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HIV and the Criminalization 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,

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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

JSM reports grants from the Ministry of Health of the Province of British Columbia, the US National Institute on Drug Abuse (NIDA), the US National Institutes of Health (NIH), AbbVie, Bristol-Myers Squibb, Gilead Sciences, Janssen, Merck, ViiV Healthcare, and the MAC AIDS Fund, outside the submitted work. All other authors declare no competing interests.

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.

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. [56] 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. [28] ART has substantially reduced morbidity and mortality associated with HIV infection and decreased onward transmission risks in people living with HIV. [910] Optimal use of ART has led to substantial decreases in new infections in PWID in various settings. [1112] 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 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. [1516] 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. [81417] 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. [15181920] 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. [2122]

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 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). [2425] 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.

RESULTS

Our search criteria identified 15 641 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).

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 H IV 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. 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, [3235364345] 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 programmes [37] 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, [262728293031] we assessed that most were methodologically weak in evaluating the association between criminalisation and HIV prevention or treatment. Specifically, the study by Cunningham and colleagues [30] 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 Koulierakis and colleagues [31] 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 colleagues [28] 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 colleagues [29] 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 settlings. 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 Law [133] 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.

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.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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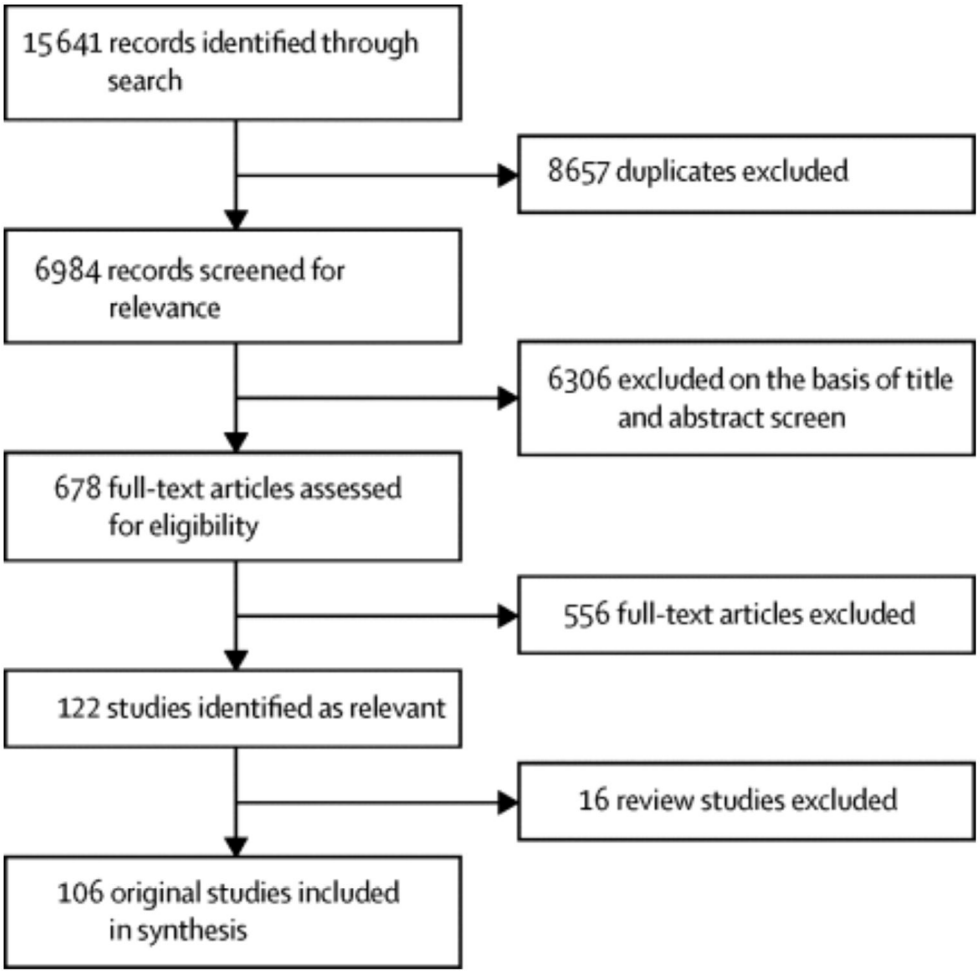

Figure 1.
Study selection

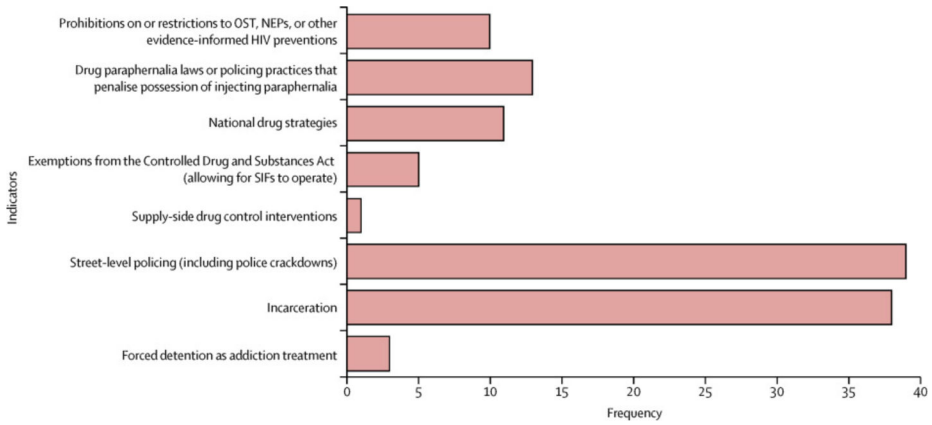

Figure 2.

