group of variables were the presence or absence of the following DSM-IV use disorders: cannabis abuse/dependence; alcohol abuse/dependence; and abuse/dependence upon sedatives, stimulants or opiates ("other drug use disorder"). All prevalence estimates were weighted to conform to independent population estimates by State, part of State, age and sex. 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 (Research Triangle Institute, 1997). The conditional prevalence – that is, prevalence among users – was estimated for DSM-IV alcohol and cannabis abuse and dependence, as well as for other drug use disorders (abuse or dependence). All odds ratios (OR) and 95% confidence intervals (95%CI) for univariate associations were estimated using unweighted data.

[1] Unpublished analyses; contact the authors of this paper for further details.

Univariate analyses were followed by a series of ordinal logistic regressions (OLR). These were carried out using STATA 5.0 for Windows (STATA Corporation, 1997). Ordinal logistic regression takes into account the natural ordering of the levels of an ordinal outcome variable. It estimates the ordered logit models of the outcome variable given a set of independent variables.

The first OLR included the following demographic variables as predictors of psychosis scores:

- sex (reference category female);
- age (reference category 18-24 years; comparison groups 25-34, 35-39, 45-49 years);
- employment status (reference category 'employed'; comparison categories 'not in the labour force', 'unemployed');
- educational attainment (reference category 'less than secondary'; comparison groups 'secondary, 'post-secondary');
- marital status (reference category 'married/defacto'; comparison categories 'divorced or separated', 'widowed', 'never married').

The second OLR added the following mental health variables as predictors:

- Eysenck's Neuroticism score from the EPQ (Eysenck & Eysenck, 1991) (range 0-12);
- DSM-IV anxiety disorder (reference category no);
- DSM-IV affective disorders (reference category no).

The third OLR added the following measures of drug use:

- regular tobacco use (reference category no);
- DSM-IV abuse: alcohol, cannabis, sedatives, stimulants, opiates (reference category no);
- DSM-IV dependence: alcohol, cannabis, sedatives, stimulants, opiates (reference category no).

All demographic variables were retained in the model. The variable that weighted estimates to conform to independent population estimates by State, part of State, age and sex, was included in the final model, but was not a significant predictor and was not retained. The mental health and drug use variables that remained significant were retained in the final model. The OR and 95%CI for each of the predictors were calculated. This provided an estimate of the average increase in odds *per additional point* on the screener for each of the variables.

Successive models were checked for changes in significance using the likelihood ratio test. The proportional odds assumption was tested for each significant predictor variable. The proportional odds assumption tests the assumption of ordinal logistic regression that the size of the logit is similar between each cut point on the ordinal scale. This assumption can be tested by carrying out a series of logistic regressions in which a dichotomous variable reflecting different cut points on the ordinal scale are used. In the case of the PS, there were 5 different cut-points: above and below a score of 1, 2, 3, 4, and 5. Hence, for each significant predictor, five univariate logistic regressions were carried out, and the size of the logits for each of these regressions compared. The assumption of proportional odds was considered to have been met if the 95% confidence intervals of the logits overlapped for all cut-points. For all the significant predictors, the size of the logits was similar across the levels of the screener, indicating that the proportional odds assumption held. This means that the average odds obtained in the ordinal logistic regression was an appropriate statistic to use as an average across the scale.

3 RESULTS

A total of 99 persons under the age of 50 years screened positively for psychosis (a weighted prevalence rate of 1.2% in this age group (SE = 0.18)). Table 2 shows the prevalence of substance use and DSM-IV substance use disorders according to case status. The odds of regular tobacco use were around 4 times greater among those screening positively for psychosis, with 60% reporting such use, compared to 27% of non-cases.

Similar proportions of cases and non-cases reported that they had used alcohol within the past 12 months (78%). However, a greater proportion of cases reported daily alcohol use: around 1 in 5 cases compared to just under 1 in 7 non-cases. There was a stronger relationship between case status and the risk of meeting criteria for a DSM-IV alcohol use disorder: around 1 in 4 cases met criteria for abuse or dependence, compared to 1 in 12 non-cases – a fourfold increased odds.

