

Research paper

Effect of reclassification of cannabis on hospital admissions for cannabis psychosis: A time series analysis



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ABSTRACT

Background: The UK Misuse of Drugs Act (1971) divided controlled drugs into three groups A, B and C, with descending criminal sanctions attached to each class. Cannabis was originally assigned by the Act to Group B but in 2004, it was transferred to the lowest risk group, Group C. Then in 2009, on the basis of increasing concerns about a link between high strength cannabis and schizophrenia, it was moved back to Group B. The aim of this study is to test the assumption that changes in classification lead to changes in levels of psychosis. In particular, it explores whether the two changes in 2004 and 2009 were associated with changes in the numbers of people admitted for cannabis psychosis.

Method: An interrupted time series was used to investigate the relationship between the two changes in cannabis classification and their impact on hospital admissions for cannabis psychosis. Reflecting the two policy changes, two interruptions to the time series were made. Hospital Episode Statistics admissions data was analysed covering the period 1999 through to 2010.

Results: There was a significantly increasing trend in cannabis psychosis admissions from 1999 to 2004. However, following the reclassification of cannabis from B to C in 2004, there was a significant change in the trend such that cannabis psychosis admissions declined to 2009. Following the second reclassification of cannabis back to class B in 2009, there was a significant change to increasing admissions.

Conclusion: This study shows a statistical association between the reclassification of cannabis and hospital admissions for cannabis psychosis in the opposite direction to that predicted by the presumed relationship between the two. However, the reasons for this statistical association are unclear. It is unlikely to be due to changes in cannabis use over this period. Other possible explanations include changes in policing and systemic changes in mental health services unrelated to classification decisions.

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Introduction

Of all areas of British drug policy over the past fifteen years, it has been cannabis that has most often seized the spotlight. Since the report of the Independent Inquiry into the Misuse of Drugs Act in 2000, there has been considerable media coverage of the question of legal classification, focused increasingly in recent years on the association between cannabis and schizophrenia and linked concerns about stronger strains of cannabis or 'skunk'. Analysis of seized samples in the USA, UK and a number of other European countries have shown some increase in the strength of cannabis as measured by tetrahydrocannabinol (THC) content (Cascini, Aiello, & Di Tanna, 2012; McLaren, Switft, Dillon, & Allsop, 2008; Mehmedic et al., 2010). This has led to increased interest in the question of how cannabis use and supply is controlled and, in the UK, in the issue of the drug's classification. The UK Misuse of Drugs Act (1971) divided

controlled drugs into three groups A, B and C, with descending criminal sanctions attached to each class. In January 2009, cannabis was upgraded from Class C to Class B at least in part, because of concerns about the links with schizophrenia.

This paper analyses trend data in monthly admissions for cannabis psychosis to explore whether the changes in the classification of cannabis in the UK were associated with the number of hospital presentations for the treatment of cannabis psychosis.

Cannabis policy in the UK

Cannabis first became a controlled drug in the UK when the 1925 Dangerous Drugs Act was enacted in 1928. This and other drug legislation was then rationalised in 1971, with the passing of the 1971 Misuse of Drugs Act. This act provided a hierarchical system by which the controlled drugs were classified, with those drugs deemed most dangerous being placed in Class A through to those deemed least dangerous in Class C. When the Act was enacted in 1971, cannabis was placed in Class B. However, in January 2004, it

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was moved from Class B to C and then in January 2009 it was moved back to Class B.

The initial reclassification to Class C was championed by the then UK Home Secretary, David Blunkett. In his evidence to the Home Affairs Select Committee (HASC) inquiry into the Government's 10-year drug strategy on 23 October 2001, he gave three main reasons for the change: liberating police time for policing Class A drugs, protecting the 'credibility' of drug education (in that the drug classes needed to reflect the actual harms caused by drugs, otherwise the credibility of all drug information would be undermined) and greater 'clarity' and 'coherence' (Lloyd, 2008a). In early 2002, both the HASC and the body of experts advising the UK Government on policy issues, the Advisory Council on the Misuse of Drugs, recommended that cannabis be reclassified. However, by late January 2004, when a Misuse of Drugs Act Modification Order was brought into effect the change, the public mood had altered, with widespread negative press reports suggesting that Blunkett had 'made a hash of it' (Warburton, May, & Hough, 2005).

