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Review of methodologies of evaluating effects of drug-related legal changes

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1. Executive summary

This paper analyses scientific and grey literature that examines the consequences of drug law changes, and describes their approach and methodologies. A multi-part search strategy identified 36 primary studies coming from Europe, North America and Australia, which were then categorised by the type of legal change they examined; changes to laws addressing illegal use and possession, changes in laws regulating legal use and possession, and enforcement strategies of existing laws such as police crackdowns and employee drug testing. Across these studies, the authors identify five types of evaluation questions and indicators, three types of data sets, and two study designs that have been used. Evaluations may highlight the intended and unintended effects of a legal change, but there can also be unexpected effects, and the full picture will describe not only the unintended but also the unexpected effects. Evaluations should not be taken as black and white proof that one law is better than another; an objective and authoritative study result will be obtained by good design, questions and indicators that reflect a wide variety of concerns, and appropriate data sets. Such studies can be solid grounds on which policymakers can base their decisions on future changes.

2. Introduction

Aim

The aim of this literature review has been to collect and analyse existing scientific and grey literature that examines the consequences of drug law changes, and to understand and categorise their approach and methodologies. Based on this, suggestions should be made as to how future evaluations of drug-related legal changes could be undertaken more objectively and effectively.

Background

As seen in the EU drugs strategy and many national strategies, evaluation is becoming a fundamental component of the European approach to drug-related interventions. Careful attention is also necessary to understand how drug laws change society in expected and unexpected ways. By evaluating the consequences of legal changes in a methodologically sound way, a solid evidence base can emerge to inform law implementation and future lawmaking.

This short review focuses almost exclusively on the approach and methodology employed in drug law evaluations and provides suggestions on how to better evaluate drug legislation and other legal changes in the future. No attention is paid to the results of the studies surveyed, although the studies might be used as examples of how different methods were applied.

Evaluation studies have been conducted for many instances of legal change in the drugs field, most frequently around the decriminalisation of cannabis use and/or possession in 11 US states in the 1970s, the introduction of Cannabis Expiation Notices[1] in parts of Australia in the late 1980s, and increased or decreased level of criminalisation of some drugs in several European countries in the 1990s and early 2000s. Other evaluation studies concern regulatory schemes for Dutch coffee shops and medicinal control systems, as well as drug testing and implementation or enforcement practices by police.

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[1] Cannabis Expiation Notices are civil or administrative warnings for cannabis use or possession.

3. Literature/Data Collection

This study is based on a data set of literature on drug related legal changes compiled in 2006 by Rödner (*Literature Review on effects of drug related legislation* (unpublished)). This data set used a sample approach as well as a key expert approach designed to access both published and unpublished materials. The search strategy comprised three steps:

1. A limited search on www.scholar.google.com, Sociological Abstracts, Criminal Justice Abstracts and PubMed was made. These databases cover different sources of information stemming from grey literature, research registers, and peer-reviewed literature from medical and social science backgrounds. The search terms included: (drug AND law), (drug AND law OR act AND impact OR effect OR evaluation), (drug AND law OR act AND change OR reform AND evaluation), and (drug AND act AND reform OR change).

2. Specialised libraries and databases were also searched manually (e.g. Drugscope and HIT, the library collections at SORAD (Centre for Social Research on Alcohol and Drugs, Stockholm, Sweden), ISGF (Research Institute for Public Health and Addiction, Zurich, Switzerland), SFA (Schweizerische Fachstelle für Alkohol- und Andere Drogenprobleme, Lausanne, Switzerland) and SIRUS (Norwegian Institute for Alcohol and Drug Research, Oslo, Norway)) and key experts and EMCDDA focal points were consulted.

3. Targeted searches were made for specific case studies, such as the legal changes for cannabis in the USA and Australia, and drug law changes in the Netherlands, Italy, Spain and Portugal.

No time limit was set for inclusion of studies, although most were conducted between the 1970s and 2005, with some historical reference to earlier laws or conditions. A limited number of studies written in languages other than English were included so that information from a wider range of countries could be incorporated. Not every language could be searched, and so most of the studies are in English (or translations into English), with a few studies in other European languages.

Of the studies detected through this search process, an initial review of abstracts was performed, and eventually a set of 60 accessible and appropriate studies were produced. The resulting database of 60 study summaries was used to extract detailed information for analysis in this literature review. From this, 24 studies were literature reviews which were only included as background material, while the remaining 36 primary studies, which evaluate legal changes as such, were reviewed in depth for this project. If anything was unclear in the study summaries, the original study was referenced for additional clarification.

4. Data analysis

The 36 evaluation studies reviewed have been classified and analysed according to: (i) the type of legal change under evaluation; (ii) the evaluation questions and indicators; (iii) the data sets used; (iv) the overall design of the evaluation studies with respect to time (before/after comparison) and location (geographical comparison).

Type of legal change

The legal change being evaluated in the available studies was classified into three groups. The largest group involved changes in response to illegal drug use or possession. This type of analysis was found in 18 of the 36 studies identified. They examined legal changes that: (a) re-classified use or possession of drugs as a criminal offence, or introduced or increased penalties; or (b) decreased penalties or applied administrative sanctions for drug use or possession, or provided for treatment instead of criminal punishment. These were changes to laws decided on by the national or regional legislative body.