Criminalisation indicators

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

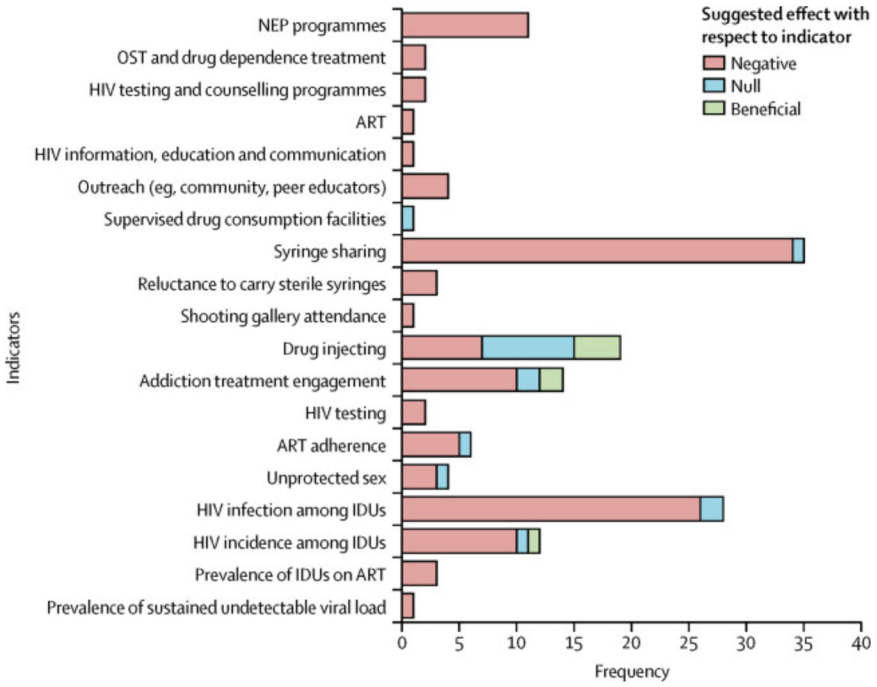

Figure 3.

HIV treatment and prevention indicators

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

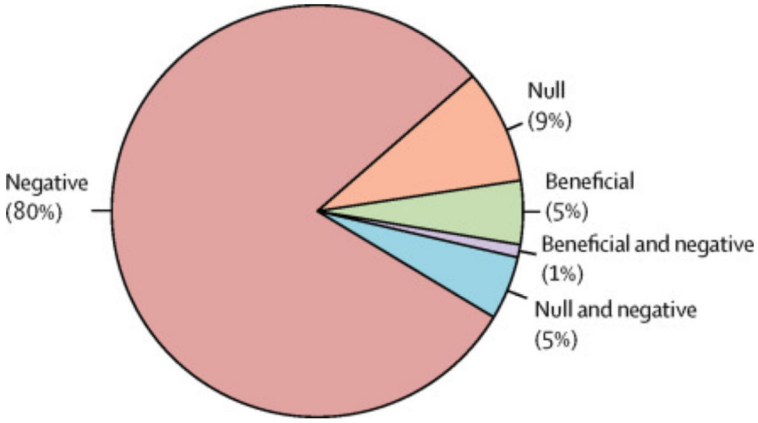

Figure 4.
Effect of criminalisation of drug use on HIV prevention and treatment (112 indicators from 106 studies)

Table 1

Summary of Included Studies n = 106

Lead author, year, and country	Study design	Sample characteristics	Quality score	Criminalization indicator(s)	Comparison group or condition	HIV indicator(s)	Conclusions on impact of criminalization on HIV (& description of key findings)
Rosenblum 2013. Russia [1]	Ecological	IDU in Russia	8	National drug strategies	Before and after 2000 (when the Taliban began an anti-opium campaign)	HIV incidence among IDU	**BENEFICIAL**: Suggested criminalization has beneficial impact (The Afghani Taliban's ban on opium production linked to reductions in HIV incidence among IDU in Eastern Europe, Central Asia, and Russia)
Rhodes 2012. Moldova [2]	Qualitative	42 lifetime IDU	N/A	Police crack downs	Before and after social and economic change in post-Soviet Europe	Drug injecting; Addiction treatment initiation and/or retention	**BENEFICIAL**: Suggested criminalization has beneficial impact (Policing associated with reductions in drug injecting and increases in OST enrolment)
Plugge 2009. England [3]	Cohort	505 female, adult prisoners	17	Incarceration (Jails, prisons, detention)	Entry into prison vs. 1 month later	Drug injecting	**BENEFICIAL:** Suggests criminalization has beneficial impact (Incarceration led to reduction in drug use among women)
Wong 2009. Canada [4]	Cross-sectional	478 youth drug users	16	Incarceration (Jails, prisons, detention)	Ever attended addiction treatment vs. not	Addiction treatment initiation and/or retention	**BENEFICIAL:** Suggests criminalization has beneficial impact (Incarceration was positively associated with enrolment in additional treatment)

Lead author, year, and country	Study design	Sample characteristics	Quality score	Criminalization indicator(s)	Comparison group or condition	HIV indicator(s)	Conclusions on impact of criminalization on HIV (& description of key findings)
Cunningham 2008. USA [5]	Before and after intervention	2.8 million adults in addictions treatment	15	Supply-side drug control interventions	Regulation changes and its effects on modes of methamphetamine administration: 1995 vs. 1996 vs. 1997	Drug injecting	**BENEFICIAL:** Suggests criminalization has beneficial impact (Changes in US federal regulations of methamphetamine precursor chemicals (ephedrine and pseudoephedrine) were positively associated with reduction in injection of methamphetamine)
Koulierakis 2006. Greece [6]	Cross-sectional	242 adult IDU	16	Incarceration (Jails, prisons, detention)	Before imprisonment versus during imprisonment	Drug injecting; Syringe sharing.	**BENEFICIAL**: Suggests criminalization has beneficial impact (Overall reduction in injecting takes place while in prison, compared with the outside) **NEGATIVE:** Suggests criminalization has negative impact (Those who continue injecting in prison take more risks by sharing more frequently)
Friedman 2011. USA [7]	Longitudin al modeling	IDU from 93 metropolitan areas	14	Street-level policing	Hard drug arrest rate in 1991 vs. 1992–2002	Drug injecting	**NULL:** Suggests criminalization has null impact (Hard drug-related arrests associated with the population rate of IDUs in 1992, but not with changes in the IDU population over time)

Lead author, year, and country	Study design	Sample characteristics	Quality score	Criminalization indicator(s)	Comparison group or condition	HIV indicator(s)	Conclusions on impact of criminalization on HIV (& description of key findings)
Rondinelli 2009. USA [8]	Cross-sectional	3209 youth-young adult IDU	15	Incarceration (Jails, prisons, detention)	HIV positive individuals vs. HIV negative individuals	HIV prevalence among IDU (diagnosed and undiagnosed)	**NULL:** Suggests criminalization has null impact (Incarceration was not associated with HIV infection)
Milloy 2009. Canada [9]	Cohort	902 adult IDU	17	Incarceration (Jails, prisons, detention)	Those reporting recent incarceration vs. those not reporting recent incarceration	Supervised drug consumption rooms	**NULL:** Suggests criminalization has null impact (Incarceration was not associated with SIF use)
Werb 2009. Thailand [10]	Cross-sectional	252 adult IDU	16	Street-level policing	Those who reported observing an increase in police presence where they purchase/consume drugs in the past 6 months vs. those who did not	Drug injecting; Addiction treatment initiation and/or retention	**NULL:** Suggests criminalization has null impact (Increase in police presence not associated with reduction in drug injecting or increased addiction treatment engagement)
Friedman 2008. USA [11]	Mathematic al modeling	96 metropolitan areas	n/a	Street-level policing	Time (1992–2002)	Drug injecting	**NULL:** Suggests criminalization has null impact (Hard drug arrests did not predict any measurable change in prevalence of IDU; no evidence that hard-drug arrests associated with decline in IDU prevalence)
Johnson 2006. USA [12]	Before and after intervention	New York's Expanded Syringe Access Program (ESAP)	9	Drug paraphernalia laws or practices that penalize or deter possession of injecting paraphernalia	Before and after ESAP	Drug injecting; Addiction treatment initiation and/or retention	**NULL:** Suggests reduced criminalization has null impact (NEP not associated with an increase in drug use)

