How Strong is the Evidence that Illicit Drug Use by Young People is an Important Cause of Psychological or Social Harm? Methodological and policy implications of a systematic review of longitudinal, general population studies

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ABSTRACT  Recreational use of illicit drugs (i.e. use not associated with a diagnosed drug problem) may cause psychological and social harm. A recent systematic review found that evidence for this was equivocal. Extensive evidence was only available in relation to cannabis use. This was relatively consistently associated with lower educational attainment and greater use of other drugs. However whether this association was causal was not clear. Cannabis use was less consistently associated with mental illness and antisocial behaviour. Causal relations between cannabis use and psychosocial harm could plausibly be mediated through either neurophysiological effects of cannabis or through social mechanisms related to use of an illegal substance. These different mechanisms might have different implications for harm-reduction policy. Alternatively associations may arise through non-causal pathways such as reverse causation, bias and confounding. In this latter situation, even effective reduction of cannabis use would be unlikely to be an effective harm-reduction policy in relation to psychosocial outcomes. Research strategies that could clarify these questions are discussed, as are the implications of these considerations for harm-reduction policy.
Background

The use of illicit drugs among young people appears to be widespread, with around four million individuals over the age of 16 years reporting illicit drug use in the United Kingdom (UK) annually (Aust et al., 2002). Drug use, particularly dependent and injection use, can be associated with significant physical, psychological and social harm (Copeland et al., 2003; Robertson et al., 1994; Robertson, 1998).

Most of the evidence on drug-related harm derives from clinical populations. Clients of drug-treatment services are defined by the problematic nature of their drug use, which tends to be of opiates and/or to involve drug injection. In population terms, these forms of drug use are apparently a minority activity, though they may have important public-health consequences. Evidence from most clinical samples is limited in its ability to clarify the existence or extent of these. First, because individuals known to treatment services may be atypical and, second, because prevalence of problems in the general population cannot be reliably estimated from treatment samples.

Moreover, most illicit drug use is of cannabis and, to a lesser extent, of psychostimulants. Most users are not clients of drug-treatment services. Nevertheless, psychological and social harm may be caused by this ‘recreational’ drug use. The aim of harm-reduction policy is to minimize all drug-related harm. It is therefore important to identify and quantify harms, physical and ‘psychosocial’, caused by recreational drug use.

Associations between drug use and harm may arise through non-causal mechanisms. These include reverse causation, where adverse psychosocial outcomes lead to drug use rather than vice versa; bias, where the association is an artefact of study methodology; and confounding, where both drug use and harm are independently associated with common antecedents. This issue of causality is of great relevance to harm-reduction policy. Prevention of drug use, no matter how effective, will not prevent harm that is merely associated with, rather than caused by, use.

Longitudinal evidence collected from young people in the general population can be helpful in answering these questions (Kandel, 1978). To this end, a systematic review was commissioned within the UK Department of Health, Drug Misuse Research Initiative. The aim of this review was to summarize longitudinal evidence relating to illicit drug use by young people in the general population to subsequent psychological or social harm, to assess the strength of this evidence and to consider its implications for policy. Effects of drug use on physical health were not a focus of this project.

The Review

A description of the methods and findings of the systematic review is available elsewhere (Macleod et al., 2004). In summary, 48 prospective observational studies relating illicit drug use by young people to subsequent psychological or social harm were identified. Only one of these studies was from the UK and the consequences of drug use was not its principal focus (Farrington, 1995). Most of the studies were of North American school children. Many simply reported sequelae of ‘drug use’ without differentiating between different types of illicit drug. The only specific type of illicit drug considered in any depth or detail across
these studies was cannabis. Cannabis use was associated with various kinds of subsequent psychosocial harm. The existence of such associations, however, does not, of itself, strongly suggest a causal relation.

Establishing Causality

The traditional scientific approach to elucidating causal mechanisms involves confirmation that experimental manipulation of the putative cause leads to a predictable effect. In many instances this approach is either unfeasible or unethical. A study randomizing young people to different levels of cannabis exposure, for example, might (though this approach is considered below) seem unlikely to be undertaken. In practice, much causal inference is based on observational data and is guided by established criteria for interpreting this (Hill, 1965).