The second group concerns changes in a variety of regulatory schemes in which use and possession of certain drugs is authorised or tolerated. Seven studies belong to this type, e.g. studies on the administration of cannabis sales in Dutch coffee shops, prescription medicine control, and heroin or methadone maintenance in British treatment clinics. These studies provide a slightly different context as they reflect how legal changes are implemented within a regulatory scheme to permit drug use or possession under a specific set of regulations, as decided on by a legislative or administrative body.

The third group includes changes in enforcement or implementation of laws. This group of 11 studies considered the effects of increased police enforcement of drug laws and specific employee and conscript drug testing programmes, which provide context on how drug laws are implemented. The decisions about enforcement come from an executive decision-making authority, such as a police force or company.

Evaluation questions and indicators

The questions and indicators chosen point to the outcome variable used for the evaluation of the legal changes, and reflect the rationale of the legal change itself. The evaluation questions ask how the legal change affects aspects of society, often but not always with respect to both intended and unintended effects.

For example, if penalties for the possession or use of drugs are increased, a main rationale for the legal change is to lower drug use through an increased penalty in the event that the user is caught by law enforcement bodies. Drug use is therefore one possible indicator for the evaluation. However, an unintended effect of such a change could be increased costs incurred by police, courts, and prison systems, and resources diverted away from preventing and punishing other kinds of crime. These unintended consequences, such as court costs or police workload, could therefore be considered as another outcome indicator for evaluation.

In general, the various evaluation questions and indicators used by the studies in this review address the following topics:

- *Use* of drugs, measured as prevalence, incidence, patterns of use, or substitution of other substances, by youths, students, or the general population
- *Health* related problems and behaviours, such as drug related deaths, emergency room visits, treatment demand, syringe disposal and needle exchange
- *Criminal justice* indicators of arrests, citations, convictions, law enforcement and court costs, imprisonment, non drug law offences[2], police activities
- *Market* indicators of price, purity, availability, seizures, buying and selling practices
- *Attitudes or Opinions* regarding the perceived harm of drug use or the general positive or negative view of the legal change.

Some evaluation studies assess only one main question and indicator, while others have a more comprehensive approach and use several evaluation questions and indicators covering different intended and unintended consequences.

Data sets

Three main types of data sets are used to respond to the evaluation questions: Health or law enforcement statistics, surveys, and ad hoc studies.

Health or law enforcement statistics generally try to account for all detected instances of a particular event, such as an arrest or drug-related death, and are based on hospital, police, court, or government records. They can be used to measure health, criminal justice, or market indicators. The case definition, the coverage (i.e. full or limited) and the reporting practices (i.e. procedures, delays) are some of the elements which can have a strong impact on the data and must therefore be taken into account when analysing and interpreting them.

Health or criminology surveys collect data from a representative sample of the general population, students, or a particular at-risk group. They collect information on drug use or other related behaviours, as well as on attitudes and perceptions regarding the availability and perceived risk of different substances. Statistical methods are used to project the results from these surveys onto the larger population.

Ad hoc studies generally are conducted by the investigators themselves, usually on a smaller scale, with more detailed and often qualitative data. They tend to be targeted at experts or those directly concerned by a legislative change, such as drug users, social workers, or police officers. They most often gauge attitudes, practices or behaviours regarding drug use, health services, or the criminal justice system.

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[2] In these studies, the indicators may be called 'non-drug-related crime', but these refer to property crimes or unspecified non-drug law offences. In EMCDDA terminology they would probably be classed as 'non-drug law offences'. The EMCDDA defines drug related crime as including:
Psychopharmacological crimes: crimes committed under the influence of a psychoactive substance, as a result of its acute or chronic use.
Economic-compulsive crimes: crimes committed in order to obtain money (or drugs) to support drug use.
Systemic crimes: crimes committed within the functioning of illicit drug markets, as part of the business of drug supply, distribution and use.
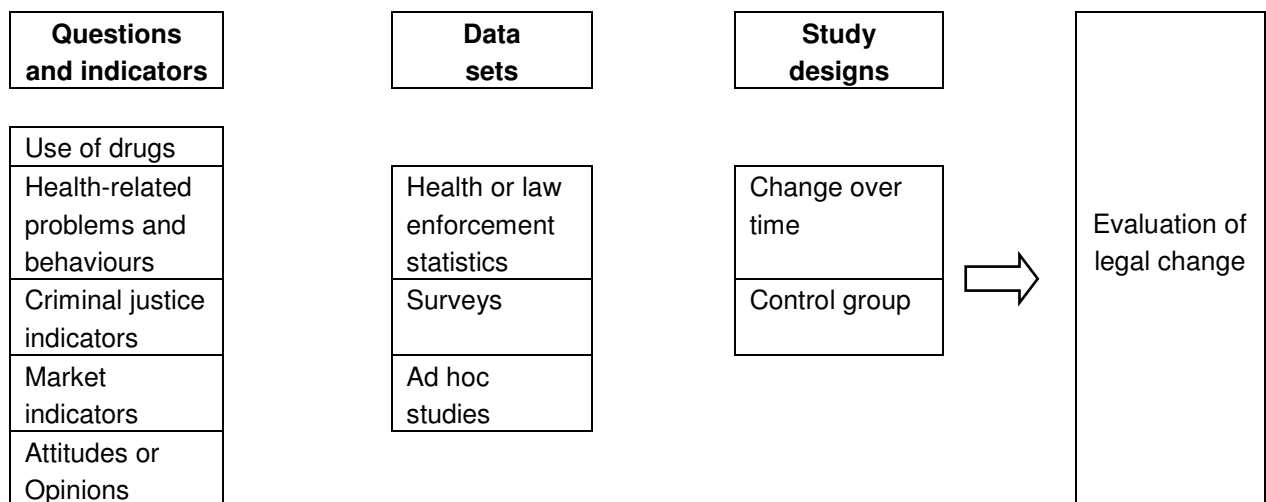Drug law offences: crimes committed in violation of drug (and other related) legislations.
(Drugs in Focus, No. 16 (2007) EMCDDA)