Table 2: Prevalence of substance use and DSM-IV substance use disorders, according to psychosis "case" status

	Non-cases	Psychosis "cases"	OR	95% CI
% Regular tobacco use	27.3 (0.7)	59.9 (9.2)	3.97	2.64, 5.97
% Alcohol use	77.7 (0.7)	78.4 (4.0)	1.01	0.63, 1.64
% Daily alcohol use	15.0 (0.7)	21.5 (5.7)	1.71	1.07, 2.74
% Alcohol use disorder	8.2 (0.5)	23.7 (5.1)	3.93	2.48, 6.24
% Cannabis use	10.5 (0.7)	30.4 (6.8)	3.98	2.59, 6.14
% Weekly cannabis use	6.8 (0.5)	22.6 (6.0)	4.15	2.58, 6.68
% Cannabis use disorder	3.3 (0.3)	16.2 (7.0)	5.86	3.37, 10.18
% Sedative use	1.2 (0.2)	7.1 (2.4)	7.32	3.99, 13.44
% Sedative use disorder	0.6 (0.1)	4.7 (2.7)	10.11	4.20, 24.36
% Stimulant use	1.3 (0.2)	9.2 (3.9)	10.22	5.26, 20.87
% Simulant use disorder	0.5 (0.1)	3.2 (2.1)	9.57	3.30, 27.77
% Opiate use	0.6 (0.1)	5.1 (2.9)	4.74	2.02, 11.10
% Opiate use disorder	0.4 (0.1)	1.9 (0.9)	7.93	2.36, 26.64

Persons screening positively for psychosis were significantly more likely to report cannabis use within the past 12 months, with 30% of cases compared to 10% of non-cases reporting use. Weekly cannabis use was around 4 times more common among cases, and cases were 6 times more likely than non-cases to meet criteria for DSM-IV cannabis abuse or dependence.

Similar patterns were observed for sedative, stimulant and opiate use within the past 12 months, with under 2% of non-cases reporting the use of each of these drugs, compared to between 5% and 9% of cases (for opiate and stimulant use, respectively). Cases were also significantly more likely to meet criteria for sedative, stimulant and opiate use disorders. Given the small numbers of users, caution must be taken in these estimates, as significant error may be involved (which is reflected in the size of the standard errors of the prevalence estimates and the 95% confidence intervals around the odds ratios).

While the prevalence estimates in Table 2 indicate how common use disorders are among the entire sample of persons included for analysis, the figures in Table 3 indicate how common use disorders were only among those who used the substances. These *conditional prevalence* estimates of drug use disorders are one way of estimating the liability of users to problematic substance use. A higher conditional prevalence estimate indicates that a greater proportion of people who report *any* use of a substance will also report *problematic* use of that substance.

As Table 3 shows, among alcohol and cannabis users, there was no relationship between psychosis case status and the likelihood of meeting criteria for DSM-IV alcohol and cannabis abuse. Similarly, users of other drug types (sedatives, stimulants or opiates) who screened positively for psychosis were no more likely than non-cases to meet criteria for other DSM-IV drug use disorders (sedatives, stimulants or opiates). This means that among those who reported using sedatives, stimulants or opiates, for example, those who had screened positively for psychosis were no more likely to have problematic use of these substances.

Table 3: Proportion of users of each substance meeting criteria for a DSM-IV use disorder according to psychosis case status

	Non-cases	Psychosis "cases"	OR (95%CI)
% Alcohol abuse	3.5	5.5	1.62 (0.59, 4.48)
% Alcohol dependence	7.0	24.7	5.03 (3.01, 8.41)
% Cannabis abuse	10.7	11.9	0.88 (0.26, 2.96)
% Cannabis dependence	20.7	41.3	2.86 (1.37, 5.99)
% Other drug use disorder	31.3	33.5	1.51 (0.59, 3.83)

There *was* a significant relationship for both alcohol and cannabis dependence (Table 3). Cases who reported cannabis use in the past year were almost 3 times more likely to be dependent upon cannabis than non-cases who had used cannabis (95%CI 1.4, 6.0). Similarly, cases who had consumed alcohol were 5 times more likely to be alcohol dependent than non-cases who had used alcohol – 1 in 4 cases who were drinkers compared to 1 in 14 non-cases who were drinkers.

3.1 MULTIVARIATE ANALYSIS

As outlined in the method section, ordinal logistic regression (OLR) was carried out to estimate the relationship between problematic drug use after taking into account the effects of demographic factors and measures of mental health problems. OLR takes into account the ordering of an ordered categorical variable (in this case, the number of psychotic symptoms). It estimates the average change in the odds ratio that is associated with successively higher cut-points on the ordered variable (i.e. for each additional symptom endorsed on the screener). This means that it is possible to use one odds ratio statistic to represent the average over all cut-points in the scale, as opposed to having a different odds ratio for each separate cut-point. Tests revealed that it was appropriate for all the predictors below (Table 4) to use the average odds across all cut-points of the PS (see methods section).

