Hospital separations for cannabis- and methamphetamine-related psychotic episodes in Australia

Louisa Degenhardt, Amanda Roxburgh and Rebecca McKetin

ABSTRACT

Objective: To examine trends in hospital separations related to "drug-induced" psychosis for cannabis and methamphetamine, in the context of patterns of cannabis and methamphetamine use in the Australian population.

Design and setting: Analysis of prospectively collected data from the National Hospital Morbidity Database on hospital separations primarily attributed to drug-induced psychosis (July 1993 – June 2004), and specifically for cannabis and amphetamines (1999–2004). Calculation of Australian population-adjusted rates of drug-induced psychosis hospital separations using estimated resident population data from the Australian Bureau of Statistics (at 30 June each year) and data on cannabis and methamphetamine use from the 2004 National Drug Strategy Household Survey.

Main outcome measures: Number of hospital separations due to drug-induced psychosis, and standardised (age-specific) rates per million population and per million users.

Results: There have been notable increases in hospital separations due to drug-induced psychosis, which appear to have been driven by amphetamine-related rather than cannabis-related episodes. The rate of hospital separations was higher for amphetamine users than for cannabis users in all age groups, and the rate increased among older amphetamine users.

Conclusions: The risk of hospitalisation for a drug-induced psychotic episode associated with amphetamine use appears to be greater than that for cannabis use in all age groups.

MJA 2007; 186: 342–345

See also page 334 and page 336

There has been long-running debate about the legal status of cannabis use in a number of countries, including Australia,[1-5] driven in part by concerns about an association between cannabis use and psychosis.[6,7]

This debate has been complicated by insufficient distinction being made between:

- enduring psychotic disorders, such as schizophrenia (a clinically recognised syndrome that is chronic and recurring);[8]
- psychotic disorders that are brief in duration, generally lasting no more than a month; and
- drug-induced psychotic episodes or symptoms, thought to be directly attributable to ingestion of a drug, which remit after abstinence or acute withdrawal.[8]

There is good epidemiological evidence of a significant association between cannabis use and the risk of meeting criteria for schizophrenia.[9,10] This does not necessarily imply that cannabis use causes schizophrenia in people who would otherwise not have developed it.[11,12] There is also good evidence to suggest that cannabis use is a more important risk factor for psychotic symptoms among those with a family history of, or pre-existing, schizophrenia.[10,13] Research has also suggested the potential for high doses of cannabis to trigger a short-lived psychotic episode; however, the evidence remains limited.[10,14]

We believe that examination of the possible relationship between cannabis use and mental health needs to be framed in the context of rates of use, rates of mental health problems, and comparison with other drugs, like methamphetamine, which also induce psychotic symptoms.[15-17]

Here, we present population-based evidence on trends in hospital separations where cannabis or methamphetamine was noted as the primary reason for the episode of care, and where the separation was noted as being primarily for a psychotic episode. We evaluate these trends according to age, the relative contributions of cannabis and amphetamines, and what is known about the epidemiology of use of these drugs in Australia.

METHODS

Data on hospital separations

Data were extracted from the National Hospital Morbidity Database (NHMD) for the period July 1993 – June 2004. The NHMD is managed by the Australian Institute of Health and Welfare (AIHW), and data are collected from all state and territory health authorities. Hospital separations refer to the reason for a patient's stay in hospital based on his or her medical records after treatment has been completed, rather than the reason for admission. Data are coded according to the World Health Organization's International classification of diseases (ICD).[18] ICD-9-CM (ninth revision, clinical modification) was used in all jurisdictions until 1998; ICD-10-AM (tenth revision, Australian modification) was used from 1999 in South Australia, Western Australia, and Queensland, and in other jurisdictions in 1998.

In ICD-9, all drug-induced psychoses were recorded under the same code, with no provision for identifying to which drug the episode related. In ICD-10, each drug type has a separate psychosis code. Accordingly, overall trends in drug-induced psychosis separations are presented for 1993–2004, with drug-specific trends for 1999–2004.