Evaluation design

Randomised controlled trials (RCT), the gold standard in evaluation methods, have not been encountered in drug law evaluation as this methodology is technically difficult to apply in such a context. Also, legal norms usually would not allow legal sanctions to be applied differently on the basis of a random process which would be the core of every RCT. The design of most evaluation studies is a natural experiment, in which changes are usually observed over time and sometimes include, as a control group, people or a location not affected by the legal change. Data collection can be done on an ongoing basis, only before and after the change (pre/post), or only after the change (post hoc). All these designs are limited with respect to the quality of conclusions which can be drawn from them. The main problem is that effects other than the legal change might have caused the changes found, and the assessment of the situation before and after the intervention might not be either independent from one another or valid.

Depending on the indicator, data could be presented as continuous time series, or as one or two discrete collections of data.

Figure 1: Illustration of the factors used in evaluations of drug-related legal changes:

5. Detailed analysis

This section examines the different studies identified in this literature review, and examines the evaluation question and indicators, data sets and tools, and evaluation designs used within the three types of legal change identified.

Changes in responses to illegal drug use and possession

The most common type of legal change found in this literature review concerns changes in the severity of responses to illegal drug use and possession. As noted above, these 18 studies examined a legal change that: (a) classified drug use or possession as a criminal offence or introduced or increased penalties; (b) decreased penalties or applied administrative sanctions for drug use or possession, or provided for treatment mandates instead of criminal punishment.

Description of Studies
From 1973-1978, 11 US states enacted laws that in some way decriminalised the use or possession of 'small amounts' of marijuana, although this is not a homogenous group of changes. Firstly, the terms to describe such re-classified offences included misdemeanour, infraction, violation, and other variations (although generally downgraded from felony or other criminal status). Additionally, the various definitions of 'small amount,' the maximum fines and prison sentences, and even specific terms differed from state to state. For example, the amount could be undefined and up to the discretion of police officers, or specifically stated as one ounce or less or 100 grams or less. In general the possession or use of cannabis was downgraded from criminal to administrative offence or the punishment was limited. Two studies examined this legal change in only one of the 11 states – California (Aldrich and Mikuriya, 1988) and Oregon (Blachly, 1976), while two more examined the change in all 11 states (Johnston et al., 1981; Theis and Register, 1993). One study examined the change in five of these states where Drug Abuse Warning Network (DAWN) data was available (Model, 1993).

In 1987 the South Australia Territory introduced a system of Cannabis Expiation Notices, essentially a civil or administrative notice for cannabis use or possession, which was examined in three studies (Atkinson et al., 1995; Donnelly et al., 2000; Sutton and Sarre, 1992). The Australian Capital Territory also applied administrative instead of criminal sanctions for cannabis use or possession in 1992 (McGeorge and Aiken, 1997).

Legal changes in several European countries were evaluated in seven studies. A Swiss law of 1975 reduced penalties for drug-consumption-related offences and raised penalties for trafficking (Bonnie, 1980). A series of Italian laws over several decades added or removed sanctions for drug use or possession (Arnao, 1994; Solivetti, 2001). Two Swedish laws of 1988 and 1993 criminalised personal drug use and added the potential for a jail sentence (BRÅ 2000), and a Czech law of 1998 introduced a penalty for personal drug use or possession (Zabransky et al., 2001). In 2001 a Portuguese law removed criminal sanctions from drug use and possession (Allen et al., 2006), and a German law of 1994 revised the obligations of prosecutors involved in drug use or possession cases (Schafer and Paoli, 2006).

Two more American legal change studies were found. One took place in California in 2000 on legally-mandated treatment for first-time non-violent drug offenders (Auerhahn, 2004). The second one studied the 1973 Rockefeller laws of New York State that increased sentences for trafficking narcotics,

including a provision that lowered the amount of drugs found that would mandate longer sentences (Winick, 1975).

Winick's and Bonnie's two studies stand out as the only studies found which examine the effects of a legal change regarding trafficking. This may be a result of the search strategy, but it does seem that the effects of raising penalties for trafficking have not been studied as much as for personal possession and use.

Evaluation questions and indicators
For this type of legal change, the basic rationale is to discourage and thus reduce drug use by increasing penalties. The main risk is that this could raise enforcement costs, promote negative health behaviours, and levy disproportionate punishment. Conversely, given that the basic rationale for a decrease of penalties is to alleviate any unnecessary burden on the criminal justice system, the risk here is that this could encourage use. The rationales for and criticisms of these legal changes are reflected in the evaluation questions and their related outcome indicators, as can be seen in the following examples, paraphrased from the studies in question:

- How did the change affect drug use (of youth or in the general population)? (Donnelly et al. 2000; McGeorge and Aitken, 1997)
- How will the prison and treatment system demographics change if this law is passed? (Auerhahn, 2004)
- Did people start using the decriminalised drug more and other drugs less? (Model, 1993; Theis and Register 1993)
- Did removing criminal sanctions reduce costs to the criminal justice system? (Aldrich and Mikuriya, 1988)
- What do police, judges, and educators think of the change? (Blachy, 1976)
- How have the police changed their strategies after personal use is criminalised? (BRÅ, 2000)

For some studies only one of these questions was asked. Other studies asked several such evaluation questions; one assumes that the study designers wanted to receive a more comprehensive picture of the effects of the change.

