

HIV among people who inject drugs in Central and Eastern Europe and Central Asia: a systematic review with implications for policy

Emma Jolley,¹ Tim Rhodes,¹ Lucy Platt,¹ Vivian Hope,^{1,2} Alisher Latypov,^{3,4} Martin Donoghoe,⁵ David Wilson⁶

To cite: Jolley E, Rhodes T, Platt L, *et al.* HIV among people who inject drugs in Central and Eastern Europe and Central Asia: a systematic review with implications for policy. *BMJ Open* 2012;**2**:e001465. doi:10.1136/bmjopen-2012-001465

► Prepublication history and additional material for this paper are available online. To view these files please visit the journal online (<http://dx.doi.org/10.1136/bmjopen-2012-001465>).

Received 10 May 2012
Accepted 6 September 2012

This final article is available for use under the terms of the Creative Commons Attribution Non-Commercial 2.0 Licence; see <http://bmjopen.bmj.com>

For numbered affiliations see end of article

Correspondence to

Tim Rhodes;
tim.rhodes@lshtm.ac.uk

ABSTRACT

Background and objectives: HIV among people who inject drugs (PWID) is a major public health concern in Eastern and Central Europe and Central Asia. HIV transmission in this group is growing and over 27 000 HIV cases were diagnosed among PWID in 2010 alone. The objective of this systematic review was to examine risk factors associated with HIV prevalence among PWID in Central and Eastern Europe and Central Asia and to describe the response to HIV in this population and the policy environments in which they live.

Design: A systematic review of peer-reviewed and grey literature addressing HIV prevalence and risk factors for HIV prevalence among PWID and a synthesis of key resources describing the response to HIV in this population. We used a comprehensive search strategy across multiple electronic databases to collect original research papers addressing HIV prevalence and risk factors among PWID since 2005. We summarised the extent of key harm reduction interventions, and using a simple index of 'enabling' environment described the policy environments in which they are implemented.

Studies reviewed: Of the 5644 research papers identified from electronic databases and 40 documents collected from our grey literature search, 70 documents provided unique estimates of HIV and 14 provided multivariate risk factors for HIV among PWID.

Results: HIV prevalence varies widely, with generally low or medium (<5%) prevalence in Central Europe and high (>10%) prevalence in Eastern Europe. We found evidence for a number of structural factors associated with HIV including gender, socio-economic position and contact with law enforcement agencies.

Conclusions: The HIV epidemic among PWID in the region is varied, with the greatest burden generally in Eastern Europe. Data suggest that the current response to HIV among PWID is insufficient, and hindered by multiple environmental barriers including restricted access to services and unsupportive policy or social environments.

ARTICLE SUMMARY

Article focus

- A systematic review to identify and synthesise prevalence estimates and risk factors for HIV among people who inject drugs (PWID) in Central and Eastern Europe and Central Asia.
- A summary of key data to describe the response to HIV among PWID in Central and Eastern Europe and Central Asia, including a brief characterisation of the policy environments.

Key messages

- The review highlights that the HIV epidemic among PWID in the region varies from country to country, with Eastern European countries generally the worst affected. Prevalence is extremely high among PWID in many countries with some studies suggesting more than one in two PWID are infected with the virus in parts of Estonia, Russia and Ukraine.
- Despite few studies explicitly examining environmental factors, our review found that gender, socio-economic position and contact with law enforcement agencies to be associated with HIV prevalence. The complex interplay between the environment and individual behaviour of PWID is not fully understood and further emphasis on understanding the social epidemiology of HIV in this group is needed.
- An integrated package of needle exchange programmes, opiate substitution therapy and anti-retroviral therapy is core to an effective response to HIV in this group. The coverage of such interventions in the region varies from low to non-existent and must be improved. Further resources coupled with improvement in the policy environments are key to reducing HIV transmission in this group.

INTRODUCTION

The HIV epidemics of Europe are diverse but in all European countries HIV disproportionately affects populations that are socially marginalised and people whose behaviour is

ARTICLE SUMMARY

Strengths and limitations of this study

- This review is the most comprehensive synthesis of HIV prevalence and risk factors among PWID in Central and Eastern Europe and Central Asia to date and is complemented by a clear synopsis of the state of the national policy environments and responses to HIV for people who inject drugs.
- The quality of the review relies on quality of the original articles, which are variable. The samples included are often selective as many studies recruited participants from specialist services or via drug user networks. Multivariate analyses are adjusted for a variety of factors, rendering direct comparisons between point-estimates difficult.
- The service coverage data are not measured in a standard manner across the region, and is from different years. The quality of data varies greatly by country, thus undermining the comparisons we can make about coverage.
- We use a crude index of 'policy environment' which is developed from binary indicators that cannot account for important nuances influencing intercountry and intracountry environments.

socially stigmatised or illegal. The epidemics in Eastern Europe and Central Asia, which are predominantly associated with injecting drug use, are among the fastest growing in the world.¹ Over two-thirds of all HIV diagnoses to date in Europe fall in Eastern Europe and Central Asia, and over 70% of these emanate from Russia.^{2 3} Over 27 000, or over 30% of new cases of HIV were attributed to injecting drug use in Central and Eastern Europe and Central Asia in 2010.^{2 3} Almost all of these (99.6%) were made in Eastern Europe and Central Asia. Accounting for differences in absolute population size, between 2006 and 2010, 89 new HIV diagnoses associated with injecting drug use have been made on average each year in the East per million people. This contrasts with Central Europe where the rate is 100 times less at 0.8 per million.²

Because of low access to and uptake of HIV testing and counselling—especially among the marginalised and stigmatised populations most at risk of HIV infection and transmission—not all HIV cases in Europe are diagnosed and reported.⁴ Estimates suggest that reported cases probably represent just over half of all people living with HIV in Europe.⁴ It is estimated that just over 2.3 million people were living with HIV in Europe in 2010, 840 000 in Western Europe and 1.5 million in Eastern Europe.⁴

There are an estimated 3.1 million people who inject drugs (PWID) in Central and Eastern Europe and Central Asia, of whom one million are estimated to be HIV infected.⁵ In Russia alone, there are an estimated 1.8 million PWID, of whom around 700 000 are thought to be HIV infected.⁵ Estimates of the prevalence of HIV among PWID in Central and Eastern Europe and Central Asia vary widely, from zero in some Central European countries where injecting drug use is less widespread, to over 20% in some countries in Eastern Europe and Central Asia, including Estonia, Moldova, Russia, and Ukraine.^{5 6}

HIV and other blood-borne infections contribute significantly to the excess morbidity and mortality experienced by PWID in Europe and elsewhere.^{7 8} HIV has the potential to spread rapidly via the sharing of needles and syringes between PWID as well as via unprotected sex between PWID and their injecting and non-injecting partners.

Social contexts of HIV epidemics

A growing body of work substantiates relationships between health harms related to drug use and social-material factors that shape vulnerability to HIV.^{9–16} The heuristic of the HIV 'risk environment' envisages HIV risk as the product of reciprocal relationships between micro-level and macrolevel influences in the physical, social, economic and policy environments which contextualise individual and community actions in relation to risk.^{9–15} This interaction has been described as a reciprocal process whereby individual actions are constrained as well as enabled by their environments and in turn shape as well as reproduce those contexts.¹⁷ Qualitative work among PWID in Russia, for example, has illustrated how reduced capacity for HIV risk reduction in the micro-environment is shaped by street-level policing practices which are in turn contextualised by broader structural policies of criminalisation and cultural practices of marginalisation which taken together produce a collectively internalised fear and sense of constrained agency among PWID.^{17 18}

Recent reviews have thus called for a shift towards social epidemiological approaches.^{9–15} These investigate how the distribution of HIV in populations is in part shaped by 'social factors', that is, forces that extend beyond 'proximal' individual-level factors and their biological mediators. This simultaneously demands a shift from binary models of 'cause and effect' to 'multilevel' models, which enable HIV risk to be understood as an effect of multiple contributing factors, at once interacting together, including potentially in 'non-linear' and 'indirect' ways.¹⁹ Delineating causal pathways to inform structural interventions is thus a daunting yet critical challenge. Recent evidence reviews suggest that currently the epidemiology of HIV among PWID rarely explicitly embraces the study of social determinants.²⁰

The social and economic transitions transforming the Central and Eastern European and Central Asian region in the past 20 years have been abrupt, dramatic and long lasting. In many countries of the region, economic uncertainty has combined with weakening social capital, an embryonic and fragile civil society, a poorly resourced and overly vertically structured health system, and public policies tackling drug use that have emphasised law enforcement and security at the expense of public health.^{16 21} Social and economic transformations following the dramatic political change in Eastern European and Central Asian countries have played a role in shaping transitions in problematic substance use as well as vulnerability to HIV.^{21–26} The opening-up of international and

trade borders, for instance, has facilitated population mixing as well as the development of heroin trafficking routes from Afghanistan to the West, also linked to the diffusion of heroin use.²⁷ There was evidence of explosive HIV outbreaks linked to injecting drug use in the former Soviet region by the mid-1990s, especially in Russia, Ukraine and Moldova.²¹

Enabling policy environments for HIV prevention

Recognising HIV epidemics as features of their social and structural contexts emphasises the potentially pivotal role of social and structural interventions in creating environments which are enabling, rather than constraining, of evidence-based HIV prevention.^{28–30} Key dimensions of ‘enabling’ policy environments conducive to effective HIV prevention for PWID include, but are not restricted to: the meaningful engagement of key stakeholders (including PWID) in policy formation and programming; a coordinated multisectoral national HIV prevention strategy emphasising an evidence-based public health and rights-oriented approach; the generation of research and surveillance on HIV epidemic spread and response; and the development and scale-up of a package of evidence-based interventions, including the removal of structural obstacles limiting their implementation.^{31–33} This has led to calls to de-emphasise the criminalisation of PWID by developing policies emphasising public health above law enforcement-dominated approaches, and for the rapid scaling-up of harm reduction interventions including syringe exchange, opioid substitution treatment (OST), and antiretroviral HIV treatment (ART), as well as community action and social support interventions.^{31 32 34–36}

Review scope

We aim to systematically review epidemiological research investigating the burden of HIV, and associated risk factors, among PWID in Central and Eastern Europe and Central Asia. We seek to identify the extent to which such epidemiological research captures measures of the HIV risk environment by delineating HIV risk factors identified at the levels of the individual and environment. We situate this epidemiological work by synthesising current evidence reviews of the extent and availability of HIV prevention targeting PWID in the region and by developing a simple index of ‘enabling’ policy environment at the country level.