We use the term "drug-induced" to be consistent with ICD-10 nomenclature; this should not be taken as an indication of our views on the nature of the relationship between cannabis/amphetamine use and psychosis or any potential causal role of the drugs. These data represent hospital separations where the treating clinician(s) considered that illicit drugs were an important trigger for the psychotic episode.

Drug-induced psychosis codes

The ICD-9 codes used to identify hospital separations related to drug-induced psychosis were: 292.1 (Paranoid and/or hallucinatory states induced by drugs); 292.2 (Pathological drug intoxication [resulting in brief psychotic states]); and 292.9 (Unspecified drug-induced mental disorders). ICD-10 codes used were: F11 (Mental and behavioural disorders due to use of opioids); F12 (cannabis); F14 (cocaine); and F15 (other stimulants). A further subdivision (.5 — Psychotic disorder) was applied to the ICD-10 codes to record amphetamine-induced psychosis separations (F15.5) and cannabis-induced psychosis separations (F12.5).

Data on drug use

The AIHW's 2004 National Drug Strategy Household Survey (NDSHS)[19] employed a

multistage, stratified sampling methodology, in which the sample ($n = 29\,445$; response rate, 48%) was stratified by geographic region, with oversampling of smaller jurisdictions. The selected respondent in each household was the person with the next birthday, and who was aged 12 years or older. The sampling frame was designed to provide (within each geographic stratum) a close-to-random sample of households. However, the resulting samples required weighting to correct for imbalances arising in the design and execution of the sampling.

Individuals who reported ever using a particular drug were asked if they had used it in the preceding 12 months; if so, they were asked about their patterns of use of the drug in this period.

Data analysis

Numbers of drug-induced psychosis separations per million population were standardised to the relative size of the population using the Australian Bureau of Statistics estimated Australian resident population figures, by age group, at 30 June of each year for 1993–2004, to produce "age-specific" rates.[20]

The total numbers of bed-days per annum for both cannabis- and amphetamine-induced psychosis separations were estimated by summing all days across episodes of care.

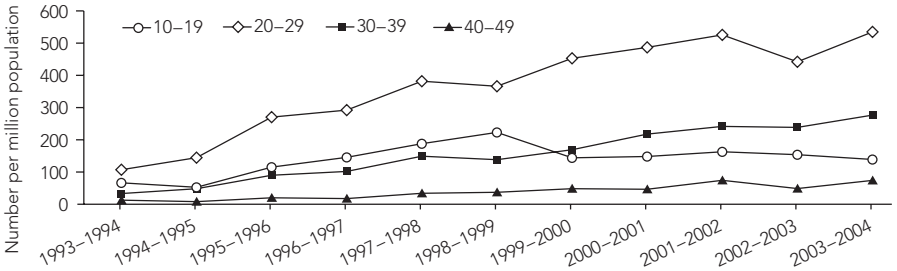
An estimated "number of past year users" was derived from the weighted population estimates of past year prevalence according to the 2004 NDSHS. Where comparisons are made between hospital separation episodes and drug-use data from the NDSHS, the numbers of separations per million cannabis and amphetamine users are standardised using weighted estimates of the population of *users* of each drug, derived from the survey data.

Standard statistical techniques were used to analyse the NDSHS data. χ^2 analyses were conducted (using unweighted data) to determine the relationship between age and frequency of amphetamine and cannabis use, and age and route of administration of amphetamines.