Given that drug use and criminal justice issues are often at the centre of concerns about this type of legal change, it is not surprising that one or both indicator types were considered in every study.

Drug use was examined in 14/18 studies. Two studies looked exclusively at use indicators, although they did so over a long time period following the legal change:

- Donnelly et al. (2000) examined lifetime cannabis use in the general population following the 1987 introduction of Cannabis Expiation Notices in South Australia.
- Theis and Register (1993) looked at use of marijuana, alcohol, and cocaine in youth after the legal change in 11 states in the 1970s, in states with and without the change, and how use shifted between substances, using the National Longitudinal Survey of Youth.
- The other 12 studies examined drug use in combination with other indicator types, as shown below.

Criminal justice indicators were considered in 11/18 evaluation studies. These indicators ranged from numbers of citations and arrests for drug offences to monetary costs for enforcement and strategies of police forces, and were often used in combination with other evaluation questions and indicators (drug use, health problems).

- Aldrich and Mikuriya (1988) examined changes in costs to the criminal justice system after a legal change in California (that made possession of one ounce or less of cannabis a misdemeanour instead of a felony), by considering time series data on arrests and court and law enforcement expenditure, available through the California Department of Justice.
- Bonnie (1980) examined police enforcement practices by looking at arrest and seizure statistics, and by interviewing government officials on trends regarding priorities and charging and release practices. This followed a legal change in Switzerland that increased penalties for trafficking and decreased penalties for drug-use-related offences.

Several studies used both indicators, i.e. drug use and criminal justice, to examine possible connections between these indicator types, and so present a broader picture of the change:

- Atkinson et al. (1995) examined drug use data from national population surveys and criminal statistics to establish if there was a net widening effect (where police take action more often because the system of punishment is simpler) after the establishment of the Cannabis Expiation Notice system in South Australia.
- Sutton and Sarre (1992) examined how the Cannabis Expiation Notice system affected police enforcement and patterns of drug use, through police department statistics and health surveys.
- Following two laws that increased penalties for use or possession in Sweden, BRÅ (2000) looked at police reports for changes in police strategies, and blood tests of arrestees for changes in the number of detected drug users.

Health indicators were also often used to evaluate legal changes (8/18), although often in combination with drug use indicators. Health indicators can also be seen as more graduated indicators of drug use, in that they show level and patterns of use with respect to level of harm, and not just prevalence or incidence.

- Model (1993) used data from the DAWN system, regarding emergency room visits according to substance mention after decriminalisation of use and/or possession of marijuana in 11 US states. The study also examined substance substitution and shifts from alcohol to marijuana or other drugs to marijuana and vice versa. One bias (acknowledged by the study) is that the ER mentions do not mean that the drug recorded was the cause of the medical reason for the visit.
- In Auerhahn (2004) treatment data was examined following a legal change mandating or providing for diversion into treatment instead of prison for drug offenders.
- In Arnao (1994) both drug use and records of overdoses were considered. The specific indicators were changes in drug-related deaths, drug treatment demand and relapse rates, and drug-related hospitalisations.

However, beyond treatment and serious health problems, such as overdoses and hospitalisations, there is relatively little information about more common health problems and behaviours, such as co-morbidity with other behavioural problems and self-reported drug related health concerns. This may be due to a dearth of available data sets and tools on such less easily detected conditions.

Market indicators can serve to measure effectiveness of restrictions on drug supply and also serve as a proxy for measuring changes in drug demand, although the exact relationship is not clear. Nevertheless, market indicators can be interesting indicators to observe following a legal change. The indicators of price and purity of drugs were only used in two evaluation studies, which will be addressed below.

Finally, two evaluations used measures of attitudes and opinion: Johnston et al. (1981) used six years of Monitoring the Future school survey data after the legal changes to examine attitudes toward perceived harm of marijuana, as well as self reported drug use. In Blachly (1976) ad hoc questionnaires were sent out to district attorneys, police chiefs, judges, parole board members, high school principals, college presidents in Oregon after a legal change to assess their general positive or negative views of the law. Hospital admission records were also considered before and after the change.

All of the preceding studies used only one or two types (drug use, criminal justice, health, attitudes and opinions) of indicators, aiming to answer a rather specific evaluation question. Only 4 of the 18 studies examined the general effect of the legal change using three or more indicator types, with the two following studies using four indicator types including market indicators:

- Zabransky et al. (2001), examined the general effects of a legal change in the Czech Republic that increased the penalty for possession, considered changes in drug use prevalence and incidence, negative health effects, market availability, and law enforcement and other costs.
- Winick (1975) also evaluated a range of indicator types of drug use, health, markets, and criminal justice, including student drug use, drug treatment demand, drug sales, prices and availability, and numbers of shoot outs, crimes, and arrests.

Allen et al. (2006) and Solivetti (2001) also provided general overviews of legal changes in Portugal and Italy, respectively, considering drug use, health, and criminal justice indicator types (general drug use prevalence, treatment demand, and police costs and behaviours).

Data sets and tools
Health and criminal statistics provided the data for most of the studies (14/18) examining responses to illegal use and possession. They were gathered mostly from police reports, government agencies and hospitals. Rather than simply observing changes in raw data sets, a few studies also performed some kind of prospective or econometric analysis on available statistical data. Auerhahn (2004) performed prospective modelling on data of prison and treatment composition to forecast the effects of a new law mandating treatment. Aldrich and Mikuriya (1988) used statistical models of cost benefit analysis to examine changes in police force costs.

