

Cannabis and Associated Physical and Mental Health Risks: A Survey of Research Evidence

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BACKGROUND

This paper consolidates the most current and earlier influential research on cannabis use and associated health risks. The research evidence reviewed derives mainly from American, European and Australasian studies.

Cannabis is the most widely used illegal substance in Australia. In NSW, 31.6% of the population over the age of 14 have tried cannabis, with 10.7% of the population reporting use of the drug in the last 12 months.¹ Approximately half of the Aboriginal population have reported using cannabis during their lives.²

The 2004 National Drug Strategy Household Survey showed that cannabis is generally considered to be a soft drug compared to heroin and amphetamines. More than 23% of those surveyed viewed regular use of cannabis to be acceptable.³ Youth surveyed during the development of the National Illicit Drug Campaign in 2003 supported this view.⁴

There is, however, growing evidence that cannabis has the potential to impact detrimentally on both physical and mental health.

Varying levels of cannabis use are referred to throughout this paper but were not defined within the research that is cited. As an indication, to quantify these levels although an agreed definition of 'chronic use' is not available, the Clinical Advisor to the Centre for Drug and Alcohol suggests that a chronic user is someone who regularly uses cannabis over a period of time of 6 months or longer, continuously, or broken over longer periods of relapse.

Summary of Research Findings

- Cannabis has a detrimental effect on the cardiovascular system. When smoked, cannabis harms the respiratory and immune systems. Reproductive organs can be harmed through frequent use and foetal development impaired.
- Cannabis warps perception, reactions are slowed, motor skills are impaired and concentration is more difficult.
- Premature ageing in the area of the brain responsible for short-term memory (hippocampus) can be caused by habitual use. Cannabis has also been linked to slowed brain development and brain damage through frequent use, particularly if consumed at a young age.
- There is a strong link between cannabis use and psychosis, particularly schizophrenia.
- Chronic use of cannabis is linked to high rates of depression, anxiety and lack of motivation⁵ in long-term users.

¹ 2004 National Drug Strategy Household Survey, Selected Results for NSW.

² 2004 National Drug Strategy Household Survey.

³ *Ibid.*

⁴ Formative research with young Australians to assist in the development of the National Illicit Drugs Campaign, Commonwealth Department of Health and Ageing, Canberra: 2003, <http://www.drugs.health.gov.au/pdf/nidc.pdf>, last accessed 21 December 2005.

⁵ Coined 'amotivation syndrome', has been the subject of studies too numerous to mention. Evidence of such a syndrome is not conclusive; however, the term is used to refer collectively to a range of symptoms repeatedly identified in chronic users including, apathy, loss of effectiveness, and diminished capacity or willingness to carry out complex, long-term plans, endure frustration, concentrate for long periods, follow routines, or successfully master new material. In adolescents, it could also be a lack of

- Cannabis use is often part of a wider pattern of substance use, including cigarettes, alcohol and other drugs.
- Research is increasingly suggesting that cannabis is an addictive drug, which can cause physical and psychological dependence.
- Young people who use cannabis frequently are at an increased risk of experiencing mental health and developmental problems, and other adverse outcomes, including suicide, other substance misuse, criminal behaviour, poor performance at school and reduced life opportunities.

ANALYSIS OF KEY ISSUES

1 Cannabis and Mental Health

Cannabis induces feelings of euphoria, relaxation and heightened senses. These effects are felt within minutes of smoking and reach a plateau lasting in excess of two hours, depending on the dose.⁶

Cannabis can also induce memory loss and dysphoric reactions, which can include anxiety, depression, paranoia, aggression and psychosis.⁷

Few studies aimed at understanding the relationship between cannabis and mental illness have been conducted, although evidence is emerging from research over the last 4 years that presents a strong case for a causal connection. Policy shifts in response to these findings are evident in other jurisdictions:

- The French government launched a media campaign in February 2005 to inform young people about the detrimental effects of cannabis, including its links to mental illness.
- Similarly, the US government developed a resource in February 2005 containing information from the Office of National Drug Control's National Youth Anti-Drug media campaign highlighting the link between cannabis use and increased risk of mental health problems. The resource noted emerging research presenting a stronger case for cannabis being a causal agent in psychiatric symptoms.
- In the United Kingdom, cannabis was downgraded from a B to a C classification in 2004; a decision that has since been subject to review, the Government citing recent studies that link cannabis use to psychosis.⁸

Advances over the last 10 years in the areas of neuroscience and genetics have been significant. However, studies of how brains function, how chemicals alter the brain's performance and how, in turn, this impacts on behaviour are inconclusive and the subject of further research.

motivation to undertake the educational and other psychological tasks that are an essential part of the transition from childhood to adulthood.

⁶ Ashton, H., 'Pharmacology and effects of cannabis', *British Journal of Psychiatry*, 2001, 178, 101-106.

⁷ *Ibid.*

⁸ Drugs are classified A, B or C depending on the relative harmfulness of the drug when misused.

1.1 Psychosis

1.1.1 The link between cannabis use and psychosis is well recognised;⁹ however, the causal connection is not clear. Some studies have shown that psychotic symptoms predict later cannabis use:

- One European study investigated 232 first-episode schizophrenia patients and found that the first symptom of schizophrenia was more often followed than preceded by use of illicit drugs with cannabis the most frequently used drug.¹⁰
- A 14-year Dutch study found that psychotic symptoms in those who had never used cannabis before the onset of psychotic symptoms predicted future cannabis use.¹¹ The study also concluded that cannabis use in individuals who did not have psychotic symptoms before they began using cannabis, predicted future psychotic symptoms.

1.1.2 There is also a growing body of evidence that regular cannabis use has a direct relationship with the onset of psychosis:

- A 25-year longitudinal study in New Zealand concluded that there is a direct link between cannabis use and psychotic symptoms and that the direction of causality is from cannabis use to psychotic symptoms.¹² This study showed a clear increase in psychotic symptoms after the start of regular use.
- A New Zealand birth cohort study found that self-reported cannabis use ('three times or more') by age 15 and age 18 predicted later schizophrenia symptoms.¹³
- Two studies demonstrate a strong association between use of cannabis and the onset of psychotic episodes in schizophrenia patients at an earlier age.¹⁴
- Two European studies of older adolescents found that cannabis use seemed to constitute a minor risk factor for psychosis but a much greater risk in those with evidence of predisposition for psychosis.¹⁵ The New Zealand study referred to above indicated that the early onset of cannabis use, before the age of 15, may constitute a stronger risk factor for psychosis than cannabis use in later adolescence.¹⁶
- A Swedish study assessed cannabis use in 50,087 18-20 year olds from 1970 to 1996.¹⁷ The study concluded that the risk for schizophrenia was increased in

⁹ Rey, J., Tennant, C., 'Cannabis and Mental Health', *British Medical Journal*; 2002, 325:1183-1184; Arseneault, L., Cannon, M., Poulton, R., Murray, R., Caspi, A., Moffitt, T., 'Cannabis use in adolescence and risk for adult psychosis: longitudinal prospective study', *British Medical Journal*, 2002, 325:1212-1213; Hall, W., Degenhardt, L., 'Cannabis and psychosis', *Australian New Zealand Journal of Psychiatry*, 2000; 34:26-34.

¹⁰ Hambrecht, M., Hafner, H., 'Substance abuse and the onset of schizophrenia', *Biological Psychiatry*, 1996, 40, 1155-1163.

¹¹ Ferdinand, R., Sondeijker, F., van der Ende, J., Selten, J-P, Huizink, A., Verhulst, F., 'Cannabis use predicts future psychotic symptoms, and vice versa', *Addiction*, 2005, 100:612-618.

¹² Fergusson, D., Horwood, L., Ridder, E., 'Tests of causal linkages between cannabis use and psychotic symptoms', *Addiction*, 100, 3:354-366, 2005.