METHODS

We reviewed data from the 30 Eastern and Central European and Central Asian countries in WHO-defined Europe, including 15 from Eastern Europe and Central Asia (Armenia, Azerbaijan, Belarus, Estonia, Georgia, Kazakhstan, Kyrgyzstan, Latvia, Lithuania, Republic of Moldova, Russian Federation, Tajikistan, Turkmenistan, Ukraine and Uzbekistan), ‘the East’ and 15 from Central Europe (Albania, Bosnia and Herzegovina, Bulgaria,

Croatia, Cyprus, Czech Republic, Hungary, Macedonia (FYR), Montenegro, Poland, Romania, Serbia, Slovakia, Slovenia and Turkey), ‘the Centre’.

Search strategy and selection criteria

We systematically searched MEDLINE, EMBASE, Global Health, Social Science Citation Index, Popline and CINAHL for studies published from 2005 to 20 October 2011. To identify articles we combine four broad search themes with the Boolean operator ‘AND’. The first theme, HIV, combined the Medical Subject Headings (MESH) terms ‘HIV’ or ‘HIV infections’ with the free word search for ‘HIV’, ‘human immunodeficiency virus’ with ‘OR’. The second theme, prevalence, incidence and risk factors, included the MESH terms ‘prevalence’, ‘incidence’, ‘risk’, ‘factor analysis’, ‘statistical’, ‘regression analysis’, ‘risk factors’, ‘risk-taking’ and ‘epidemiology’ with the free words ‘prevalen*’, ‘incidence’, ‘risk*’, ‘correlat*’, ‘determinant*’, ‘vulnerab*’, ‘regression’, ‘risk’, ‘(enhanc*adj3) transmission’, ‘multivar*’, ‘(route*adj3 transmission)’, ‘(factor*adj3 transmission)’, ‘social norm*’, ‘network’, ‘socio-demographic’, ‘socio-economic’, ‘lifestyle’ and ‘epidemiol*’ with ‘OR’. The third theme, geographic coverage, included the names of the countries in the region, as well as the free word terms ‘Europe*’ and ‘Central Asia*’ combined with ‘OR’. The fourth theme, PWID, combined the MESH terms ‘substance abuse’, ‘intravenous’, ‘needle sharing’ and ‘heroin dependence’ with the free word terms ‘IDU*’, ‘inject*’, ‘intravenous’, ‘heroin’, ‘addict*’, ‘opiate*’, ‘narco*’, ‘psychotropic*’, ‘psychoactive*’, ‘drug depend#n*’, ‘(recreation*adj3 drug*)’, ‘harm reduction’, ‘syringe*’, ‘methadone’, ‘opioid*’, ‘syringe*’, ‘(needle*adj3 shar*)’, and ‘(illegal*adj3 drug*)’ combined with ‘OR’.

Additionally, we systematically searched websites of research institutes, service providers, and donor organisations working with PWID across the region including recent reports from countries reporting to the United Nations General Assembly Special Session on HIV/AIDS (UNGASS). We searched the website of the European Monitoring Centre for Drugs and Drug Addiction (EMCDDA) for data and sources reported from member and neighbouring countries. Conference abstracts from the International Conference on the Reduction of Drug Related Harm (2005–2011) and the International AIDS Conference (2006, 2008 and 2010) were also searched. Our review conformed to the PRISMA checklist for systematic reviews.³⁷

Study selection and eligibility criteria

All abstracts were reviewed. Studies were excluded if they were: (1) published before 2005; (2) fell outside the defined geographic region; (3) did not focus on HIV among PWID; (4) did not sample PWID; or (5) did not focus on bio-confirmed HIV prevalence or incidence, or injecting or sexual risk practices. Papers were also excluded if they reported a sample size less than 50, had unclear sampling methods or they contained no

primary data, although the references were searched to gather primary studies not identified by the search. Papers not fitting the inclusion criteria were set aside to aid interpretation of the systematic review findings. Figure 1 summarises the papers searched and retained in the review. Following full-text review 100 peer-reviewed and grey literature documents were identified as meeting our criteria, of which 70 reported an incidence or prevalence measure and 30 demographic or risk factor data only. Of the 70 documents reporting prevalence or incidence data, 14 included the results of a multivariate analysis.

Two authors (EJ and LP) independently assessed the quality of the studies reporting HIV prevalence estimates using a scoring system that graded the papers on: wide geographic coverage; most recent study; population sampled; and recruitment setting. We allocated up to three points each for most recent studies, population sampled, country coverage and for the range of settings sampled, and deducted one point for drug treatment only samples due to the potential for bias.³⁸

Data extraction

The results of the multivariate studies meeting our inclusion criteria were extracted as presented, regardless of the strength of association. Comparable factors were collected and examined using forest plots showing the effect estimates and 95% CI. We classified the results of the multivariate studies as ‘individual-level’ factors or ‘environmental-level’ factors based on the proximity of the risk of the factor in terms of HIV transmission. Individual-level risk characteristics or activities included injecting and sexual risks, such as sharing needles or unprotected sex, that shape an individual’s HIV risk through direct biological mechanisms. Environmental-level factors are those which have no direct biological means of influencing HIV risk; however, their presence or absence has been identified as an independent factor in the risk faced by an individual, indicating their role in shaping a ‘risk environment’.

Coverage of HIV prevention interventions

In addition to the systematic review, data summarising the coverage of HIV prevention interventions was drawn

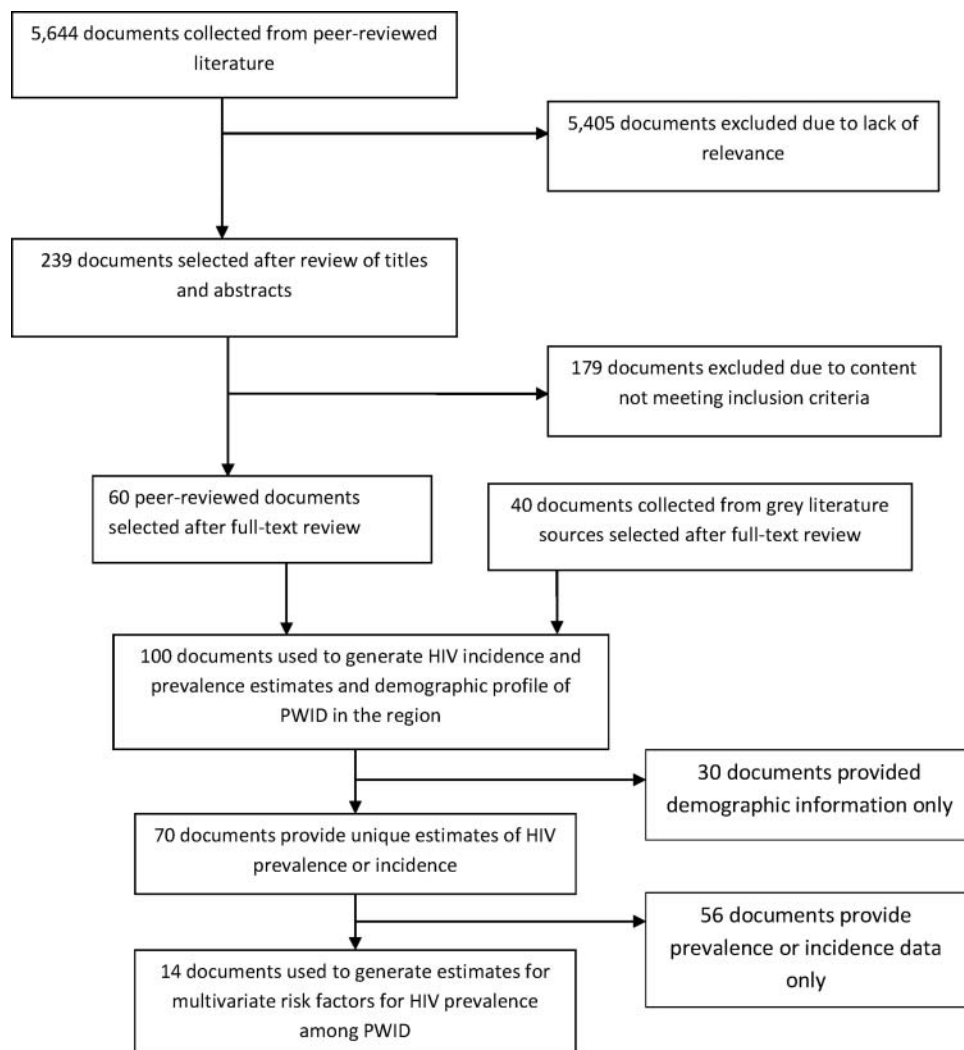


Figure 1 Flowchart of study selection.

primarily from recently published reviews³⁹ and previously published country-level data.⁴⁰ These data are collected from a variety of sources, including UNGASS, WHO and systematic reviews of scientific literature,³⁹ as well as from routine national reports.⁴⁰

Policy environment index

We generated a simple index of 'enabling' policy environment. Our interpretation of an enabling policy environment drew upon guidelines generated by WHO,⁴¹ UNAIDS,⁴² international non-government organisations (NGOs)⁴³ and peer-reviewed papers in this field.^{20 30 32 44} As outlined in box 1, the core items of the index included indicators, at the country level, of: coordinated national strategy to HIV prevention and drug use (indicated by evidence of explicit inclusion of 'harm reduction' in national-level strategy, and monitoring and evaluating HIV epidemics); meaningful engagement of stakeholders in HIV prevention policy formation and programming (indicated by evidence of a national organisation of drug users); and evidence-based HIV prevention intervention approaches (indicated by presence of OST and NSP, presence of OST and NSP in prison settings, and evidence of de-emphasising criminalisation through the use of administrative penalties for drug use possession for personal use).