Data from surveys on health risk behaviour were used in half the studies (9/18), and were the most common data set to measure drug use. This is especially the case when examining drug use and attitudes among youth, due to the availability of health survey data sets such as Monitoring the Future and the European School Survey Project on Alcohol and other Drugs (ESPAD). Studies assessing general drug use in the population often had national household surveys such as the US National Household Survey on Drug Use and Health (NHSDUH) at their disposal.

Seven of the 18 evaluations used ad hoc studies to examine health behaviours and drug use habits of specific users, as well as localised information about police behaviours and crime levels, and attitudes of relevant professionals. Five of them performed some kind of ad hoc investigation which was used in combination with existing statistics or surveys. In the only study using ad hoc data only (McGeorge and Aiken 1997), students from two universities in two Australian territories were asked to fill out questionnaires about their current drug use and their past drug use before the legal change in one of the territories. One study followed over 2 000 individuals over several years, tracking their criminal and treatment histories (Schafer and Paoli 2006) following a change in law regarding prosecutorial priorities in Germany.

Evaluation design

Almost all of the studies used a before and after design, either with time series statistical data, or with discrete measurements taken before and after the change. Two studies measured indicators only after the change, but in these cases they also investigated past drug use, reflections on personal behavioural changes, or how opinions have changed since the legal change (Blachy, 1976; McGeorge and Aiken, 1997). Exceptionally, in one study statistics for the prison population taken before the legal change were put into a prospective model, in order to anticipate the potential outcomes of a legal change before it was actually implemented (Auerhahn 2004).

Five studies included control groups (Donnelly et al., 2000; Johnston et al., 1981; McGeorge and Aiken, 1997; Model, 1993; Theis and Register, 1993), but most often in Australia and the United States, where other states or territories were used as controls. Four of these five studies with control groups also took before and after measurements (except McGeorge and Aiken, 1997).

Summary

The majority (13/18) of these studies evaluated changes that decreased penalties for drug use or possession, with the focus of studies on the US 11 state decriminalisation and the South Australia Cannabis Expiation Notices. Four studies evaluated increases in penalties, and one looked at several decades of changes where penalties both increased and decreased (Solivetti, 2001).

The most frequent evaluation questions and indicators were about drug use (14), offences and criminal justice practices (11), health problems (8), markets (2), and attitudes (2), which correspond to the focuses of the rationales and criticisms of the legal changes. Even though this group of studies considers a wide range of indicators, reflecting both rationales and criticisms, individually most studies have a much more narrow scope, only considering one or two evaluation questions to be answered. Considering that changing such penalties is often perceived to have a broad impact on society, it is interesting that few aspects of such an impact are consistently evaluated.

Regarding the data sets used, health and criminal statistics were used the most often (14), perhaps because they are less resource intensive for the investigators. Existing health surveys were also used frequently (9). Six studies examined ad hoc data. Although ten studies used two types of data sets, only three studies measured specific indicators with both ad hoc and statistical or survey data. The use of multiple data set types to measure a specific indicator provides a reliable way of cross checking information and results.

Finally, nearly every study included some kind of before and after measurement, although not always for every indicator. Two studies asked after the legal change about attitudes or retrospective self reported drug use, and one considered a prospective view before the change. However, only five studies used control groups.

Changes in regulatory schemes

While the first category of legal change regarded illegal use and possession, this category of studies examines changes to regulatory schemes involving controlled substances—limited instances of drug use or possession permitted under certain conditions. These seven studies evaluated different aspects of five regulatory schemes. In this group the number of studies found is quite limited, and so general conclusions should not be drawn on this basis, also as the studies had a clear focus on illicit substances.

Description of Studies
Dutch coffee shops provide the context for two studies about administratively limiting marijuana sales, one on the effects of limiting the amount sold at any one time from 30 grams to 5 grams (Korf, 2001a), and the other observing the consequences of a rise in the minimum buying age from 16 to 18 years old (Korf, 2001b).

The other regulatory schemes involve drug use and possession within a medical setting. Treatment clinics in the UK carried out a system of heroin and methadone maintenance for addicts; their initial efforts were evaluated in two studies (Johnson, 1975; Smart, 1974). Another study examined limiting availability of prescribed Methedrine (methamphetamine) by doctors and hospitals in the UK (Alarcon, 1972). A study on the inclusion of benzodiazepines in the New York State Triple Prescription Plan examines the effects of more requirements and paperwork for each prescription (Simoni-Wastila et al., 2004). A law allowing the use of marijuana for medicinal purposes in California was also evaluated (Khatapoush and Halfors, 2004).

These changes either restricted or increased the accessibility of the substance through establishing or modifying existing regulations. The coffee shop, Methedrine, and benzodiazapine studies examined the results of adding further restrictions for drugs already in regulatory schemes. The heroin maintenance and medical marijuana studies involved bringing a substance out of a completely prohibited area and into a regulatory scheme.

