

# The implications of recent findings on the link between cannabis and psychosis

## THE NEW FINDINGS

Recent studies have increased long-standing concerns that cannabis use can trigger or exacerbate psychosis and schizophrenia. Widely publicized, these findings have led to calls for tougher laws and/or more aggressive enforcement of prohibitions against cannabis use and distribution [1]. The findings may be confounded by unobserved factors. Even if they prove broadly correct, these findings would still have more implications for clinical practice than for broader public policy. Their policy marginality reflects the fact that the psychosis effects add modestly to the total damage from cannabis use. In addition, there is little evidence that tougher enforcement or laws effectively reduce use. However, these findings may be important for design of specific services to individuals with marijuana use disorders and to individuals at risk for psychiatric disorders

Some studies report dose–response links between cannabis use and subsequent onset of schizophrenia [2,3]. A recent review article summarizes five strong studies, all of which report adjusted odds ratios exceeding 2.0 in assessing the link between cannabis use and schizophrenia [4]. Several studies indicate that cannabis may hasten the onset of schizophrenia symptoms among individuals predisposed to such disorders [5]. Other studies suggest gene–environment interactions within a small minority of marijuana users [6].

Still other studies raise additional concerns about the phenomenon of cannabis psychosis [5]. A recent follow-up study in Denmark indicates that approximately half of individuals hospitalized for cannabis-induced psychotic symptoms will be diagnosed subsequently with schizophrenia spectrum disorders [7]. A Dutch study showed that, among individuals with no baseline psychiatric disorders, cannabis users were more likely than others to display psychotic symptoms and disorders [8]. Among those with psychotic symptoms at baseline, cannabis use was associated with markedly worse outcomes.

The most widely cited study is a cohort study of 1969–70 Swedish conscripts (97% of all Swedish males aged 18–20), followed over 25 years [3]. Although the authors control for several pertinent factors they cannot control for several important potential confounders, such as family genetic histories. The majority of excess schizophrenia risk was concentrated in the subgroup who had used cannabis more than 50 times during their life-time, with much more modest effects found among lighter users.

## POLICY IMPLICATIONS

For the purpose of this editorial, we presume that there are credible, although not definitive, links between cannabis use and psychotic disorders. This provides a worst-case scenario for policy makers. If these links prove causal and clinically important, what are the implications for public policy? Do they imply that society should be more punitive toward cannabis use than it is now?

The new findings on schizophrenia add to the estimated social costs of cannabis use and potentially provide the justification for harsher laws and/or tougher enforcement of cannabis prohibitions. In making these decisions, benefit–cost analysis provides a useful frame, although scarcely a definitive policy conclusion.

The benefits of tougher policies can be put into two categories: (1) the reductions in annual schizophrenia incidence and (2) reductions in other costs of cannabis use. The costs also take two forms: (1) the actual government expenditures on policing, courts and corrections to increase the legal risks or costs of cannabis use and (2) non-monetary economic costs, such as increased intrusiveness of the state and reduction in life-time opportunities resulting from a cannabis conviction for those affected by the more intense enforcement.

All numbers here are soft. We conduct the analysis for the United States because more data are available and because it is more likely that the new findings might affect decisions there, given the readiness of US decision makers to respond to findings of increased danger. We examine the desirability of tougher enforcement that reduces cannabis prevalence by 20% (a large but not historically unprecedented decline) and which induces a comparable reduction in cannabis-induced schizophrenia.

### Benefits

#### *Reductions in psychosis incidence*

Data presented by Zammit and collaborators (calculated from their Table 2) imply an 8% cannabis-related population-attributable risk (PAR) for schizophrenia [3]. US schizophrenia incidence is approximately 0.25 per 1000. Approximate calculations suggest that a 20% reduction in cannabis use translates into a schizophrenia incidence reduction of approximately 1.6% of the base rate, corresponding to 1200 incident cases prevented per year.