Ethics approval

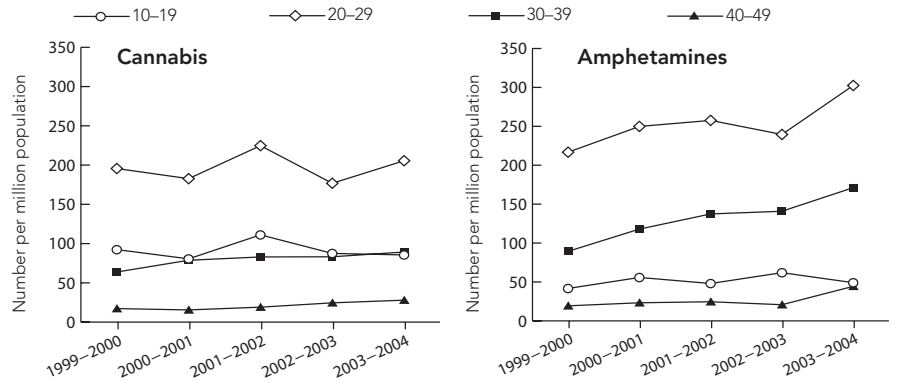
Ethics approval for the study was granted by the AIHW Ethics Committee and the Human Research Ethics Committee of the University of New South Wales.

1 Number of hospital separations for drug-induced* psychosis per million population by age group (years), Australia, 1993–2004†



* The term "drug-induced" is used for consistency with ICD-10 nomenclature; it does not imply evidence of a causal role of drugs in psychosis. † Figures are standardised to the Australian population figures as at 30 June each year for each age group. ◆

2 Number of hospital separations for drug-induced* psychosis for cannabis and amphetamines per million population by age group (years), Australia, 1999–2004†



* The term "drug-induced" is used for consistency with ICD-10 nomenclature; it does not imply evidence of a causal role of drugs in psychosis. † Figures are standardised to the Australian population figures as at 30 June each year for each age group. ◆

RESULTS

The number of separations with drug-induced psychosis as the primary problem among those aged 10–49 years increased from 55.5 per million population in 1993–1994 to 253.1 per million population in 2003–2004. This increase was most marked among older age groups: the age-specific rate increased fivefold among those aged 20–29 years, sixfold among those aged 40–49 years, and eightfold among those aged 30–39 years, compared with the rate among those aged 10–19 years, which was less than doubled (Box 1). Across this period, age-specific rates of drug-induced psychosis separations were consistently highest among those aged 20–29 years.

From 1999–2000 to 2003–2004, amphetamines accounted for the largest proportion of all drug-induced psychosis separations, ranging from 41% in 1999–2000 to 55% in 2003–2004, while cannabis accounted for 39%–45% of separations over this period. The number of both cannabis- and amphetamine-induced psychosis separations per million population was highest among the 20–29-year age group (Box 2). Age-specific rates among the 10–19-year age group were lower for amphetamine-induced psychosis than for cannabis-induced psychosis (41.6–61.9 and 80.5–111.1 separations per million population, respectively). Age-specific rates for cannabis-induced psychosis remained relatively stable across all age groups, compared with steady increases for amphetamine-induced psychosis. From 1999–2000 to 2003–2004, amphetamines accounted for an increasing proportion of drug-induced psychosis separations among older age groups (from 47% to 62%), while cannabis consistently accounted for around 60% of drug-induced psychosis separations among the youngest age group.

The total number of bed-days for cannabis-induced psychosis separations was 8067 in 1999–2000, compared with 5679 for

amphetamine-induced psychosis separations. In 2003–2004, the total number of bed-days had increased to 10 439 for cannabis, and 8068 for amphetamines. The percentage increase in bed-days was greater for amphetamine-induced separations (42%) over this period, compared with cannabis (29%).

Although hospital separations due to both cannabis- and amphetamine-induced psychosis (raw numbers and age-specific rates) were highest among those aged 20–29 years (Box 3), these figures do not take into account the relative number of users of the drugs. The number of hospital separations in 2003–2004 due to cannabis- and amphetamine-induced psychosis per million users of each drug showed a distinctly different age pattern. The estimated number of cannabis-induced psychosis separations per million cannabis users was highest among the youngest age groups. In contrast, the estimated number of amphetamine-induced psychosis separations per million amphetamine users was highest among the older age groups.