The changes brought about in January 2004 were complicated by the simultaneous enactment of the Criminal Justice Act 2003, which introduced amendments to the Police and Criminal Evidence Act of 1984 making possession of cannabis (but no other Class C drug) an arrestable offence. It also increased the maximum sentence for all Class C trafficking and supply offences from 5 to 14 years – the same maximum for Class B offences. This effectively rendered the legal difference between cannabis as a Class C drug and cannabis as a Class B drug insignificant, although this was poorly understood by the media and presumably, the wider public (Lloyd, 2008b). However, the move to Class C did affect policing. Before the introduction of the new legislation in 2004, the Association of Chief Police Officers (ACPO) introduced guidance on which aggravating factors would warrant an arrest for cannabis possession and in which circumstances police officers should give a 'street warning' – a formal, on-the-spot warning (ACPO, 2003). An evaluation of these changes concluded that 'Overall our findings suggest that the reclassification of cannabis... has had a smaller impact than advocates of the change hoped and than opponents feared' (May, Duffy, Warburton, & Hough, 2007, p. 44).

A new concern in many of the media reports from 2004 onwards, was the mental health effects of smoking cannabis – in particular the association with psychosis (Lloyd, 2008a). Psychosis is a term that describes a range of symptoms, for example: distortions of reality, hearing voices, difficulty in thinking and problems with motivation (Turkington & Weiden, 2009). Media concerns have particularly focused on the stronger varieties of cannabis, and their role in cannabis induced psychosis: 'sensimilla' or 'skunk' has higher Δ -9-tetrahydrocannabinol (THC) and lower cannabidiol (CBD) than cannabis resin, both of which may be associated with psychosis (ACMD, 2008; Weissenborn & Nutt, 2012). Reflecting these concerns, the Advisory Council on the Misuse of Drugs (ACMD) was twice asked in the space of three years, by the Home Secretaries at the time, to consider the evidence in this area. Its two resulting reports in 2005 and 2008 both reaffirmed that cannabis should remain in Class C (ACMD, 2005, 2008). However, ignoring these recommendations, the Home Secretary Jacqui Smith announced in May 2008 that she would be moving cannabis back to Class B, stating that:

There is accumulating evidence, reflected in the Advisory Council on the Misuse of Drugs report, showing that the use of stronger cannabis may increase the harm to mental health. Some young people may be 'binge smoking' to achieve maximum possible intoxication which may be very serious to their mental health.

Thus, fears about the mental health harms associated with cannabis became the rationale for the cannabis reclassification decision. This paper will explore whether there is an association between the two, as measured by admissions to psychiatric hospitals in England.

Methods

Records of admissions for cannabis psychosis in National Health Service Hospitals in England, were extracted from the Hospital Episodes Statistics (HES) database for the period between April 1999 and December 2010. Records of a diagnosis of psychosis due to use of cannabis consisted of nine ICD-10 diagnostic categories, F12.0–F12.5, F12.7–F12.9 (World Health Organisation, 2010). Patients with a secondary diagnosis of cannabis psychosis were excluded. Similar monthly admission data for all psychotic admissions were also obtained, for comparison. HES data was provided by the NHS Information Centre in an anonymised format, therefore ethical approval for this study was not required.

Statistical analyses

The HES-derived cannabis psychosis admission numbers were analysed using interrupted time series analysis. We used interrupted time series analysis to estimate changes in levels and trends in cannabis psychosis after the reclassification of cannabis from B to C and then from C to B. This method controls for baseline level and trend when estimating expected changes in the outcome due to the intervention (England, 2005; Hartmann, Gottman, & Jones, 1980). Wagner, Soumerai, Zhang, and Ross-Degnan (2002) provides a useful explanation of level and trend in an interrupted times series "A change in level, e.g. a jump or drop in the outcome after the intervention, constitutes an abrupt intervention effect. A change in trend is defined by an increase or decrease in the slope of the segment after the intervention as compared with the segment preceding the intervention."

Reflecting the on-off nature of the switch from B to C and then back to B, the analysis includes both the introduction of the intervention and its removal, known as a reversal design (Biglan, Ary, & Wagenaar, 2000). This adds to the strength of any causal inference in the change observed.

Three segments, with two pre-determined interruption points were constructed. The interruption points were marked as January 2004 and January 2009, as these represent the time points at which reclassification was introduced.

