

HIV and the criminalisation of drug use among people who inject drugs: a systematic review



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Summary

Background Mounting evidence suggests that laws and policies prohibiting illegal drug use could have a central role in shaping health outcomes among people who inject drugs (PWID). To date, no systematic review has characterised the influence of laws and legal frameworks prohibiting drug use on HIV prevention and treatment.

Methods Consistent with PRISMA guidelines, we did a systematic review of peer-reviewed scientific evidence describing the association between criminalisation of drug use and HIV prevention and treatment-related outcomes among PWID. We searched MEDLINE, Embase, SCOPUS, PsycINFO, Sociological Abstracts, CINAHL, Web of Science, and other sources. To be included in our review, a study had to meet the following eligibility criteria: be published in a peer-reviewed journal or presented as a peer-reviewed abstract at a scientific conference; examine, through any study design, the association between an a-priori set of indicators related to the criminalisation of drugs and HIV prevention or treatment among PWID; provide sufficient details on the methods followed to allow critical assessment of quality; be published or presented between Jan 1, 2006, and Dec 31, 2014; and be published in the English language.

Findings We identified 106 eligible studies comprising 29 longitudinal, 49 cross-sectional, 22 qualitative, two mixed methods, four mathematical modelling studies, and no randomised controlled trials. 120 criminalisation indicators were identified (range 1–3 per study) and 150 HIV indicators were identified (1–5 per study). The most common criminalisation indicators were incarceration (n=38) and street-level policing (n=39), while the most frequent HIV prevention and treatment indicators were syringe sharing (n=35) and prevalence of HIV infection among PWID (n=28). Among the 106 studies included in this review, 85 (80%) suggested that drug criminalisation has a negative effect on HIV prevention and treatment, 10 (9%) suggested no association, five (5%) suggested a beneficial effect, one (1%) suggested both beneficial and negative effects, and five (5%) suggested both null and negative effects.

Interpretation These data confirm that criminalisation of drug use has a negative effect on HIV prevention and treatment. Our results provide an objective evidence base to support numerous international policy initiatives to reform legal and policy frameworks criminalising drug use.

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Introduction

Worldwide, an estimated 8·4 million to 19·0 million individuals inject psychoactive drugs.¹ The public health concerns associated with the use of injection drugs are numerous and include the spread of infectious diseases, most notably HIV. About 13% of people who inject drugs (PWID) are thought to be living with HIV, which amounts to roughly 1·7 million individuals.²

UNAIDS has estimated that 30% of new HIV infections outside of the more generalised HIV epidemics of sub-Saharan Africa are attributable to the use of injection drugs.² Countries that have been identified as being particularly affected by HIV epidemics among PWID include China, Malaysia, Russia, Ukraine, and Vietnam.³ These five countries account for roughly half (47%) of all PWID estimated to be living with HIV in low-income and middle-income countries.⁴ Although prevalence estimates of HIV among PWID in China, Ukraine, and Vietnam indicate notable improvements from the early 2000s to 2012,⁵ HIV epidemics are expanding in some regions of eastern Europe and central Asia, in the

Middle East, and in north Africa, and this expansion is attributed in part to the use of injection drugs.^{5,6} Indeed, in 2014, 51% of new HIV infections in eastern Europe and central Asia and 28% of those in the Middle East and north Africa were estimated to be among PWID, highlighting their continued relevance as a key population in the global fight against HIV.⁷

Since the expansion of highly active antiretroviral therapy (ART) to low-income and middle-income countries in 2000, the course of the HIV pandemic has been substantially altered.^{2,8} ART has substantially reduced morbidity and mortality associated with HIV infection and decreased onward transmission risks in people living with HIV.^{9,10} Optimal use of ART has led to substantial decreases in new infections in PWID in various settings.^{11,12} However, access to treatment has not been equitable for HIV-positive PWID.¹³ Treatment inequities are particularly acute in China, Malaysia, Russia, Ukraine, and Vietnam, where PWID carry a disproportionate burden of HIV.⁴ Although PWID constitute an estimated 67% of HIV cases in these

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Research in context

Evidence before this study

Despite substantial advances in the reduction of HIV incidence and mortality internationally, the use of injection drugs continues to be a key driver of the global HIV epidemic. Mounting evidence suggests that structural risk factors, including laws and policies prohibiting illegal drug use, have a central role in shaping health outcomes among people who inject drugs (PWID). However, after searching MEDLINE, Embase, SCOPUS, PsycINFO, Sociological Abstracts, CINAHL (Cumulative Index to Nursing and Allied Health Literature), and Web of Science from Jan 1, 2006, to Feb 20, 2017, no systematic reviews on criminalisation of drug use and HIV prevention and treatment were found. Search terms included "people who inject drugs", "IDU", "substance use disorder", "substance dependence", "addiction", "street drugs", "heroin", "cocaine", "crack", "methamphetamine", "drug legislation", "drug law enforcement", "incarceration", "jails", "prisons", "criminalization", "crackdown", "mandatory minimum sentences", "HIV/AIDS", "condoms", "syringe sharing", "syringe exchange", "needle exchange", "substance use treatment", "addiction treatment", "supervised drug consumption", "methadone", "opioid substitution therapy", "buprenorphine", "naloxone", "HIV education", "HIV treatment", "antiretroviral treatment", "ART", "highly active antiretroviral treatment", and "HIV testing" (a full list of search terms is provided in the appendix).

Added value of this study

This study is, to our knowledge, the first systematic review of the scientific literature describing the influence that laws and

legal frameworks criminalising drug use have on HIV prevention and treatment among PWID. Our finding that 85 of the 106 eligible studies suggest that drug criminalisation has a harmful effect on HIV prevention and treatment—just five studies suggest beneficial effects and one study suggests both beneficial and harmful effects—provides a compelling evidence base for informing global HIV prevention and treatment efforts.

Implications of all the available evidence

This systematic review provides objective evidence indicating that criminalisation of PWID is harmful for HIV prevention and treatment strategies. To effectively support HIV prevention and treatment efforts globally and help end the AIDS epidemic, the available evidence highlights that international efforts are urgently needed to reform existing legal and policy frameworks that attempt to limit the harms of drug use. We believe the findings from our systematic review are applicable to a broad population, including national and international policy makers and practitioners working in HIV prevention and treatment. These results are directly relevant to the potential success of key international initiatives to address the global HIV epidemic, including the Global Fund and UNAIDS 90-90-90 targets aimed at substantially scaling up access to, and the effect of, HIV treatment by 2020.

five countries, only 25% of individuals on HIV treatment are PWID.⁴ PWID are also the group least likely to know their HIV statuses.¹⁴

Inequities in access to HIV prevention programmes for PWID also exist. Despite clear evidence of the effectiveness of opioid substitution therapies in reducing the risks of HIV transmission, global estimates suggest that access remains inadequate because only 65% of the global PWID population lives in countries where opioid substitution therapy is available.^{15,16} In the five aforementioned countries with the most well established injection-driven HIV epidemics, less than 2% of PWID have access to opioid substitution therapies.⁴ Analyses also suggest that global coverage of programmes to exchange or distribute sterile needles and syringes, a central pillar of HIV prevention for PWID, are inadequate.¹

At present, reducing HIV incidence by improving HIV prevention and treatment for PWID is an urgent international priority, as identified by several high level initiatives, including the Global Fund to Fight AIDS, Tuberculosis and Malaria and the UNAIDS 90-90-90 targets, which are aimed at substantially scaling up access to, and the effect of, HIV treatment by 2020.^{8,14,17}

Although practices at the individual level contribute to disparities in HIV infection rates and access to HIV prevention and treatment among PWID, mounting evidence generated over more than two decades suggests that higher-order or structural risk factors, including laws and policies criminalising drug use, could also have a central role in shaping health outcomes.^{15,18–20} Criminalisation of drug use places PWID in precarious legal situations and estimates suggest that 56–90% of PWID will be incarcerated at some stage during their life.^{21,22}

International agencies and programmes such as UNAIDS identify criminalisation and punitive laws as a primary reason why the level of decline in HIV incidence and mortality taking place globally is not being observed in PWID.² However, there has been, to the best of our knowledge, no systematic assessment of the peer-reviewed research literature characterising the influence that laws and legal frameworks criminalising drug use might have on HIV prevention and treatment among PWID. Consequently, we did a systematic review to describe the association between criminalisation of drug use and HIV prevention and treatment among PWID.