We use a reasonable but rough social valuation of \$500 000 per averted (or delayed) case of schizophrenia.

This \$500 000 figure greatly exceeds per-patient lifetime cost-of-illness (COI) estimates for psychotic disorders [9,10]. COI estimates, however, do not include the large impact of disorders on individual wellbeing. This figure implies that a 20% reduction in marijuana use would be associated with \$600 million in averted social costs.

#### *Reductions in other costs of cannabis use*

The only systematic estimates of the social costs of cannabis use are by Caulkins *et al.* [11]. They estimate that cannabis use in 1998 generated \$7.2 billion in total costs in the United States, and note the weak evidentiary base available. We assume that a 20% reduction in use would lower those total costs, not including schizophrenia, by \$1.5 billion.

### **Costs**

#### *Government expenditures*

One possibility is that cannabis use can be reduced simply by enacting tougher statutory penalties, with minimal increase needed in actual enforcement expenditures. Most studies from the mid-1970s to the late 1990s, however, found no association between cannabis use rates and the existence of criminal penalties for simple possession of cannabis [12,13]. More recent studies, summarized by Hall & Pacula, throw doubt on these findings [14]. Not only are the results sensitive to statistical specification, but there is a question as to whether the measures of decriminalization or depenalization capture accurately the relevant changes in penalties faced by users [15]. For example, in the United States cannabis possession arrest rates per capita hardly differ between decriminalization or depenalization states and others.

One reason for this apparent paradox is that depenalization covers only possession, not use. In depenalization states it is still possible to be arrested for smoking a joint in public; depenalization may be an unimportant change. Thus it is unlikely that merely increasing penalties for cannabis possession of itself can reduce use substantially.

No study has found more than a small effect of marginal enforcement changes on cannabis use. Kilmer, in a preliminary study, estimates that within Europe the probability of arrest, conditional upon using cannabis in a given year, is 2–3% [16]. The United States, for all the ferocity of its rhetoric on this subject, also generates an arrest probability no higher than 3%; cannabis possession arrests total about 750 000 per annum, but the total number of past-year cannabis users estimated from the National Survey of Drug Use and Health in 2004 is about 25 million [17]. With minimal risk of incarceration, even where statutes allow for criminal sanctions [P. Reuter,

P. Hirschfield & C. Davies, unpublished observations], youthful users may be little affected by the probability of arrest.

There is, however, another mechanism through which enforcement policy might be able to affect cannabis use, namely supply-side enforcement that makes the drug more expensive and/or less available. Caulkins has shown a strong negative correlation between price and the prevalence of cannabis use among high school seniors in the United States over the period 1981–97 [18]. How much would it cost to increase cannabis enforcement so that, via higher prices, use would decline by 20%? Focusing on the supply-side reduces the moral tension that accompanies increased aggression against those who only use the drug.

Cannabis enforcement expenditures aimed at sellers in the United States are certainly in the billions of dollars. Arrests for cannabis distribution and growing exceed 100 000. Further, Sevigny & Caulkins report about 35 000 people incarcerated in federal and state prisons for cannabis offenses, almost all for selling [19]. For the purpose of these calculations we assume that it cost \$1 billion to raise cannabis prices by 20% [20,21], and that this would generate a 20% reduction in cannabis use, which assumes a price elasticity of  $-1$ , larger than most reported in the literature.

#### *Non-governmental costs*

There are in addition a variety of other costs, not reflected in the budget. The penalties imposed for cannabis convictions in the United States are quite varied. For example, a permanent resident or naturalized citizen can be sent back to his home country as a result of a felony conviction; this generates a surprising number of tragedies, with children born in, for instance, Vietnam or Guatemala but having lived in the United States all their adult lives finding themselves returned to a nation within which they can barely function. Government-guaranteed student loans can be withheld, along with welfare benefits and, in a predictable fashion, more otherwise law-abiding youth will end up with criminal records that do make a difference to their life prospects.