A long time series, as represented by the current study with 141 monthly measurement points, increases confidence, reduces standard errors, increases power, reduces the possibility of type 1 error, and improves detection of autocorrelation or secular trends (Ramsey, 2003). Furthermore, with 57 monthly measurements taken before the intervention, regression to the mean should be mitigated (Shadish, Cook, & Campbell, 2002).

Preliminary checks on the models indicated some autocorrelation in the data. Therefore the Cochrane–Orcutt auto regression procedure was used to correct for first order serially correlated errors. The Durbin Watson statistics of all final models was close to the preferred value of 2, indicating that no serious autocorrelation remained.

Time series can often exhibit seasonal fluctuations. If seasonal fluctuations exist, then it is important that these are controlled for in the analysis to avoid spurious associations. The analysis was repeated including a seasonality variable (coded as 1 for winter and 0 for other months) in the model.

In order to address the question of whether any change in cannabis admissions might simply reflect wider changes in

Table 1
Results from the time series analysis of cannabis psychosis admissions.^a

	Estimates (95% confidence interval)	P-value
Baseline trend	0.51 (0.26 to 0.76)	<0.0001
	<i>0.51 (0.29 to 0.73)</i>	<i><0.0001</i>
Immediate level change after reclassification from B to C	8.92 (–1.85 to 19.70)	0.10
	<i>9.06 (–0.53 to 18.65)</i>	<i>0.06</i>
Trend change after reclassification from B to C	–0.94 (–1.27 to –0.60)	<0.0001
	<i>–0.93 (–1.23 to –0.64)</i>	<i><0.0001</i>
Immediate level change after reclassification from C to B	–0.02 (–13.86 to 13.82)	0.99
	<i>–1.08 (–13.57 to 11.42)</i>	<i>0.87</i>
Trend change after reclassification from C to B	0.89 (0.02 to 1.77)	0.05
	<i>0.96 (0.18 to 1.74)</i>	<i>0.02</i>

^a Results in italics are from the sensitivity analysis adjusting for seasonality.

any-cause psychosis admission, a similar analysis was conducted on all admissions for psychosis.

Results

Cannabis psychosis admissions

Fig. 1 and Table 1 show the trends in admissions and the results of the time series analysis. From 1999 up to the first reclassification in 2004, there was a significantly increasing mean number of monthly admissions for cannabis psychosis ($p < 0.0001$). There was little or no evidence of an immediate level change after the first ($p = 0.10$) or second ($p = 0.99$) reclassification. However, there were significant changes in the month-to-month trend in the mean number of admissions after the first ($p < 0.0001$) and second ($p = 0.05$) reclassifications. After the first (2004) reclassification, there was a decreasing month-to-month change in mean number of admissions for cannabis psychosis and after the second (2009) there was an increasing trend in the month-to-month admissions. The results from the sensitivity analysis including seasonality were similar to those from the unadjusted analysis.

All psychosis admissions

Fig. 2 and Table 2 show a similar analysis for all psychosis admissions. Before the first reclassification in 2004, there was a non-significant, slightly decreasing month-to-month change in the mean number of admissions for all psychosis ($p = 0.26$). In 2004 there was evidence of a significant immediate increase in level change ($p = 0.04$) at the point of reclassification and then a significantly decreasing month-to-month trend in the mean number of admissions after the first reclassification in January 2004, compared

to before ($p = 0.004$). However, there was little or no evidence of an increase or decrease in the level ($p = 0.54$) and slope ($p = 0.12$) change after the second reclassification in 2009. The results from the sensitivity analysis including seasonality were similar to those from the unadjusted analysis. Despite the much larger number of all psychosis admissions, the highly significant associations found for the changing trends in cannabis psychosis are not found.

Discussion

This study appears to suggest that there may be an association between the reclassification of cannabis and hospital admissions for cannabis psychosis: although in the opposite direction to that envisaged by Jacque Smith's reasoning for moving cannabis to Class B in 2009. There was a significant, declining trend in admissions following the shift from Class B to C in 2004, suggesting that reducing the classification of cannabis does not result in an increase in serious mental health problems such as cannabis psychosis. However there are a number of factors which could lie behind this apparent association between the decline in hospital admissions and the reclassification of cannabis.