Evaluation questions and indicators
A rationale for these regulatory systems is to allow people to get access to controlled drugs, either for medical purposes or to avoid contact with the criminal black market. Criticisms include the risks of misuse of the drugs and their diversion into a criminal black market. Therefore, the criticisms and rationales for this type of legal change involve the relationships between use and the market. Again, these concerns can be seen in the evaluation questions and indicators, paraphrased here:

- How does reducing the maximum amount of cannabis purchased at one time change the behaviours of the owners and clients of coffee shops, particularly with respect to how much and how frequently the cannabis is bought and sold? (Korf, 2001a)
- Does raising the minimum age for buying cannabis in Dutch coffee shops achieve the intended goal of reducing use among youth? (Korf, 2001b)
- How does limiting the production and supply of Methedrine affect the prevalence of use of the drug, use and possession of other drugs, and drug offences? (Alarcon, 1972)

- How does the establishment of the British treatment clinics affect the number of heroin addicts? And how much of the heroin administered in the clinic enters the street market? (Johnson, 1975; Smart, 1974)
- How does increasing administrative prescription procedures for benzodiazepines affect the prescribed use of the drug and other psychoactive drugs in a clinically vulnerable population? (Simoni-Wastila et al., 2004)
- Does allowing approved patients to grow and use marijuana for medicinal purposes change opinions about the harm of marijuana or the use of marijuana and other drugs in the general public? (Khatapoush and Hallfors, 2004)

From the evaluation questions, it is clear that all of the studies examined drug use indicators. The other indicator types, while used, cannot be clustered as neatly as for the legal changes regarding illegal use, above. Studies in this category will therefore be subdivided here into how they tried to measure use of the drug either inside or outside the regulatory system. Perceived harm of the drug after its entry into the regulatory scheme was also measured by one study (Khatapoush and Hallfors, 2004).

Drug use within the regulatory scheme was measured by comparing numbers of prescriptions among Medicaid patients to measure use of benzodiazepines (Simoni-Wastila et al., 2004). In the study regarding lowering the maximum amount of cannabis purchasable in coffee shops (Korf, 2001a), the primary indicators were market indicators, of buying and selling habits, price, and quantity. Both the British treatment clinic studies measured the numbers of heroin addicts in the treatment system, as well as health and drug use of the participants (Johnson, 1975; Smart, 1974).

Drug use outside the regulatory scheme was evaluated in various ways. The coffee shop study regarding raising the minimum purchasing age from 16 to 18 questioned the effect on use in youth (Korf, 2001b). The medical marijuana study assessed attitudes about the perceived harm of marijuana, as well as use of marijuana and other drugs (Khatapoush and Hallfors, 2004). One of the British treatment clinic studies also assessed illegal sales of heroin that had been obtained through the clinic (Johnson, 1975).

Both approved and unapproved drug use were considered by Alarcon (1972), following the restrictions on Methedrine availability. The study more broadly examined drug use, health, and criminal justice in the context of following the cases of addicts and monitoring their drug use, hospital entries, and criminal justice system encounters. This was the only study that assessed such a range of indicator types within a regulatory scheme, albeit for only one group of drug addicts. All the other studies were much more specific in the evaluation question and indicators.

Market indicators are used much more for this type of legal change. There is also more combination between market indicators and use or criminal justice indicators because of the concern that these drugs could be obtained outside the regulatory scheme.

Data sets and tools
Health and criminal statistics were used to examine numbers of addicts and their drug offences (Smart, 1974; Johnson, 1975) and numbers of prescriptions (Simoni-Wastila et al., 2004). A national health survey was used to measure cannabis use in youth (Korf, 2001b). Ad-hoc information was gathered through on site interviews and surveys about drug sales or use (Korf, 2001a) and a telephone interview survey on attitudes towards perceived drug harm and drug (Khatapoush, 2004). Many of the statistics used (such as

prescription numbers) and ad hoc investigations (such as cannabis sales figures) were derived from the regulatory schemes themselves.

The Methedrine study (Alarcon, 1972), in following several individual users of heroin and Methedrine, also gathered data from hospital and court visits, as well as interviews with relevant professionals and surveys with the group members themselves.

Evaluation design
All seven of the studies had a before and after design, although one study used its 'before' data from a comparable and similar study conducted before the change (Korf 2001a). Three of these studies took time series data from national surveys among youth, following individual cases, or prescription databases.

Two studies also had control groups: the benzodiazepine TPP study in New York State compared data from the neighbouring state of New Jersey, and the study following introduction of medical marijuana in California collected data from other states as well.

Summary
Drug use was again the main indicator of concern here, but this time with respect to drug use within or outside the regulatory scheme. The way in which the drugs are transferred to the consumers is also evaluated through market indicators, which are looked at much more closely than the legal changes for illegal use or possession, again, perhaps because market data from these regulatory schemes are more readily available.

Despite the smaller range of data sets used to evaluate these changes, one explanatory feature is that in conducting these evaluations it is easier to find readily available data sets or easily accessible participants for ad hoc studies because in most cases the drug use, possession, and sales are not hidden or stigmatised by illegality. For this group, also, a broader set of outcome indicators was generally used.

Changes in enforcement / implementation

These studies examine drug law implementation by considering how drug laws are enforced, either by police action or through drug testing. Unlike the other two legal change categories, however, changes in enforcement activities were not precipitated by a change in the law.

Description of Studies
Eight of these 11 studies evaluated short term crackdowns in sections of Oslo (Olson and Skretting, 2006), Vancouver (Wood et al, 2004), London (Best et al, 2001), and New York City (Cooper et al, 2005), and long term increased enforcement efforts of several months or years in Portugal (Mendes, 2000) and the US states of New York (Shepard and Blackley, 2005) and Florida (Benson, 2001), as well as New York City (Johnson and Natarajan, 1995).