Indicator data were obtained from a combination of sources, including: global reports of harm reduction policy and coverage;⁴⁵ country profiles collated and updated by the EMCDDA;⁴⁶ our systematic review of research studies (see above and figure 1); and the International Network of People who Use Drugs (Albers ER, personal communication with EJ, 2011). The index was constructed by allocating equal weight to each of the six items and aggregating a score for each country, with higher scores indicating a more 'enabling' environment conducive to evidence-based public health approaches.

RESULTS

HIV incidence

Only three papers reviewed reported HIV incidence among PWID in this region. Two in Tallinn, Estonia, reported an HIV incidence rate of 31/100 person-years (PY) in 2004, decreasing to 9/100 PY in 2009 among people injecting for less than 3 years.^{47 48} The other from St. Petersburg, Russia, reported a rate of 4.5/100 PY.⁴⁹

HIV prevalence

Estimates of HIV prevalence among PWID vary widely throughout the region. A total of 79 sources reported HIV prevalence estimates (some multiple), of which 67 reported unique HIV prevalence estimates among PWID in the region; 44 from Eastern Europe and Central Asia^{6 49–88} and 21 from Central Europe^{89–109} and two that contained data from both regions.^{40 110}

Box 1 A simple index of enabling policy environment

Meaningful engagement of stakeholders

▶ The meaningful involvement of people who inject drugs (PWID) in policies affecting their health and welfare and in related HIV prevention programming is accepted as an important indicator of 'health policy' formation.^{42 157} While assessing 'meaningful involvement' is complex, we adopt a simple indicator: *the presence of a national organisation of drug users*.

Coordinated national strategy to HIV prevention and drug use

▶ Explicit and supportive reference to 'harm reduction' in national policy documents can mark a commitment to evidence-based interventions as part of HIV prevention responses targeting PWID. International agencies advocate institutional and national-level endorsement of harm reduction as a feature of national strategy.^{33 158} We adopt *evidence of explicit supportive reference to harm reduction in national strategy* as an indicator of enabling policy environment.

▶ Monitoring and evaluating the state of the epidemic and response are important elements of building evidence-based responses.^{40 159} Targeted sero-prevalence and behavioural surveillance is recommended in concentrated HIV epidemics.¹⁶⁰ We adopt as an indicator of enabling policy *evidence of at least one HIV sero-prevalence and one behavioural study among PWID since 2000*.

Implementation of Public Health-oriented approaches to reducing harm

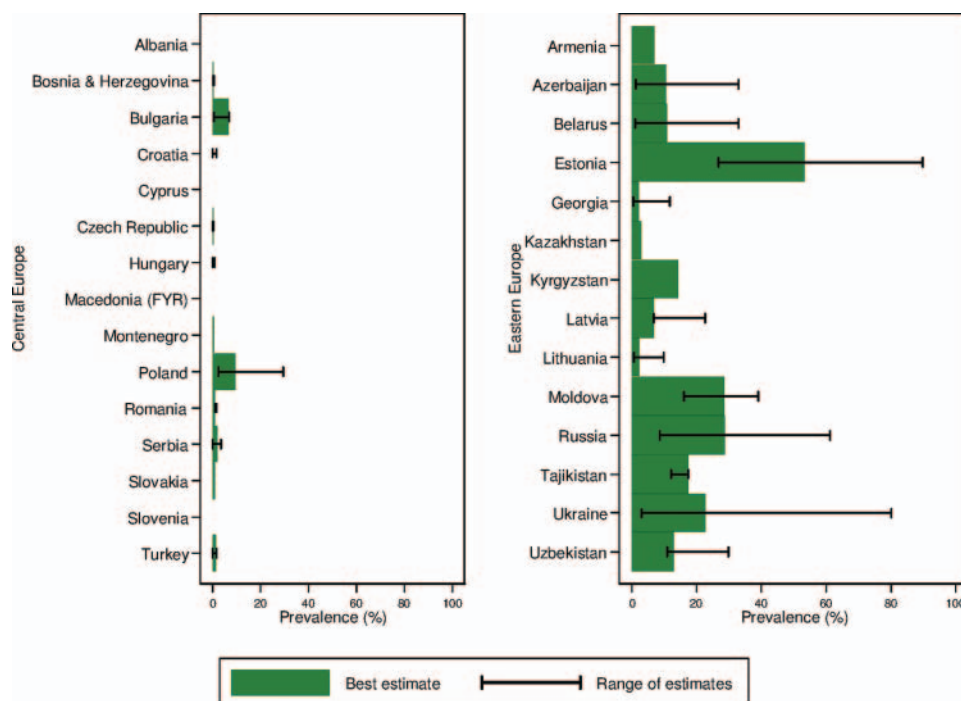
▶ Drug control policies which seek to distinguish drug users from drug traders and traffickers, and which de-emphasise the criminalisation of drug users, can give priority to public health-oriented approaches to reducing drug-related harm. We adopt the *application of administrative rather than criminal penalties for drug use and possession of quantities for personal use* as an indicator of an enabling policy environment.

▶ We adopt *the legal availability of opioid substitution treatment (OST) and needle and syringe distribution programmes (NSP)* in a country as an indicator of enabling policy environment. These are core components of the recommended nine combination HIV prevention interventions for PWID.³³ Many countries have adopted at least some recommended measures, but often the components missing are OST and NSPs. The effectiveness of both in improving the health of PWID is well established,^{32 154 161} especially for OST.^{162–168} OST also facilitates access to and augments the effects of other interventions, such antiretroviral HIV treatment.^{32 151}

▶ *The availability of OST and NSPs in prison* can show a country's willingness to address the needs of even the most marginalised of its citizens, as well as demonstrating noteworthy scale of the programmes. Because of existing laws concerning drug use and possession, PWID in many countries account for disproportionately high rates of incarceration.¹³⁹ Prisons may act as a risk environment for HIV transmission linked to drug injecting. International guidelines¹⁶⁹ recommend continuity of services between prison and communities and some countries have developed successful partnerships between penal systems and HIV services, including in the European region.¹⁷⁰

Multiple estimates exist for many countries (figure 2), and where this was the case we applied the scoring system described above (see Methods section) to select

Figure 2 The range of HIV prevalence estimates for countries in the Central and Eastern European region, along with the estimate judged 'best' highlighted in green.



the estimate that appeared to be most representative at the country level. Using these estimates, we have categorised country HIV epidemics among PWID as: 'low' (up to 1%); 'medium' (2–5%); 'high' (5–20%); and 'very high' (greater than 20%).

No country in the East can be considered to have a 'low level' of HIV among PWID, and only Kazakhstan, Georgia and Lithuania have 'medium level' epidemics, according to the studies examined here. Of the remaining 11 countries with data (no data exist for Turkmenistan), three have prevalence estimates of over 20% (Moldova, Russia and Ukraine) and Estonia has a prevalence of over 50%. In the Centre only Poland and Bulgaria appear to have 'high level' epidemics and neither of these exceed 10% prevalence. Several countries (Albania, Croatia, Cyprus, Hungary, Macedonia and Slovenia) report 0% HIV prevalence among PWID. However, there are less data from this region and sample sizes are generally smaller so the estimates may be less robust than those from the East.

Demographic profile

Generally, three times as many men as women inject drugs, although male predominance reached as high as 95% in some studies from the Caucasus.^{50 54 55 62 64 85 111} The mean age of PWID participating in studies was mid-20s, although many studies restrict recruitment to PWID aged 18 or over. The proportion of PWID reporting having regular income was generally low.

Pattern of injecting drug use

Heroin is the drug of choice among PWID in Europe, although there are sub-regional differences. In Moldova,¹¹² Ukraine⁷³ and Russia,⁵² the injection of home-produced opioids such as 'hanka' or 'shirka'

(a liquid poppy extract) is reported alongside heroin injection. In Estonia the use of the synthetic opiate, fentanyl ('China White', 'White Persian' or 'Afghan'), has become common alongside amphetamine injection.^{71 113} In Central Europe, heroin is reported as the main drug injected, although studies also report between 30% and 51% injecting amphetamines as their main drug,^{100 114 115} and the Czech Republic reports the highest prevalence of methamphetamine use in Europe.^{116–118} The frequency of injection varies widely throughout the region.