Cause Precedes Effect

The first criterion is that data needs to be longitudinal. It must be established that a proposed cause precedes a possible effect before a causal relation can be seriously considered. Confidence that this criterion has been satisfied is arguably only possible when exposure has been measured prior to outcome. Retrospective exposure measurement may be compromised by recall bias. The review was confined to genuinely prospective studies where drug exposure was measured prior to measurement of psychosocial outcome.

Existence of a Plausible Mechanism

Plausible mechanisms that could mediate associations between cannabis use and several types of psychosocial harm exist. For example, cannabis appears to have neurophysiological effects that might lead to cognitive impairment and lower educational attainment (Solowij, 1998). Neurophysiological effects could also, conceivably, increase risk of mental illness (Tanda et al., 1997). Cannabis use may also give entry to social situations that increase the risk of experiencing harm. Use is generally illegal. In this situation, users will be more likely to be exposed to illegal markets where other illicit substances may be sold thereby increasing their risk of using these substances (Lenton, 2001). To differing degrees, use may also be associated with involvement in ‘alternative’ or ‘non-conventional’ culture and the exposure of users to the risk of criminalization. Social mechanisms such as these could lead to lower educational attainment and a higher probability of involvement in general antisocial behaviour (Lynskey & Hall, 2000). Though discussion of plausible mechanisms is important when considering questions of causality, it is also important to recognize that existence of a mechanism is, of itself, arguably the weakest criterion for causality (Davey Smith et al., 1992). Ostensibly plausible mechanisms can be advanced that may mediate many associations irrespective of their true causal basis. Further, the observational studies identified in the systematic review were not designed to test particular mechanisms. They were intended to identify associations that could have arisen through several causal or non-causal mechanisms.
Consistency of Associations Between Studies

A truly causal relation between a particular exposure and outcome should, in general, be consistently apparent across similar groups of people, studied in similar settings within broadly comparable historical periods. Direct comparison of results between different studies, identified in the review, was complicated by considerable heterogeneity of subjects, settings, measures and analytic approaches.

These studies reported a consistent association between greater cannabis use in early adolescence and subsequent lower educational attainment of moderate magnitude and strength. Cannabis use in early to mid adolescence also was consistently associated with greater risk of subsequent use of other illicit drugs. The strength and magnitude of this association varied, though in one study both were substantial (Fergusson & Horwood, 2000). Cannabis use, particularly in early adolescence, showed a relatively consistent association with greater subsequent reporting of psychological symptoms. Associations with specific subcategories of psychological problems were less consistent. One study reported an association between reported cannabis use in late adolescence and subsequent clinical psychiatric illness (schizophrenia) of moderate strength and magnitude (Andreasonn et al., 1987). Reported adolescent cannabis use was inconsistently associated with later involvement in antisocial behaviour, though some studies found that individuals reporting greater use also reported greater involvement.

The ability of future research to identify consistent associations will substantially depend on the comparability of study populations along with standardization of study measures. Satisfaction of these conditions allows the use of quantitative approaches to synthesis and assessment of consistency. Lack of comparability and standardization of measures between studies identified in the review meant that these approaches were felt unlikely to be useful, and formal ‘meta-analysis’ was therefore not attempted. (Egger et al., 1998)

Specificity of Association: Comparison with Effects of Licit Drug Use

The extent to which an exposure–outcome association should be specific depends on the intervening mechanism and different mechanisms may causally link the same exposure to different outcomes. Nevertheless, relative specificity of association is a useful criterion for inferring causality (Weiss, 2002). The plausible mechanisms discussed above involving mediation through contact with criminalized commerce could conceivably allow for some similarity of effects between different illicit drugs, principally because they are all illegal. However, this consideration should not apply to comparisons between apparent effects of use of licit drugs with those of illicit drugs. Not all studies reported associations between use of tobacco and alcohol and the psychosocial outcomes considered in this review. In those that did, however, associations in the same direction of similar strength and magnitude were often seen. This was particularly true with respect to tobacco use and educational outcomes and in relation to tobacco use and later use of other ‘harder’ drugs (Ellickson et al., 1998; Kandel, 1975). This non-specificity of association seems less compatible with a causal relation. It is important that future studies consider effects of both licit and illicit drugs.