¹³ Arseneault, L. et al, 2002.

¹⁴ Veen, N., Selten, J.P, van der Tweel, I., Feller, W., Hoek, H., Kahn, R., 'Cannabis Use and Age at Onset of Schizophrenia', *American Journal of Psychiatry*, 2004, 161:501-506; Arendt, M., Rosenberg, R., Foldager, L., Perto, G., Munk-Jorgensen, P., 'Cannabis-induced psychosis and subsequent schizophrenia-spectrum disorders: follow-up study of 535 incident cases', *British Journal of Psychiatry*, 2005, 187, 510-515.

¹⁵ Van Os J., Bak, M., Hanssen, M., Bijl, R., De Graaf, R., Verdoux, H., 'Cannabis use and psychosis: a longitudinal population-based study', *American Journal of Epidemiology*, 2002, 156, 319-327; Henquet, C., Krabbendam, L., Spaiwen, J., Kaplan, C., Lieb, R., Witschen, H., Van Os, J., 'Prospective cohort study of cannabis use, predisposition for psychosis and psychotic symptoms in young people', *British Medical Journal*, 2005, 330, 11.

¹⁶ Arseneault, L. et al, 2002.

¹⁷ Zammit, S., S., Allebeck, P., Andreasson, S., Lundberg, I., Lewis, G., 'Self-reported cannabis use as a risk factor for schizophrenia in Swedish conscripts of 1969: a historical cohort study', *British Medical Journal*, 2002, 325, 1195-1212.

those who reported that they had ever used cannabis at initial assessment, the effect being dependent on dose. Those who had used cannabis more than 50 times before the initial assessment were 6.7 times more likely to develop schizophrenia.

- A Danish study found that almost half of patients treated for cannabis related mental disorder go on to develop schizophrenic illness.¹⁸

1.1.3 The most broadly accepted explanation is that cannabis use is a component cause and a risk factor leading to psychosis and psychotic symptoms. This position is supported by 2 separate reviews of recent cannabis studies and related literature.¹⁹

1.1.4 Evidence has recently emerged that an individual's genetic make-up may cause them to be particularly susceptible to cannabis-induced psychosis:

- An American study found that the risk for individuals with a predisposition for psychosis was much higher.²⁰
- Another study found that people with a particular genetic makeup were 5 times more susceptible to psychosis.²¹

1.1.5 Studies show that young people are the most effected by cannabis.²² The earlier the age of onset of cannabis, the greater the risk of psychotic outcomes:

- A US study showed that the rate of mental illness is about 8-9% among US adults and 12% for those who use cannabis. Among those who had used the drug before the age of 12, mental illness prevalence jumped to 21%.²³
- A Greek study found that cannabis use at a young age contributes to psychotic symptoms with very high risks for users under the age of 16.²⁴
- Another US study conducted brain scans on male teenagers who were daily, long-term users of cannabis as well as adolescent schizophrenia patients who did not use cannabis.²⁵ They found that a region of the brain was atrophied in both the cannabis users and those with schizophrenia. The cannabis smokers were underdeveloped on the left side of the brain, whereas those suffering from schizophrenia had atrophy on both sides of the brain. These findings are supported by an Australian study, which presented Brain Scan Imaging showing that brain activity and damage caused by cannabis consumption mimics that found in people suffering from schizophrenia.²⁶

¹⁸ Arendt, M., et al, 2005.

¹⁹ Arseneault, L., Cannon, M., Witton, J., Murray, R., 'Causal association between cannabis and psychosis: examination of the evidence', *The British Journal of Psychiatry*, 2004, 184: 110-117; Semple, D., McIntosh, A., Lawrie, S., 'Cannabis as a risk factor for psychosis: systematic review', *Journal of Psychopharmacology*, 2005, 19:187-194.