Table 4: Significant predictors of psychosis scores - results of ordinal logistic regression[1]

	Coefficient	SE	Z	p	OR	95%CI
EPQ Neuroticism score	0.139	0.014	9.98	<.001	1.15	1.12, 1.18
DSM-IV affective disorder	0.602	0.109	5.50	<.001	1.83	1.47, 2.26
Regular tobacco use	0.356	0.078	4.58	<.001	1.43	1.23, 1.66
DSM-IV anxiety disorder	0.545	0.121	4.52	<.001	1.72	1.36, 2.19
DSM-IV cannabis dependence	0.692	0.181	3.83	<.001	2.00	1.40, 2.85
DSM-IV alcohol dependence	0.396	0.127	3.11	<.005	1.49	1.16, 1.91
DSM-IV opiate abuse	1.878	0.807	2.33	<.05	6.54	1.34, 31.81

[1] Demographic variables were included in this model, but for simplicity, are not presented here. See Appendix B for details

Table 4 presents the significant mental health and drug use variables that remained in the final OLR model ($\chi^2_{19\ df}$ = 656.38, p <.0001, pseudo R^2 = 0.09); for simplicity, demographic variables are not presented here (see Appendix B for details of the demographic variables). The mental health variables

were all significant predictors of PS scores, with both DSM-IV affective and anxiety disorders associated with increased scores on the screener. Higher scores on the Neuroticism scale of the EPQ were also associated with higher scores on the PS.

Taking into account the effects of these mental health and demographics factors, several measures of problematic substance use remained significant predictors of increased scores in the final model (Table 4). With each additional symptom reported, there was a doubling of the odds of cannabis dependence, while alcohol dependence and regular tobacco use were associated with similar increases in average odds per additional symptom (around 1.45). Opiate abuse was also significant – it was associated with an average increased odds of 6.5 per additional psychotic symptom, although the 95% confidence interval around this estimate was very wide (1.3, 31.8).

4 DISCUSSION

In the Australian population, people who screened positively for psychosis were more likely than those who did not to have significant substance use problems. The majority of these persons were daily tobacco smokers, around 1 in 4 reported daily alcohol use, with a similar proportion reporting at least weekly cannabis use. A significant minority met criteria for alcohol and cannabis use disorders. Furthermore, 1 in 5 reported use of sedatives, stimulants or opiates more than 5 times within the past year, and one third of these met criteria for a use disorder. The rates of illicit drug use, and of regular and problematic use of all substances examined, were significantly higher among those who screened positively ("cases") than among those who did not ("non-cases").

These findings are consistent with clinical research with persons who meet criteria for psychotic disorders, which has found high rates of tobacco use (Glassman, 1993; Goff et al., 1992; Masterson & O'Shea, 1984), cannabis use and use disorders (Fowler et al., 1998; Wheatley, 1998), alcohol use problems (Drake et al., 1989; Drake & Wallach, 1989; Fowler et al., 1998), and illicit drug use (Drake & Wallach, 1989). They are also consistent with the findings of the ECA, which found elevated rates of schizophrenia among those with substance use disorders (Anthony & Helzer, 1991; Helzer et al., 1991).

Of particular concern was the finding that dependence among alcohol and cannabis users was significantly more likely among "cases" of psychosis than "non-cases". It may be that persons likely to have psychotic disorders are at particular risk of developing problematic use when they use these drugs. This was examined further by examining the prevalence of cannabis and alcohol dependence among users of these substances. Among those who reported using alcohol or cannabis, those who screened positively for psychosis were much more likely to be dependent users. Cases who reported cannabis use in the past year were almost 3 times more likely to be dependent upon cannabis than non-cases who had used cannabis, while cases who had consumed alcohol were 5 times more likely to be alcohol dependent than non-cases who had used alcohol. This is worrying as the use of cannabis in particular may increase the risks of worsening of or relapse to psychotic symptoms (Hall & Degenhardt, 2000; Linszen, Dingemans, & Lenior, 1994); dependent cannabis use would presumably further increase these risks.