Methods

Search strategy and selection criteria

We completed this systematic review using PRISMA guidelines.²³ We searched MEDLINE, Embase, SCOPUS, PsycINFO, Sociological Abstracts, CINAHL (Cumulative Index to Nursing and Allied Health Literature), Web of Science, DARE (Database of Abstracts and Reviews of Effects via OVIDSP), Google Scholar, the National Library of Medicine's Meeting Abstracts database, and online archives of the International AIDS Conference (IAC), the Conference on HIV Pathogenesis, Treatment, and Prevention (IAS), and the Conference on Retroviruses and Opportunistic Infections (CROI) for studies published between Jan 1, 2006, and Dec 31, 2014. We also hand-searched reference lists of published reviews and relevant included studies.

Terms related to our three key concepts (PWIDs, criminalisation of drug use, and HIV prevention and treatment) were searched both as MeSH terms and as key words. A detailed MEDLINE search strategy is provided in the appendix (pp 1–3). To be included in our review, a study had to meet the following eligibility criteria: be published in a peer-reviewed journal or presented as a peer-reviewed abstract at a scientific conference; examine, through any study design, the association between an a-priori set of indicators related to the criminalisation of drugs and HIV prevention or treatment among PWID; provide sufficient details on the methods followed to allow critical assessment of quality; be published or presented between Jan 1, 2006, and Dec 31, 2014; and be published in the English language.

Our systematic review was done in two stages. We did the first search in 2012 and captured literature published for the years 2006–10. We did a second search in 2015 and captured literature published between the years 2011–14. We used the same methods and approaches for the two stages, and both searches were overseen by the same authors (TC and KD).

Data analysis

As a first step, all publication titles were screened by our trained reviewer (TC) to exclude articles that clearly did not meet the aforementioned inclusion criteria. The appendix (pp 4–6) provides an overview of indicators related to criminalisation and to HIV prevention and treatment used in our systematic review. If our reviewer coded the publication title as being potentially relevant, we reviewed the abstract of the article in full. If, after reviewing the abstract, our reviewer concluded that the publication was potentially relevant, we retrieved the full-text copy of the article.

Review of the full-text copy of articles, and data extraction for relevant articles, was done by one of our three trained reviewers (TC, L Ti, or H Han) and checked by a second reviewer (TC, L Ti, or H Han). Reviewers showed high agreement on article inclusion (86·7%), and discrepancies were reviewed and resolved by our senior study team

member (KD). Data extraction was also checked by KD. To ensure consistency in data extraction, we developed a standardised form on the basis of a detailed results framework (appendix, pp 4–6) to manage data extraction for each eligible record. Our form included details on the following: the country where the research was done; study design; study sample characteristics (sample size, population); criminalisation indicators (18 categories); comparison group or condition; HIV prevention or treatment indicators (30 categories); and relevant findings, including the overall suggested effect of the criminalisation indicator on the HIV indicator or indicators. We used three possible categories for overall effect: beneficial, which described studies suggesting that criminalisation of drugs has a beneficial effect on HIV prevention or treatment (or, conversely, that reducing criminalisation has a negative effect on HIV prevention or treatment); null, which described studies suggesting that criminalisation of drugs has no effect on HIV prevention or treatment (or, similarly, that reducing criminalisation has no such effect); and negative, which described studies suggesting that criminalisation of drugs has a negative effect on HIV prevention or treatment (or, conversely, suggesting that reducing criminalisation has a beneficial effect).

Our assessment of the overall suggested effect of the criminalisation indicator on the HIV indicator or indicators was based on data reported in the studies. For example, if a criminalisation indicator (eg, street-level policing) was reported to be statistically associated with an HIV indicator (eg, syringe sharing), we used the direction of the statistical association to determine whether the study suggested that criminalisation had a beneficial effect (eg, street-level policing was reported to be negatively associated with syringe sharing) or a negative effect (eg, street-level policing was reported to

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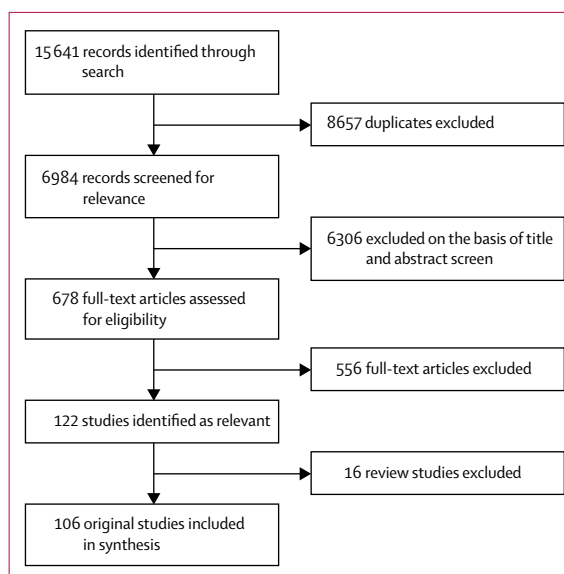


Figure 1: Study selection

be positively associated with syringe sharing). If there was no statistically significant association between the two indicators (eg, street-level policing and syringe sharing), we coded the study as suggesting a null association between criminalisation and HIV prevention and treatment.

We assessed the methodological quality of observational quantitative studies with a modified version of the Downs and Black checklist for reporting of health-care studies, which has been shown to be a reliable measure for observational studies (see appendix pp 7–8 for scoring

criteria).^{24,25} Out of a total score of 18, higher scores reflect stronger methodological quality. All eligible studies were assessed by two of our trained reviewers (TC and A Pilarinos).

Role of the funding source

The funders had no role in study design, data collection, data analysis, data interpretation, or writing of the report. The corresponding author had full access to all the data in the study, and KD and SB had final responsibility for the decision to submit for publication.

	Study design; country	Sample characteristics	Quality score	Criminalisation indicators	Comparison group or condition	HIV indicators	Effect of criminalisation on HIV
Rosenblum and Jones (2013) ²⁶	Ecological; Russia	IDUs in Russia	8	National drug strategies	Before and after 2000 (when the Afghan Taliban began an anti-opium campaign)	HIV incidence among IDUs	Beneficial: Afghan Taliban's ban on opium production linked to reductions in HIV incidence among IDUs in eastern Europe, central Asia, and Russia
Rhodes and Bivol (2012) ²⁷	Qualitative; Moldova	42 lifetime IDUs	NA	Police crackdowns	Before and after social and economic change in post-Soviet Europe	Drug injecting; addiction treatment initiation or retention, or both	Beneficial: policing associated with reductions in drug injecting and increases in OST enrolment
Plugge et al (2009) ²⁸	Cohort; England	505 female adult prisoners	17	Incarceration (jails, prisons, detention)	Entry into prison vs 1 month later	Drug injecting	Beneficial: incarceration led to reduction in drug use among women
Wong et al (2009) ²⁹	Cross-sectional; Canada	478 young drug users (median age 22 years; IQR 20–24)	16	Incarceration (jails, prisons, detention)	Those who ever attended addiction treatment vs those who did not	Addiction treatment initiation or retention, or both	Beneficial: incarceration was positively associated with enrolment in additional treatment
Cunningham et al (2008) ³⁰	Before and after intervention; USA	2.8 million adults in addiction treatment	15	Supply-side drug-control interventions	Regulation changes and their effects on modes of methamphetamine administration: 1995 vs 1996 vs 1997	Drug injecting	Beneficial: changes in US federal regulations of methamphetamine precursor chemicals (ephedrine and pseudoephedrine) were positively associated with reductions in injection of methamphetamine
Koulierakis (2006) ³¹	Cross-sectional; Greece	242 adult IDUs	16	Incarceration (jails, prisons, detention)	Before imprisonment vs during imprisonment	Drug injecting; syringe sharing	Beneficial: overall reduction in injecting while in prison, compared with outside prison Negative: those who continue injecting in prison take more risks by sharing more frequently than those outside prison
Friedman et al (2011) ³²	Longitudinal modelling; USA	IDUs from 93 metropolitan areas	14	Street-level policing	Hard-drug arrest rate in 1991 vs in 1992–2002	Drug injecting	Null: hard-drug-related arrests associated with the population rate of IDUs in 1992, but not with changes in the IDU population over time
Rondinelli et al (2009) ³³	Cross-sectional; USA	3209 young and young-adult IDUs (median age 23.9 years; IQR 21–27)	15	Incarceration (jails, prisons, detention)	HIV-positive individuals vs HIV-negative individuals	HIV prevalence among IDUs (diagnosed and undiagnosed)	Null: incarceration was not associated with HIV infection
Milloy et al (2009) ³⁴	Cohort; Canada	902 adult IDUs	17	Incarceration (jails, prisons, detention)	Those reporting recent incarceration vs those not reporting recent incarceration	Supervised drug consumption rooms	Null: incarceration was not associated with SIF use
Werb et al (2009) ³⁵	Cross-sectional; Thailand	252 adult IDUs	16	Street-level policing	Those who reported observing an increase in police presence where they purchase or consume drugs in the past 6 months vs those who did not	Drug injecting; addiction treatment initiation or retention, or both	Null: increase in police presence not associated with reduction in drug injecting or increased engagement with addiction treatment