Contact with criminal justice systems

The data reviewed from Eastern Europe and Central Asia suggest that between half and three-quarters of PWID have experienced arrest. A study among 600 PWID in Odessa, Ukraine found that police beatings were common, with nearly 50% reporting at least one such experience.^{20 119} Studies in other regions also suggest relatively high rates of police arrest (42–76% ever having been arrested).^{18 27 107 120} In Estonia and Lithuania, an estimated 58–70% of PWID had been in prison at least once.⁷⁴ In Georgia and Russia, this figure was between 6% and 37%,^{18 52 64 65 79 121 122} In Central Europe, between 18% and 50% of respondents report previously having been in prison.^{93 107}

Individual-level risk factors for HIV

No studies examined risk factors linked to HIV in the Centre, and so we summarise the findings of the multivariate HIV risk factor analyses from 14 papers identified by our review in the East,^{49 51–53 57 65 72 73 88 113 121 123–125} although two^{65 72} present new analyses of data already published in other papers also presented here.^{123 125} Table 1 summarises the key characteristics of the 14 papers as well as the factors explored in the multivariate

Table 1 Summary of studies presenting multivariate analyses of risk factors for HIV among people who inject drugs (PWID) in Central and Eastern Europe and Central Asia

Study (year)	Location	Sample	Individual-level risk factors	Environmental-level risk factors
Platt <i>et al</i> (2006) ¹¹³	Estonia, Tallinn	350 PWID who injected in past 4 weeks recruited by respondent-driven sampling (RDS)	Primary injection of opioid or amphetamine in past 4 weeks*; Duration of injecting career; Shared needle in past 4 weeks; Shared equipment in past 4 weeks; Injected with a used needle of a sex partner in past 4 weeks*; Number of sexual partners in past year	Age; Gender; Main source of income in past 4 weeks; Ethnicity; Ever registered in drug treatment*; Ever been in prison; Ever attended needle exchange
Abel-Ollo <i>et al</i> (2009) ⁷¹	Estonia, Tallinn and Kohtla-Järve	450 PWID (350 from Tallinn and 100 from Kohtla-Järve) who injected in past 4 weeks recruited by RDS. For analysis the participants were categorised as HIV-, HIV+ aware of their status and HIV+ unaware of their status, according to self-reported status at the time of testing The data from Tallinn is also analysed above	Analysis of risk factors for HIV among participants aware of their status (ref HIV participants): Sharing used needles/syringes in past 4 weeks*; Unprotected sex in past 4 weeks; Sharing water*; PWID as sex partner in past year*; Sharing injection equipment with sexual partner in past year*; Having two or more sex partners in past year; Unprotected intercourse in past year; Ever sharing needles with HIV+ person*. Analysis of risk factors for HIV among participants unaware of their status (ref HIV- participants): Sharing used needles/ syringes in past 4 weeks; Unprotected sex in past 4 weeks; Sharing water; PWID as sex partner in past year; Sharing injection equipment with sexual partner in past year; Having two or more sex partners in past year*; Unprotected intercourse in past year*; Ever sharing needles with HIV+ person. Earlier age of initiation to injecting*; Primary injection of opioid or amphetamine*; Receptive sharing in past 6 months*	
Uusküla <i>et al</i> (2010) ⁸⁸	Estonia, Tallinn	350 PWID, aged 18+, who injected in past 2 months recruited by RDS		Ever attended syringe exchange*; Main source of income other than work*; Unemployment at habitat level*; Residential change at habitat level*

Continued

Table 1 Continued

Study (year)	Location	Sample	Individual-level risk factors	Environmental-level risk factors
Platt <i>et al</i> (2005) ¹²⁵	Russia, Togliatti	268 Male PWID who injected in past 4 weeks recruited in 2001 by outreach workers	Duration of injection; Injected with used paraphernalia in past 4 weeks*; Injected with used needle in past 4 weeks; Ever injected homemade drugs; Injected with used needle from someone known to be HIV+; Injected with used needle from someone known to be HCV+*; Unprotected anal or vaginal sex with a regular partner in past 4 weeks; Unprotected anal or vaginal sex with a casual partner in past 4 weeks*; Ever had an STI	Ever been in prison; Ever been in drug treatment; Ever been arrested
	Russia, Togliatti	89 Female non-sex worker PWID who injected in past 4 weeks recruited in 2001 by outreach workers	Duration of injection; Injected with used paraphernalia in past 4 weeks; Injected with used needle in past 4 weeks*; Ever injected homemade drugs; Injected with used needle from someone known to be HIV+; Injected with used needle from someone known to be HCV+; Unprotected anal or vaginal sex with a regular partner in past 4 weeks; Ever had an STI	Ever been in prison; Ever been in drug treatment; Ever been arrested
	Russia, Togliatti	66 Female sex worker PWID who injected in past 4 weeks recruited in 2001 by outreach workers	Duration of injection; Injected with used paraphernalia in past 4 weeks; Injected with used needle in past 4 weeks; Ever injected homemade drugs*; Injected with used needle from someone known to be HIV+; Injected with used needle from someone known to be hepatitis C virus+; Unprotected anal or vaginal sex with a regular partner in past 4 weeks; Ever had an STI	Ever been in prison; Ever been in drug treatment; Ever been arrested;
Platt <i>et al</i> , 2008 ⁶⁵	Russia, Togliatti	230 PWID (134 in 2001 from the study above, and 96 from 2004) who reported injecting for 3 years or less and injected in past 4 weeks were recruited by outreach workers in 2001 and through RDS in 2004	Duration of injecting career*; Frequency of injection; Ever injected homemade drugs; Injected with used needles in past 4 weeks; Used a previously used filter; Frontloading in past 4 weeks*;	Year of study*; Gender; Age; District of residence; Education; Main source of income

Continued

Table 1 Continued

Study (year)	Location	Sample	Individual-level risk factors	Environmental-level risk factors
			Injected with a prefilled syringe; Frequency of reusing the same needle; Ever exchanged sex for money, drugs or goods*; History of STIs	in past 4 weeks; History of prison; Police arrest in past year; Ever in drug treatment*; Main source of needles in past 4 weeks; Ever been tested for HIV
Kozlov <i>et al</i> (2006) ⁴⁹ *outcome is HIV incidence at 12 month follow up to enrolment	Russia, St. Petersburg	520 Sero-negative PWID enrolled in cohort study who injected at least three times/week in past month or reused another's injecting equipment at least three times in past 3 months	Frequency of injecting psychostimulants*; Number of sex partners in past 6 months; Selling sex for money or goods in past 6 months	
Niccolai <i>et al</i> (2010) ¹²¹	Russia, St. Petersburg	387 Ever injectors were enrolled through RDS	Unsafe injection in past 30 days*; Has STI*;	Unemployed*
Rhodes <i>et al</i> (2006) ⁵²	Russia, Moscow	455 PWID who injected in past 4 weeks recruited by outreach workers	Duration of injecting career; Last day injected, number of times injected*; Frequency of injection; Main drug injected in past 4 weeks; Injected with used needle in past 4 weeks; Shared paraphernalia in past 4 weeks; Ever injected with used needles*; Number of sex partners in past year; History of STI*	Gender; Age; Education; Main source of income in past 4 weeks; Ever been in prison*; Ever registered as a drug user*
	Russia, Volgograd	517 PWID who injected in past 4 weeks recruited by outreach workers	Duration of injecting career; Frequency of injection*; Ever injected homemade drugs; Injected with used needle in past 4 weeks; Shared paraphernalia in past 3 weeks; Ever injected with used needles; Injected with needle previously used by sex partner in past 12 months*; Number of sex partners in past year; History of STI	Gender; Age; Education; Main source of income in past 4 weeks*; Ever registered as a drug user
	Russia, Barnaul	501 PWID who injected in past 4 weeks recruited by outreach workers	Duration of injecting career; Last day injected, number of times injected*; Frequency of injection; Main drug injected in past 4 weeks; Ever injected homemade drugs;	Gender; Age; Education; Main source of income in past 4 weeks;

Continued

Table 1 Continued

Study (year)	Location	Sample	Individual-level risk factors	Environmental-level risk factors
			Injected with used needle in past 4 weeks; Shared paraphernalia in past 4 weeks*; Filled syringe from working syringe in past 4 weeks; Ever injected with used needles; Number of sex partners in past year; History of STI	Ever been in prison; Ever registered as a drug user
Beyrer <i>et al</i> (2009) ⁷²	Tajikistan, Dushanbe	419 PWID who injected in past month aged 17 or over recruited through snowball technique	Daily injection in past 6 months*	Ethnicity* Model adjusted for gender
Stachowiak <i>et al</i> (2006) ¹²³	Tajikistan, Dushanbe	207 Ethnic Tajik PWID (subsample of above) aged 17 or over recruited through snowball technique	Injecting at least daily for past 6 months*; Less than 3 years since initiation of injection; Injects 'alone'*; Injected with used needle in past 6 months	Reports narcotics 'very easy' to obtain*; Ever experienced drug treatment*
Booth <i>et al</i> (2006) ⁵¹	Ukraine, Kiev, Odessa, Makeevka/ Donetsk	778 PWID aged 18+ who injected in past 30 days and were unaware of their HIV status recruited through outreach workers	Injected sedative/ opiate mix in past 30 days*; Daily injection in past 30 days*; Sex in past 30 days*; Sex with HIV+ or unknown status partner in past 30 days*	Age*; Gender*; City of origin*
Robbins <i>et al</i> (2010) ¹²⁴	Ukraine, Odessa, Kiev, Donetsk	313 Youth aged 15–24 who live part or full time on the street and reported ever injecting recruited by time–location sampling	Last sex unprotected*; Ever diagnosed with STI* Model adjusted for gender, age, education, work for pay, orphan status, spending nights outside of residence ≥2 nights/week for past few months/ no place to live, city of residence	
Dumchev <i>et al</i> (2009) ⁷³	Ukraine, Vinnitsya	268 PWID aged 18+ who report at least three injections in past 30 days and have lived in Vinnitsya for past year, recruited through snowball sampling	Shared needles with HIV+ person in past year*; Inject opiates daily*	HIV knowledge score*
Taran <i>et al</i> (2011) ⁵⁷	Ukraine, 16 cities	3487 PWID aged 16+ who injected in past 30 days and were recruited through RDS	Type of drug injected in past month; Duration of injecting career*; Injecting frequency in past month; Used alcohol with drugs in past month*; Shared needle at last injection*; Frequency of sharing paraphernalia in past month*; Sexual contact in past year	Gender*; Marital status; Occupation*; Education*
Sanchez <i>et al</i> (2006) ⁵³	Uzbekistan, Tashkent	701 Self-identified PWID aged 18+ available for 2 weeks after enrolment by outreach workers	Age at first drug use; First illicit drug of use*; Duration of injecting career; Current heroin use; Injecting frequency;	Age; Gender; Nationality; Marital status; Employment status*

Continued

Table 1 Continued

Study (year)	Location	Sample	Individual-level risk factors	Environmental-level risk factors
			Poppy-straw use; Group drug use; Sharing needles; Own syringe; Blood transfusion; STI history; Hepatitis history*; TB history; STI symptoms; Sell sex for drugs; Condom use*; Number of sexual partners in past month	Education status; Needle exchange programme; AIDS knowledge; protection for AIDS; Donated blood for money*

* p Value reported ≤ 0.05 .

analysis. The forest plots summarised in figures 3 and 4 synthesise the effects of particular individual and environmental risk factors on HIV. Although studies measure similar associations, it is important to note that each may have carried out analyses in a unique manner, adjusting for different confounding variables.