In order for the change in classification to have had a causal impact on levels of cannabis psychosis, there would need to have been a chain of influence between the two: reclassification would need to have led to changes in cannabis use, such changes would need to have impacted on levels of cannabis psychosis and these changes would, in turn, need to be reflected in admissions for cannabis psychosis. As Fig. 3 shows, cannabis use has gradually declined over the period 2003–2010, showing a very different trajectory to admissions for cannabis psychosis. However, this trend could mask more complex changes in cannabis use. It is

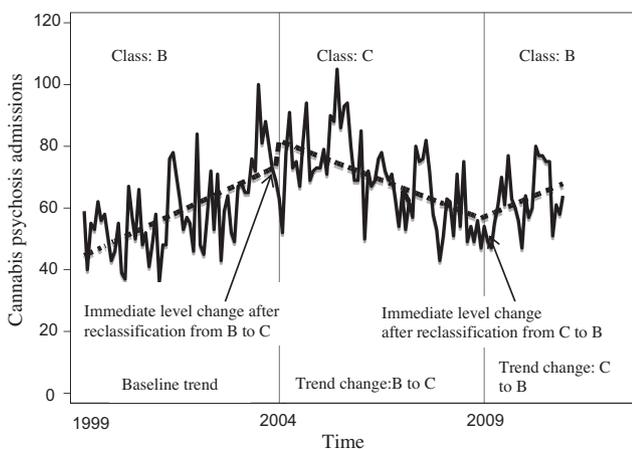


Fig. 1. Trend in the number of admissions for cannabis psychosis.

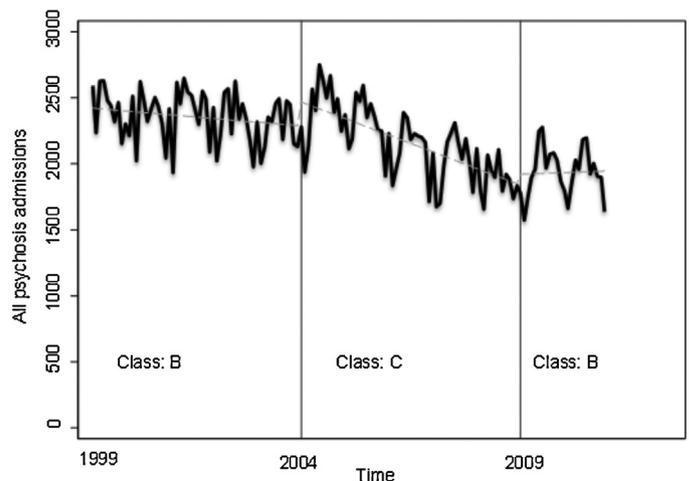


Fig. 2. Trend in the number of admissions for any psychotic episode.

Table 2
Results from the time series analysis of all psychotic admissions.^a

	Estimates (95% confidence interval)	P-value
Baseline trend	-2.36 (-6.43 to 1.72)	0.26
	-2.29 (-5.79 to 1.21)	0.20
Immediate level change after reclassification from B to C	190.41 (12.24 to 368.58)	0.04
	186 (31.07 to 342.10)	0.02
Trend change after reclassification from B to C	-8.17 (-13.67 to -2.67)	0.004
	-8.21 (-12.92 to -3.49)	0.001
Immediate level change after reclassification from C to B	71.70 (-158.91 to 302.30)	0.54
	62.99 (-141.26 to 267.23)	0.54
Trend change after reclassification from C to B	11.51 (-2.98 to 25.99)	0.12
	12.46 (-0.22 to 25.15)	0.05

^a Results in italics are from the sensitivity analysis adjusting for seasonality.

theoretically possible that the change from B to C in 2004 was associated with safer use of the drug, leading to reduced incidence of psychosis. For example, oral consumption is easier to hide than smoking but the level of intoxication is difficult to control (Coggans, Dalgarno, Johnson, & Shewan, 2004) and could therefore confer risk. The liberalising legal change could have led to a switch from eating to smoking cannabis and an associated reduction in psychotic episodes.

Ultimately, we do not have sufficiently detailed knowledge of cannabis use over this period in order to shed light on such theories due to the lack of a detailed survey of cannabis use (Lloyd & McKeganey, 2010). However, it is clear that cannabis smoking has always been by far the most common mode of consumption (e.g. Bennett, 2008; McBride, 1995). Moreover, given the considerable confusion surrounding what the change in cannabis classification actually meant in legal terms (Advisory Council on the Misuse of Drugs, 2008; Warburton et al., 2005), this seems an unlikely explanation.