This study also found that a number of problematic substance use variables remained significant predictors of higher scores on the psychosis screener even after accounting for demographics, neuroticism, and DSM-IV anxiety and affective disorders. Hence, it was not the case that the confounding variables considered here explained the univariate associations between "case" status and problematic substance use. Hence, this study indicated that the association between psychotic symptoms and problematic drug use in the Australian population *is not* due to the effects of demographic characteristics, personality, or to the presence of other mental health problems.

Given the cross-sectional nature of the data from the NSMHWB, however, it is not possible to distinguish between other competing explanations for the associations observed here. These include the hypotheses: that drug use is a form of self-medication for persons with psychosis; that psychosis is drug-induced; and that drug use exacerbates or precipitates psychotic symptoms among vulnerable individuals (see reviews by (Hall, 1998; Hall & Degenhardt, 2000)). Prospective studies have found that cannabis use was related to an increased risk of receiving a diagnosis of schizophrenia within the following 15 years (Andreasson, Allebeck, & Rydberg, 1987); while prospective studies of persons with

psychosis have suggested that cannabis use predicts relapse to psychotic symptoms among persons with psychotic disorders (Jablensky, Sartorius, & Ernberg, 1991; Linszen et al., 1994). In the case of the Linszen et al. study, other substance use (including alcohol) was controlled (Linszen et al., 1994). Replications of these findings are needed. Controlled outcome studies of substance abuse treatment for persons with psychosis are also needed to see whether cessation of drug use predicts improvement in psychotic symptoms (Hall, 1998).

One limitation of this study was that the psychosis screener was (by definition) not an instrument designed to produce diagnoses of DSM-IV psychotic illnesses. It was designed to detect possible cases, and so a) some persons who were classed as "cases" may not have met diagnostic criteria for psychotic illnesses, and b) some persons who may have met such criteria were not identified as cases. However, the prevalence estimate produced here (1.2%; 95%CI 1-1.4%) is similar to that produced by the ECA using diagnoses of DSM-III psychotic disorders (0.8-1.2%)(Keith et al., 1991). Furthermore, unless there was a relationship between the measurement of substance use and the construct that the psychosis screener was attempting to measure, which is unlikely, such measurement error would reduce the strength of the association between substance use and psychosis.

Another factor to consider was that the NSMHWB was a household survey – it did not assess persons in dwellings such as hospitals, inpatient psychiatric institutions, and correctional facilities. This meant that persons with psychotic disorders who were in such facilities were not included in the survey; such persons would have been likely to have more severe psychiatric problems, and perhaps more likely to have substance use problems. However, this is not likely to have affected the strength of the observed *association* between substance use and psychotic symptoms – rather, it would most likely have meant that persons who had more severe symptoms of psychosis, with more severe substance use problems, were undersampled (meaning that those from the "extremes" of the distribution were not included).

These two limitations can be assessed to some degree by comparing the findings of the current study with those of the Low Prevalence Study (LPS) carried out in Perth, Melbourne, Brisbane and Canberra as an additional part of the NSMHWB (Jablensky et al., 1999). This study comprised persons who *were* assessed according to diagnostic criteria for psychotic disorders (ICD-10). Furthermore, significant proportions of this sample had resided in institutions (20%), hostels (14%), or been living in rooming houses, hotels, shelters or homeless (9%) during the past month (Jablensky et al., 1999).

Reassuringly, the patterns of drug use were similar across the samples (Table 5). The somewhat higher rates of drug use disorders in the LPS sample are likely to reflect the fact that lifetime diagnoses were used, compared to 12-month diagnoses in the NSMHWB. The rates of tobacco smoking appear somewhat higher among females in the NSMHWB sample, and among males in the LPS sample.

Table 5: Prevalence of substance use and substance use disorders among cases from the NSMHWB sample, and from the Low Prevalence Study sample

	NSMHWB "cases"[1]	Low Prevalence study[2]
% Tobacco use	64 (males); 65 (females)	73 (males); 56 (females)
% Near daily alcohol use	37	37
% Alcohol use disorder	24	30
% At least weekly cannabis use	23	24
% Cannabis use disorder	16	25
% Other drug use disorder	7	13

1. All diagnoses 12-month
2. All diagnoses lifetime

There are a number of implications of the present study. First, there was a strong relationship between screening positively for psychosis and reporting *problematic* use of tobacco, alcohol, cannabis, and other illicit drugs. The mental health risks of such problematic use need to be disseminated to persons who are at risk of psychotic illness, to persons who have already been diagnosed with a psychotic illness, and conversely, to persons who are heavy substance users. In particular, the risks of exacerbation of, or relapse to mental health problems need to be highlighted.