As shown by the individual risk factor estimates presented in figure 3, many studies investigated the link between HIV and *injecting with a used or shared needle*. Although the effect sizes tend towards increased HIV risk, most results are inconclusive, ‘social-desirability’ bias possibly influencing self-reported responses. Injecting with the used needle of a sex partner was found in Volgograd⁵² and Tallinn¹¹³ to clearly increase an individual’s odds of HIV. More definitively, injecting with a needle previously used by someone known to have HIV or hepatitis C is shown in most studies to be clearly positively correlated.^{72 125} *Daily injecting* is also found to be positively associated. Many reviewed studies also associate *longer injecting careers* with greater odds of having HIV.¹²⁵ Although a Russian study found no difference in an individual’s odds of HIV according to the primary drug they inject,¹²⁶ studies in Estonia found that primary injectors of an opiate (fentanyl) had between three and four and a half times greater odds of HIV than individuals who primarily inject amphetamines.^{113 127}

Regarding exploration of HIV and associated *sexual risk* including sex work (SW), most multivariate analyses explored the associations between exchanging sex for drugs or money, the number of sexual partners, and unprotected vaginal or anal sex, as risk factors. Although several strong univariate associations were found, these tended not to hold in the multivariate models (figure 3). This could be because sample sizes were insufficient or because much sexual risk behaviour is determined by other individual or environmental factors such as gender, socio-economic status or injecting behaviour.

Environmental-level risk factors for HIV

Although most studies presented show adjusted ORs (AOR) identifying female *gender* as a risk factor for HIV (figure 4), the CIs generally straddle one and are inconclusive.

Multiple studies link HIV to the *socio-economic status* of PWID, though economic status is defined through different measures, including level of education, employment (regular or not) and income (regular or not, legal or not; figure 4). Of these measures, only an individual’s employment status showed a consistent association with HIV, with unemployed individuals or those having a main source of income that was not work, showing greater odds of HIV than others.^{53 57 88 121} An Estonian multilevel study included neighbourhood level data in its analyses and found neighbourhood level effects of unemployment (10% increment in unemployment AOR 5.95, 95% CI 2.47 to 14.31) and habitat change since 1989 (10% change AOR 1.89, 95% CI 1.09 to 3.26) to be both associated with HIV prevalence (results not presented).

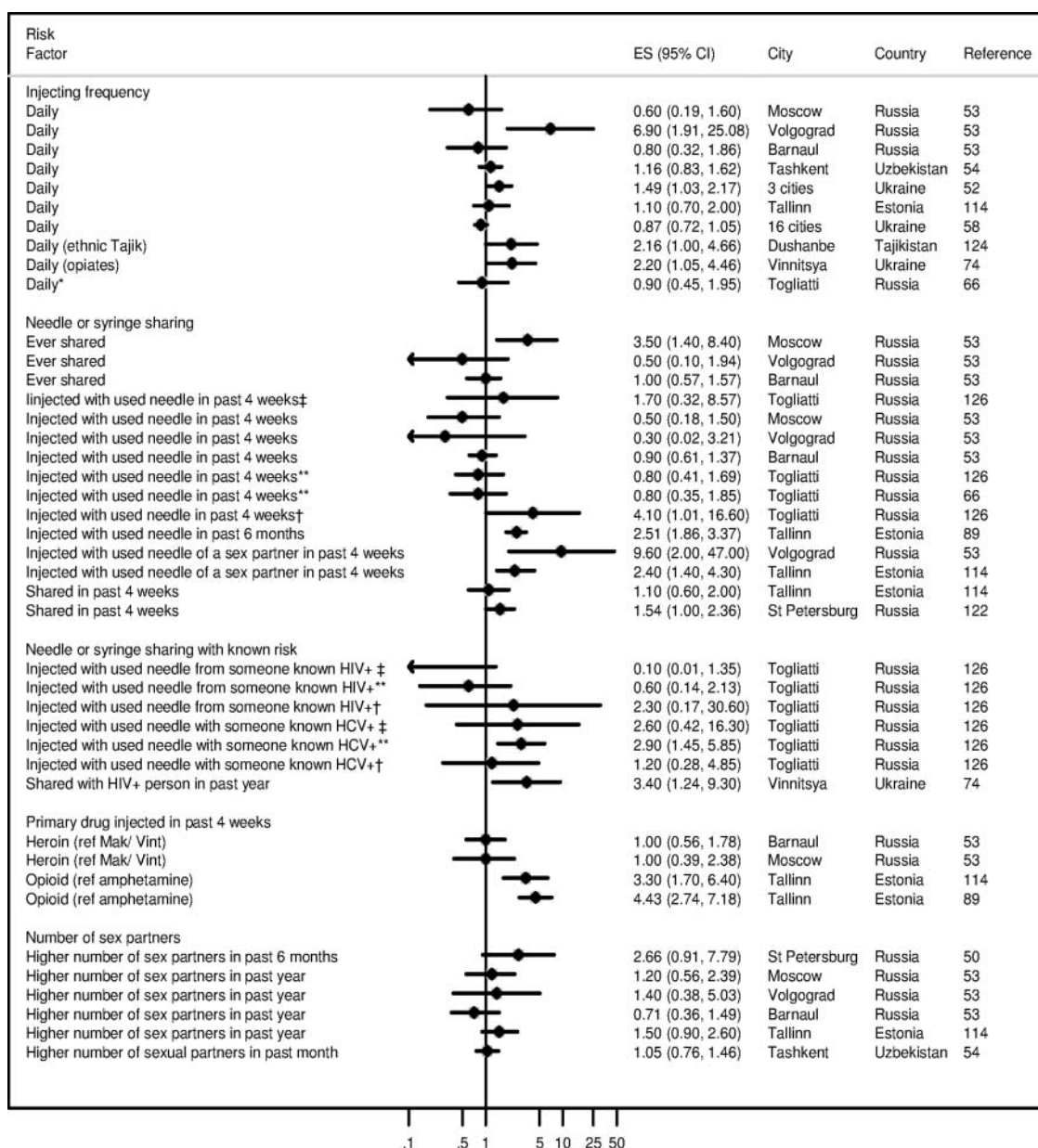


Figure 3 Adjusted effect estimates of individual level risk factors present in multivariate studies of PWID. *New people who inject drugs (PWID) (≤ 3 years); **male PWID; †female (non- sex work (SW)) PWID; ‡female (SW) PWID.

Several studies have examined *contact with law enforcement agencies* as an environmental factor linked with the odds of being HIV infected, although the results produced by the systematic review have large CIs and are largely inconclusive.^{52 65 113 125} The review reveals that contact between police and PWID in the region is highly commonplace and no studies examined the frequency or duration of contact.

In addition to the universally relevant factors highlighted above, some studies analysed the relationship between HIV and determinants that are particular to local context (results not shown). For example, a study in Tajikistan found that respondents identifying as Tajik (AOR 7.06, $p < 0.001$) or other ethnicity (AOR 6.05, $p < 0.001$) as opposed to Russian were at higher risk of

testing positive for HIV.⁷² A study in Uzbekistan similarly found respondents of Uzbek ethnicity to have higher odds of HIV than their Russian counterparts (AOR 1.20, 95% CI 0.80 to 1.80).⁵³ However, a study in Estonia found that ethnic Estonians had a reduced odds of HIV compared with those of Russian or other backgrounds (AOR 0.63, 95% CI 0.28 to 1.25).¹¹³ In Moscow and Tallinn ever having been registered as a PWID at drug treatment was found to be associated with more than double the odds of HIV (AOR 2.4, 95% CI 1.3 to 4.7; AOR 2.4, 95% CI 1.5 to 3.8).^{52 113} Conversely, a study in Togliatti in Russia conducted among 96 new (<3 years) injectors found having been in drug treatment in the past as negatively associated with risk of HIV (AOR 0.4, 95% CI 0.1 to 1.0).¹²⁸