To summarize these indicative benefit–cost calculations, we estimate about \$2.1 billion of benefits from cutting marijuana consumption by 20%, of which a little less than one-third come from psychosis cases averted. For costs, we estimated \$1 billion in budgetary costs. It is impossible to estimate the non-governmental costs, but there would not have to be many thousands of additional low-level cannabis selling convictions, incarcerations and injustices to generate another billion in costs to individuals.

There is much room for judgement about the desirability of tougher marijuana enforcement. Disagreements

about these judgements will probably arise from the huge uncertainties about the value to be placed on the social costs of schizophrenia: the probable effect of tougher punishment on marijuana price and use, as well as value judgements about the appropriateness of tough penalties for selling a drug that is generally seen as only moderately harmful.

The case is country-specific. The United States appears to be tougher on cannabis sellers than other nations. If the marginal benefits of enforcement decline with increasing stringency, then perhaps the new findings cannot justify greater toughness in the United States but could provide the basis for increased toughness in countries that have traditionally made little effort to restrict the availability of cannabis.

## PRACTICE IMPLICATIONS

The most direct potential implication of the new suggestive findings occur outside criminal justice policy and in the realm of treatment and prevention providers. Cannabis is used widely among patients in substance abuse and mental health treatment programs. For example, Budney and collaborators report that between 50 and 85% of clients receiving treatment for opioid disorders are also marijuana users, and that almost all clients who use marijuana upon entry continue some level of use during their course of treatment [22]. Current findings suggest that efforts to monitor or prevent regular cannabis use might bring larger benefits than was thought previously, particularly when such interventions serve patients facing especially high risks of marijuana-associated psychiatric disorders. For those concerned with adolescent mental health, the same findings also suggest that greater emphasis should be placed on detecting frequent cannabis use as a high-risk behavior. The new research—should it hold up—would also increase the premium on uncovering gene–environment interactions that may be associated with heightened schizophrenia risk among chronic marijuana users.

Whatever the ultimate biological findings, current studies are a reminder that cannabis cannot be considered completely benign. If it can be shown that cannabis contributes to profound psychiatric morbidity, even within a small user subgroup, it would be reasonable to worry that cannabis might have other, less obvious, consequences for mental function of clinical and public health concern.

## CONCLUSIONS

A drug-policy version of the ‘precautionary principle’ suggests that policy makers remain open to the possibility that marijuana might be shown to have very harmful

effects—effects that might potentially justify more stringent policies than we would otherwise support. For many reasons, we ourselves believe that the precautionary principle encourages extreme, unreflective responses that may, ironically, increase population risks [23]. However, such principles furnish useful provocation to an overly comfortable prior course.

Intoxicating substances bring unexpected dangers, especially for adolescents and for heavy users. Such research should especially chasten people who take ‘harm reduction’ seriously as a guiding question for drug policy. If marijuana proves more harmful than we thought, it deserves somewhat greater emphasis in prevention than it otherwise would.

Finally, we should note the remarkable fact that major longitudinal health studies generally ignore cannabis use, even as such use has become a normative behavior in many western countries. Cannabis brings many effects, with direct or indirect consequences for health. Prominent cohort studies explore the role of diet, smoking, exercise, socio-economic status and other factors for mortality and health. The paucity of comparable longitudinal research on cannabis remains striking. Policy makers require stronger assessment of the effects of this drug.