There has certainly been a significant change over this period in the type of cannabis used: from mainly cannabis resin to mainly herbal cannabis with higher levels of Δ -9-tetrahydrocannabinol (THC) and lower levels of cannabidiol (CBD). It has been suggested that the latter may increase the risk of a psychotic reaction in the individual user (UK Drug Policy Commission, 2012). However, again, it is hard to see how reclassification could have affected the availability and use of different types of cannabis. With regard to the link between cannabis use and psychosis, the decision to move cannabis to Class B in 2008/2009 was made against a backdrop of media articles warning of the dangers of high-strength cannabis or 'skunk', the dangers of 'a single joint' and individual cases of the sudden onset of schizophrenia following cannabis use. Prime

Minister Gordon Brown made it clear that his personal commitment to reclassification was a response to new, 'lethal' forms of cannabis and the potential for a stronger association with schizophrenia. However, the available evidence suggests that, if there is an association between cannabis and schizophrenia, it is a weak and probably complex one (e.g. Advisory Council on the Misuse of Drugs, 2008; Arseneault, Cannon, & Witton, 2004; Gage, Zammit, & Hickman, 2013) and one where early heavy use confers risk over prolonged periods of time (Hickman, Vickerman, & Macleod, 2007).

Another possible explanation lies in policing, which has clearly been impacted by the changes in classification. Following the shift from B to C, street warnings were introduced to allow police officers to confiscate cannabis and issue a warning at street level, without the need for arrest. This could have led to less contact with users whose cannabis psychosis may have become more apparent had they been arrested. Thus, in theory, such changes could have led to less people being referred to mental health services for psychotic symptoms, where cannabis was known to be involved. However, it is likely that referrals from the police to mental health care make up only a small minority of cannabis psychosis admissions. Statistics on detentions under the Mental Health Act show that only three per cent of such detentions were made following use of Section 136, which involves the removal of persons by the police and temporary detention for assessment (Health & Social Care Information Centre, 2011).

It is, perhaps, more likely that the trends in cannabis psychosis reflect other changes that have nothing to do with cannabis classification. One possible explanation is that the changing trend in cannabis psychosis reflects broader trends in the incidence of schizophrenia. However, Frisher, Crome, Martino, and Croft (2009)

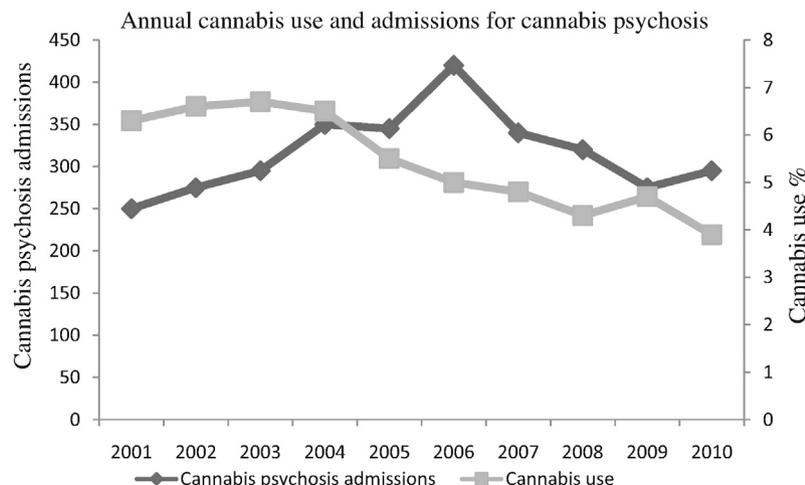


Fig. 3. Annual admissions for cannabis psychosis compared with cannabis use.

report that “Between 1996 and 2005 the incidence and prevalence of schizophrenia and psychosis were either stable or declining.” They found this was true for both general practice and hospital admission data. Such a trend seems at odds with the increase in cannabis psychosis shown in this study over 1999–2004. A further possible influencing factor is the changing landscape of mental health care in the UK. Following the closure of the large institutional hospitals in the 1990s, community mental health care has increased. With the advent of assertive outreach, crisis resolution and supported housing teams, and the associated decrease in acute hospital bed provision it could be that people presenting with cannabis psychosis are less likely to be admitted to hospital. Rather they are diverted to a community team who manage and treat the individual, this might account for the decrease in hospital admissions following on from the reclassification of cannabis in 2004. However, it is unclear why this effect would come into play at this particular point in time, nor why admissions should start to increase again after 2009.