Lead author, year, and country	Study design	Sample characteristics	Quality score	Criminalization indicator(s)	Comparison group or condition	HIV indicator(s)	Conclusions on impact of criminalization on HIV (& description of key findings)
Kerr 2006. Canada [13]	Before and after intervention	871 adult IDU	12	Exemptions from controlled drug and substances act (allowing for SIFs to operate)	Before and after SIF	Drug injecting	**NULL:** Suggests reduced criminalization has null impact (SIF not associated with an increase in drug use)
Palepu 2006. Canada [14]	Cohort	278 HIV positive IDU	16	Incarceration (Jails, prisons, detention)	Those with history of incarceration vs. not	ART adherence	**NULL:** Suggests criminalization has null impact (Incarceration not associated with HAART adherence)
Cardoso 2006. Brazil [15]	Cross-sectional	478 adult drug users, mostly IDU, half HIV positive	15	Incarceration (Jails, prisons, detention)	Those with history of incarceration vs. not	HIV incidence among IDU	**NULL:** Suggests criminalization has null impact (Incarceration not associated with HIV incidence)
Huo 2006. USA [16]	Cohort	707 adult IDU	15	Incarceration (Jails, prisons, detention)	Those with history of incarceration vs. not	Drug injecting	**NULL:** Suggests criminalization has null impact (History of incarceration was not associated with injection cessation)
Chen 2013. China [17]	Cross-sectional	613 IDU, majority male	16	Incarceration (Jails, prisons, detention)	Number of times receiving compulsory drug treatment	Unprotected sex; syringe sharing; HIV prevalence among IDU	**NULL:** Suggests reduced criminalization has null impact (Compulsory drug treatment not associated with condom use or syringe sharing) **NEGATIVE**: Suggests criminalization has negative impact (Compulsory drug treatment associated with increased risk of HIV infection)

Lead author, year, and country	Study design	Sample characteristics	Quality score	Criminalization indicator(s)	Comparison group or condition	HIV indicator(s)	Conclusions on impact of criminalization on HIV (& description of key findings)
Hayashi 2013. Thailand *18*	Cross-sectional	468 adult IDU	15	Forced detention as addiction treatment; street-level policing	Various	Drug injecting; syringe sharing	**NULL:** Suggests criminalization has null impact (Compulsory drug detention centers not associated with reductions in drug injecting) **NEGATIVE**: Suggests criminalization has negative impact (Police planting illicit drugs on IDU associated with syringe sharing)
DeBeck 2009. Canada *19*	Cohort	1,603 adult IDU	16	Incarceration (Jails, prisons, detention)	Before and after incarceration	Drug injecting	**NULL:** Suggests criminalization has null impact (Incarceration not associated with significant changes in frequent drug use) **NEGATIVE:** Suggests criminalization has negative impact (Incarceration negatively associated with injection cessation)
Friedman 2006. USA *20*	Cross-sectional	89 large metropolitan areas	15	Street-level policing	Different metropolitan areas	HIV prevalence among IDU (diagnosed and undiagnosed); drug injecting	**NULL: S**uggests criminalization has null impact (Policing had no impact on prevalence of drug injecting) **NEGATIVE:** Suggests criminalization has negative impact (Criminalization has negative

Lead author, year, and country	Study design	Sample characteristics	Quality score	Criminalization indicator(s)	Comparison group or condition	HIV indicator(s)	Conclusions on impact of criminalization on HIV (& description of key findings)
							impact on HIV prevalence)
Caiaffa 2006. Brazil [21]	Cross-sectional	1144 adult IDU	16	Incarceration (Jails, prisons, detention)	Those with history of incarceration vs. not	HIV prevalence among IDU (diagnosed and undiagnosed)	**NULL:** Suggests criminalization has null impact (Incarceration was not positively associated with HIV infection across all settings) **NEGATIVE**: Suggests criminalization has negative impact (Incarceration was positively associated with HIV infection in some groups)
Gu 2014. China [22]	Cross-sectional	133 adults on methadone treatment	13	Street-level policing	Those who worry about police arrest vs. not	Addiction treatment initiation and/or retention	**NEGATIVE**: Suggests criminalization has negative impact (Concern about arrest associated with nonattendance at methadone clinic)
Kerr 2014. Thailand [23]	Cross-sectional	435 adult IDU	14	Forced detention as addiction treatment	Those with exposure to compulsory drug detention vs. not	HIV testing	**NEGATIVE**: Suggests criminalization has negative impact (Exposure to compulsory drug detention positively associated with avoiding healthcare services)
Rahnama 2014. Iran [24]	Cross-sectional	572 male, adult IDU	13	National drug strategies	Before and after large-scale implementation of harm reduction programs	Needle exchange programs	**NEGATIVE**: Suggests reduced criminalization has beneficial impact (After implementing harm reduction

Lead author, year, and country	Study design	Sample characteristics	Quality score	Criminalization indicator(s)	Comparison group or condition	HIV indicator(s)	Conclusions on impact of criminalization on HIV (& description of key findings)
							programs, awareness and use of NEPs was relatively high among IDU in Tehran)
Madden 2014. Australia [25]	Before and after intervention	IDU 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 IDU	**NEGATIVE:** Suggests reduced criminalization has beneficial impact (Australia's public health and human rights-based approach to harm reduction contributed to a relatively low prevalence of HIV among IDU)
Huang 2014. Taiwan [26]	Cross-sectional	3,851 prisoners and 4,357 cohort participants	18	National drug strategies	Before and after the introduction of nationwide harm reduction services in 2006	HIV incidence among IDU; HIV prevalence among IDU (diagnosed and undiagnosed)	**NEGATIVE:** Suggests reduced criminalization has beneficial impact (The harm reduction program contributed to significant reductions in HIV incidence and prevalence among IDU)
Werb 2014. Canada [27]	Mathematical modeling	Canadian prisoners	13	Prohibitions on or restrictions to OST, NEPs or other evidence-informed HIV prevention interventions	Before and after proposed introduction of NEPs in prisons	HIV incidence among IDU	**NEGATIVE:** Suggests reduced criminalization has beneficial impact (Modeling indicates that prison-based NEPs may reduce HIV incidence in prisons)
Ngo 2014. Vietnam [28]	Cross-sectional	1,080 male IDU	12	Street-level policing	Those with past experience being stopped by police in relation to drug use vs. not	Syringe sharing	**NEGATIVE**: Suggests criminalization has negative impact (Street-level policing associated