NDSHS data describing the different patterns of use of these drugs (Box 4) suggested that younger cannabis users were more likely to report using very large quantities of cannabis per occasion of use (2–5 g; $\chi^2 = 28.60$; $P < 0.001$), despite having a lower frequency of use than older users ($\chi^2 = 34.9$; $P < 0.001$). There did not appear to be age-related differences in the frequency of amphetamine use. Older amphetamine users, however, were more likely than younger users to report injecting amphetamines ($\chi^2 = 15.7$; $P < 0.005$). They were also more likely to have used crystalline methamphetamine, whereas younger users were more likely than older users to report that they had used prescription amphetamines in tablet form ($\chi^2 = 20.39$; $P < 0.001$).

Among all age groups, the number of amphetamine-induced psychosis separations per million amphetamine users was considerably higher than the comparable number for cannabis.

3 Number and prevalence of drug-induced* psychosis hospital separations for cannabis and amphetamines in 2003–2004, and prevalence of use of these drugs, by age group, Australia†

Age group (years)	No. of separations for drug-induced psychosis	No. of separations per million population (95% CI)	Prevalence of past year drug use‡	No. of past year users‡	No. of separations per million users (95% CI) ‡
Cannabis					
10–19§	237	85 (75–96)	13.8	305 000	777 (774–780)
20–29	568	205 (189–222)	26.0	718 000	791 (789–793)
30–39	266	89 (79–100)	15.9	475 000	560 (558–562)
40–49	83	28 (22–34)	8.7	258 600	321 (320–323)
Amphetamines					
10–19§	136	49 (41–57)	3.3	73 900	1840 (1827–1853)
20–29	836	302 (282–323)	10.7	295 000	2834 (2824–2844)
30–39	510	171 (156–186)	4.1	120 700	4225 (4201–4249)
40–49	132	44 (37–52)	0.4	34 200	3860 (3819–3901)

* The term "drug-induced" is used for consistency with ICD-10 nomenclature; it does not imply evidence of a causal role of drugs in psychosis. † Only 2003–2004 separations data from the National Hospital Morbidity Database are included. ‡ Estimates of past year users of each drug are derived from the 2004 Australian National Drug Strategy Household Survey (NDSHS).[19] § Due to restrictions on age categories, hospital separations are for those aged 10–19 years, whereas NDSHS data are for those aged 12–19 years. This may have led to an overestimate of the separations per million users for this age group; however, the number of 10–12-year old drug users is likely to be small, limiting the extent of the overestimate. ◆

4 Patterns of cannabis and amphetamine use among past year users of each drug by age group (years), Australia, 2004[19]

	12–19	20–29	30–39	40–49
Proportion using cannabis …				
daily	9%	16%	21%	20%
weekly — less than daily	21%	21%	25%	28%
monthly — less than weekly	14%	12%	12%	10%
every few months or less	56%	51%	42%	42%
On a day of cannabis use, proportion typically using …				
⩽ 1 g	29%	44%	39%	44%
2–5 g	53%	40%	40%	35%
6 g or more	18%	16%	21%	21%
Proportion using amphetamines …				
daily	3%	0.4%	2%	0.6%
weekly — less than daily	11%	9%	9%	12%
monthly — less than weekly	15%	16%	16%	16%
every few months or less	70%	73%	73%	72%
Proportion injecting amphetamines	10%	15%	27%	27%
Proportion using crystalline methamphetamine	33%	38%	40%	42%

DISCUSSION

Despite the relationship between cannabis use and psychosis (particularly among young people) receiving increasing media attention,[3,6,7] we found relatively stable numbers of hospital separations for cannabis-induced psychosis over the 5 years from 1999 to 2004. In contrast, hospital separations for amphetamine-induced psychosis had increased, particularly among those aged 20 years and older. This pattern was also evident among separations for drug-induced psychosis in general, suggesting that the increases over the decade to 2004 were driven by amphetamine rather than cannabis. Rates of hospital separations were proportionally higher for amphetamine users than cannabis users in all age groups. Although the total number of bed-days was higher for cannabis-related separations, there was a greater increase in the number of bed-days for amphetamine-related separations between 1999 and 2004.