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	Study design; country	Sample characteristics	Quality score	Criminalisation indicators	Comparison group or condition	HIV indicators	Effect of criminalisation on HIV
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Friedman et al (2008) ³⁶	Mathematical modelling; USA	96 metropolitan areas	NA	Street-level policing	Time (1992 to 2002)	Drug injecting	Null: hard-drug arrests did not predict any measurable change in prevalence of IDUs; no evidence that hard-drug arrests were associated with decline in IDU prevalence
Johnson et al (2006) ³⁷	Before and after intervention; USA	New York's Expanded Syringe Access Program (ESAP)	9	Drug paraphernalia laws or practices that penalise or deter possession of injecting paraphernalia	Before and after ESAP	Drug injecting; addiction treatment initiation or retention, or both	Null: NEP not associated with an increase in drug use
Kerr et al (2006) ³⁸	Before and after intervention; Canada	871 adult IDUs	12	Exemptions from Canada's 1996 Controlled Drugs and Substances Act (allowing SIFs to operate)	Before and after SIF use	Drug injecting	Null: SIF use not associated with an increase in drug use
Palepu et al (2006) ³⁹	Cohort; Canada	278 HIV-positive IDUs	16	Incarceration (jails, prisons, detention)	Those with history of incarceration vs those without	ART adherence	Null: incarceration not associated with adherence to ART
Cardoso et al (2006) ⁴⁰	Cross-sectional; Brazil	478 adult drug users, mostly IDUs, 50% HIV-positive	15	Incarceration (jails, prisons, detention)	Those with history of incarceration vs those without	HIV incidence among IDUs	Null: incarceration not associated with HIV incidence
Huo et al (2006) ⁴¹	Cohort; USA	707 adult IDUs	15	Incarceration (jails, prisons, detention)	Those with history of incarceration vs those without	Drug injecting	Null: history of incarceration was not associated with injection cessation
Chen et al (2013) ⁴²	Cross-sectional; China	613 IDUs, majority male	16	Incarceration (jails, prisons, detention)	Number of times receiving compulsory drug treatment	Unprotected sex; syringe sharing; HIV prevalence among IDUs	Null: compulsory drug treatment not associated with condom use or syringe sharing Negative: compulsory drug treatment associated with increased risk of HIV infection
Hayashi et al (2013) ⁴³	Cross-sectional; Thailand	468 adult IDUs	15	Forced detention as addiction treatment; street-level policing	Various	Drug injecting; syringe sharing	Null: compulsory drug detention centres not associated with reductions in use of injection drugs Negative: police planting illicit drugs on IDUs associated with syringe sharing
DeBeck et al (2009) ⁴⁴	Cohort; Canada	1603 adult IDUs	16	Incarceration (jails, prisons, detention)	Before and after incarceration	Drug injecting	Null: incarceration not associated with significant changes in frequent drug use Negative: incarceration negatively associated with injection cessation
Friedman et al (2006) ⁴⁵	Cross-sectional; USA	89 large metropolitan areas	15	Street-level policing	Different metropolitan areas	HIV prevalence among IDUs (diagnosed and undiagnosed); drug injecting	Null: policing had no effect on prevalence of drug injecting Negative: criminalisation has negative effect on HIV prevalence
Caiaffa et al (2006) ⁴⁶	Cross-sectional; Brazil	1144 adult IDUs	16	Incarceration (jails, prisons, detention)	Those with history of incarceration vs those without	HIV prevalence among IDUs (diagnosed and undiagnosed)	Null: incarceration was not positively associated with HIV infection across all settings Negative: incarceration was positively associated with HIV infection in some groups
Gu et al (2014) ⁴⁷	Cross-sectional; China	133 adults on methadone treatment	13	Street-level policing	Those who worry about police arrest vs those who do not	Addiction treatment initiation or retention, or both	Negative: concern about arrest associated with non-attendance at methadone clinic
Kerr et al (2014) ⁴⁸	Cross-sectional; Thailand	435 adult IDUs	14	Forced detention as addiction treatment	Those with exposure to compulsory drug detention vs those without	HIV testing	Negative: exposure to compulsory drug detention positively associated with avoidance of health-care services
Rahnama et al (2014) ⁴⁹	Cross-sectional; Iran	572 male, adult IDUs	13	National drug strategies	Before and after large-scale implementation of harm reduction programmes	NEPs	Negative: after implementation of harm reduction programmes, awareness and use of NEPs was relatively high among IDUs in Tehran

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	Study design; country	Sample characteristics	Quality score	Criminalisation indicators	Comparison group or condition	HIV indicators	Effect of criminalisation on HIV
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Madden and Wodak (2014) ⁵⁰	Before and after intervention; Australia	IDUs in Australia	9	National drug strategies	Before and after implementation of harm reduction policies	Outreach (community, peer educators, public health nurses, street teams); HIV incidence among IDUs	Negative: Australia's public health and human rights-based approach to harm reduction contributed to a relatively low prevalence of HIV among IDUs
Huang et al (2014) ⁵¹	Cross-sectional; Taiwan	3851 prisoners and 4357 cohort participants	18	National drug strategies	Before and after introduction of nationwide harm reduction services in 2006	HIV incidence among IDUs; HIV prevalence among IDUs (diagnosed and undiagnosed)	Negative: the harm reduction services contributed to significant reductions in HIV incidence and prevalence among IDUs
Werb (2014) ⁵²	Mathematical modelling; Canada	Canadian prisoners	13	Prohibitions on or restricted access to OST, NEPs, or other evidence-informed HIV prevention interventions	Before and after proposed introduction of NEPs in prisons	HIV incidence among IDUs	Negative: modelling indicates that prison-based NEPs might reduce HIV incidence in prisons
Ngo et al (2014) ⁵³	Cross-sectional; Vietnam	1080 male IDUs	12	Street-level policing	Those with past experience of being stopped by police in relation to drug use vs those without	Syringe sharing	Negative: street-level policing associated with syringe sharing
Lunze et al (2014) ⁵⁴	Cross-sectional; Russia	582 HIV-positive IDUs	15	Street-level policing	Those who experienced extrajudicial police arrests (needle possession or for needles or drugs planted by police) vs those who did not	Syringe sharing	Negative: extrajudicial police arrests associated with receptive needle sharing
Beletsky et al (2014) ⁵⁵	Cross-sectional; USA	514 IDUs, majority male	14	Street-level policing	Those whose syringes were confiscated by police vs those whose syringes were not	Syringe sharing	Negative: syringe confiscation associated with receptive syringe sharing
Izenberg et al (2013) ⁵⁶	Cross-sectional; Ukraine	94 HIV-positive IDUs recently released from prison	15	Incarceration (jails, prisons, detention)	Those who experienced unofficial detention vs those who did not	Addiction treatment initiation or retention, or both; ART adherence	Negative: detention associated with ART and OST treatment interruptions
Ti et al (2013) ⁵⁷	Cross-sectional; Thailand	350 IDUs who are either HIV-negative or whose HIV status is unknown	13	Street-level policing	Those who noticed an increased police presence when buying or using drugs in past 6 months vs those who did not	HIV testing and counselling	Negative: increased police presence associated with HIV test avoidance
Chakrapani et al (2013) ⁵⁸	Qualitative; India	23 IDUs with history of incarceration; four key informants	NA	Incarceration (jails, prisons, detention)	Before and during prison time	ART adherence	Negative: incarceration linked to ART interruptions
Wen-Jing et al (2013) ⁵⁹	Before and after intervention; Taiwan	IDUs in Taiwan	8	National drug strategies	Before and after implementation of the national pilot harm reduction programme	HIV incidence among IDUs	Negative: Taiwan's national pilot harm reduction programme linked to a decrease in HIV incidence
Ti et al (2013) ⁶⁰	Cohort; Canada	991 young people who use drugs (median age 19·8 years; IQR 21·9–23·7)	15	Street-level policing	Those who experienced police confrontation vs those who did not	Drug injecting	Negative: being stopped, searched, or detained by police without arrest associated with any drug injecting
Hayashi (2013) ⁶¹	Cross-sectional; Thailand	42 718 adult IDUs (multiple studies)	16	Street-level policing	Various	Syringe sharing; HIV prevalence among IDUs (diagnosed and undiagnosed)	Negative: exposure to single and multiple street-level policing tactics associated with syringe sharing and HIV seropositivity
Lin et al (2013) ⁶²	Cross-sectional; Taiwan	781 methadone seekers, majority IDUs	16	Incarceration (jails, prisons, detention)	Those with more drug-related convictions vs those with fewer convictions	HIV prevalence among IDUs (diagnosed and undiagnosed)	Negative: drug-related criminal convictions linked to HIV seropositivity
Beletsky et al (2013) ⁶³	Cross-sectional; Mexico	624 female IDUs who are sex workers and at risk for HIV	15	Street-level policing	Those who have had syringes confiscated by police vs those who have not	HIV prevalence among IDUs (diagnosed and undiagnosed)	Negative: syringe confiscation associated with HIV seropositivity
Wagner et al (2013) ⁶⁴	Mixed methods; USA	217 IDUs	13	Street-level policing	Those who are concerned about getting a ticket or being arrested for carrying a needle or cooker vs those who are not	Syringe sharing	Negative: fear of street-level policing associated with receptive syringe sharing