²⁰ Henquet, C., et al, 2005;

²¹ Caspi, A., Moffitt, E., Cannon, M., McClay, J., Murray, R., Harrington, H., Taylor, A., Arseneault, L., Williams, B., Braithwaite, A., Poulton R., Craig W., 'Moderation of the effect of adolescent-onset cannabis use on adult psychosis by a functional polymorphism in the catechol-o-methyltransferase gene: Longitudinal evidence of a gene X environment interaction', *Biological Psychiatry*, 2005, 57(10):1117-27.

²² Stefanis, M., Delespaul, P., Henquet, C., Bakoula, C., Stefanis, N., Van Os, J., 'Early Adolescent Cannabis Exposure and Positive and Negative Dimensions of Psychosis', *Addiction*, 2004, 99, 1333-1341.

²³ National Survey on Drug Use and Health, Office of Applied Studies, USA, August 2005.

²⁴ Stefanis, M., 2004.

²⁵ North Shore University Hospital – Long Island Jewish Healthcare System, presented to the Radiological Society of North America, reported in Join Together Online, <http://www.jointogether.org/sa/news>, last accessed 3 December 2005; Professor Sanjiv Kumra, Albert Einstein College of Medicine, New York, findings presented to the Radiological Society of North America, November 2005.

²⁶ McKay, D.R., Tennant, C.C., 'Is the grass greener? The link between cannabis and psychosis', *Medical Journal Australia*, 2000, 172:284-86.

1.2 Depression, anxiety and suicidal ideation

1.2.1 Frequent use of cannabis has been linked to depression, anxiety, suicidal thoughts and attempts in long-term users:

- A Columbian longitudinal study of 2,226 adolescents found a clear correlation between cannabis use and elevated levels of anxiety and depression.²⁷
- A 21-year New Zealand study found that use of cannabis, particularly heavy or regular use was linked to later increases in depression, suicidal thoughts and attempts.²⁸
- An Australian cohort study over 6 years showed that frequent cannabis use in teenagers doubles risk of depression and anxiety, with teenage girls who use cannabis daily 5 times more likely to develop depression.²⁹ This study made two other findings, first that the level of use was found to relate directly to the extent of depression and anxiety; second, that depression and anxiety in teenagers do not predict later cannabis use, ruling out self-medication as the reason for the association.
- A US study over a 14-16 year period found that people who were not depressed and used marijuana at the beginning of the study were 4 times more likely to suffer from depression at follow up.³⁰ 2 other American studies indicate that young people who consume cannabis on a weekly basis are 3 times more likely than non-users to contemplate and attempt suicide.³¹
- Another New Zealand study of the relationship between cannabis abuse / dependence and suicide attempts found that cannabis use may make an independent contribution to the risk of serious suicide attempts, both directly and through the possible effects of cannabis abuse on the risk of other mental disorders.³²
- A British study suggested that anxiety, depression and suicidal thoughts are more common in anxious or psychologically vulnerable individuals.³³ This study also associated cannabis consumption with an increase in suicide attempts.

2 Cannabis and Physical Health

Cannabis contains more than 426 harmful chemicals. The primary psychoactive constituent in cannabis is tetrahydrocannabinol or THC. THC is stored in the fatty tissues of the body for long periods of time in the testes, liver and brain.³⁴ Cannabis combines many of the properties of alcohol, tranquilisers, opiates and hallucinogens. It acts as a sedative, painkiller, psychedelic and stimulates appetite.³⁵

²⁷ Brook, J; Rosen, Z.; Brook, D., 'The effect of early marijuana use on later anxiety and depressive symptoms', 2001, *NYS Psychologist*, 35-39, 2001.

²⁸ Fergusson, D., Horwood, J., Swain-Campbell, N., 'Cannabis use and psychosocial adjustment in adolescence and young adulthood', 97:1123-1135, 2002.

²⁹ Patton, G., Coffey, C., Carlin, J., Degenhardt, L., Lynskey, M., Hall, W., 'Cannabis use and mental health in young people: cohort study', *British Medical Journal*, 2002; 325:1212-3.