The number of separations per million users of each drug revealed differences among the population of users. Hospitalisations for amphetamine users were highest among the older age groups, which may be due to the higher rates of injecting and of crystalline methamphetamine use reported among these groups in the NDSHS. Recent

Australian research found that those reporting crystalline methamphetamine use were more likely than those using methamphetamine powder to be dependent; and dependent users were more likely to experience psychotic episodes.[21] In other words, given their heavier patterns of use, crystalline methamphetamine users may be at elevated risk of psychotic symptoms compared with other methamphetamine users.

The number of separations for cannabis-induced psychosis per million cannabis users showed the reverse age trend, with higher rates among younger cannabis users. More research is needed to examine this issue, but it may be related to the reported heavier use on each occasion of use among younger age groups. It might be argued that these higher rates of cannabis-induced psychosis are an artefact of difficulties in differentiating between drug-induced psychosis and schizophrenia, with clinicians erring against making a diagnosis of schizophrenia. However, if this were the case, one would expect to see a similar pattern of amphetamine-induced psychosis separations among the younger age groups. The distinct age-related differences between amphetamine- and cannabis-induced psychosis separations suggest that age alone is not sufficient to determine a clinician's diagnostic decision.

Study limitations

Some limitations arising from the hospital separation data (NHMD data) need to be considered. First, a diagnosis of drug-induced psychosis depends on many factors, including the clinician's perceptions of a drug's potential to cause a psychotic episode, and the extent to which a drug use history is taken at the time of consultation. Second, differential diagnoses of schizophrenia and drug-induced psychosis may be difficult to determine. Third, only primary drug problems were included here, so multiple drug use is not examined. Finally, mental health and drug use service delivery, as well as coding practices, may have changed over the period of study, and increases in drug-related separations may be attributable to changes in hospital admission thresholds, bed availability, or coding of principal diagnoses. Only cases where drug-induced psychosis was recorded as the primary problem at the time of separation were analysed, which may have led to an underestimate in the occurrence of drug-induced psychosis.

Despite these limitations, trends reported here are consistent with other indicators of cannabis and amphetamine use and related harm. Cannabis markets have remained fairly stable in Australia, while amphetamine markets have changed quite dramatically, with increasing use of crystalline methamphetamine and increasing numbers of methamphetamine laboratories.[21-23] In addition, health professionals in each jurisdiction use the *National health data dictionary*[24] to ensure coding consistency and comparability; a comprehensive compliance evaluation of the NHMD reported that the quality of principal diagnosis data at a national level "is considered to be very good".[25]

One of the major limitations of the drug use data (NDSHS data) is that general population surveys are likely to underestimate the prevalence of dependent drug use.[26] Although the NDSHS may not capture more disadvantaged amphetamine users, this is not likely to have a significant impact on the figures presented here. Most amphetamine users are irregular users of the drug, even when sentinel groups of regular ecstasy users are studied.[19,21]

Conclusions

This study goes some way towards providing a context within which to frame the current debate surrounding cannabis use and psychosis. The potential causal role of cannabis was not addressed here but is an issue that clearly requires further investigation. Although concern about links between cannabis and psychotic symptoms is understandable, amphetamine use seems to have a higher risk of psychotic symptoms requiring hospital treatment and represents a risk for more users in all age groups.

ACKNOWLEDGEMENTS

This article is one of the products of the National Illicit Drug Indicators Project, which is funded by the Australian Government Department of Health and Ageing. The Department did not have any role in the study design, analysis or writing of the article. We thank Professor Richard Mattick for his comments on a final draft of the article.

COMPETING INTERESTS

None identified.