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	Study design; country	Sample characteristics	Quality score	Criminalisation indicators	Comparison group or condition	HIV indicators	Effect of criminalisation on HIV
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Pan et al (2013) ⁶⁵	Cohort; Canada	372 people who use drugs, majority IDUs	15	Street-level policing	Those who are exposed to street-based policing vs who are not	Syringe sharing	Negative: being stopped by police associated with syringe sharing
Smith et al (2012) ⁶⁶	Cross-sectional; China	18 key informants	9	National drug strategies	Before and after legalisation of methadone	Addiction treatment initiation or retention, or both; HIV prevalence among IDUs (diagnosed and undiagnosed)	Negative: implementation of harm reduction policies (primarily OST, some NEPs) linked to increased access to methadone among IDUs and averted HIV infections
Fatseas et al (2012) ⁶⁷	Cross-sectional; France	648 IDUs, majority male	17	National drug strategies	Before and after the introduction of harm reduction policies (1995)	HIV prevalence among IDUs (diagnosed and undiagnosed); syringe sharing	Negative: implementation of harm reduction policies associated with decreases in HIV prevalence, sharing syringes, and drug paraphernalia
Csete and Grob (2012) ⁶⁸	Qualitative; Switzerland	Key informants	NA	National drug strategies	Before and after the 1990s (when the Swiss Federal Office of Public Health eliminated various regulations to support development of low-threshold methadone programmes)	OST and drug dependence treatment; addiction treatment initiation or retention, or both	Negative: reducing restrictions on methadone use associated with increased enrolment in methadone treatment
Lee and Li (2012) ⁶⁹	Cross-sectional; Taiwan	Attendees of methadone treatment centres and NEPs	13	National drug strategies	Those who live in areas where the National Pilot Harm Reduction Program (PHRP) was implemented vs those who do not	HIV incidence among IDUs	Negative: PHRP associated with relative reductions in HIV incidence
Cooper et al (2012) ^{70,71}	Longitudinal modelling; USA	4067 and 4178 IDUs, majority male (multiple studies)	15	Street-level policing	District-level exposure to drug-related arrests	Syringe sharing	Negative: arrest rates elevate the odds of injecting with an unsterile syringe and undermine the effects of better access to NEPs
Peng et al (2011) ⁷²	Cross-sectional; Taiwan	114 HIV-positive individuals; 149 HIV-negative controls; all female prisoners	15	Incarceration (jails, prisons, detention)	Number of times imprisoned	HIV prevalence among IDUs (diagnosed and undiagnosed)	Negative: multiple incarcerations associated with HIV seropositivity
Volkman et al (2011) ⁷³	Cross-sectional; Mexico	727 IDUs	16	Street-level policing	Those who were exposed to street-based policing vs who were not	Drug injecting	Negative: street-level policing linked to frequent injection drug use
Strathdee et al (2011) ⁷⁴	Cross-sectional; Mexico	620 female IDU sex workers	14	Street-level policing	Those whose syringes were confiscated by police vs those whose syringes were not	HIV prevalence among IDUs (diagnosed and undiagnosed)	Negative: syringe confiscation in exchange for no arrest associated with HIV seropositivity
El Dabaghi et al (2010) ⁷⁵	Cross-sectional; Lebanon	424 adult prisoners; 55 prison staff	8	Incarceration (jails, prisons, detention)	No comparison group	Syringe sharing; drug injecting; unprotected sex	Negative: incarceration described as an environment where high risk behaviours take place, including injecting, syringe sharing, and unprotected sex
Mimiaga et al (2010) ⁷⁶	Qualitative; Ukraine	16 HIV-positive, adult IDUs	NA	Street-level policing	No comparison group	ART adherence; addiction treatment initiation or retention, or both	Negative: police practices identified as a barrier to ART adherence and OST access
Kerr et al (2010) ⁷⁷	Cohort; Canada	740 adult IDUs	14	Prohibitions on or restrictions to OST, NEPs or other evidence-informed HIV prevention interventions	Before and after change in NEP policy (relaxation of rules)	Syringe sharing; HIV incidence among IDUs	Negative: expansion of syringe distribution associated with reduction of syringe sharing and decline in HIV incidence
Kheirandish et al (2010) ⁷⁸	Cross-sectional; Iran	459 male, adult IDU prisoners, 25% HIV-positive	14	Incarceration (jails, prisons, detention)	Those with a history of using opioids in jail vs those with no history of using opioids in jail	HIV prevalence among IDUs (diagnosed and undiagnosed)	Negative: use of opiates in jail positively associated with HIV infection
Sarang et al (2010) ⁷⁹	Qualitative; Russia	209 young-adult IDUs in three Russian cities	NA	Street-level policing	No comparison group	Syringe sharing	Negative: fear of arrest from police attributed to syringe sharing and reluctance to access sterile syringes

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	Study design; country	Sample characteristics	Quality score	Criminalisation indicators	Comparison group or condition	HIV indicators	Effect of criminalisation on HIV
(Continued from previous page)							
Philbin and Zhang (2010) ⁸⁰	Qualitative; China	20 adult IDUs using NEPs or methadone; 15 non-government service providers	NA	Street-level policing	No comparison group	Addiction treatment initiation or retention, or both	Negative: police identified as a barrier to accessing methadone
Shahbazi et al (2010) ⁸¹	Before and after intervention; Iran	341 IDU prisoners	11	Prohibitions on or restricted access to OST, NEPs, or other evidence-informed HIV prevention interventions	Before and after introduction of NEPs in prison	Syringe sharing	Negative: introduction of NEPs in prison in Iran reduced syringe sharing
Pinkerton (2010) ⁸²	Mathematical modelling; Canada	Insite (Vancouver SIF)	NA	Exemptions from the Controlled Drug and Substances Act (allowing SIFs to operate)	With and without SIF	HIV incidence among IDUs	Negative: mathematical modelling suggests that SIF prevents HIV incidence
Fairbairn et al (2010) ⁸³	Qualitative; Canada	20 adult IDUs	NA	Prohibitions on or restricted access to OST, NEPs, or other evidence-informed HIV prevention interventions	No comparison group	Syringe sharing	Negative: prohibition on assisted injection in Vancouver SIF described as a barrier to using facility and led individuals to allow others to inject them outside the facility; assisted injection positively associated with syringe sharing and HIV infection
Strathdee et al (2010) ¹⁸	Mathematical modelling; global (with emphasis on Ukraine, Pakistan, and Kenya)	94 studies	NA	Street-level policing; prohibitions on or restricted access to OST, NEPs, or other evidence-informed HIV prevention interventions; drug paraphernalia laws or practices that penalise or deter possession of injecting paraphernalia	Various	HIV incidence among IDUs; HIV prevalence among IDUs (diagnosed and undiagnosed); NEPs; OST and drug dependence treatment; prevalence of IDUs on ART	Negative: mathematical modelling suggests eliminating police beating would reduce HIV infection in Ukraine by 2–19%; availability of OST would decrease HIV incidence by 28% in Karachi; provision of combination interventions (scale-up NEP, OST, and ART for IDUs) would reduce HIV infections by 67% in Nairobi
Bravo et al (2009) ⁸⁴	Cross-sectional; Spain	249 young IDUs	13	Exemptions from the Controlled Drug and Substances Act (allowing SIFs to operate)	SIF users vs non-SIF users	Syringe sharing	Negative: SIF users less likely to borrow used syringes than non-SIF users
Ngo et al (2009) ⁸⁵	Qualitative; Vietnam	23 government and non-government informants; eight IDUs	NA	Police crackdowns	No comparison group	Outreach (community, peer educators, public health nurses, street teams); NEPs	Negative: police crackdowns described as limiting needle and syringe distribution and outreach efforts
Vahdani et al (2009) ⁸⁶	Cross-sectional; Iran	202 homeless adults; 109 (54%) with a history of substance abuse, of whom 34 (31%) were IDUs	15	Incarceration (jails, prisons, detention)	HBV-positive individuals vs HCV-positive individuals vs HIV-positive individuals	HIV prevalence among IDUs (diagnosed and undiagnosed)	Negative: previous imprisonment positively associated with HIV infection
Des Jarlais et al (2009) ⁸⁷	Before and after intervention; USA	2312 adult IDUs attending drug detoxification programme	15	Prohibitions on or restricted access to OST, NEPs, or other evidence-informed HIV prevention interventions	Before and after large-scale NEPs were implemented in New York, NY, USA	HIV prevalence among IDUs (diagnosed and undiagnosed); syringe sharing	Negative: expansion or implementation of large-scale syringe exchange programme associated with reduction in HIV prevalence and syringe sharing
Rafiey et al (2009) ⁸⁸	Cross-sectional; Iran	2091 male, adult IDUs from treatment centres, prisons, and streets	15	Incarceration (jails, prisons, detention)	Those who ever shared syringes vs those who did not	Syringe sharing	Negative: arrest and history of imprisonment positively associated with ever sharing syringes
Krüsi et al (2009) ⁸⁹	Qualitative; Canada	22 HIV-positive adult IDUs attending a HIV care programme; seven staff members of HIV care programme	NA	Exemptions from the Controlled Drug and Substances Act (allowing SIFs to operate)	HIV care staff vs HIV care attendees	Targeted information, education, and communication for IDUs and their sexual partners	Negative: supervised injection supported IDUs' access to HIV prevention education
Hayashi et al (2009) ⁹⁰	Cross-sectional; Thailand	252 adults, majority IDUs	16	Incarceration (jails, prisons, detention)	Those with history of incarceration vs those without	Syringe sharing; drug injecting	Negative: incarceration positively associated with syringe sharing and injecting midazolam