Limitations of the study

There are several limitations to the research. No independent check of the primary data could be undertaken; it is therefore difficult to estimate the error that it contains. Areas where error could occur include fidelity to diagnostic criteria which is a particular issue for the diagnosis of cannabis psychosis. Although guidance is offered in the main classification indices, as [Baldacchino, Hughes, and Kehoe \(2012\)](#) observes “. . . a distinctive cannabis psychopathology that is clearly distinguishable from other psychotic presentations has not been adequately demonstrated”. It is also difficult to determine the impact of the increased public attention to the mental health risks of cannabis use and the corresponding vigilance for this phenomenon by the clinician responsible for making a diagnosis.

We are unable to determine how many individuals were discharged and then re-admitted more than once in the study period, as the data is collected in an anonymised way.

As we only included data derived from NHS hospitals not the private sector, there is likely to be an under estimate for admissions by all diagnostic groups examined.

A further limitation concerns the fact that only hospital admissions are examined: those individuals who developed cannabis psychosis but were not admitted to hospital are not included. The question of whether and how the proportion of admitted cases varied over the study period cannot therefore be addressed.

We have not made any allowance for a potential time lag in our analysis. It is likely that psychotic symptoms may not materialise for some time after the heavy use of cannabis during adolescence. Therefore at a population level there is potential for a non-linear complex and temporally interrupted relationship between overall cannabis use and presentations of cannabis psychosis.

Conclusion

This study has shown a surprising relationship between cannabis classification and admissions for cannabis psychosis: a relationship that is antithetical to that assumed by the decision to move cannabis to Class B in 2009. Explaining why this should be the case is a considerable challenge and we suspect that the pronounced changes in admission trends that we have found are likely to be driven by causal factors other than changes in classification. Nevertheless, there is the potential for mental health and other practitioners to be influenced by national debates about cannabis – themselves stimulated by policy changes such as reclassification. This research has highlighted the need for research that explores

the way that diagnoses of cannabis psychosis are made and the influences that operate on these decisions.

With regard to cannabis classification more broadly, there is also a need for research which examines the impact of changes in the classification of cannabis on policing. The only clear impact of cannabis reclassification has been on policing, which changed following the 2004 move from B to C. However, we have little understanding of how policing may have changed following the reclassification of cannabis to Class B in 2009, which was accompanied by new guidance ([Association of Chief Police Officers, 2009](#)). Finally, this study was unable to explore the possible impact of cannabis classification on the nature of cannabis use, including strength, dose and route of administration, because there is no detailed annual survey of cannabis (or other recreational) drug use in the UK: a gap which needs to be filled.

However, the overriding conclusion of this study is that there is no evidence to support the logic underpinning the 2009 move to Class B: over the studied period cannabis psychosis admissions have increased while cannabis has been a Class B drug and decreased while it has been a Class C drug. In this context, it is interesting that, in a recent interview with the *Radio Times* magazine (*Radio Times*, November 2012) anticipating a documentary on the subject, *Jacque Smith* reconsidered her decision to reclassify cannabis to Class B:

Was that worth the positive impacts of the change in law that I introduced? I'm no longer sure it was. I don't believe in decriminalisation or legalisation. But knowing what I know now, I would resist the temptation to resort to the law to tackle the harm from cannabis.

The classification of cannabis is a very high profile issue, with the attendant political involvement that this implies. The intention to reclassify cannabis to Class B was one of the first announcements of the Labour government under the new premiership of Gordon Brown. It was a cost-free and headline grabbing policy change that provided considerable support for the new Prime Minister from unlikely quarters. To quote the leader of the right-leaning newspaper, *The Daily Mail* (9 May, 2008): ‘Gordon Brown's decision to reclassify cannabis as a dangerous Class B drug is both brave and right.’ While the evidence shows that the two reclassifications of cannabis have had a minimal legal and social impact in terms of cannabis use and cannabis psychosis, the symbolic and political importance of reclassification has remained potent, explaining the continuing attraction of tinkering with Class.

Conflict of interest

No conflict of interest.

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