³⁰ Bovasso, G., 'Cannabis abuse as a risk factor for depressive symptoms', *The American Journal of Psychiatry*; 2001; 158:2033.

³¹ Greenblatt, J., 'Adolescent self-reported behaviours and their association with marijuana use', based on data from the National Household Survey on Drug Abuse, 1994-1996, SAMSHA, 1998; Lynskey, M., Glowinski, A., Todorov, A., Bucholz, K., Pamela A., Madden, P., Nelson, E., Statham, D., Martin, N., Heath, A., 'Major Depressive Disorder, Suicidal Ideation, and Suicide Attempt in Twins Discordant for Cannabis Dependence and Early-Onset Cannabis Use', *Archives of General Psychiatry*, 2004;61:1026-1032.

³² Beautrais, A., Joyce, P., Mulder, R., 'Cannabis abuse and serious suicide attempts', *Addiction*, 1999, 94: 1155.

³³ Johns, A., 'Psychiatric effects of Cannabis', *British Journal of Psychiatry*, 2001, 178, 116-122.

³⁴ Volkow N., et al, *Psychiatry Research Neuroimaging*, 67:29-38, 1996.

³⁵ Ashton, H., 2001.

Its toxicity is extremely low and no deaths directly due to poisoning or overdose by heavy cannabis use have ever been reported in worldwide literature.³⁶

2.1 Effects on the cardiovascular and respiratory systems

Cannabis impacts on the cardiovascular system by producing a rapid heart rate (from 20 to 100% above baseline) and alters the vessels around the heart.³⁷ Postural hypotension and fainting may occur. Tolerance is quickly developed to these effects and are therefore not considered to be of high concern.³⁸ In extreme cases however, fatal cardiac incidence have been reported in young cannabis users after heavy cannabis consumption.³⁹

The long term effects of smoking cannabis are consistent with those of tobacco smoking. A marijuana cigarette contains one-third more tar than an equivalent tobacco cigarette,⁴⁰ carbon monoxide, bronchial irritants, tumour initiators, tumour promoters and carcinogens.⁴¹ Heavy users over a long period of time have an increased risk of developing cancers of the aerodigestive tract.⁴² Consumption is associated with bronchitis and emphysema, and there is an increased incidence of a rare form of throat cancer in young people.⁴³

2.2 Perception cognition and psychomotor performance

Generally, perceptions of colours, sounds and emotions may be heightened during cannabis use and perception of time, distorted. Hallucinations may also occur.

Cognitive and psychomotor performance is also impaired. Reactions are slowed, short-term memory and motor skills are impaired and concentration is more difficult.⁴⁴ Cannabis use impairs both road-driving and machinery operating skills. There are some reports of an increase in road accidents among people who drive when under the influence of cannabis, with one recent overseas study showing that cannabis use almost doubles the risk of fatal crashes.⁴⁵ Most cannabis users are unaware of the impact it has on their motor skills, or that one dose can continue to have an effect 24 hours after its consumption.⁴⁶ There is considerable evidence that performance in

³⁶ *Ibid.*

³⁷ Joy, J., Watson, S., and Benson, J., eds., 'Marijuana and medicine: assessing the evidence base', Washington: National Academy Press, 1999.

³⁸ *Ibid.*, Hall, W. 'Reducing harms caused by cannabis use: the policy debate in Australia', *Drug and Alcohol Dependence*, 2001, 62, 163-174; Hall, W. and Solowij, N., 'Adverse effects of cannabis', *Lancet*, 1998, 352, 1611-1616; Hall, W. Solowij, N. and Lemon, J. 'The health and psychological consequences of cannabis use', Canberra: Australian Government Publishing Service, 1994.

³⁹ Ashton, H., 2001.

⁴⁰ Benson, M. and Bentley, A.M., 'Lung Disease induced by drug addiction', *Thorax*, 50, 1125-1127.

⁴¹ British Medical Association, 'Therapeutic Uses of Cannabis', London: Harwood Academic.