(Table continues on next page)

	Study design; country	Sample characteristics	Quality score	Criminalisation indicators	Comparison group or condition	HIV indicators	Effect of criminalisation on HIV
(Continued from previous page)							
Small et al (2009) ⁹¹	Qualitative; Canada	12 HIV-positive, male, adult IDUs on ART	NA	Incarceration (jails, prisons, detention)	No comparison group	ART adherence; prevalence of IDUs on ART	Negative: incarceration described as deterring or creating difficulties for IDUs to access ART
Pollini et al (2009) ⁹²	Cross-sectional; Mexico	898 male, adult IDUs	15	Incarceration (jails, prisons, detention); street-level policing; drug paraphernalia laws or practices that penalise or deter possession of injecting paraphernalia	Ever incarcerated vs ever injected while incarcerated vs ever engaged in receptive sharing while incarcerated	Drug injecting; syringe sharing	Negative: being arrested for sterile syringe possession independently associated with use of injection drugs during incarceration; multiple incarcerations independently associated with syringe sharing in prison
Suntharasamai et al (2009) ⁹³	Cohort; Thailand	2295 adult IDUs, HIV-negative at baseline	16	Incarceration (jails, prisons, detention)	Those with history of incarceration vs those without	HIV incidence among IDUs	Negative: incarceration was positively associated with HIV incidence
Milloy et al (2009) ⁹⁴	Cohort; Canada	889 adult IDUs	16	Incarceration (jails, prisons, detention)	Those with history of incarceration vs those without	Syringe sharing	Negative: release from prison associated with syringe sharing
Thomson et al (2009) ⁹⁵	Cross-sectional; Thailand	1189 young adults, half IDUs, majority HIV-positive	16	Incarceration (jails, prisons, detention)	Those with history of incarceration vs those without	HIV prevalence among IDUs (diagnosed and undiagnosed)	Negative: incarceration positively associated with HIV infection
Thanh et al (2009) ⁹⁶	Qualitative; Vietnam	45 HIV-positive, adult IDUs	NA	Street-level policing; drug paraphernalia laws or practices that penalise or deter possession of injecting paraphernalia	No comparison group	Outreach (community, peer educators, public health nurses, street teams); NEPs; reluctance to carry sterile syringes	Negative: policing practices and fear of arrest described as a deterrent for carrying and distributing syringes by peer educators
Reid and Aitken (2009) ⁹⁷	Qualitative; China	39 government and non-government informants representing 19 stakeholder bodies across China	NA	Police crackdowns	No comparison group	Addiction treatment initiation or retention, or both; NEPs; HIV testing and counselling	Negative: policing practices found to limit access to HIV prevention programmes and interventions, including addiction treatment; also found to inhibit delivery of services
Sheue-Rong et al (2008) ⁹⁸	Cohort; Taiwan	3229 IDUs enrolled in methadone programme	9	National drug strategies	HIV incidence before and after harm reduction campaign	HIV incidence among IDUs	Negative: introduction of harm reduction campaign (methadone, syringe exchange programme, HIV screening, and counselling services) associated with 43% decrease in new HIV infections 1 year after intervention, and an additional 44% decrease the following year
Schleifer et al (2008) ⁹⁹	Qualitative; Thailand	50 stakeholders; 50 drug users from five Thai provinces	NA	National drug strategies	No comparison group	ART; prevalence of IDUs on ART	Negative: national drug policies and policing practices described as barriers to getting IDUs onto ART
Pollini et al (2008) ¹⁰⁰	Cross-sectional; Mexico	428 adult IDUs	16	Street-level policing; drug paraphernalia laws or practices that penalise or deter possession of injecting paraphernalia	Arrested for carrying syringes vs not arrested	Syringe sharing	Negative: being arrested for carrying syringes positively associated with receptive syringe sharing
Philbin et al (2008) ¹⁰¹	Cross-sectional; Mexico	427 adult IDUs	15	Street-level policing; drug paraphernalia laws or practices that penalise or deter possession of injecting paraphernalia	Attending vs not attending shooting galleries	Syringe sharing; shooting gallery attendance	Negative: policing practices positively associated with shooting gallery attendance, which is associated with syringe sharing
Chen et al (2008) ¹⁰²	Cross-sectional; Taiwan	241 male, adult prisoners, mostly IDUs, half HIV-positive	15	Incarceration (jails, prisons, detention)	HIV-positive vs HIV-negative individuals	HIV prevalence among IDUs (diagnosed and undiagnosed)	Negative: incarceration positively associated with HIV infection
Azim et al (2008) ¹⁰³	Cross-sectional; Bangladesh	561 male, young-adult IDUs	15	Street-level policing	Ever arrested for being a drug user vs never arrested	HIV prevalence among IDUs (diagnosed and undiagnosed)	Negative: being arrested for being a drug user positively associated with HIV infection

(Table continues on next page)