AUTHOR DETAILS

Louisa Degenhardt, PhD, MPsych(Clinical), Senior Lecturer
Amanda Roxburgh, BA(Hons)Psych, MCrim, Senior Research Officer
Rebecca McKetin, PhD, Research Fellow
National Drug and Alcohol Research Centre, University of New South Wales, Sydney, NSW.
Correspondence: l.degenhardt@unsw.edu.au

REFERENCES

1 Strang J, Witton J, Hall W. Improving the quality of the cannabis debate: defining the different domains. *BMJ* 2000; 320: 108-110.
2 Lenton S. Pot, politics and the press — reflections on cannabis law reform in Western Australia. *Drug Alcohol Rev* 2004; 23: 223-233.
3 Think again on cannabis: PM. *The Australian* 2005; 11 Nov: Sect. 3.
4 Get tough on cannabis: PM. *The Australian* 2005; 14 Nov: Sect. 1.
5 Support for stiffer cannabis penalties. *The Australian* 2005; 23 Nov: Sect. 3.
6 Cannabis is worst drug for psychosis. *The Australian* 2005; 21 Nov: Sect. 3.
7 Pot psychosis? What am I saying … er, what was I saying? *The Australian* 2005; 14 Nov: Sect. 10.
8 American Psychiatric Association. Diagnostic and statistical manual of mental disorders. 4th ed. Washington, DC: APA, 1994.
9 Degenhardt L, Hall W. Cannabis and psychosis. *Curr Psychiatry Rep* 2002; 4: 191-196.
10 Hall W, Degenhardt L, Teesson M. Cannabis use and psychotic disorders: an update. *Drug Alcohol Rev* 2004; 23: 433-443.
11 Degenhardt L, Hall W, Lynskey M. Testing hypotheses about the relationship between cannabis use and psychosis. *Drug Alcohol Depend* 2003; 71: 37-48.
12 Degenhardt L, Hall W. Is cannabis a contributory cause of psychosis? *Can J Psychiatry* 2006; 51: 556-565.
13 Henquet C, Krabbendam L, Spauwen J, et al. Prospective cohort study of cannabis use, predisposition for psychosis, and psychotic symptoms in young people. *BMJ* 2005; 330: 11-14.
14 Hall W, Degenhardt L. Is there a specific "cannabis psychosis"? In: Castle DJ, Murray R, editors. Marijuana and madness. Cambridge: Cambridge University Press, 2004: 89-100.
15 Connell PH. Amphetamine psychosis. Maudsley Monograph No. 5. London: Chapman and Hall, 1958.
16 Bell DS. The experimental reproduction of amphetamine psychosis. *Arch Gen Psychiatry* 1973; 29: 35-40.
17 Cohen SI, Johnson K. Psychosis from alcohol or drug abuse. *BMJ* 1988; 297: 1270-1271.
18 World Health Organization. The ICD-10 classification of mental and behavioural disorders — diagnostic criteria for research. Geneva: WHO, 1993.
19 Australian Institute of Health and Welfare. 2004 National Drug Strategy Household Survey: first results. (AIHW Cat. No. PHE 57.) Canberra: AIHW, 2005.
20 Bland M. An introduction to medical statistics. London: Oxford University Press, 2004.
21 McKetin R, McLaren J, Kelly E. The Sydney methamphetamine market: patterns of supply, use, personal harms and social consequences. NDLERF Monograph No. 13. Sydney: National Drug and Alcohol Research Centre, UNSW, 2005.
22 Stafford J, Degenhardt L, Dunn M, et al. Australian trends in ecstasy and related drug markets 2005: findings from the Party Drugs Initiative. NDARC Monograph No. 58. Sydney: National Drug and Alcohol Research Centre, UNSW, 2005.
23 Australian Crime Commission. Illicit drug data report 2003–04. Canberra: ACC, 2005.
24 Health Data Standards Committee. National health data dictionary. Version 13. (AIHW Cat. No. HWI 88.) Canberra: Australian Institute of Health and Welfare, 2006.
25 Australian Institute of Health and Welfare. National minimum data set for admitted patient care: compliance evaluation 2001–02 to 2003–04. (AIHW Cat. No. HSE 44.) Canberra: AIHW, 2006: 99.
26 Hall W, Ross J, Lynskey M, et al. How many dependent opioid users are there in Australia? NDARC Monograph No. 44. Sydney: National Drug and Alcohol Research Centre, UNSW, 2000.

(Received 15 Dec 2005, accepted 9 Jan 2007) ❑