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Lead author, year, and country	Study design	Sample characteristics	Quality score	Criminalization indicator(s)	Comparison group or condition	HIV indicator(s)	Conclusions on impact of criminalization on HIV (& description of key findings)
							with syringe sharing)
Lunze 2014. Russia *29*	Cross-sectional	582 HIV positive IDU	15	Street-level policing	Those who experienced extra-judicial police arrests (needle possession or for needles or drugs planted by police) vs. not	Syringe sharing	**NEGATIVE**: Suggests criminalization has negative impact (Extrajudicial police arrests associated with receptive needle sharing)
Beletsky 2014. USA *30*	Cross-sectional	514 IDU, majority male	14	Street-level policing	Those whose syringes were confiscated by police vs. not	Syringe sharing	**NEGATIVE**: Suggests criminalization has negative impact (Syringe confiscation associated with receptive syringe sharing)
Izenberg 2013. Ukraine *31*	Cross-sectional	94 HIV positive IDU recently released from prison	15	Incarceration (Jails, prisons, detention)	Those who experienced unofficial detention vs. not	Addiction treatment initiation and/or retention; ART adherence	**NEGATIVE**: Suggests criminalization has negative impact (Detention associated with ART and OST treatment interruptions)
Ti 2013. Thailand *32*	Cross-sectional	350 IDU who either HIV negative or status is unknown	13	Street-level policing	Those who noticed an increased police presence when buying or using drugs in last six months vs. not	HIV testing and counselling	**NEGATIVE**: Suggests criminalization has negative impact (Increased police presence associated with HIV test avoidance)
Chakrapani 2013. India *33*	Qualitative	23 IDU with history of incarceration; 4 key informants	N/A	Incarceration (Jails, prisons, detention)	Before and during prison time	ART adherence	**NEGATIVE**: Suggests criminalization has negative impact (Incarceration linked with ART interruptions)

Lead author, year, and country	Study design	Sample characteristics	Quality score	Criminalization indicator(s)	Comparison group or condition	HIV indicator(s)	Conclusions on impact of criminalization on HIV (& description of key findings)
Wen-Jing 2013. Taiwan *34*	Before and after intervention	IDU in Taiwan	8	National drug strategies	Before and after the implementation of the national pilot harm reduction program	HIV incidence among IDU	**NEGATIVE:** Suggests reduced criminalization has beneficial impact (Taiwan's national pilot harm reduction program linked to a decrease in HIV incidence)
Ti 2013. Canada *35*	Cohort	991 street-involved youth who use drugs	15	Street-level policing	Those who experienced police confrontation vs. not	Drug injecting	**NEGATIVE:** Suggests criminalization has negative impact (Being stopped, searched, or detained by police without arrest associated with any drug injecting)
Hayashi 2013. Thailand *36*	Cross-sectional	42–718 adult IDU (multiple studies)	16	Street-level policing	Various	Syringe sharing; HIV prevalence among IDU (diagnosed and undiagnosed)	**NEGATIVE:** Suggests criminalization has negative impact (Exposure to single and multiple street-level policing tactics associated with syringe sharing and HIV seropositivity)
Lin 2013. Taiwan *37*	Cross-sectional	781 methadone seekers, majority IDU	16	Incarceration (Jails, prisons, detention)	Those with more drug-related convictions vs. less	HIV prevalence among IDU (diagnosed and undiagnosed)	**NEGATIVE:** Suggests criminalization has negative impact (Drug-related criminal convictions linked with HIV seropositivity)
Beletsky 2013. Mexico *38*	Cross-sectional	624 female IDU who are sex workers and are at risk for HIV	15	Street-level policing	Those who have had syringes confiscated by police vs. not	HIV prevalence among IDU (diagnosed and undiagnosed)	**NEGATIVE**: Suggests criminalization has negative impact (Syringe

Lead author, year, and country	Study design	Sample characteristics	Quality score	Criminalization indicator(s)	Comparison group or condition	HIV indicator(s)	Conclusions on impact of criminalization on HIV (& description of key findings)
							confiscation associated with HIV seropositivity)
Wagner 2013. USA [39]	Mixed methods	217 IDU	13	Street-level policing	Those concerned about getting a ticket or being arrested for carrying a needle or cooker vs. not	Syringe sharing	**NEGATIVE**: Suggests criminalization has negative impact (Fear of street-level policing associated with receptive syringe sharing)
Pan 2013. Canada [40]	Cohort	372 people who use drugs, majority IDU	15	Street-level policing	Those exposed to street-based policing vs. not	Syringe sharing	**NEGATIVE**: Suggests criminalization has negative impact (Being stopped by police associated with syringe sharing)
Smith 2012. China [41]	Cross-sectional	18 key informants	9	National drug strategies	Before and after legalization of methadone.	Addiction treatment initiation and/or retention; HIV prevalence among IDU (diagnosed and undiagnosed)	**NEGATIVE:** Suggests reduced criminalization has beneficial impact (Implementation of harm reduction policies [primarily OST, some NEPs] linked to increased access to methadone among IDU and averted HIV infections)
Fatseas 2012. France [42]	Cross-sectional	648 IDU, majority male	17	National drug strategies	Before and after the introduction of harm reduction policies (1995)	HIV prevalence among IDU (diagnosed and undiagnosed); syringe sharing	**NEGATIVE:** Suggests reduced criminalization has beneficial impact (Implementation of harm reduction policies associated with decreases in HIV prevalence, and sharing syringes and drug paraphernalia)