	Study design; country	Sample characteristics	Quality score	Criminalisation indicators	Comparison group or condition	HIV indicators	Effect of criminalisation on HIV
(Continued from previous page)							
Miller et al (2008) ¹⁰⁴	Qualitative; Mexico	43 adult IDUs	NA	Street-level policing; drug paraphernalia laws or practices that penalise or deter possession of injecting paraphernalia	No comparison group	Reluctance to carry sterile syringes	Negative: policing practices deter IDUs from carrying sterile injecting equipment
Strathdee et al (2008) ¹⁰⁵	Cohort; Mexico	1056 adult IDUs	14	Street-level policing	HIV-positive vs HIV-negative individuals	HIV prevalence among IDUs (diagnosed and undiagnosed)	Negative: being arrested for having track-marks was independently associated with HIV infection
Epperson et al (2008) ¹⁰⁶	Cross-sectional; USA	356 male adults, 86 IDUs	14	Incarceration (jails, prisons, detention)	Recent criminal justice involvement vs no recent criminal justice involvement	HIV prevalence among IDUs (diagnosed and undiagnosed); syringe sharing	Negative: incarceration positively associated with syringe sharing and HIV prevalence
Milloy et al (2008) ¹⁰⁷	Cohort; Canada	902 adult IDUs	17	Incarceration (jails, prisons, detention)	Reporting an incarceration event vs not reporting an incarceration event	Syringe sharing; HIV prevalence among IDUs (diagnosed and undiagnosed)	Negative: incarceration positively associated with syringe sharing and HIV prevalence
Werb et al (2008) ¹⁰⁸	Cohort; Canada	1247 adult IDUs	16	Incarceration (jails, prisons, detention)	Those with history of incarceration vs those without	Syringe sharing; unprotected sex	Negative: incarceration positively associated with unprotected sex and syringe sharing
Cohen and Amon (2008) ¹⁰⁹	Qualitative; China	19 adult IDUs; 20 government and non-government informants	NA	Street-level policing; drug paraphernalia laws or practices that penalise or deter possession of injecting paraphernalia	No comparison group	HIV testing; NEPs; addiction treatment initiation or retention, or both	Negative: policing practices and fear of arrest described as creating barriers to getting tested for HIV, getting sterile syringes, and accessing methadone programmes
Neaigus et al (2008) ¹¹⁰	Cross-sectional; USA	526 adult IDUs	16	Prohibitions on or restricted access to OST, NEPs, or other evidence-informed HIV prevention interventions	New Jersey residents (no NPSS) vs New York residents (NPSS)	HIV prevalence among IDUs (diagnosed and undiagnosed); syringe sharing	Negative: prohibitions on syringe distribution programmes positively associated with syringe sharing and increased HIV prevalence among IDUs
Courtenay-Quirk et al (2008) ¹¹¹	Cross-sectional; USA	581 HIV-positive adults, 161 IDUs	16	Incarceration (jails, prisons, detention)	Those with history of incarceration vs those without	Prevalence of sustained undetectable viral load among IDUs	Negative: incarceration negatively associated with having an undetectable viral load
Werb et al (2008) ¹¹²	Cross-sectional; Canada	465 adult IDUs	14	Street-level policing; drug paraphernalia laws or practices that penalise or deter possession of injecting paraphernalia	Those who have been stopped by police in past 6 months vs those who have not	Syringe sharing	Negative: street-level policing positively associated with syringe sharing
Tempalski et al (2008) ¹¹³	Cross-sectional; USA	72 NEPs within 35 metropolitan areas that report heroin as the dominant drug	16	Prohibitions on or restrictions to OST, NEPs, or other evidence-informed HIV prevention interventions	NEP coverage in different metropolitan areas	NEPs	Negative: government funding of NEPs contributes to better syringe coverage
Sarang et al (2008) ¹¹⁴	Qualitative; Russia	1682 young-adult IDUs	16	Street-level policing; drug paraphernalia laws or practices that penalise or deter possession of injecting paraphernalia	No comparison group	NEPs; reluctance to carry sterile syringes	Negative: street-level policing linked with reluctance to access NEPs, and therefore reduced access to sterile syringes
Shannon et al (2008) ¹¹⁵	Qualitative; Canada	46 female sex workers	NA	Street-level policing; drug paraphernalia laws or practices that penalise or deter possession of injecting paraphernalia	No comparison group	NEPs; unprotected sex; reluctance to carry sterile syringes	Negative: policing reduces willingness to carry clean syringes, limits access to HIV prevention, services, and increases risk of unprotected sex
Raykhert et al (2008) ¹¹⁶	Cross-sectional; Ukraine	1507 adults with tuberculosis	16	Incarceration (jails, prisons, detention)	Civilians vs those in a penitentiary	HIV prevalence among IDUs (diagnosed and undiagnosed)	Negative: incarceration positively associated with HIV infection
Wood et al (2007) ¹¹⁷	Cohort; Canada	1031 adult IDUs	16	Exemptions from the Controlled Drug and Substances Act (allowing SIFs to operate)	Before and after opening of SIFs	Addiction treatment initiation or retention, or both	Negative: allowing SIFs to operate associated with increased entry into addiction treatment

(Table continues on next page)

	Study design; country	Sample characteristics	Quality score	Criminalisation indicators	Comparison group or condition	HIV indicators	Effect of criminalisation on HIV
(Continued from previous page)							
Rich et al (2007) ¹¹⁸	Cross-sectional; USA	473 adult drug users	15	Prohibitions on or restricted access to OST, NEPs, or other evidence-informed HIV prevention interventions	Rhode Island (legal NPSS) vs Massachusetts (no legal NPSS)	Syringe sharing	Negative: legalisation of non-prescription sterile syringes in Rhode Island associated with reductions in syringe sharing compared with Massachusetts, where syringes remained outlawed
Rácz et al (2007) ¹¹⁹	Qualitative; Hungary	150 young IDUs	NA	Street-level policing; drug paraphernalia laws or practices that penalise or deter possession of injecting paraphernalia	No comparison group	Syringe sharing	Negative: syringe sharing positively associated with street-level policing
Razani et al (2007) ¹²⁰	Qualitative; Iran	40 government and non-government informants; 66 adult IDUs	NA	Incarceration (jails, prisons, detention)	No comparison group	Syringe sharing	Negative: incarceration positively associated with syringe sharing
Bluthenthal et al (2007) ¹²¹	Cross-sectional; USA	24 NEPs, 1576 adult IDUs	16	Prohibitions on or restricted access to OST, NEPs, or other evidence-informed HIV prevention interventions	Syringe dispensation policies: needs-based vs one-for-one plus some additional syringes vs strict one-for-one	NEPs	Negative: when restrictions on NEP dispensation policies were decreased, adequate syringe coverage increased
Dolan et al (2007) ¹²²	Cohort; USA	258 HIV-positive, adult IDUs	15	Incarceration (jails, prisons, detention)	Those with history of incarceration vs those without	ART adherence	Negative: history of incarceration associated with poorer responses (virological and immunological) than no history of incarceration after ART initiation
Rhodes et al (2006) ¹²³	Qualitative; Russia	27 adult police officers	NA	Street-level policing; drug paraphernalia laws or practices that penalise or deter possession of injecting paraphernalia	No comparison group	NEPs	Negative: policing practices are barriers to accessing NEPs and sterile syringes)
Davis et al (2006) ¹²⁴	Cross-sectional; USA	637 young-adult drug users	16	Street-level policing	Those with criminal justice involvement vs those without	HIV prevalence among IDUs (diagnosed and undiagnosed)	Negative: incarceration positively associated with HIV infection
Rhodes et al (2006) ¹²⁵	Cross-sectional; Russia	1473 young-adult IDUs	15	Incarceration (jails, prisons, detention)	Those with history of incarceration vs those without	HIV prevalence among IDUs (diagnosed and undiagnosed)	Negative: incarceration positively associated with HIV infection
Small et al (2006) ¹²⁶	Qualitative; Canada	30 adult IDUs; nine service providers	NA	Street-level policing	No comparison group	Outreach (community, peer educators, public health nurses, street teams); syringe sharing	Negative: policing observed to have negative effect on multiple HIV prevention indicators
Tyndall et al (2006) ¹²⁷	Cohort; Canada	1035 adult IDUs	17	Incarceration (jails, prisons, detention)	Those with history of incarceration vs those without	HIV prevalence among IDUs (diagnosed and undiagnosed)	Negative: incarceration positively associated with HIV infection
Zamani et al (2006) ¹²⁸	Cross-sectional; Iran	207 male, adult IDUs	16	Incarceration (jails, prisons, detention)	Those with history of incarceration vs those without	HIV prevalence among IDUs (diagnosed and undiagnosed)	Negative: incarceration positively associated with HIV infection
Miller et al (2006) ¹²⁹	Cohort; Canada	542 young-adult IDUs	15	Incarceration (jails, prisons, detention)	Age of injection initiation: 16 years or younger vs older than 16 years	Drug injecting	Negative: incarceration associated with initiating drug injecting at a younger age
Sarang et al (2006) ¹³⁰	Qualitative; Russia	209 young-adult IDUs	NA	Incarceration (jails, prisons, detention)	No comparison group	Syringe sharing	Negative: incarceration positively associated with syringe sharing because of scarcity of sterile syringes
Callon et al (2006) ¹³¹	Cohort; Canada	1463 adult IDUs	15	Incarceration (jails, prisons, detention)	Those with history of incarceration vs those without	Addiction treatment initiation or retention, or both	Negative: incarceration negatively associated with methadone maintenance treatment

IDU=injection drug user. NA=not applicable. OST=opioid substitution therapy. SIF=supervised injection facility. NEP=needle exchange programme. ART=antiretroviral therapy. HBV=hepatitis B virus. HCV=hepatitis C virus. NPSS=non-prescription syringe sales. *Includes two similar studies.