There are interesting parallels in the current debate around the psychosocial consequences of cannabis use with historical discussions of the effects of tobacco
use by young people during the early part of the 20th century. Concerns over psychosocial effects of tobacco, particularly on educational performance, were more prominent than those around effects on physical health (in fact the latter were often dismissed) (Sandwick, 1912). The conclusions of one early prospective observational study of North American college students exemplify this perspective (Meylan, 1910). Tobacco use by adolescents was, in these accounts, condemned in view of its psychosocial effects:

> It has been shown conclusively in this study that the use of tobacco by college students is closely associated with idleness, lack of ambition, lack of application and low scholarship. (Meylan, 1910, p.177)

However, in relation to physical health outcomes the author states:

> There is no scientific evidence that the moderate use of tobacco by healthy mature men produces any beneficial or injurious physical effects that can be measured. (Meylan, 1910, p.177)

The possibility of adverse effects of moderate cannabis use on physical health is seldom dismissed in contemporary discussions. However, an emphasis on psychosocial outcomes is common (Kandel, 2003; Rey & Tennant, 2002).

Assessment of the Influence of Known Non-causal Mechanisms Influencing Apparent Associations in Observational Data

Judgements of causality partly depend on consideration of the extent to which the above criteria have been satisfied. They also depend on assessment of the possible influence of one of the three main non-causal mechanisms that can generate misleading associations in observational research: reverse causation; bias; and confounding.

The Influence of Confounding

Confounding is, arguably, the most difficult interpretational issue to address in non-experimental studies of associations between drug use and harm. The same factors (related to social disadvantage, development, family and peer groups) that antedate psychological and social problems in adolescence and young adulthood also appear to be associated with drug use (McArdle & Macleod, 2004; Maughan & McCarthy, 1997; McGee et al., 2000; Robins, 1978). Drug use, in some individuals, could be viewed as part of a syndrome of problematic behaviour rather than, predominantly, a cause of problems in its own right (Jessor & Jessor, 1977). This relates to the concept of ‘independence’, that part of a relation between exposure and outcome that is truly causal, i.e. the influence of the exposure on the outcome that exists irrespective of the apparent association arising because of shared antecedents. It also has a bearing on the concept of the ‘attributable risk’ of a particular exposure, such as drug use, in relation to a specific outcome. This suggests the extent to which elimination of the exposure would reduce incidence of the outcome assuming an unconfounded, completely causal relation between the two. For example, over 80% of lung cancer is estimated to be attributable to tobacco smoking. (Thun et al., 2002) Even assuming an unconfounded, completely causal, relation between cannabis use and harm the risk of a particular outcome attributable to cannabis use can be low.
For example the relative risk of school failure has been reported as over three fold among frequent cannabis users yet, in this population, only around 3% of school failure could be attributed to frequent cannabis use. (Hickman et al., 2004)

Identifying independent effects in observational data is difficult (Davey Smith & Phillips, 1990). The approach used by most reviewed studies that attempted to address the issue was to adjust for potential confounding factors by including a measure of them in multivariate models. Movement of effect estimates towards the null value is evidence of confounding. Many investigators appear to make the additional assumption that any residual, conventionally significant, effect apparent after adjustment represents the true—'independent'—effect of the relevant exposure. This assumption is of dubious validity (Davey Smith & Phillips, 1992). Imprecision in the measurement of correlated covariates leads to inadequate adjustment (Phillips & Davey Smith, 1991). The relevant covariates in this situation (drug use, psychosocial outcomes and factors that may precede both of these) were generally either unmeasured or measured crudely in the studies reviewed, making residual confounding likely in adjusted estimates. Confounding may also generate apparently ‘positive’ psychosocial effects of drug use. For example, an association with higher income reported in some studies may reflect an earlier entry to the workforce, associated with a lesser commitment to continued education (Kandel et al., 1995).

Assessment of the likely influence of confounding is facilitated by comparison of adjusted with unadjusted effect estimates. If both are essentially the same, or if adjustment appears to strengthen the effect, then important confounding by the adjustment factors is less likely. Many studies did not present unadjusted estimates, making such comparison impossible. Most presented estimates adjusted simultaneously for several potential confounding factors, making assessment of the influence of particular factors difficult. In general, where comparison with unadjusted estimates was possible, adjusted estimates of most effects were considerably attenuated towards the null value.

Sensitivity analyses can provide some insight into the possible contribution of confounding to observed effects (Greenland, 1996). A recent sensitivity analysis based on North American data suggested common antecedents, contributing to a general ‘propensity to use drugs’, were sufficient to explain any apparent associations between use of one drug and use of another (Morral et al., 2002).