Lead author, year, and country	Study design	Sample characteristics	Quality score	Criminalization indicator(s)	Comparison group or condition	HIV indicator(s)	Conclusions on impact of criminalization on HIV (& description of key findings)
Csete 2012. Switzerland [43]	Qualitative	Key informants	N/A	National drug strategies	Before and after the 1990's	OST and drug dependence treatment; Addiction treatment initiation and/or retention	**NEGATIVE:** Suggests reduced criminalization has beneficial impact (Reducing restrictions on methadone use associated with increased enrolment in methadone treatment)
Lee 2012. Taiwan [44]	Cross-sectional	Attendees of methadone treatment centers and NEPs	13	National drug strategies	Those living in areas where the National Pilot Harm Reduction Program (PHRP) was implemented vs. not	HIV incidence among IDU	**NEGATIVE:** Suggests reduced criminalization has beneficial impact (National Pilot Harm Reduction Program associated with relative reductions in HIV incidence)
Cooper 2012. USA [1,45,46]	Longitudin al modeling	4,067 & 4,178 IDU, majority male (multiple studies)	15	Street-level policing	District-level exposure to drug-related arrest	Syringe sharing	**NEGATIVE**: Suggests criminalization has negative impact (Arrest rates elevate the odds of injecting with an unsterile syringe and undermine the effects of better NEP access)
Peng 2011. Taiwan [47]	Cross-sectional	114 cases who are HIV +; 149 controls who are HIV−; all female prisoners	15	Incarceration (Jails, prisons, detention)	Number of times imprisoned	HIV prevalence among IDU (diagnosed and undiagnosed)	**NEGATIVE**: Suggests criminalization has negative impact (Multiple incarcerations associated with HIV seropositivity)
Volkmann 2011. Mexico [48]	Cross-sectional	727 IDU	16	Street-level policing	Those exposed to street-based policing vs. not	Drug injecting	**NEGATIVE**: Suggests criminalization has negative impact

Lead author, year, and country	Study design	Sample characteristics	Quality score	Criminalization indicator(s)	Comparison group or condition	HIV indicator(s)	Conclusions on impact of criminalization on HIV (& description of key findings)
							(Street-level policing linked to frequent injection drug use)
Strathdee 2011. Mexico *49*	Cross-sectional	620 female IDU sex workers	14	Street-level policing	Those whose syringes were confiscated by police vs. not	HIV prevalence among IDU (diagnosed and undiagnosed)	**NEGATIVE**: Suggests criminalization has negative impact (Syringe confiscation in exchange for no arrest associated with HIV seropositivity)
El Dabaghi 2010. Lebanon *50*	Cross-sectional	424 adult prisoners; 55 prison staff	8	Incarceration (Jails, prisons, detention)	No comparison group	Syringe sharing; drug injecting; unprotected sex	**NEGATIVE:** Suggests criminalization has negative impact (Incarceration described as an environment where high risk behaviours take place, including injecting, syringe sharing, and unprotected sex)
Mimiaga 2010. Ukraine *51*	Qualitative	16 HIV positive, adult IDU	n/a	Street-level policing	No comparison group.	ART adherence; Addiction treatment initiation and/or retention	**NEGATIVE:** Suggests criminalization has negative impact (Police practices identified as barrier to ART adherence and OST access)
Kerr 2010. Canada *52*	Cohort	740 adult IDU	14	Prohibitions on or restrictions to OST, NEPs or other evidence-informed HIV prevention interventions	Before and after change NEP in policy (relaxation of rules)	Syringe sharing; HIV incidence among IDU	**NEGATIVE:** Suggests reduced criminalization has beneficial impact (Expansion of syringe distribution associated with reduction of syringe sharing

Lead author, year, and country	Study design	Sample characteristics	Quality score	Criminalization indicator(s)	Comparison group or condition	HIV indicator(s)	Conclusions on impact of criminalization on HIV (& description of key findings)
							and decline in HIV incidence)
Kheirandish 2010. Iran *53*	Cross-sectional	459 male, adult, IDU prisoners, one quarter HIV positive	14	Incarceration (Jails, prisons, detention)	History of using opioids in jail vs. no history of using opioids in jail	HIV prevalence among IDU (diagnosed and undiagnosed)	**NEGATIVE:** Suggests criminalization has negative impact (Using opiates in jail positively associated with HIV infection)
Sarang 2010. Russia *54*	Qualitative	209 youth-adult IDU in 3 Russian cities	n/a	Street-level policing	No comparison group	Syringe sharing	**NEGATIVE:** Suggests criminalization has negative impact (Fear of arrest from police attributed to syringe sharing and reluctance to access sterile syringes)
Philbin 2010. China *55*	Qualitative	20 adult IDU using NEPs or methadone; 15 non-government service providers	n/a	Street-level policing	No comparison group	Addiction treatment initiation and/or retention	**NEGATIVE:** Suggests criminalization has negative impact (Police identified as barrier to accessing methadone)
Shahbazi 2010. Iran *56*	Before and after intervention	341 IDU prisoners	11	Prohibitions on or restrictions to OST, NEPs or other evidence-informed HIV prevention interventions	Before and after introduction of NEP in prison	Syringe sharing	**NEGATIVE:** Suggests reduced criminalization has beneficial impact (Introduction of NEP in prison in Iran reduced syringe sharing)
Pinkerton 2010. Canada *57*	Mathematical modeling	Insite (Vancouver SIF)	n/a	Exemptions from controlled drug and substances act (allowing for SIFs to operate)	Vancouver with and without SIF	HIV incidence among IDU	**NEGATIVE:** Suggests reduced criminalization has beneficial impact (Mathematical modeling suggests that SIF prevents HIV incidence)

Lead author, year, and country	Study design	Sample characteristics	Quality score	Criminalization indicator(s)	Comparison group or condition	HIV indicator(s)	Conclusions on impact of criminalization on HIV (& description of key findings)
Fairbairn 2010. Canada *58*	Qualitative	20 adult IDU	n/a	Prohibitions on or restrictions to OST, NEPs or other evidence-informed HIV prevention interventions	No comparison group	Syringe sharing	**NEGATIVE:** Suggests criminalization has negative impact (Prohibition on assisted injection in Vancouver SIF described as 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 2010. Global (emphasis on Ukraine, Pakistan and Kenya) *59*	Mathematic al modeling	94 studies	n/a	Street-level policing; Prohibitions on or restrictions to OST, NEPs or other evidence-informed HIV prevention interventions; Drug paraphernalia laws or practices that penalize or deter possession of injecting paraphernalia	Various	HIV incidence among IDU; HIV prevalence among IDU (diagnosed and undiagnosed); Needle exchange programs; OST and drug dependence treatment; prevalence of IDU on HAART	**NEGATIVE:** Suggests reduced criminalization has beneficial impact (Mathematical modeling 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 IDU) would reduce HIV infections by 67% in Nairobi)
Bravo 2009. Spain *60*	Cross-sectional	249 youth IDU	13	Exemptions from controlled drug and substances act (allowing for SIFs to operate)	SIF users vs. non-SIF users	Syringe sharing	**NEGATIVE:** Suggests reduced criminalization has beneficial impact