⁴² Tashkin, D., et al, 'Respiratory and immunologic consequences of smoking marijuana smoking', *Journal of Clinical Pharmacology*, 2002, 42:11.

⁴³ *Ibid.*

⁴⁴ Smiley, A., 'Marijuana: on road and driving simulator studies' in Kalant, H. et al, eds, *The Health Effects of Cannabis*, 1999, Toronto, 171-191.

⁴⁵ World Health Organisation, 'Program on Substance Abuse', *Cannabis: A Health Perspective and Research Agenda*, 1997, Geneva: WHO; Laumon, B., Gadegbeku, B., Martin, J.L., Biecheler, M.B., and the SAM Group, 'Cannabis intoxication and fatal road crashes in France: population based case-control study', *British Medical Journal*, December 2005; 331: 1371.

⁴⁶ Leirer, V.O., Yesavage, J.A. & Morrow, D.G., 'Marijuana carry-over effects on aircraft pilot performance', *Aviation & Space Environmental Medicine*, 62, 221-227.

chronic cannabis users remains impaired even when they are not actually intoxicated.⁴⁷

There is nothing conclusive to suggest that chronic cannabis use causes permanent cognitive impairment; however there is evidence to suggest that long term use will impact upon memory, attention and organisation and integration of complex information.⁴⁸ There is also evidence linking cannabis with ageing in the part of the brain responsible for short term memory (hippocampus).⁴⁹ Evidence suggests that the longer the period of cannabis use, the more pronounced the cognitive impairment. It is not yet known whether the impairment can be reversed.

2.3 Impact on development

People who use cannabis, particularly habitual users, may experience learning difficulties.

Young people who use cannabis appear to be at a very high risk of experiencing developmental problems. Research has shown that adolescents who regularly smoke marijuana can risk damaging a key neural pathway associated with language development.⁵⁰ Other research referred to at 2.1, shows that the earlier an adolescent consumes cannabis, the greater the likelihood of brain damage and associated complications.

There is evidence that suggests heavy adolescent use of cannabis impairs educational performance. Cannabis use has been linked to an increased risk of failing to complete high school, job instability, poor educational performance, nonconformity and poor adjustment.⁵¹

There is some research which associates cannabis use with unhealthy reproductive systems in both male and female habitual users.⁵² There is also some evidence to suggest that cannabis can cause genetic mutation which can be passed onto future generations.⁵³

There have been insufficient studies of the impact of cannabis use on foetal development for conclusions to be drawn, although similar symptoms to tobacco consumption during pregnancy are likely, including a reduced birthweight.⁵⁴ There may be an increased risk of leukaemia among children exposed to cannabis in

⁴⁷ Hall, W. and Solowij, N., 1998.

⁴⁸ Solowij, N., *Cannabis and Cognitive Functioning*, 1998, Cambridge University Press; Solowij, 'Long term effects of cannabis on the central nervous system', Kalant, H., et al, eds, *The Health Effects of Cannabis*, 1999, Toronto, 195-265.

⁴⁹ Kuehne, J., Mendelson, J.H. and David, K.R., 'Computed tomographic examination of heavy marijuana users', *Journal of the American Medical Association*, 1977, 237(1231-1232); Rumbaugh, C.L., Fang, H.H., Wilson, G.H., Higgins, R.E. and Mestek, M.F., 'Cerebral CT findings in drug abuse: Clinical and experimental observations', *Journal of Computer Assisted Tomography*, 1980, 4(3), 330-334; Landfield, P.W., Cadwallader, L.B. and Vinsant, S., 'Quantitative changes in hippocampal structure following long-term exposure to Δ^9 -tetrahydrocannabinol: possible mediation by glucocorticoid systems', *Brain Research*, 1988, 443, 47-62.

⁵⁰ Professor Sanjiv Kumra, November 2005 (see ref. fn. 25).

⁵¹ Fergusson D., Horwood L., 2002.