Reverse Causation and Bias

It is possible that illicit drug use may be more the consequence of certain problems than their cause. Drug use may represent self-medication against psychological or psychosocial distress (Rey & Tennant, 2002). To some extent, the longitudinal design of the studies reviewed mitigates against the possibility of significant reverse causation and some studies attempted to adjust for pre-existing psychological problems in their analyses. It is still possible that, in some individuals, subclinical psychological problems preceded and may have precipitated illicit drug use. Similarly, it is possible that in some individuals, whose subclinical psychological problems preceded their drug use, drug use exacerbated these problems. These scenarios, where particular mental states preceded, rather than resulted from, drug use, could all be seen as examples of reverse causation.

Several types of bias that may have influenced the evidence informing this discussion are identified in our review. Despite the comprehensive search
strategy employed, it is possible that we failed to identify relevant data, particularly unpublished, negative studies. This may have biased our findings (Easterbrook et al., 1991). Further, other biases may have influenced the results of the individual studies that we did locate. Several studies identified involved substantial loss to follow-up. The relation between drug use and psychosocial outcomes among individuals lost to follow up may be different than among those retained, introducing selection bias. For example, if the former group experienced greater drug-related problems then the overall association between drug use and problems would be underestimated.

In all the studies identified in the review, drug use was measured through uncorroborated self-report, and this may have introduced further bias. Self-reports of drug use can be unreliable, particularly in general population studies involving individuals whose drug-using status is not already apparent (Colon et al., 2001). In particular, reporting tendency may influence self-reports of drug use. Some individuals may tend to either under, or over, report their use, perhaps reflecting differing perceptions regarding the types of behaviour that are socially desirable. This might result in random misclassification of exposure status and consequent dilution of effect estimates. However, in the situation where the same reporting tendency has a similar influence on outcome measurement, the result will be the generation of a spurious (i.e. non-causal) exposure–outcome association (Macleod et al., 2002). For example, the tendency of some individuals to either over, or under report their drug use will, if present, lead to an apparent association between use of one drug and use of another. This artefact may underlie some apparent ‘gateway’ effects (Macleod et al., 2003). Similarly, a tendency to under or over report drug use may be part of a tendency to under or over report proscribed behaviour in general. Such a tendency could explain some apparent associations between drug use and reported involvement in a range of antisocial activities. Reporting tendency could also influence apparent positive associations (in early adulthood) between drug use and income, if individuals of higher social position were more prepared to disclose drug use. This issue is not primarily one of the validity of self-report. Reporting tendency may still influence valid (by conventional criteria) measures (Macleod et al., 2002). Moreover, many constructs are not readily amenable to other forms of measurement (Stone et al., 2000). Nevertheless it is important to consider the possible influence of reporting tendency and associated bias when attempting to interpret the association between any substantially subjective exposure and substantially subjective outcome. The additional use of objective measures (i.e. measures not influenced by reporting tendency) is helpful, particularly because it allows effect estimates obtained using these to be contrasted with those seen in relation to subjective measures. Objective measurement of drug use is possible in a variety of biological substrates (Wolff et al., 1999). Wider use of such measures is likely in future epidemiological studies (Anthony et al., 2000).

Problems Attributing Causality: An Example

Assessment of causality in observational data is seldom straightforward, even when using the above criteria. This can be illustrated through consideration of one association between drug use and harm—that between smoking tobacco and risk of being a victim of homicide (Davey Smith et al., 1992; Davey Smith & Phillips, 2001). Smoking is in fact associated with various forms of violent death,
including suicide and accidents (Miller et al., 2000). The association is seen consistently across a number of large, high-quality studies where tobacco exposure was measured prior to outcome assessment in apparently valid ways. Estimates appeared to be robust to adjustment for potential confounding factors. The question of plausibility is interesting. Plausible mechanisms linking smoking to suicide (for example through increased risk of chronic disease) can be advanced. Further, both smoking tobacco and the mental states that lead to suicide seem to have common antecedents. Depressed individuals are more likely both to start smoking and to find it more difficult to stop (Jorenby et al., 1999; Lipkus et al., 1994). The type of ‘risk-taking’ personality that may be associated with smoking may also be linked to other forms of risk-taking. Thus there are several ways in which an association between smoking tobacco and increased risk of violent death may arise. However, it seems unlikely that reduction in homicide rates are one of the benefits that are likely to accrue from effective prevention of smoking. Rather the association between smoking tobacco and risk of being murdered largely illustrates the power of confounding in observational data. People who use drugs (whether tobacco or cannabis) are likely to be different from people who do not in various ways other than the fact of their drug use. The complex dimensions of this difference, which may themselves have profound implications for health experience, are difficult to index in epidemiological studies. Residually confounded associations between drug use and health outcomes may be the rule, rather than the exception.