Lead author, year, and country	Study design	Sample characteristics	Quality score	Criminalization indicator(s)	Comparison group or condition	HIV indicator(s)	Conclusions on impact of criminalization on HIV (& description of key findings)
							(SIF users less likely to borrow used syringes)
Ngo 2009. Vietnam [61]	Qualitative	23 government and non-government informants; 8 IDU	n/a	Police crack downs	No comparison group	Outreach (community, peer educators, public health nurses, street teams); Needle exchange programs	**NEGATIVE:** Suggests criminalization has negative impact (Police crack downs described as limiting needle and syringe distribution and outreach efforts)
Vahdani 2009. Iran [62]	Cross-sectional	202 homeless adults, one-third IDU	15	Incarceration (Jails, prisons, detention)	HBV positive individuals vs. HCV positive individuals vs. HIV positive individuals	HIV prevalence among IDU (diagnosed and undiagnosed)	**NEGATIVE:** Suggests criminalization has negative impact (Previous imprisonment positively associated with HIV infection)
Des Jarlais 2009. USA [63]	Before and after intervention	2,312 adult IDU attending drug detoxification program	15	Prohibitions on or restrictions to OST, NEPs or other evidence-informed HIV prevention interventions	Before and after large-scale needle exchanges were implemented in New York	HIV prevalence among IDU (diagnosed and undiagnosed); syringe sharing	**NEGATIVE:** Suggests reduced criminalization has beneficial impact (Expanding/ implementing large scale syringe exchange program associated with reduction in HIV prevalence and syringe sharing)
Rafiey 2009. Iran [64]	Cross-sectional	2091 male, adult IDU from treatment centers, prisons, and streets	15	Incarceration (Jails, prisons, detention)	Those who ever shared syringes vs. not	Syringe sharing	**NEGATIVE:** Suggests criminalization has negative impact (Arrest and history of imprisonment positively associated with ever sharing syringes)

Lead author, year, and country	Study design	Sample characteristics	Quality score	Criminalization indicator(s)	Comparison group or condition	HIV indicator(s)	Conclusions on impact of criminalization on HIV (& description of key findings)
Krusi 2009. Canada [65]	Qualitative	22 HIV positive adult IDU attending HIV care program; 7 staff members of HIV care program	n/a	Exemptions from controlled drug and substances act (allowing for SIFs to operate)	HIV care staff vs. HIV care attendees	Targeted information, education and communication for IDUs and their sexual partners	**NEGATIVE:** Suggests reduced criminalization has beneficial impact (Supervised injection supported IDU access to HIV prevention education)
Hayashi 2009. Thailand [66]	Cross-sectional	252 adults, majority IDU	16	Incarceration (Jails, prisons, detention)	Those with history of incarceration vs. not	Syringe sharing; drug injecting	**NEGATIVE:** Suggests criminalization has negative impact (Incarceration positively associated with syringe sharing and injecting midazolam)
Small 2009. Canada [67]	Qualitative	12 HIV positive, male, adult, IDU on HAART	n/a	Incarceration (Jails, prisons, detention)	No comparison group	ART adherence; prevalence of IDU on HAART	**NEGATIVE:** Suggests criminalization has negative impact (Incarceration described as deterring/creating difficulties for IDU to access HAART)
Pollini 2009. Mexico [68]	Cross-sectional	898 male, adult IDU	15	Incarceration (Jails, prisons, detention); Street-level policing; Drug paraphernalia laws or practices that penalize 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:** Suggests criminalization has negative impact (Being arrested for sterile syringe possession independently associated with injecting drugs during incarceration; multiple incarcerations independently associated with syringe sharing in prison)

Lead author, year, and country	Study design	Sample characteristics	Quality score	Criminalization indicator(s)	Comparison group or condition	HIV indicator(s)	Conclusions on impact of criminalization on HIV (& description of key findings)
Suntharasamai 2009. Thailand [69]	Cohort	2,295 adult IDU, HIV negative at baseline	16	Incarceration (Jails, prisons, detention)	Those with history of incarceration vs. not	HIV incidence among IDU	**NEGATIVE:** Suggests criminalization has negative impact (Incarceration was positively associated with HIV incidence)
Milloy 2009. Canada [70]	Cohort	889 adult IDU	16	Incarceration (Jails, prisons, detention)	Those with history of incarceration vs. not	Syringe sharing	**NEGATIVE:** Suggests criminalization has negative impact (Release from prison associated with syringe sharing)
Thomson 2009. Thailand [71]	Cross-sectional	1189 young adults, half IDU, majority HIV positive	16	Incarceration (Jails, prisons, detention)	Those with history of incarceration vs. not	HIV prevalence among IDU (diagnosed and undiagnosed)	**NEGATIVE:** Suggests criminalization has negative impact (Incarceration positively associated with HIV infection)
Thanh 2009. Viet Nam [72]	Qualitative	45 HIV positive, adult IDU	n/a	Street-level policing; Drug paraphernalia laws or practices that penalize or deter possession of injecting paraphernalia	No comparison group	Outreach (community, peer educators, public health nurses, street teams); Needle exchange programs; reluctance to carry sterile syringes	**NEGATIVE:** Suggests criminalization has negative impact (Policing practices and fear of arrest described as deterrent for carrying syringes and distributing syringes by peer educators)
Reid 2009. China [73]	Qualitative	39 government and non-government informants representing 19 stakeholder bodies across China	n/a	Police crack downs	No comparison group	Addiction treatment initiation and/or retention; Needle exchange programs; HIV testing and counselling	**NEGATIVE:** Suggests criminalization has negative impact (Policing practices found to limit access to HIV prevention programs and interventions

Lead author, year, and country	Study design	Sample characteristics	Quality score	Criminalization indicator(s)	Comparison group or condition	HIV indicator(s)	Conclusions on impact of criminalization on HIV (& description of key findings)
							including addiction treatment; also found to inhibit delivery of services)
Sheue-Rong 2008. Taiwan [74]	Cohort	3,229 IDU enrolled in methadone program	9	National drug strategies	HIV incidence before and after harm reduction campaign	HIV incidence among IDU	**NEGATIVE:** Suggests reduced criminalization has beneficial impact (Introduction of harm reduction campaign (methadone, syringe exchange program, HIV screening and counseling services) associated with 43% decrease in new HIV infectors one year after intervention, and additional 44% decrease the following year)
Schleifer 2008. Thailand [75]	Qualitative	50 stakeholders; 50 drug users from 5 Thai provinces.	n/a	National drug strategies	No comparison group	ART/HAART; Prevalence of IDU on HAART	**NEGATIVE:** Suggests criminalization has negative impact (National drug policies and policing practices described as barriers to getting IDU onto ART/ HAART)
Pollini 2008. Mexico [76]	Cross-sectional	428 adult IDU	16	Street-level policing; Drug paraphernalia laws or practices that penalize or deter possession of injecting paraphernalia	Arrested for carrying syringes vs. not	Syringe sharing	**NEGATIVE:** Suggests criminalization has negative impact (Being arrested for carrying syringes positively associated with