Table: Summary of 106 included studies

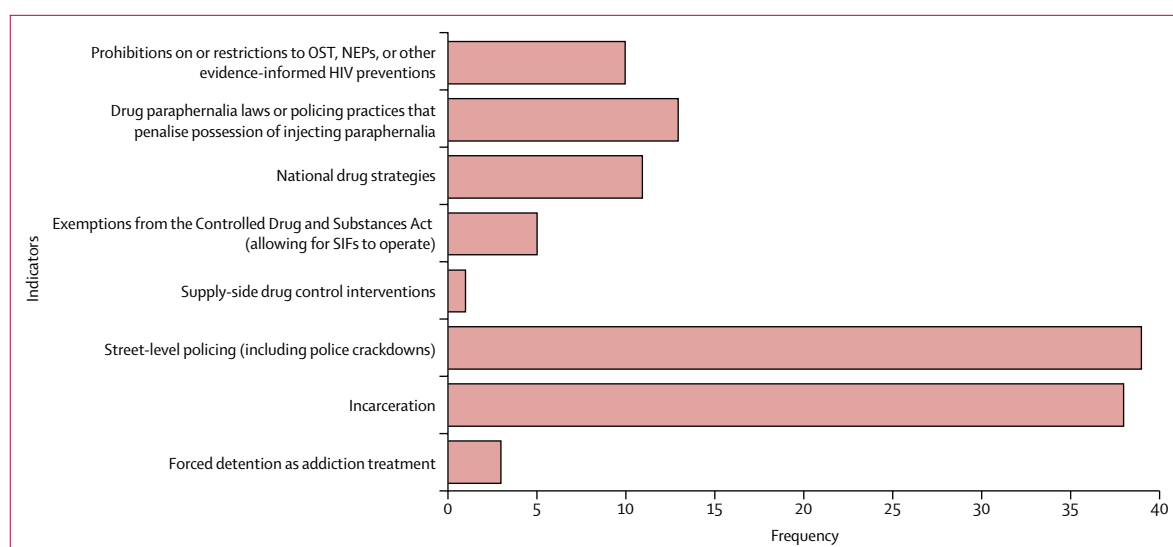


Figure 2: Criminalisation indicators

Some studies reported on multiple criminalisation indicators. OST=opioid substitution therapy. NEP=needle exchange programme. SIF=supervised injection facility.

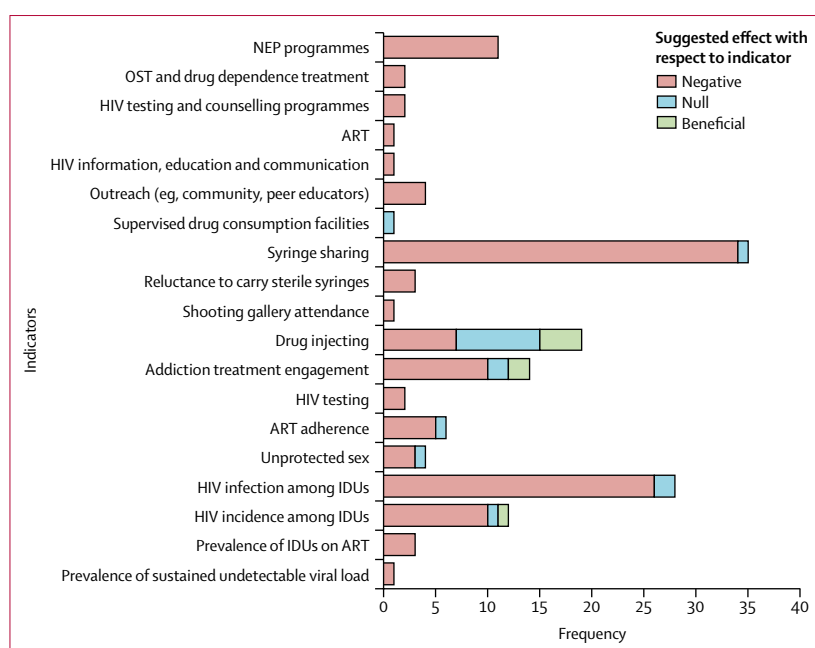


Figure 3: HIV treatment and prevention indicators

NEP=needle exchange programme. OST=opioid substitution therapy. ART=antiretroviral therapy. IDUs= injection drug users.

Results

Our search criteria identified 15641 citations (see appendix p 9 for records retrieved from each database), of which 6984 were unique records (figure 1). Our initial screening on the basis of the title and abstract excluded 6306 records. Following an assessment of the full text of the remaining 678 articles, we determined that 556 did not meet the inclusion criteria and these articles were excluded. We extracted data from the remaining

122 articles, of which 16 were review articles and therefore excluded from the final analysis. Our study synthesis was therefore based on 106 original studies, which are summarised in the table. These comprised 29 longitudinal studies (combined category for cohort studies, before and after interventions, and other longitudinal study designs; 27%), 49 cross-sectional studies (46%), two mixed methods studies (2%), four mathematical modelling studies (4%), and 22 qualitative studies (21%; appendix p 10). No randomised controlled trials were identified.

Our methodological quality assessment scores for observational quantitative studies (n=80) based on the modified Downs and Black checklist ranged from 11 to 15 with a median score of 15 of a possible 18 (appendix p 11). The most common study location was North America (n=42, 40%), followed by Asia (n=27, 25%), eastern Europe (n=12, 11%), South America (n=10, 9%), the Middle East (n=8, 8%), Europe (n=5, 5%), and Oceania (n=1, 1%), and there was one multisite study (n=1, 1%).

The studies we identified reported on eight of the possible 18 criminalisation indicators. Street-level policing (including police crackdowns) was the most frequently cited criminalisation indicator (n=39, 37%), closely followed by incarceration (n=38, 36%). Other frequently cited criminalisation indicators included drug paraphernalia laws and practices that penalise or deter possession of injecting paraphernalia (n=13, 12%), national drug strategies (n=11, 10%), prohibitions on or restrictions in access to opioid substitution therapies, needle and syringe exchange programmes, or other evidence-informed HIV prevention interventions (n=10, 9%), exemptions from drug laws to allow supervised injection facilities to operate without the

risk of prosecution (five studies, 5%), forced detention as a form of addiction treatment (three studies, 3%), and supply-side drug-control interventions (one study, 1%; figure 2).

Of the possible 30 HIV prevention and treatment indicators, we assessed that 19 were reported in connection with criminalisation of drug use. Syringe sharing was the most frequent indicator we identified ($n=35$, 33%), followed by prevalence of HIV infection among PWID ($n=28$, 26%), drug injecting ($n=19$, 18%), engagement with addiction treatment ($n=14$, 13%), HIV incidence among PWID ($n=12$, 11%), and needle and syringe exchange programmes ($n=11$, 10%; figure 3).

Among the 106 eligible studies, we assessed that 85 (80%) suggested that criminalisation of drug use has negative effects on HIV prevention and treatment, 10 (9%) suggested no association between drug criminalisation and HIV prevention and treatment, five (5%) suggested that criminalisation has a beneficial effect on HIV prevention and treatment, one (1%) suggested both beneficial and negative effects,³¹ and five (5%) suggested both null and negative effects of criminalisation on HIV prevention and treatment (figure 4; appendix pp 12–14).^{42–46}

Relevant findings from the 16 identified review articles are summarised in the appendix (pp 15–18). We assessed that all 16 review articles suggested that criminalisation negatively affected HIV prevention and treatment, although one article also suggested that criminalisation was beneficial as adherence to HIV treatment was increased among incarcerated individuals.¹³²

Discussion

The results of our systematic review suggest that criminalisation of drug use has a negative effect on HIV prevention and treatment. This negative effect was particularly evident in relation to decreased needle and syringe distribution, increased syringe sharing, and an increased burden of HIV among PWID. Specifically, our findings from the available evidence were primarily concentrated on a number of key criminalisation indicators (incarceration, street-level policing, drug paraphernalia laws and practices, prohibitions or restrictions on evidence-informed HIV prevention interventions, and national drug strategies) and indicated that these aspects of the criminalisation of drug use negatively affect HIV prevention and treatment among PWID, particularly with respect to levels of injection drug use, high-risk practices such as syringe sharing, access to sterile injecting equipment through needle exchange programmes, and prevalence of HIV infection among PWID.

Across all study designs and types of criminalisation indicators, we found that the reviewed evidence consistently showed clear patterns of criminalisation having negative effects on HIV prevention and treatment at the individual, programmatic, and population level.