The other three studies in this category evaluated programmes of drug testing in employment. In 1981, the US military started random drug testing of recruits and personnel, and this was the background for two studies (Bachman, 1999; Mehay and Pacula, 1999). Many companies also test employees as a condition of employment, as considered in Hoffman and Lavison (1999). Drug testing can be seen as a means of enforcement because although the primary aim of doing the testing is to prevent use and promote safety,

an outcome of a positive test for drug use can be some kind of sanction or punishment; in the US military zero tolerance program, this can be a termination of association or employment.

Evaluation questions and indicators
Again, the rationales and criticisms for these efforts can be seen in how the studies evaluate these changes. Intensified police enforcement and police crackdowns are undertaken to remove dealers, increase safety, and limit drug use and crime. Unwanted consequences and criticisms include diversion of police resources, decreased resident-police cooperation, and increased health challenges for users. The intent of the drug testing is to prevent use and promote safety, although criticisms include ineffectiveness and disproportionate infringement of civil liberties.

The evaluation questions for these studies addressed:

- How did the police crackdown affect the experiences, attitudes, and behaviours of police, community residents, users, and dealers? Specifically: use patterns and health behaviours of users, safety of neighbourhood, price and purity of drugs, practices of dealers to avoid arrest, and attitudes of police involved (Benson, 2001; Best et al, 2001; Cooper et al, 2005; Johnson and Natarajan, 1995; Olson and Skretting, 2006; Wood et al, 2004).
- How did increased drug enforcement affect police resources and non drug law offences? (Benson, 2001; Mendes, 2000; Shepard and Blackley, 2005)
- Does drug testing reduce use? (Bachman, 1999; Hoffman and Lavison, 1999; Mehay and Pacula, 1999)

All of these studies examined effects on criminal justice and markets indicator types, but only occasionally also considering drug use and health problems.

Whereas in the other types of legal changes the most common specific criminal justice indicators concerned numbers of drug offences and changes in implementation costs, these kinds of specific indicators should logically increase during short term police crackdowns and long term increased enforcement. Therefore, the specific criminal justice indicators considered in these studies included neighbourhood safety, police attitudes, non drug law offences, and allocation of police resources.

Market indicators such as prices and purity were also considered by three studies (Best et al., 2001; Johnson and Natarajan, 1995; Wood et al., 2004). Only Best et al. (2001), however, was looking primarily at market indicators.

Two studies looked at attitudes; attitudes and practices to avoid arrest by crack dealers (Johnson and Natarajan, 1995) and attitudes and experiences of drug users and community members (Olson and Skretting, 2006). This latter study is interesting in its evaluation of attitudes of both those ostensibly subjected to increased enforcement and those ostensibly benefitting from increased enforcement.

Another two studies, also focusing on those subjected to increased enforcement, considered health habits of drug users with regard to safe needle use and disposal in the context of police crackdowns:

- In Wood et al. (2004), injecting drug users were surveyed before and after a police crackdown to determine their drug use patterns, needle exchange practices, as well as the prices of drugs.

- In Cooper et al. (2005), drug users were interviewed and surveyed through snowball sampling after a police crackdown in New York City. The drug users were asked about the effect of the event on their ability to 'reduce harm' to themselves by using safe injecting sites, clean needles, and taking other precautions.

When drug use was considered in the police enforcement studies, it was considered together with health related behaviours, beyond basic prevalence of use (Best et al., 2001; Wood et al., 2004).

The employment drug testing only considered drug use indicators but drug use in this sense is treated as an offence by the drug testing.

Data sets and tools
Statistics from police records were used to measure crime rates. One study, Shepard and Blackley (2005), also applied econometric analysis to crime rates during long-term intensified drug enforcement efforts in New York State in the 1990s, to determine the incidence of non-drug law offences. Two other studies also looked at incidence of non drug law offences during periods of long-term intensified drug enforcement—Mendes (2000) examined property crime rates in Portugal, and Benson et al. (2001) examined non drug law offences and police resources in Florida.

All three of the employment testing studies used data from health surveys to assess drug use and drug testing. One study used longitudinal panel data from Monitoring the Future, tracking cohorts of high school seniors for two years after graduation and compared active duty recruits with non-military classmates (Bachman, 1999). Another study used the National Health Survey on Drug Abuse and a Department of Defense Worldwide Survey of Health Related Behaviours to compare drug use in military personnel and civilian populations before and after adoption of military employee zero tolerance policy (Mehay and Pacula, 1999). A third study used data from one year of the National Health Survey on Drug Abuse to compare self reported drug use between people who were drug tested through their employment and people who were not drug tested (Hoffman and Lavison, 1999).

Almost all other health, market, and attitude information was largely ad hoc qualitative and was gathered through interviews with drug users in treatment and through snowball sampling, with dealers and neighbourhood residents and police.

Evaluation design
For the studies concerning long term intensified enforcement, data was analysed before, after, and often during the period of change. For the studies of short term police crackdowns, evaluations were conducted mostly after the event to ask about participants' views of what had changed since the event. One of the short term police crackdown studies was able to use data gathered discretely before and after the event (Wood et al. 2004).

Only one of the four short term police crackdown studies featured a control group, which was in another neighbourhood in the same city (Best et al, 2001). The crackdown targeted dealers, so the study compared changes in the purchase and use of several drugs, as well as their price and purity, between the two neighbourhoods.

Two of the employment drug-testing studies were performed before and after either the introduction of drug testing or the entering of a cohort into a drug testing situation. The third study compared self-reported drug use and employment testing of one year, in which case the control group would be those surveyed that were not in drug-tested employment.