Lead author, year, and country	Study design	Sample characteristics	Quality score	Criminalization indicator(s)	Comparison group or condition	HIV indicator(s)	Conclusions on impact of criminalization on HIV (& description of key findings)
							receptive syringe sharing)
Philbin 2008. Mexico *77*	Cross-sectional	427 adult IDU	15	Street-level policing; Drug paraphernalia laws or practices that penalize or deter possession of injecting paraphernalia	Attending shooting galleries vs. not	Syringe sharing; Shooting gallery attendance	**NEGATIVE:** Suggests criminalization has negative impact (Policing practices positively associated with shooting gallery attendance, which is associated with syringe sharing)
Chen 2008. Taiwan *78*	Cross-sectional	241 male, adult, prisoners, mostly IDU, half HIV positive	15	Incarceration (Jails, prisons, detention)	HIV positive individuals vs. HIV negative individuals	HIV prevalence among IDU (diagnosed and undiagnosed)	**NEGATIVE:** Suggests criminalization has negative impact (Incarceration positively associated with HIV infection)
Azim 2008. Bangladesh *79*	Cross-sectional	561 male, youth-adult IDU	15	Street-level policing	Ever arrested for being a drug user vs. not	HIV prevalence among IDU (diagnosed and undiagnosed)	**NEGATIVE:** Suggests criminalization has negative impact (Being arrested for being a drug user positively associated with HIV infection)
Miller 2008. Mexico *80*	Qualitative	43 adult IDU	n/a	Street-level policing; Drug paraphernalia laws or practices that penalize or deter possession of injecting paraphernalia	No comparison group	Reluctance to carry sterile syringes	**NEGATIVE:** Suggests criminalization has negative impact (Policing practices deter IDU from carrying sterile injecting equipment)
Strathdee 2008. Mexico *81*	Cohort	1056 adult IDU	14	Street-level policing	HIV positive individuals vs. HIV negative individuals	HIV prevalence among IDU (diagnosed and undiagnosed)	**NEGATIVE:** Suggests criminalization has negative impact (Being arrested for having track-marks was

Lead author, year, and country	Study design	Sample characteristics	Quality score	Criminalization indicator(s)	Comparison group or condition	HIV indicator(s)	Conclusions on impact of criminalization on HIV (& description of key findings)
							independently associated with HIV infection)
Epperson 2008. USA [82]	Cross-sectional	356 male adults, one-quarter IDU	14	Incarceration (Jails, prisons, detention)	Recent criminal justice involvement vs. no recent criminal justice involvement	HIV prevalence among IDU (diagnosed and undiagnosed); syringe sharing	**NEGATIVE:** Suggests criminalization has negative impact (Incarceration positively associated with syringe sharing and HIV prevalence)
Milloy 2008. Canada [83]	Cohort	902 adult IDU	17	Incarceration (Jails, prisons, detention)	Reporting an incarceration event vs. not reporting an incarceration event	Syringe sharing; HIV prevalence among IDU (diagnosed and undiagnosed)	**NEGATIVE:** Suggests criminalization has negative impact (Incarceration positively associated with syringe sharing and HIV prevalence)
Werb 2008. Canada [84]	Cohort	1247 adult IDU	16	Incarceration (Jails, prisons, detention)	Those with history of incarceration vs. not	Syringe sharing; unprotected sex	**NEGATIVE:** Suggests criminalization has negative impact (Incarceration positively associated with unprotected sex and syringe sharing)
Cohen 2008. China [85]	Qualitative	19 adult IDU; 20 government and non-government informants	n/a	Street-level policing; Drug paraphernalia laws or practices that penalize or deter possession of injecting paraphernalia	No comparison group	HIV testing; Needle exchange programs; Addiction treatment initiation and/or retention	**NEGATIVE:** Suggests criminalization has negative impact (Policing practices and fear of arrest described as creating barriers for getting tested for HIV, getting sterile syringes, and accessing

Lead author, year, and country	Study design	Sample characteristics	Quality score	Criminalization indicator(s)	Comparison group or condition	HIV indicator(s)	Conclusions on impact of criminalization on HIV (& description of key findings)
							methadone programs)
Neaigus 2008. USA [86]	Cross-sectional	526 adult IDU	16	Prohibitions on or restrictions to OST, NEPs or other evidence-informed HIV prevention interventions	New Jersey residents (no NPSS) vs. New York residents (NPSS)	HIV prevalence among IDU (diagnosed and undiagnosed); syringe sharing	**NEGATIVE:** Suggests criminalization has negative impact (Prohibitions on syringe distribution programs positively associated with syringe sharing and higher HIV prevalence among IDU)
Courtenay-Quirk 2008. USA [87]	Cross-sectional	581 HIV positive adults, one-quarter IDU	16	Incarceration (Jails, prisons, detention)	Those with history of incarceration vs. not	Prevalence of sustained undetectable viral load among IDU	**NEGATIVE:** Suggests criminalization has negative impact (Incarceration negatively associated with having an undetectable viral load)
Werb 2008. Canada [88]	Cross-sectional	465 adult IDU	14	Street-level policing; Drug paraphernalia laws or practices that penalize or deter possession of injecting paraphernalia	Those who have been stopped by police in the last 6 months vs. those who have not	Syringe sharing	**NEGATIVE:** Suggests criminalization has negative impact (Street-level policing positively associated with syringe sharing)
Tempalski 2008. USA [89]	Cross-sectional	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	Needle exchange programs	**NEGATIVE:** Suggests reduced criminalization has beneficial impact (Government funding of NEPs contributes to better syringe coverage)
Sarang 2008. Russia [90]	Qualitative	1682 youth-adult IDU	16	Street-level policing; Drug paraphernalia laws or practices that penalize or	No comparison group	Needle exchange programs; reluctance to carry sterile syringes	**NEGATIVE:** Suggests criminalization has