**Interpretation of Current Evidence**

In view of the issues discussed above, it was impossible confidently to attribute causality to any of the associations between cannabis use and psychosocial harm identified in the review. This is not equivalent to a conclusion that cannabis use does not cause psychosocial harm. Rather it is a recognition that the evidence currently available is inadequate to answer the question. This inadequacy is even greater in relation to questions of important (in public health terms) psychosocial consequences of recreational use of other illicit drugs. For example, concerns have been raised, in relation to possible effects of ‘ecstasy’ use on psychological health (Reneman et al., 2001; Kish, 2002). No prospective, general population evidence relating to this question was identified. Adverse psychosocial consequences of use of opiates and cocaine might be expected, based on experience with treatment samples. Little relevant evidence from general population samples was identified and the public health consequences of this type of drug use remain unclear.

The review did not consider physical health outcomes. That current evidence for important adverse psychosocial consequences of cannabis use is weak should not distract from the fact that, since most users appear to smoke cannabis with tobacco, chronic use seems unlikely to be harmless to physical health (Taylor et al., 2000, 2002). Among Swedish military conscripts, a single report of cannabis use in late adolescence did not predict mortality by mid adulthood (Andreasson & Allebeck, 1990). This apparent lack of effect could have reflected random exposure misclassification (the single measure of use in late adolescence seems unlikely to capture true lifetime exposure). Alternatively, follow-up may not have been adequate to identify effects with long latency periods. Suspicion that either or both of these considerations are relevant is strengthened by the fact that, in the
same cohort, tobacco use had no apparent influence on mortality over the same follow-up period.

Policy Implications

The findings of this review have potential implications for several areas of policy. First, they have implications for research-funding policy. These implications and the caveats associated with each of them are summarized in Table 1. The results of this review also have implications for evidence-based harm-reduction policy. These implications depend partly on the interpretation of whether the relation between illicit drug use (principally cannabis use, since virtually all evidence identified related to cannabis) and psychosocial harm is causal and, if it is, the mechanism mediating it. These issues are summarized in Table 2.

Table 1. Problems with current evidence on the relation between illicit drug use and harm, potential solutions and caveats associated with these

<table>
<thead>
<tr>
<th>Problem</th>
<th>Potential solution</th>
<th>Caveats</th>
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<tbody>
<tr>
<td>1. Results across different studies difficult to compare.</td>
<td>Use of standardized designs and measures.</td>
<td>Requires greater investment in research, doesn't overcome basic limitations of observational studies.</td>
</tr>
<tr>
<td>2. Study results may have little external validity because study population is atypical.</td>
<td>Use of general population samples with high follow-up rates.</td>
<td>Certain convenience samples may be easier to study and attrition difficult to avoid in practice. 1. also applies.</td>
</tr>
<tr>
<td>3. Uncorroborated self-reported measures may have allowed reporting bias to generate spurious associations.</td>
<td>Use of objective/corroborated measures.</td>
<td>These measures may be more expensive and use of them may deter some participants. Most toxicological tests are qualitative rather than quantitative and have limited detection window. 1. also applies.</td>
</tr>
<tr>
<td>4. Confounding, particularly by early life factors, may account for the associations observed.</td>
<td>Birth-cohort design, alongside adoption of general principles to assess influence of confounding described in text, should allow consideration of such factors.</td>
<td>Expensive, logistically complex design that only produces results in longer term. 1. also applies.</td>
</tr>
<tr>
<td></td>
<td>Mendelian randomization.</td>
<td>Demands sophisticated biological understanding of mechanisms, existence of suitable known polymorphisms and large sample sizes.</td>
</tr>
<tr>
<td></td>
<td>Experimental studies.</td>
<td>Reliable means to manipulate exposure difficult to find. May require large samples with long follow up to demonstrate effects.</td>
</tr>
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Table 2. Alternative interpretations of evidence around the relation between cannabis use and psychosocial harm, possible policy implications of these for harm reduction policy and associated issues