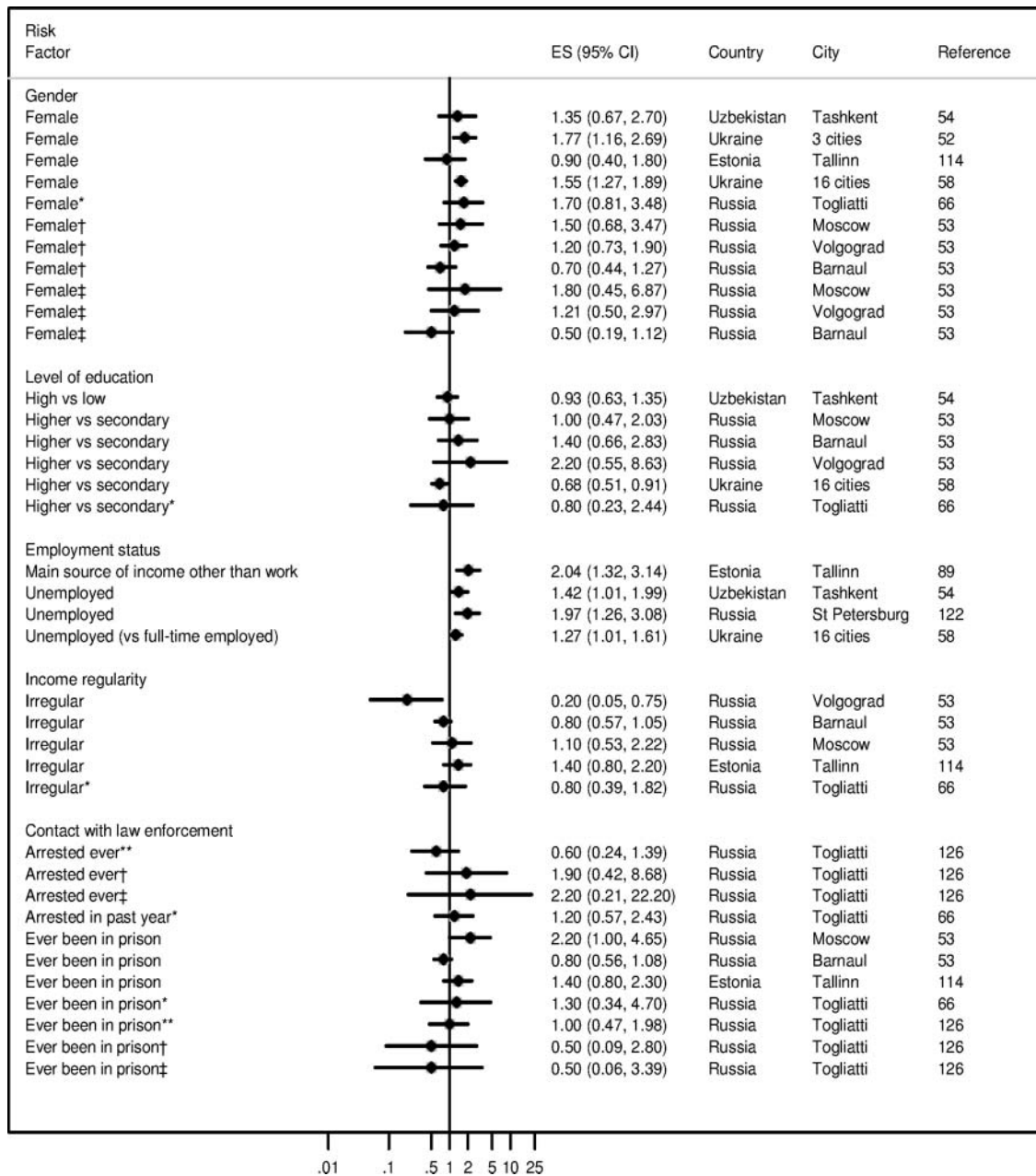


Figure 4 Adjusted effect estimates of environmental level risk factors present in multivariate studies of PWID. *New people who inject drugs (PWID) (≤ 3 years); **male PWID; †female (non-sex work (SW)) PWID; ‡female (SW) PWID.

HIV prevention coverage

Coverage—the proportion of the population at risk reached by an intervention, ideally with sufficient intensity to have probable impact—emerges as a critical determinant of HIV prevention effectiveness.^{32 129–131} Our review did not focus on collating primary data but sought to synthesise coverage estimates relevant to the Central and Eastern European and Central Asian region from key recently published reviews regarding NSPs, OST and ART.^{39 40} These data are contained in figure 5. They indicate that NSPs were available in all countries of the region, except for Turkey, though intervention coverage varies widely. For instance, whereas 50% of PWID in Hungary in 2007 had access to NSPs, with each receiving

around 135 clean needles a year (135 per PWID based on country-level estimates of PWID), in Russia only 7% of PWID had such access to NSPs, with each receiving 56 needles each a year (4 per PWID based on country-level estimates of PWID). These estimates do not include pharmacy-based provision, which is a primary source in some countries in this region, including Russia.¹³² Figure 5 also shows that 4 of the 30 countries in this region reporting evidence of injecting drug use did not provide OST: Russia, Uzbekistan, Turkmenistan and Turkey. Coverage of OST is generally low, with Slovenia showing the greatest coverage.

Comparing the proportion of HIV cases caused by injecting drug use with the corresponding proportion of

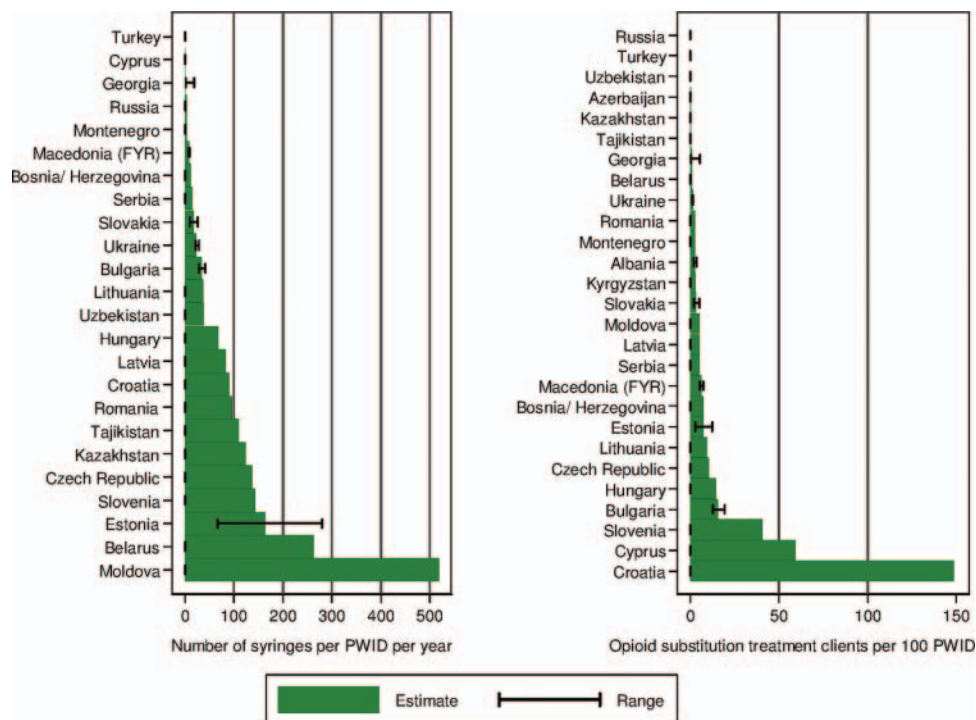


Figure 5 Estimated numbers of syringes distributed per people who inject drugs (PWID) per year and estimated number of opioid substitution treatment clients per 100 PWID in the latest year for which data is available.^{39 40}

people receiving antiretroviral therapy who inject drugs, in 2002, 71% of the reported people living with HIV acquired HIV infection through injecting drug use, whereas only 20% of those receiving antiretroviral therapy were people who injected drugs. In 2005 and 2006, among 21 and 23 countries with available data, people who injected drugs represented 77% of reported cases and 26% of antiretroviral therapy recipients, a proportion that declined to 22% in 2010 among 19 reporting countries. Although no trends can be statistically ascertained due to incomparable samples (notably missing data from the Russian Federation in 2002 and 2010), these data suggest that most of the people who acquire infection in reporting countries are people who inject drugs and that, despite this, their treatment needs remain considerably underserved.⁴

We found no data relating to the impact or coverage of structural level interventions on HIV among PWID, although recent legislative changes in Moldova and the Czech Republic have de-emphasised the criminalisation of small amounts of drugs possession.

Enabling policy environments

Figure 6 shows the results of the policy index developed (see Methods section) to describe the distribution of enabling policy environments throughout Central and Eastern Europe and Central Asia. Darker shading represents seemingly more supportive policy environments for HIV prevention and lighter shading seemingly less supportive environments.

Of the 30 countries in the region, 25 explicitly and supportively mentioned harm reduction in their national strategies, and 27 have undertaken at least one sero-prevalence and one behavioural study among PWID in the last 10 years. In 26 countries, OST and NSP are available generally, but available in prison in only three countries. Five countries have national organisations of drug users, and five countries use administrative rather than criminal penalties for people found possessing small quantities of drugs for personal use.

On the basis of the index, the countries with the most supportive policy environments are Moldova and Romania. The countries with the least supportive environments are Turkmenistan and Turkey. Turkmenistan does not show any of the features of a supportive environment according to our index, although Turkey has conducted at least one sero-prevalence and one behavioural study among PWID in the last 10 years. In Russia, where the majority share of HIV infections among PWID in the region are located, the national strategy refers to harm reduction as a threat to efforts to reduce the demand for drugs, with NSPs and OST specifically mentioned as problematic for federal level support.¹³³ OST is unavailable in Russia, and NSPs are limited in number, with none available to prisoners, and there is a focus on criminal rather than administrative penalties for drugs possession. However, there is some evidence of drug user activism and organisation (Albers ER, personal communication with EJ, 2011).

Russia and Ukraine both feature among the countries experiencing high HIV prevalence among PWID, and

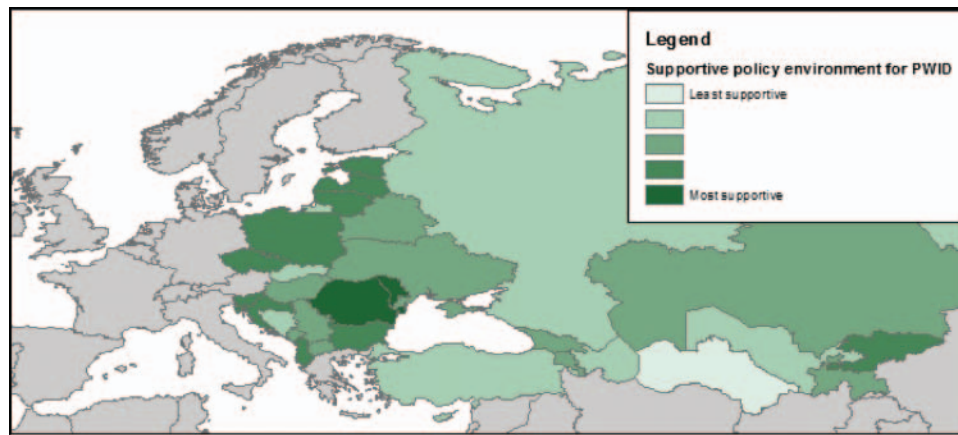


Figure 6 Map showing the supportiveness of the policy environments for HIV among people who inject drugs in Europe.

like Russia, criminal punishment rather than administrative sanctions for drug use and possession is the norm in Ukraine. While Ukraine has a relatively high number of NSPs alongside increasing availability of OST, it does not provide harm reduction services in prisons. Moldova and Estonia also feature among the high-HIV-prevalent countries but both appear as to present relatively supportive environments for PWID. However, to our knowledge, neither has an active national drug user organisation and neither NSP or OST in prison settings.