Lead author, year, and country	Study design	Sample characteristics	Quality score	Criminalization indicator(s)	Comparison group or condition	HIV indicator(s)	Conclusions on impact of criminalization on HIV (& description of key findings)
				deter possession of injecting paraphernalia			negative impact (Street-level policing linked with reluctance to access NEPs, and therefore less access to sterile syringes)
Shannon 2008. Canada *91*	Qualitative	46 female sex workers	n/a	Street-level policing; Drug paraphernalia laws or practices that penalize or deter possession of injecting paraphernalia	No comparison group	Needle exchange programs; unprotected sex; reluctance to carry sterile syringes	**NEGATIVE:** Suggests criminalization has negative impact (Policing reduces willingness to carry clean syringes and limits access to HIV prevention services, and increases risk for unprotected sex)
Raykhert 2008. Ukraine *92*	Cross-sectional	1507 adults infected with tuberculosis	16	Incarceration (Jails, prisons, detention)	Civilians vs. penitentiary	HIV prevalence among IDU (diagnosed and undiagnosed)	**NEGATIVE:** Suggests criminalization has negative impact (Incarceration positively associated with HIV infection)
Wood 2007. Canada *93*	Cohort	1031 adult IDU	16	Exemptions from controlled drug and substances act (allowing for SIFs to operate)	Before and after SIF opening	Addiction treatment initiation and/or retention	**NEGATIVE:** Suggests reduced criminalization has beneficial impact (Allowing SIF to operate associated with increased entry into addiction treatment)
Rich 2007. USA *94*	Cross-sectional	473 adult drug users	15	Prohibitions on or restrictions to OST, NEPs or other evidence-informed HIV prevention interventions	Rhode Island (legal NPSS) vs. Massachusetts (no legal NPSS)	Syringe sharing	**NEGATIVE:** Suggests reduced criminalization has beneficial impact (Legalization of non-prescription sterile syringes in Rhode Island

Lead author, year, and country	Study design	Sample characteristics	Quality score	Criminalization indicator(s)	Comparison group or condition	HIV indicator(s)	Conclusions on impact of criminalization on HIV (& description of key findings)
							associated with reductions in syringe sharing when compared with Massachusetts where syringes remained outlawed)
Rácz 2007. Hungary *95*	Qualitative	150 youth IDU	n/a	Street-level policing; Drug paraphernalia laws or practices that penalize or deter possession of injecting paraphernalia	No comparison group	Syringe sharing	**NEGATIVE:** Suggests criminalization has negative impact (Syringe sharing positively associated with Street-level policing)
Razani 2007. Iran *96*	Qualitative	40 government and non-government informants; 66 adult IDU	n/a	Incarceration (Jails, prisons, detention)	No comparison group	Syringe sharing	**NEGATIVE:** Suggests criminalization has negative impact (Incarceration positively associated with syringe sharing)
Bluthenthal 2007. USA *97*	Cross-sectional	24 NEPs, 1576 adult IDU	16	Prohibitions on or restrictions 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	Needle exchange programs	**NEGATIVE:** Suggests reduced criminalization has beneficial impact (When restrictions on NEP dispensation policies decreased, adequate syringe coverage increased)
Dolan 2007. USA *98*	Cohort	258 HIV positive, adult, IDU	15	Incarceration (Jails, prisons, detention)	Those with history of incarceration vs. not	ART adherence	**NEGATIVE:** Suggests criminalization has negative impact (Incarceration negatively associated with poorer responses (virologic and immunologic)

Lead author, year, and country	Study design	Sample characteristics	Quality score	Criminalization indicator(s)	Comparison group or condition	HIV indicator(s)	Conclusions on impact of criminalization on HIV (& description of key findings)
							after HAART initiation)
Rhodes 2006. Russia [99]	Qualitative	27 adult police officers	n/a	Street-level policing; Drug paraphernalia laws or practices that penalize or deter possession of injecting paraphernalia	No comparison group	Needle exchange programs	**NEGATIVE:** Suggests criminalization has negative impact (Policing practices are barriers to accessing NEP/ sterile syringes)
Davis 2006. USA [100]	Cross-sectional	637 youth-adult drug users	16	Street-level policing	Those with criminal justice involvement vs. not	HIV prevalence among IDU (diagnosed and undiagnosed)	**NEGATIVE:** Suggests criminalization has negative impact (Incarceration positively associated with HIV infection)
Rhodes 2006. Russia [101]	Cross-sectional	1473 youth-adult IDU	15	Incarceration (Jails, prisons, detention)	Those with history of incarceration vs. not	HIV prevalence among IDU (diagnosed and undiagnosed)	**NEGATIVE:** Suggests criminalization has negative impact (Incarceration positively associated with HIV infection)
Small 2006. Canada [102]	Qualitative	30 adult IDU; 9 service providers	n/a	Street-level policing	No comparison group	Outreach (community, peer educators, public health nurses, street teams); syringe sharing	**NEGATIVE:** Suggests criminalization has negative impact (Policing observed to have negative impact on multiple HIV prevention indicators)
Tyndall 2006. Canada [103]	Cohort	1035 adult IDU	17	Incarceration (Jails, prisons, detention)	Those with history of incarceration vs. not	HIV prevalence among IDU (diagnosed and undiagnosed)	**NEGATIVE:** Suggests criminalization has negative impact (Incarceration positively associated with HIV infection)

Lead author, year, and country	Study design	Sample characteristics	Quality score	Criminalization indicator(s)	Comparison group or condition	HIV indicator(s)	Conclusions on impact of criminalization on HIV (& description of key findings)
Zamani 2006. Iran *104*	Cross-sectional	207 male, adult IDU	16	Incarceration (Jails, prisons, detention)	Those with history of incarceration vs. not	HIV prevalence among IDU (diagnosed and undiagnosed)	**NEGATIVE:** Suggests criminalization has negative impact (Incarceration positively associated with HIV infection)
Miller 2006. Canada *105*	Cohort	542 young adult IDU	15	Incarceration (Jails, prisons, detention)	Age of injection initiation: younger vs. older	Drug injecting	**NEGATIVE:** Suggests criminalization has negative impact (Incarceration associated with initiating injecting at a younger age)
Sarang 2006. Russia *106*	Qualitative	209 youth-adult IDU	n/a	Incarceration (Jails, prisons, detention)	No comparison group	Syringe sharing	**NEGATIVE:** Suggests criminalization has negative impact (Incarceration positively associated with syringe sharing due to lack of availability of sterile syringes)
Callon 2006. Canada *107*	Cohort	1463 adult IDU	15	Incarceration (Jails, prisons, detention)	Those with history of incarceration vs. not	Addiction treatment initiation and/or retention	**NEGATIVE:** Suggests criminalization has negative impact (Incarceration negatively associated with MMT)

*1*Includes two similar studies: (i) Cooper, Hannah LF, et al. “Drug-related arrest rates and spatial access to syringe exchange programs in New York City health districts: Combined effects on the risk of injection-related infections among injectors.” *Health & Place* 18.2 (2012): 218–228; (ii) Cooper, Hannah, et al. “Spatial access to sterile syringes and the odds of injecting with an unsterile syringe among injectors: A longitudinal multilevel study.” *Journal of Urban Health* 89.4 (2012): 678–696.

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