Second, more attention needs to be given to the *physical* health risks of heavy or problematic substance use by persons with psychotic illnesses. The significantly higher rate of tobacco smoking among persons with psychosis means they are at greater risk of tobacco-related diseases such as lung cancer (US Surgeon General, 1982). This risk may be particularly high since there is some evidence to suggest that persons with psychosis may smoke more heavily and use higher tar cigarettes (Masterson & O'Shea, 1984), factors that would increase the harms associated with smoking. Nicotine substitution may be one way in which these harms may be reduced among this population, using nicotine patches or gum. Interventions aimed at abstinence may also be of use among this group. Unfortunately, there is no research that has examined the adequacy of such treatments for this group. Future research could evaluate the feasibility of interventions aimed at assisting persons with psychotic illnesses who smoke to reduce or stop their tobacco use, for example, using nicotine replacement therapy or cognitive behavioural techniques.

Cannabis smokers may also face physical health risks (Hall & Solowij, 1998; Hall, Solowij, & Lemon, 1994). For example, recent evidence suggests that cannabis smokers may face an increased risk of mouth and throat cancers (Zhang et al., 1999). Furthermore, there are significant risks associated with the heavy use of alcohol including cognitive impairment, liver damage, and cardiovascular disease (English et al., 1995).

Finally, the use of alcohol, cannabis, sedatives, opiates and stimulants may be contraindicated in persons receiving antipsychotic medications (e.g. (Lutz, 1976). Substance use may also interfere with an individual's functioning, for example in lowered treatment compliance (Drake et al., 1989; Pristach & Smith, 1990), and increased housing instability or homelessness (Drake et al., 1991). All of these

adverse outcomes would reduce the likelihood that people with psychotic illnesses could live stable lives.

4.1 CONCLUSION

This study presented information on the Australian population-level association between substance use and psychotic symptoms. Persons screening positively for psychosis were significantly more likely to use tobacco, cannabis and alcohol regularly, and to have met criteria for substance use disorders in the past year. There also appeared to be a greater likelihood for psychosis "cases" who were using alcohol and cannabis to be dependent upon these substances. This suggests that such persons might be more vulnerable to developing dependent use than persons who do not screen positively for psychosis.

Analyses revealed that the association between problematic drug use and psychotic symptoms was not due to demographic characteristics, or to the presence of other mental health problems such as anxiety or affective disorders. Cannabis and alcohol dependence remained significant predictors of increasing numbers of psychotic symptoms, as did regular tobacco use. Given the prevalence of these three problems, this finding is of particular concern – 60% of those screening positively were regular smokers, one in four (24%) met criteria for an alcohol use disorder, and around 1 in 6 (16%) met criteria for a cannabis use disorder.

The possible mental and physical health risks of heavy substance use need to be made clear to those diagnosed with psychotic illness, those at risk of developing psychotic illness, and to those who are heavy substance users. Future work might examine effective treatments for substance use problems among persons with psychotic illnesses.

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APPENDIX - ORDINAL LOGISTIC REGRESSION

Table 6: Results of ordinal logistic regression – demographic variables

	Coefficient	SE	Z	p	OR	95%CI
Male[1]	0.039	0.081	0.49	ns	1.04	0.89, 1.22
25-34 years[2]	0.021	0.109	0.189	ns	1.02	0.83, 1.26
35-44 years[2]	-0.334	0.121	-2.76	<.01	0.72	0.56, 0.91
45-49 years[2]	-0.381	0.149	-2.55	<.01	0.68	0.51, 0.92
Secondary education completed[3]	0.028	0.115	0.34	ns	1.03	0.82, 1.29
Postsecondary completed[3]	0.206	0.087	2.37	<.05	1.23	1.03, 1.46
Separated/divorced[4]	0.769	0.104	7.41	<.001	2.16	1.76, 2.65
Widowed[4]	-0.173	0.558	-0.31	ns	0.84	0.28, 2.51
Never married[4]	0.454	0.093	4.89	<.001	1.57	1.31, 1.89
Part-time employed[5]	0.134	0.098	1.37	ns	1.14	0.94, 1.39
Unemployed[5]	0.394	0.140	2.82	2.82	1.48	1.13, 1.95
Not in labour force[5]	0.192	0.104	1.85	ns	1.21	0.99, 1.49

1. reference "female"
2. reference "18-24 years"
3. reference "less than secondary completed"
4. reference "married"
5. reference "employed full time"