DISCUSSION

HIV epidemic contexts

All but one country (Turkmenistan) in Central and Eastern Europe and Central Asia has generated survey-based estimates of HIV prevalence among PWID. Our review of these studies shows that HIV prevalence among PWID is highest in the Eastern European countries of Estonia, Russia, Moldova and Ukraine (over 20% in each), and lowest in the Central European countries of Albania, Croatia, Cyprus, Hungary, Macedonia (FYR) and Slovenia (0% in each). We identified only three HIV incidence studies among PWID in the region, showing an incidence of 9/100 PY in Estonia in 2009⁴⁸ and 4.5/100 PY in Russia.⁴⁹ Accepting that country estimates of HIV prevalence inevitably only reflect the characteristics of the particular samples from which they are drawn, these estimates taken together reiterate that the burden of HIV linked to injecting drug use falls in the East, and especially Russia, where over half of all HIV cases among PWID in the region are located.

Multivariate analyses of HIV risk factors among PWID underscore injecting with a used needle/syringe, frequent injecting, and injecting opiates as opposed to amphetamines as proximal factors associated with increased risk of HIV. We acknowledge that the findings of the multivariate studies we synthesise in the review may not be directly comparable, as they have been derived from studies using different regression

techniques and adjusting for different confounding factors. While most of the epidemiological studies we reviewed did not embrace, by design, the exploration of environmental risk factors—as is the case with HIV epidemiological studies globally²⁰—a number of important factors in the HIV risk environment can be identified. These included increased HIV risk among *women*, an association we interpret to have indirect, rather than biological, causative roots through pathways involving multiple linked socio-economic differences related to gender. Although most studies showed women at greater risk of HIV than men, the CIs presented include the null value, preventing us from drawing conclusions on the effect of gender on HIV risk. The lack of conclusive evidence could be due to the small number of women often recruited in to research, as well as genuine variability in the consequences of female gender in different settings. Qualitative data from Ukraine suggest that female PWID are at increased risk of psychological, physical (including sexual) and economic violence from their male partners, constraining capacity to negotiate safer sex, safer injecting practices and access to helping services, thus elevating their HIV risk.¹³⁴

Additionally, *socio-economic status*—whether measured by income or employment—emerged as important, although only employment status appeared conclusively associated with HIV risk. The direction and pathways income and employment effects have on HIV risk may vary locally. The ways in which HIV links to wealth and poverty is shaped by social context, and in some settings injecting has diffused among those whose economic status may be comparable to the wider local population.^{52 135}

Lastly, we note contact with *criminal justice agencies*, including experience of incarceration, as an important risk factor,^{52 65 113 125} although the studies systematically reviewed here were inconclusive in this regard. Studies evidencing the adverse effects of the legal environment on HIV risk among PWID suggest a relationship between street-based policing practices, including extra-judicial ones such as police violence, and increased HIV

vulnerability, including through reduced capacity for risk avoidance as a consequence of safety short-cuts and rushed injections borne out of a fear of detection or arrest.^{18 27 119 136–138} While evidence internationally links prison and a history of incarceration to elevated odds of HIV among PWID,^{139 140} only three countries in the region (Moldova, Romania and Kyrgyzstan) provide harm reduction services to prisoners. An association between HIV among PWID and being of a minority ethnicity that cannot otherwise be explained by needle sharing has been noted elsewhere, and linked to material as well as other social inequalities, including access to support services.^{141 142} In parts of Eastern Europe and Central Asia where PWID are often required to register as such to obtain drug treatment or are forced to through contact with police, this can lead to increased social marginalisation as well as reducing their ability to gain employment or even to drive a car.¹⁴³

While the epidemiological studies we reviewed provide some pointers to the role of HIV risk environments, they are self-evidently limited in their capacity to capture how HIV is an effect of social context. This highlights the urgency to develop specifically tailored social epidemiological approaches, which build into their designs from the outset measures of micro and macro risk environment. It also highlights the importance of mixed-methods approaches, especially those combining qualitative with epidemiological data.¹⁴⁴ For example, by linking HIV epidemiology to data on shifting drug trafficking routes it has been possible to plot the macrophysical distribution of HIV.¹⁴⁵ In the region of Central and Eastern Europe and Central Asia, the potentially HIV risk productive role of transit routes for heroin originating from Afghanistan through Central Asian countries along the 'Northern Route' to Russia and beyond provides a similar example. In 2009, UNODC estimated that 25% of all Afghan heroin (95 metric tons) was transported along this route, with the majority travelling through Tajikistan, to Osh in Kyrgyzstan, and then on to Kazakhstan, before arriving in Russia.¹⁴⁶ The effects of this trafficking route appear to have HIV impacts with Kulyab, in Tajikistan, a major hub for Afghan opiate trafficking, reporting the highest HIV prevalence among PWID in Tajikistan at 34.5% in 2009 compared with the national average of 17.3%.¹⁴⁷ Jalal-Abad reported the highest HIV prevalence among PWID in Kyrgyzstan at 14% in 2007¹⁴⁸ compared with a national average of 7.7%.⁸³ In Kazakhstan, there is substantial overlap between the sites with the largest number of diagnosed HIV infections, largest number of registered drug users and highest number of heroin seizures.¹⁴⁹

Future epidemiological studies of HIV among PWID need to better systematically develop measures of HIV risk environment and how these combine to increase or reduce HIV risk.²⁰ Because epidemiological studies of PWID tend to focus on the proximal determinants of risk behaviour and HIV transmission, there is a need to shift towards capturing distal factors and how these interplay

to produce pathways of risk.^{19 20 28 150} Principal among these, according to our review, should be gender, social-economic status, and the effects of criminalisation.

In addition to the limitations discussed above, the study is subject to several potential biases including missing key documents, especially those not published in the English language. Individual studies may tend to publish what are considered 'interesting' results, leading to potential publication bias towards analyses reporting significant results. This can lead a systematic review such as ours to overstate the effect of several factors. As some elements of this review were undertaken by the same authors, this may reduce protection against human error and preservation of independence between the stages of the review.

Towards enabling policy environments

It is well established that HIV prevention targeting PWID requires a 'combination intervention' approach tailored to local setting, including a balance of: needle and syringe distribution programmes (NSPs); opioid substitution treatment (OST); antiretroviral HIV treatment (ART); peer education and outreach; HIV testing and counselling services; and the promotion of public policies and other structural changes conducive to public health approaches.^{20 32 33 151–153} Evidence for the effectiveness of these interventions is well established.^{32 151 154 155} The extent of HIV prevention intervention coverage, however, varies throughout the region, and is largely inadequate.^{39 40} Many of the countries with the lowest levels of harm reduction service provision are also those with the highest HIV prevalence and the largest per-capita number of new diagnoses. The unavailability of OST in Russia in particular means that the majority of PWID in the region do not have access to an integral component of evidence-based HIV prevention.

Structural interventions seek to remove environmental barriers to HIV prevention while enabling environmental conditions which protect against vulnerability to HIV. While the relationships between HIV-related policies and their impacts upon micro-level HIV risk practices are clearly not straight forward, the policy environment is a clear object of structural intervention and change. Our review identified no evidence specifically relating to the impact or coverage of structural-level interventions on HIV among PWID, although recent legislative changes in Moldova and the Czech Republic have de-emphasised the criminalisation of small amounts of drug possession, and evidence elsewhere in Europe links such initiatives with reduced HIV risk and increased access to helping services.¹⁵⁶

In the absence of social epidemiological data generated from systematic review, we developed a crude index of 'enabling policy environment' based on indicators of: national-level policy endorsing of harm reduction approaches; research of HIV prevalence and risk behaviour among PWID; drug user community organisation; availability of OST and NSPs; availability of OST and

NSPs in prison settings; and application of administrative rather than criminal penalties for drug use and possession (see box 1). Such an index seeks to include quantifiable indicators of the practical application of 'healthy policy', at least as far as such data is comparatively available. We acknowledge the limits of this exercise, but argue for the need for future epidemiological research to better monitor indicators of enabling and risk environment alongside proximal risk factors for HIV, especially those pertaining to community involvement and partnership in policy formation, availability of HIV prevention in criminal justice settings, and shifts towards de-emphasising the criminalisation of drug use through providing treatment or care as an alternative to arrest or imprisonment.

Applying our index of enabling policy environment highlighted large discrepancies throughout the region. Of the countries with a seemingly unsupportive environment for HIV prevention among PWID, Turkmenistan may present a particular concern, for it is located between countries of high HIV prevalence, situated on a heroin trafficking route and appears to lack a baseline of epidemiological evidence. Other countries—including Russia, Uzbekistan and Azerbaijan—appear to present weak policy environments for HIV prevention, compounding potential risk linked to low-level HIV prevention coverage. The lack of systematic monitoring of policy environment indicators in the region, and the neglected attention paid to monitoring the effect of structural-level factors on microrisk relationships in epidemiological research, hampers an understanding of how European HIV epidemic contexts may differ markedly regarding HIV prevention need and potential. The development of structural HIV prevention interventions as part of a combination intervention approach clearly requires evidence of how environmental-level factors impact upon HIV risk.

The importance of reducing vulnerability to HIV/AIDS, by understanding and removing structural barriers, is increasingly recognised in European HIV policy, for example as one of the four strategic directions of the European Action Plan for HIV/AIDS 2012–2015, which proposes actions to: address laws and regulations that present obstacles to effective HIV prevention, treatment care and support; strengthen the enforcement of protective laws and regulations; strengthen civil society involvement in the HIV response and ensure gender and age equity in access to HIV and related health services.