Summary

Unlike the first two legal changes, almost all of the studies examining increases in enforcement considered unintended consequences of these changes (such as whether there is an increase in other crimes). However, the studies on short-term police crackdowns rarely looked at long term effectiveness (e.g. whether crime increases again several months after crackdown), despite the fact that their operation in a small area would suggest that such follow-up is easier.

The employment drug testing studies were a bit more limited, in that they only looked at drug use, usually concluding that the drug testing could be correlated with lower drug use. However, it could not be concluded that the drug testing alone was the only factor contributing to the lower drug use rates, as self-selection (drug users may be less likely to enlist) and other lifestyle factors often play important roles in prevalence of drug use.

It is noteworthy that all of these particular legal changes were about increases in enforcement. There were no studies in this review about decreases in enforcement—such as explicit relaxation of drug law enforcement in a particular neighbourhood or region, or the phasing-out of drug testing by an employer. This may be, in part, a result of the original search strategy, but a further brief search provided few results of such studies.

6. Conclusions and Recommendations

We have seen 36 studies, evaluating changes regarding illegal use, regulated use and enforcement. From these we have identified the common use of five evaluation questions and indicator types, three data set types and two broad study designs. Depending on the type of change, various questions and indicator types or combinations of indicators were used to evaluate the change. Data sets and designs were chosen to answer the evaluation question and measure the appropriate indicator but, at the same time, the researchers may have been constrained by resources and effectively limited to what was easily available or could be carried out.

Half of the studies (18/36) examined in this literature review considered responses to illegal drug use and possession. Although this may be a result of the search strategy, this is also slightly surprising because there are many more examples in the last few decades of legal changes in regulatory schemes, as well as short-term police crackdowns, long-term intensified enforcement, and introduction of employment drug testing.

Overall, the studies on the responses to illegal drug use and possession had the broadest range of indicators, regulatory schemes had the stronger data sets, and the studies looking at increased enforcement took unintended consequences into account the most. As regards study design, a small proportion from each legal change type had both before and after measurements and control groups (4/18 for illegal drug use and possession, 2/7 for regulatory schemes, 2/11 for enforcement and drug testing).

Using evaluation questions that examine how the legal change affects aspects of society, a wider evaluation shows a more complete picture. These questions should take into account both the rationales and criticisms of the legal change, in order to identify the most comprehensive and appropriate indicators. This will allow both intended and unintended consequences of the legal change to be examined. Combining different indicator types is a good way of ensuring this. While some studies only considered drug use and/or criminal justice indicators, a more intricate and comprehensive evaluation of the change can be provided by taking into consideration health problems in combination with drug use, or market changes in combination with criminal justice indicators. Understanding and acknowledging how indicators could be related to each other gives a more comprehensive picture of the situation. High costs and lack of resources may present limitations to covering such a broad range of indicators. However, even studies limited to one or two indicators can provide valuable information when conducted with appropriate data sets and tools. These simple studies tend to be most effective if the indicator and data are particularly appropriate for the changes under evaluation.

In addition to careful consideration of the indicators, it is important that the study uses data sets and collecting tools that answer the evaluation question as precisely as possible, yet can be verified and cross checked as well. Ad-hoc data is more likely to fit the evaluation question, as the researchers can design a study that best reflects their purpose. However, it is harder to process a bigger sample in this case and account for inconsistencies. Statistics and health survey data are more likely to be consistent, standardised and available for many years or large groups, but may not accurately reflect what the researchers need to measure. As regards the longitudinal aspect, data in time series rather than discrete measurements may demonstrate effects of the legal changes better, particularly by allowing for time lags in implementation, normalisation to the public, and changes in the discretion of the police and prosecutors. Yet, depending on the tools and the indicator, discrete measurements may be more feasible and sufficient. Nevertheless, the inability of some statistical sets to reflect the evaluation question and the lack of consistent time series data

highlights the need to develop and maintain high quality, comparable, and accessible data collection mechanisms, if the evaluation of these often high-profile legal changes is to continue.

The optimal study design will have both before and after measures and a control group. Although studies should have before and after measures to assess the effects of the legal change, this can be difficult if data collection does not begin until after the legal change and there is no acceptable statistical record or previous study available. Therefore, it is best to start evaluating a legal change before the change begins. If possible, it is also important to measure the long term effectiveness of a legal change, through discrete follow-ups or continuous time series spanning years or even decades. Having a control group is also of great benefit as it eliminates other possible sources of change and bias, although as seen in this group of studies, they usually are taken from similar states or territories in the same country.

Statements summarising the effectiveness of a change should be based on solid or suitably qualified evidence. A simple study should probably not be considered in isolation in evaluating a legal change. Studies are designed within frameworks to answer the evaluation questions set. Occasionally, they answer a question that was not asked although that is uncommon. A comprehensive overview of several studies to evaluate a legal change should apply the above considerations in selecting studies that reflect a range of indicators.

We have talked about studies that highlight the intended and unintended effects reflected in the rationale and criticisms of the change. It should not be forgotten that there can also be unexpected effects. The full picture will display both the unintended and also the unexpected effects, and often points to further matters to be taken into consideration.

Such studies therefore are not black and white proof that one law is better than another, but they should be solid grounds on which policymakers of whatever political conviction can base their decisions on future changes. An objective and authoritative study result will be obtained by good design, questions and indicators that reflect a wide variety of concerns and appropriate data sets. Keeping in mind these ideas can contribute to building solid evidence bases to objectively evaluate legal changes.

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