<table>
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<tr>
<th>Interpretation of evidence</th>
<th>Policy implication</th>
<th>Important issues</th>
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<tbody>
<tr>
<td>Cannabis use has no causal relation to psychosocial harm.</td>
<td>Prohibition of cannabis use on the basis of reducing psychosocial harm is unjustified and should be abandoned.</td>
<td>Difficult to predict effects on electoral popularity of administration implementing this reform. Ignores issue of physical harm.</td>
</tr>
<tr>
<td>Cannabis use may be causally related to psychosocial harm.</td>
<td>Imperative is to discover most effective means to prevent/reduce cannabis use. Prohibition should be compared to other models, (e.g. legalization within strict regulatory framework) and the model associated with least net harm adopted.</td>
<td>Effect of different policies in terms of ‘net harm’ difficult to evaluate in practice. Fears of negative effects on electoral popularity might favour conservative approach.</td>
</tr>
<tr>
<td>Cannabis use definitely related to psychosocial harm through biological (e.g. neurophysiological) pathways.</td>
<td>As above.</td>
<td>As above (i.e. prohibition unlikely to be abandoned). Could be argued that this approach inconsistent with policy on tobacco and alcohol and ignores issue of personal rights and responsibilities.</td>
</tr>
<tr>
<td>Cannabis use definitely related to psychosocial harm through social pathways.</td>
<td>As pathway to harm probably dependent on legal status of cannabis this should be changed.</td>
<td>Again, may be unpopular with electorate. This may be exploited by political opponents.</td>
</tr>
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</table>

Research Funding Policy

Evidence-based policy requires research able to clarify the many issues related to possible effects of illicit drug use that are currently unclear. Some of this relates to basic laboratory science. Qualitative or ethnographic research is also likely to make a contribution. We do not consider either of these areas in detail here but concentrate instead on population-based, epidemiological research.

Better Observational Studies

Substantial clarification around many of the areas that we have discussed could be provided by prospective, observational studies that address the issues we have raised. That is, studies that follow up genuinely population-based samples of people from a young age (ideally from conception), incorporate valid, objective, standardized measures of all relevant factors and analyse their results in a manner that best enables them to have confidence that they have not been misled by bias, reverse causation or confounding. General population-based birth cohorts are the optimum observational design for investigating determinants of health across the life-course. In particular, they allow consideration of early-life factors. Prospective studies starting in later life, for example in
adolescence, are limited in this regard. Two birth cohorts in New Zealand provided, arguably, the most robust evidence identified in the review (Fergusson et al., 1996; Silva & Stanton, 1996). Other birth cohorts, including those based in the UK, are at a stage in their evolution where if appropriately resourced they could provide important insights (Golding et al., 2001; Susser et al., 2000).

Innovations in genetic epidemiology have provided another strategy whereby observational studies may overcome the general problem of confounding by behavioural or environmental correlates of the exposure of interest. Use of the principle of ‘Mendelian randomization’ may prove as valuable in studying the consequences of substance use as it has in clarifying the causes of cardiovascular disease and cancer (Davey Smith & Ebrahim, 2003). This will principally depend on the identification of genetic polymorphisms that reliably influence levels of substance use (Macleod et al., 2004).

**Experimental Studies**

Coverage of all the diverse philosophical and mathematical issues that complicate the issue of drawing causal inference from observational data is beyond the scope of this paper (Berkane, 1997; Parascandola & Weed, 2001; Rothman, 1976; Susser, 1991). The question of causality that appears most relevant to public health policy in this area is a more straightforward pragmatic issue. What, if any, proportion of the psychological and social harm associated with drug use would be prevented by preventing drug use? For example, what would be the effect of a 5% reduction in cannabis use by adolescents on the incidence of schizophrenia?

Questions of effectiveness are, in general, best answered by experimental studies. Random allocation of individuals to different exposure levels should ensure that any effects seen are not attributable to confounding or selection bias. This approach, generally speaking, provides the most powerful means to identify true causal relations and assess the effectiveness and public health impact of an intervention based on these (Davey Smith & Ebrahim, 2002). Advantages of experimental, compared to observational, studies in this context have frequently been demonstrated (Lawlor et al., 2004).