⁵² Issorides, M., 1979, *Marijuana Biological Effects*, 377-88, Pergamon Press, New York; Moffit, A., Malouf, J., Thompson, C., 1998, *Drug Precipice*, Sydney, University of NSW Press Ltd., 8.

⁵³ Moffit, A., Malouf, J., Thompson, C., 1998.

⁵⁴ Fergusson, D. et al, 'Maternal use of cannabis and pregnancy outcome', *British Journal of Obstetrics and Gynaecology*, 2002, 109:1, 21.

utero.⁵⁵ There is no conclusive evidence that cannabis consumption during pregnancy causes birth defects.

3 Polydrug use

Cannabis use is part of a wider pattern of substance use including cigarettes, alcohol and other drugs, particularly amongst teenagers.⁵⁶ Some researchers have considered cannabis to be a 'gate way' drug for some young people where an identified pattern of behaviour shows a percentage will progress from cannabis to 'harder drugs'.⁵⁷ In 2003, 90% of heroin users in The Salvation Army's Bridge Program reported that they commenced illicit drug use with cannabis.⁵⁸ There is no evidence to suggest, however, that an individual who consumes cannabis is more susceptible or likely to go on to try other drugs because they have used cannabis. Substance use may, for example, be part of broader risk taking behaviour.⁵⁹ Research also shows that teenagers who have emotional and behavioural problems are more likely to use cannabis, tobacco and alcohol.⁶⁰

4 Cannabis Dependence Syndrome

Research is increasingly showing that cannabis is a drug that causes physical and psychological dependence.⁶¹ The addictive properties of cannabis have been recognised through chronic users experiencing withdrawal symptoms upon ceasing the drug and more individuals seeking treatment for assistance with these symptoms.⁶² Symptoms are similar to those experienced when withdrawing from alcohol and other drugs.⁶³

⁵⁵ Findings of a US study cited in Scott, T., Grice, T., *The Great Brain Robbery*, Sydney, Allen and Unwin, 93.

⁵⁶ *Ibid.*

⁵⁷ Yamaguchi K, Kandel DB. Patterns of drug use from adolescence to adulthood. II. Sequences of progression. *Am J Public Health* 1984; 74: 668-672; Kandel, D., ed. *Stages and pathways of drug involvement: examining the gateway hypothesis*, New York, Cambridge University Press, 2002.

⁵⁸ The Salvation Army website, http://www.salvos.org.au/SALVOS/NEW/RESOURCES/DOCUMENTS/DangersofDrugs/Dangers_of_Drugs_Aug03MARIJUANA.pdf, last accessed 13 December 2005.

⁵⁹ Other research has shown, for example, that people becoming addicted to alcohol contributes to later addiction to illicit drugs: *Drinking often leads to drugs*, The Courier-Mail, 28 November 2005.

⁶⁰ Sawyer, M., Arney, F., Baghurst, P., Clark, J., Graetz, B., Kosky, R., Nurcombe, B., Patton, G., Prior, M., Raphael, B., Rey, J., Whaites, L. and Zubrick, S., *The Mental Health of Young People in Australia*, Canberra: Mental Health and Special Programs Branch, Commonwealth Department of Health and Aged Care, 2000.

⁶¹ Kouri, E., Pope, H., 'Abstinence symptoms during withdrawal from chronic marijuana use', *Experimental and Clinical Psychopharmacology*, 2000, 8:4; Budney, A., and Moore, B., 'Development and consequences of cannabis dependence', *Journal of Clinical Pharmacology*, 2002, 42:11.

⁶² Coffey, C., Carlin, J., Lynskey, M., Ning, L., Patton, G., 'Adolescent precursors of cannabis dependence: findings from the Victorian Adolescent Health Cohort Study', *British Journal of Psychiatry*, 2003, 182:330-336.

⁶³ Kouri, E.M., Harrison, G., Pope, G., Jr, 'Changes in aggressive behaviour during withdrawal from long-term marijuana use', *Psychopharmacology*, 143, 302-308.