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## References

1. Frean A., Hawks N. Cannabis dangers prompts review of ‘soft’ law. London, UK: *The Times*, 19 March 2005.
2. Maki P., Veijola J., Jones P., Murray G., Koponen H., Tienari P. *et al.* Predictors of schizophrenia—a review. *Br Med Bull* 2005; **73/74**: 1–15.
3. Zammit S., Allebeck P., Andreasson S., Lundberg I., Lewis G. Self reported cannabis use as a risk factor for schizophrenia in Swedish conscripts of 1969: historical cohort study. *BMJ* 2002; **325**: 1199.
4. Arseneault L., Cannon M., Witten J., Murray R. Causal association between cannabis and psychosis: examination of the evidence. *Br J Psychiatry* 2004; **184**: 110–7.
5. Hall W. Cannabis use and psychosis. *Drug Alcohol Rev* 1998; **17**: 433–44.
6. Caspi A., Moffitt T., Cannon M., McClay J., Murray R., Harrington H. *et al.* 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-environment interaction. *Biol Psychiatry* 2005; **57**: 1117-27.
7. Arendt M., Rosenberg R., Foldager L., Perto G., Miunk-Jorgenson P. Cannabis-induced psychosis and subsequent schizophrenia-spectrum disorders: follow-up study of 535 incident cases. *Br J Psychiatry* 2005; **187**: 510-15.
  8. van Os J., Bak M., Hanssen M., Bijl R., de Graaf R., Verdoux H. Cannabis and psychosis: a longitudinal population-based study. *Am J Epidemiol* 2002; **156**: 319-27.
  9. Genduso L., Haley J. Cost of illness studies for schizophrenia: components, benefits, results, and implications. *Am J Managed Care* 2000; **3**: 873-7.
  10. McDonald M., Hertz R., Lustik M., Unger A. Healthcare spending among community-dwelling adults with schizophrenia. *Am J Managed Care* 2005; **11**: S242-7.
  11. Caulkins J., Pacula R., Paddock S., Chiesa J. *School Based Drug Prevention. What Kind of Drug Use Does It Prevent?* Santa Monica, CA: RAND Corporation; 2002.
  12. Donnelly N., Hall W., Christie P. The effects of partial decriminalisation on cannabis use in South Australia 1985-1993. *Aust J Public Health* 1995; **19**: 281-7.
  13. Single E. The impact of marijuana decriminalization: an update. *J Public Health Policy* 1989; **10**: 456-66.
  14. Hall W., Pacula R. *Cannabis Use and Dependence: Public Health and Public Policy*. Cambridge, UK: Cambridge University Press; 2003.
  15. Pacula R., MacCoun R., Reuter P. What does it mean to decriminalize marijuana? a cross-national empirical examination. In: Lindgren B., Grossman M., editors. *Substance Use: Individual Behaviors, Social Interactions, Markets and Politics Advances in Health Economics and Health Services Research*. Amsterdam: Elsevier; 2005, p. 347-70.
  16. Kilmer B. Do cannabis possession laws influence cannabis use? In: Spruit I., editor. *Cannabis 2002 report: Technical report of the International Scientific Conference*. Brussels, Belgium: Ministry of Public Health of Belgium; 2002, p. 119-41.
  17. Caulkins J., Pacula R. Marijuana markets: inferences from reports by the household population. *J Drug Issues* 2006; **36**: 173-200.
  18. Caulkins J. P. Can supply factors suppress marijuana use by youth? *Fed Am Sci Drug Policy Anal Bull* 1999; **7**: 3-5.
  19. Sevigny E., Caulkins J. Kingpins or mules? An analysis of drug offenders incarcerated in federal and state prisons. *Criminol Public Policy* 2004; **3**: 401-34.
  20. Boyum D., Reuter P. *An Analytic Assessment of U.S. Drug Policy*. Washington, DC: American Enterprise Institute; 2005.
  21. Miron J. Budgetary implications of marijuana prohibition. Available from <http://www.prohibitioncosts.org/MironReport.pdf> (accessed 20 April 2006).
  22. Budney A., Bickel W., Amass L. Marijuana use and treatment outcome among opioid-dependent patients. *Addiction* 1998; **93**: 493-503.
  23. Sunstein C. *Laws of Fear: Beyond the Precautionary Principle*. Cambridge, UK: Cambridge University Press; 2005.