Randomizing young people to different levels of drug exposure may seem questionable. However, *de facto*, this is the condition achieved by experimental studies that happen to assess a preventive intervention that subsequently proves to be effective. Unfortunately, studies of this type, identified in the review, seldom went further than to report if an intervention appeared to cause a reduction in drug use. We identified no studies that took the additional step of relating this randomly allocated reduction in drug use to a robust measure of subsequent harm. One constraint on this approach is the lack of interventions, reliably producing sustained and substantial reductions in illicit drug use (White & Pitts, 1998).

This problem notwithstanding, experimental studies of this type could provide a means to improve understanding of the relation between drug use and harm. Investment in interventions aimed at preventing or reducing illicit drug use among young people is politically popular and is therefore likely to remain high, irrespective of current evidence for effectiveness. However, those commissioning and funding such interventions should recognize that, like all unevaluated health technology, they have the potential to do harm as well as good. For example, a recent, rigorous evaluation of an intervention designed
to prevent initiation of smoking among school children found that initiation rates were higher in the intervention compared to the control group (Aveyard et al., 1999).

There are various reasons why advising young people not to do something that is harmful could have the opposite effect. Because of this, it seems important that public-health interventions in the drugs field be subject to the same rigorous standards of evaluation as health technologies in general. The fact that this will also help to clarify true causal relations is a useful by-product.

Harm-reduction Policy

For some years, health and social policy around the use of illicit drugs has been informed by the pragmatic philosophy of ‘harm reduction’ (Heather et al., 1993). In simple terms, rather than being based on a moral position on the rights and wrongs of drug use, per se, such a philosophy recognizes that drug use exists and aims to minimize harm that may result from this. Some have criticized the harm-reduction approach, suggesting that through failing to condemn drug use, proponents effectively condone it (Phillips, 2000). These criticisms aside, harm reduction is now, ostensibly, the dominant paradigm shaping drug policy in the UK (Home Office, 2002). Relatively small-scale, predominantly educational, initiatives notwithstanding, the major policy manifestations of the harm-reduction philosophy (needle exchange, substitute prescribing) have related to opiate use and have not, primarily, been driven by concerns around reducing harms experienced by drug users (who have been seen as a relatively small and marginalized group). Rather, the aim of policy has been to reduce harms to the wider community such as transmission of infectious diseases and drug-related crime (ACMD, 1988; Home Office, 2002).

Unlike the types of drug use that have most shaped harm-reduction policy to date, cannabis use appears to be widespread. In fact, around half of young people appear to have used it at least once and a significant number use it regularly (Aust et al., 2002). If there is a causal association between cannabis use and harm then policy to reduce this harm is clearly an important public-health issue. Moreover, it is an issue that relates mainly to the welfare of people who do use drugs, rather than people who do not.

In many instances, it seems that political policy plays a greater role in shaping what is considered to be robust scientific evidence than vice versa (Davey Smith et al., 2001). Further, adopting an evidenced-based, harm-reduction policy around cannabis is constrained by the equivocal nature of current evidence. Different interpretations of current evidence might lead to different policy conclusions, within a harm-reduction framework. The points made below are summarized in Table 2.

One possible interpretation of existing evidence is that it provides no basis to conclude that cannabis use causes significant psychosocial harm. Within this interpretation, prevention of cannabis use, by whatever means, will not reduce harm. Prohibition of cannabis use, on harm-reduction grounds, is therefore unjustified and should be abandoned. Similarly, intervening to reduce cannabis use by means other than through prohibition is a waste of resources that could be better spent elsewhere.

There are problems with this interpretation. It ignores the issue of physical harm, discussed above. And whatever the scientific evidence base, there appears
a widespread perception that cannabis use is an important social and public-health problem, to which prohibition is a sensible response. Any administration proposing any form of decriminalization of cannabis use is therefore likely to face accusations of irresponsibility and to risk alienating at least part of its electoral support.