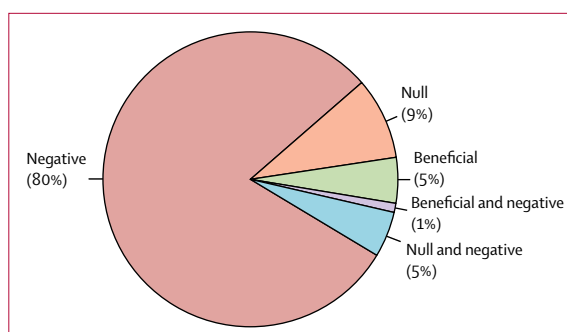


Figure 4: Effect of criminalisation of drug use on HIV prevention and treatment 112 indicators from 106 studies.

15 studies reported no statistically significant association between criminalisation and HIV; however, many of these studies focused on aspects of criminalisation that were directly intended by implementers to support HIV prevention and treatment. Specifically, almost half the studies that reported no statistically significant association between criminalisation and HIV considered some aspect of often punitive drug law enforcement and found that it was not associated with reductions in the frequency of drug use,⁴⁴ injection cessation,⁴¹ or declines in injection drug use,^{32,35,36,43,45} contrary to what was intended. This finding suggests that criminalisation, in addition to negatively affecting HIV prevention and treatment, does not seem to be mitigating these harmful effects by making positive contributions in other areas of HIV prevention and treatment. Conversely, two separate studies that reported no statistically significant association between criminalisation and drug use considered the effect of expanding syringe access programmes³⁷ and establishing a supervised injection facility where individuals were exempt from the otherwise-applicable laws criminalising drug possession.³⁸ These studies found no measurable increases in drug injecting, suggesting that, contrary to concerns expressed by some opponents of these interventions, reducing the criminalisation of PWID, and focusing instead on evidence-based HIV prevention and treatment measures, is unlikely to result in increased rates of drug use.

Among the six studies that reported findings suggesting that criminalisation had a beneficial effect on HIV prevention and treatment,^{26–31} we assessed that most were methodologically weak in evaluating the association between criminalisation and HIV prevention or treatment. Specifically, the study by Cunningham and colleagues³⁰ found that criminalising possession of drug precursor materials was associated with changes in the administration of methamphetamines in California, USA. However, in relation to HIV prevention indicators, observed changes in drug administration had both positive effects (reduction in injection) and negative effects (increase in smoking associated with increased dependency), suggesting that criminalisation of drug

precursors cannot definitively be characterised as supporting HIV prevention efforts. Similarly, the cross-sectional study by Koulirakis and colleagues³¹ found that, although incarceration was associated with an overall reduction in injection drug use (which is beneficial), it was also associated with more risky drug use practices (specifically, syringe sharing), suggesting that incarceration also has substantial harmful effects. The cohort study by Plugge and colleagues²⁸ concluded that incarceration was associated with reduction in injection drug use among female inmates 1 month after entering prison, but the study did not follow up participants to confirm whether these reductions were sustained after their release from prison. The cross-sectional study by Wong and colleagues²⁹ found that street-involved young people (defined as youth who are absolutely, periodically, or at imminent risk of being homeless or who use services for homeless youth) who had a history of enrolling in addiction treatment were more likely to also have a history of incarceration than those with no history of addiction treatment. Although this finding could indicate that incarceration was an entry point into addiction treatment for youth, the authors caution that temporality cannot be inferred from their data and that the association between incarceration and addiction treatment could be attributed to episodes of higher intensity drug use, which subsequently increases the likelihood of seeking addiction treatment, as well as increasing the risk of having interactions with the criminal justice system.²⁹ On the basis of these studies, we conclude that the potential for criminalisation to have beneficial effects on HIV prevention and treatment seems weak and, at best, possible in few settings.

Our systematic review has various limitations. First, our review protocol did not capture all relevant evidence on the association between criminalisation of drug use and HIV prevention and treatment. For example, we restricted our search to peer-reviewed literature and were therefore unable to consider community reports and data that exist outside the peer-review process. Although these criteria limit the scope of evidence we could examine, we felt it was important to focus only on research that had been scrutinised through the peer-review process. Furthermore, an unsystematic scan of the grey literature suggests that the peer-reviewed literature largely agrees with community reports and perspectives, indicating that the results of our analysis are in keeping with findings in non-peer-reviewed reports. Similarly, limiting the time period for our review from 2006 to 2014 excludes a substantive body of evidence related to criminalisation and HIV prevention and treatment that was generated before 2006, and does not reflect findings from studies published after 2014. Although this is a limitation, when we examined each year over the 9-year study period, the range for the percentage of studies that found a negative effect of criminalisation was 71–100% and the range for

the percentage of studies that found a beneficial effect of criminalisation was 0–17% (appendix pp 13, 14). This assessment suggests that the variation in overall study conclusions per year is relatively minimal and increasing the duration of the study period would have been unlikely to meaningfully affect the overall conclusions of our systematic review. An additional limitation of our study protocol relates to simplification of the study findings to indicators for criminalisation and for HIV prevention and treatment. This approach does not adequately capture and communicate the unique contributions that ethnographic research has made to understanding the processes by which criminalisation affects HIV prevention and treatment. Although a more expansive review protocol would have been beneficial, we wanted to ensure that we used a systematic approach that was transparent and could be replicated by other investigators. For these reasons, we elected to follow a strict review protocol based on specified indicators. Another limitation of our systematic review is the challenge inherent in consistently conceptualising, identifying, and coding potentially relevant indicators of interest that include both social phenomena and clearly defined objective criteria such as medical diagnoses. Similarly, given that the effects of the criminalisation indicators on the HIV indicators of interest are rarely direct, there are additional challenges associated with interpreting these associations. To minimise the biases these challenges might introduce, our review protocol involved development of a detailed review guide and all extracted data were checked by a second independent trained reviewer. Although it is expected that there would be variation in how other reviewers might conceptualise and code our indicators of interest, given the decisiveness of our findings, we have no reason to suspect that our overall conclusions would be substantially different if they were done by other investigators. Many of our indicators of interest, such as HIV incidence and prevalence, are challenging to measure and data are not consistently collected among key populations across different settings. As a result, our systematic review probably does not fully capture the extent to which criminalisation of drug use affects HIV prevention and treatment. On a related note, most studies included in our systematic review were done in North America and Asia; however, the effects of criminalisation on HIV prevention and treatment are of relevance in many other settings. Another limitation of the available data is that, given ethical considerations and logistics, no randomised controlled trials on criminalisation and HIV prevention and treatment were identified. As a result, the most objective estimates of the association between criminalisation and HIV prevention and treatment are derived from observational studies that cannot establish causation. Despite this limitation, as noted in the results, the methodological quality of the quantitative studies was reasonably good, and all identified qualitative studies

suggested that criminalisation has a negative effect on HIV prevention and treatment. Lastly, our systematic review was done in two stages. To protect against possible inconsistencies, the same investigators led both stages (TC and KD), all data extraction was checked by a second independent trained reviewer (TC, L Ti, or H Han), and we strictly adhered to our detailed review guide in both stages.

In conclusion, we found that the available evidence consistently suggests that criminalisation of drug use has negative effects on HIV prevention and treatment among PWID. This evidence base provides clear support for moving away from the use of criminalisation as a strategy to try to limit the harms of drug use. Our finding is consistent with the recommendations of several international policy initiatives to reform legal and policy frameworks criminalising drug use, including the Global Commission on HIV and the Law¹³³ and the Global Commission on Drug Policy.¹³⁴ It is also relevant for the success of global commitments to reduce the individual and societal burden of HIV infection. Specifically, our review of the evidence emphasises that decisive efforts to move away from punitive policies, including criminalisation, to manage injection drug use will be pivotal to achieving the UNAIDS targets of diagnosing 90% of people living with HIV, treating 90% of people who are diagnosed, and achieving viral suppression for 90% of people on HIV treatment by 2020.¹⁴ Our findings indicate that international efforts are urgently needed to reform existing legal and policy frameworks that attempt to limit the harms of drug use, to effectively support HIV prevention and treatment efforts globally and to help end the HIV epidemic.

Contributors

KD, TC, and SB were primarily responsible for the study design; TC led the screening and data extraction with oversight from KD; KD prepared the figures and the first draft of the analysis; TC, JSM, CB, RE, SS, EW, and SB helped with interpretation of data, contributed to the main content of the manuscript, and provided critical revisions. All authors approved the final manuscript.

Declaration of interests

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