A second possible interpretation of existing evidence is that it at least allows the possibility that cannabis use may be, by whatever mechanism, causally related to psychosocial harm. Policy to reduce this harm might take several forms. One is prevention of cannabis use, through the development of effective interventions. Prohibition has never been formally evaluated in these terms though does not appear to have a strong candidature as an effective means of reducing cannabis use. For example, availability and use appear to have increased irrespective of prohibition (Aust et al., 2002). In areas where limited decriminalization has been introduced, rates of use do not generally appear to have been influenced (European Monitoring Centre for Drugs and Drug Addiction, 2000; Single, 1989). Further, evidence suggests that criminalization of individuals who use cannabis does not decrease their use (Fergusson et al., 2003). Finally, individuals who do not use cannabis do not report concern over its legal status as their main reason for this decision (Police Foundation, 2001).

The question of whether prohibition is a source of harm in itself should also be considered (Wodak et al., 2002). Where cannabis remains illegal entrepreneurial opportunities are created for criminals. The public health consequences of what has been described as a ‘welfare system for present-day criminals’ are difficult to quantify (Maynard, 2002). However, it seems unlikely that the promotion of criminal commerce and culture that has resulted from drug prohibition is a positive thing, in health and social terms. As discussed above, contact with this culture and commerce, along with the criminalization that can result from such contact, may be an important mechanism through which cannabis use leads to harm. Further, this completely unregulated market makes product quality control effectively impossible and research into drug effects extremely difficult. In view of these considerations, harms resulting from a true causal relation between cannabis use and adverse psychosocial outcomes could still be outweighed by harms resulting from prohibition. Indeed some of the former might be mediated through the latter.

Other than the questionable effectiveness of cannabis prohibition as an approach to prevention, it can be criticized as inconsistent with other policy approaches. For example, there are numerous activities whose direct hazards exceed any immediately obvious benefits (such as ‘extreme sports’) that are not prohibited. Further, prohibition justified on the grounds of maximizing public health utility could also be seen as inconsistent with policy around tobacco and alcohol. The harmful effects to users of these latter psychoactive drugs are predominantly mediated through direct biological mechanisms, are well recognized and are of substantial public health importance. Indeed the harm caused by tobacco and alcohol use appears to exceed the harms associated with use of all illicit drugs combined (Collins & Lapsley, 2002). Debate continues as to how much past experiments in alcohol prohibition can usefully inform discussions around current drug policy (Tyrrell, 1997). This discourse notwithstanding, it is notable that prohibition of alcohol use, other than by vulnerable groups or in situations likely to lead to risk of harm to those other than the user, is seldom seriously suggested as part of harm-reduction policy. Debate around the policy response
to alcohol has become complicated by evidence that moderate use may not be harmful (in fact may even be beneficial) (Doll, 1997). These considerations do not appear to apply to tobacco use. Indeed even the relatively low exposure associated with ‘passive’ smoking may cause significant public health harm (Davey Smith, 2003). Yet even the most committed anti-tobacco activists appear to believe that complete prohibition is unlikely to form the basis of an effective harm-reduction policy. Instead they advocate a framework very similar to that around alcohol use. That is, greater control of production and distribution, prohibition of sale to vulnerable groups, prohibition of use likely to cause harm to those other than the user and the development of more effective prevention.

It is not our intention to simplify the arguments around prohibition of cannabis use. However a number of alternatives to the current rather muddled framework are possible and deserve consideration in the context of the public health aim of reducing the most harm to the most people (Police Foundation, 2001). Recent initiatives in the UK have included the reclassification of cannabis within the terms of the Misuse of Drugs Act (Home Office, 2002). Use is still prohibited but criminal penalties are slightly less severe and policing will be less intensive, freeing up resources to be directed towards other areas. It will be interesting to see whether this change in legal status will substantially influence any apparent effects of cannabis use.

Finally, it must be acknowledged again that much of the evidence of relevance to social policy around drugs is equivocal and open to partisan interpretation. Many of the issues discussed above in relation to the effects of drug use apply to evidence on the effects of policy. Moreover, evaluation of the effects of policy presents considerably greater challenges than evaluation of the effects of drugs (Pawson & Tilley, 1997).

Conclusions

Currently, evidence of an important causal relation between cannabis use and adverse psychosocial outcomes is not strong. Evidence on the psychosocial consequences of use of other illicit drugs, at the population level, is virtually non-existent. Pragmatic aims of reducing drug-related harm are currently constrained by this uncertainty concerning which harms are actually caused by drug use. Uncertainty around the wider effects of policy itself is also important. Various research strategies could improve the quality and quantity of evidence in this area and facilitate the adoption of truly evidence-based harm-reduction policy.

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