Author affiliations

¹Centre for Research on Drugs and Health Behaviour, London School of Hygiene and Tropical Medicine, London, UK

²Centre for Infections, Health Protection Agency, London, UK

³Eurasian Harm Reduction Network, Vilnius, Lithuania

⁴Global Health Research Center of Central Asia, Columbia University, New York, New York, USA

⁵Division of Communicable Diseases, Health Security and Environment, World Health Organization Regional Office for Europe, Copenhagen, Denmark

⁶Global HIV/AIDS Programme, World Bank, Washington DC, USA

Contributors TR, LP and VH developed the methodology for the systematic review. TR, LP, VH, AL and EJ reviewed the collected literature. EJ and VH extracted the data. EJ conducted the data analysis. TR and EJ interpreted the data and drafted the manuscript. All authors reviewed the manuscript and commented on the data and interpretation. All authors gave approval for the manuscript to be submitted.

Funding This review was undertaken as part of a larger project funded by the World Bank to review HIV in vulnerable populations in Europe, grant number 7153690.

Competing interests None.

Provenance and peer review Not commissioned; externally peer reviewed.

Data sharing statement No additional data are available.

REFERENCES

1. Joint United Nations Programme on HIV/AIDS (UNAIDS). Global report: UNAIDS report on the global AIDS epidemic 2010, 2010.
2. European Centre for Disease Prevention and Control/WHO Regional Office for Europe. *HIV/AIDS surveillance in Europe 2010*. Stockholm: European Centre for Disease Prevention and Control, 2011.
3. Department of Health and Social Development of Russian Federation, Federal Service for supervision of Consumer Protection and Human Welfare, Federal Government Central Science Research Agency Institute of Epidemiology, Federal Research and Methodological Center for Prevention and Control of AIDS. HIV INFECTION Newsletter № 35. Moscow, 2011.
4. UNAIDS. Global HIV/AIDS response: epidemic update and health sector progress towards Universal Access. Progress Report 2011.
5. Mathers BM, Degenhardt L, Phillips B, *et al*. Global epidemiology of injecting drug use and HIV among people who inject drugs: a systematic review. *Lancet* 2008;372:1733–45.
6. UNGASS. ed. UNGASS Country Progress Report: Republic of Moldova. Chisinau, Moldova, 2010.
7. Bargagli AM, Hickman M, Davoli M, *et al*. Drug-related mortality and its impact on adult mortality in eight European countries. *Eur J Pub Health* 2006;16:198–202.
8. Degenhardt L, Hall W, Warner-Smith M. Using cohort studies to estimate mortality among injecting drug users that is not attributable to AIDS. *Sex Transm Infect* 2006;82(suppl 3):iii56–63.
9. Cusick L. Widening the harm reduction agenda: from drug use to sex work. *Int J Drug Policy* 2006;17:3–11.
10. Poundstone KE, Strathdee S, Celentano DD. The social epidemiology of human immunodeficiency virus/acquired immunodeficiency syndrome. *Epidemiol Rev* 2004;26:25–35.
11. Rhodes T. The 'risk environment': a framework for understanding and reducing drug-related harm. *Int J Drug Policy* 2002;13:85–94.
12. Rhodes T, Singer M, Bourgois P, *et al*. The social structural production of HIV risk among injecting drug users. *Soc Sci Med* 2005;61:1026–44.
13. Sumartojo E. Structural factors in HIV prevention: concepts, examples, and implications for research. *Aids* 2000;14(suppl 1):S3–10.
14. Latkin CA, Hua W, Forman VL. The relationship between social network characteristics and exchanging sex for drugs or money among drug users in Baltimore, MD, USA. *Int J STD AIDS* 2003;14:770–75.
15. Latkin C, Mandell W, Vlahov D, *et al*. Personal network characteristics as antecedents to needle-sharing and shooting gallery attendance. *Social Netw* 1995;17:219–28.
16. Donoghoe MC, Lazarus JV, Matic S. HIV/AIDS in the transitional countries of eastern Europe and central Asia. *Clin Med J R College Physicians* 2005;5:487–90.
17. Rhodes T, Wagner K, Strathdee SA, *et al*. Structural violence and structural vulnerability within the risk environment: theoretical and methodological perspectives for a social epidemiology of HIV risk among injection drug users and sex workers. In: O'Campo P, Dunn JR, eds. *Rethinking social epidemiology: towards a science of change*. Springer: London, 2011.
18. Sarang A, Rhodes T, Sheon N, *et al*. Policing drug users in Russia: risk, fear, and structural violence. *Subst Use Misuse* 2010;45:813–64.
19. Galea S, Hall C, Kaplan GA. Social epidemiology and complex system dynamic modelling as applied to health behaviour and drug use research. *Int J Drug Policy* 2009;20:209–16.

20. Strathdee SA, Hallett TB, Bobrova N, *et al.* HIV and risk environment for injecting drug users: the past, present, and future. *Lancet* 2010;376:268–84.
21. Rhodes T, Ball A, Stimson GV, *et al.* HIV infection associated with drug injecting in the Newly Independent States, eastern Europe: the social and economic context of epidemics. *Addiction* 1999;94:1323–36.
22. Bjerregaard P. Rapid socio-cultural change and health in the Arctic. *Int J Circumpolar Health* 2001;60:102–11.
23. Durkheim E. *Suicide*. London: Routledge, 2002.
24. McKee M, Leon DA. Social transition and substance abuse. *Addiction* 2005;100:1205–9.
25. Leon DA, Chenet L, Shkolnikov VM, *et al.* Huge variation in Russian mortality rates 1984–94: artefact, alcohol, or what? *Lancet* 1997;350:383–8.
26. Barnett T, Whiteside A, Khodakevich L, *et al.* The HIV/AIDS epidemic in Ukraine: its potential social and economic impact. *Soc Sci Med* 2000;51:1387–403.
27. Rhodes T, Mikhailova L, Sarang A, *et al.* Situational factors influencing drug injecting, risk reduction and syringe exchange in Togliatti City, Russian Federation: a qualitative study of micro risk environment. *Soc Sci Med* 2003;57:39–54.
28. Gupta GR, Parkhurst JO, Ogden JA, *et al.* Structural approaches to HIV prevention. *Lancet* 2008;372:764–75.
29. Blankenship K, Friedman S, Dworkin S, *et al.* Structural interventions: concepts, challenges and opportunities for research. *J Urban Health* 2006;83:59–72.
30. Rhodes T, Simic M. Transition and the HIV risk environment. *BMJ* 2005;331:220–3.
31. World Health Organisation (WHO). Policy and Programming Guide for HIV/ Aids Prevention and Care among Injecting Drug Users, 2005.
32. Degenhardt LMB, Vickerman P, Rhodes T, *et al.* Prevention of HIV infection for people who inject drugs: why individual, structural, and combination approaches are needed. *Lancet* 2010;376:285–301.
33. World Health Organisation (WHO). WHO, UNODC, UNAIDS Technical Guide for countries to set targets for universal access to HIV prevention, treatment and care for injecting drug users, 2009.
34. Beyrer C, Malinowska-Sempruch K, Kamarulzaman A, *et al.* Time to act: a call for comprehensive responses to HIV in people who use drugs. *Lancet* 2010;376:551–63.
35. Wood E, Werb D, Marshall BD, *et al.* The war on drugs: a devastating public-policy disaster. *Lancet* 2009;373:989–90.
36. Joint United Nations Program on AIDS (UNAIDS). International Guidelines on HIV/AIDS and Human Rights: 2006 Consolidated Version, 2006.
37. Liberati A, Altman DG, Tetzlaff J, *et al.* The PRISMA statement for reporting systematic reviews and meta-analyses of studies that evaluate health care interventions: explanation and elaboration. *J Clin Epidemiol* 2009;62:e1–34.
38. Watters JK, Biernacki P. Targeted sampling: options for the study of hidden populations. *Soc Problems* 1989;46:416–30.
39. Mathers BMDL, Ali H, Wiessing L, *et al.* HIV prevention, treatment, and care services for people who inject drugs: a systematic review of global, regional, and national coverage. *Lancet* 2010;375:1014–28.
40. European Monitoring Centre for Drugs and Drug Addiction (EMCDDA). Statistical bulletin 2011. Secondary Statistical bulletin 2011 2011. <http://www.emcdda.europa.eu/stats11> (accessed 18 Jan 2012).
41. World Health Organisation (WHO). *Adelaide recommendations on healthy public policy*. Geneva: World Health Organization, 1988.
42. Reference Group to the United Nations on HIV and Injecting Drug Use. Consensus Statement of the Reference Group to the United Nations on HIV and Injecting Drug Use 2010.
43. International HIV/AIDS Alliance (Secretariat). Enabling Legal Environments for Effective HIV Responses, 2010.
44. Tawil O, Verster A, O'Reilly KR. Enabling approaches for HIV/AIDS prevention: can we modify the environment and minimize the risk? *AIDS* 1995;9:1299–306.
45. International Harm Reduction Association. The Global State of Harm Reduction 2010: key issues for broadening the response. In: Cook C., 2010.
46. European Monitoring Centre for Drugs and Drug Addiction (EMCDDA). Country Overviews. Secondary Country Overviews 2011. <http://www.emcdda.europa.eu/publications/country-overviews> (accessed 18 Jan 2012).
47. Uuskula A, Kals M, Rajaleid K, *et al.* High-prevalence and high-estimated incidence of HIV infection among new injecting drug users in Estonia: need for large scale prevention programs. *J Public Health* 2008;30:119–25.
48. Uuskula A, Jarlais DCD, Kals M, *et al.* Expanded syringe exchange programs and reduced HIV infection among new injection drug users in Tallinn, Estonia. *Bmc Public Health* 2011;11.
49. Kozlov AP, Shabolts AV, Toussova OV, *et al.* HIV incidence and factors associated with HIV acquisition among injection drug users in St Petersburg, Russia. *AIDS* 2006;20:901–6.
50. Smolskaya TT, Yakovleva AA, Kasumov VK, *et al.* *HIV Sentinel Surveillance in High-Risk Groups in Azerbaijan, Republic of Moldova and in the Russian Federation*. Europe: World Health Organisation (WHO), 2004.
51. Booth REKC, Brewster JT, Sinitsyna L, *et al.* Predictors of HIV sero-status among drug injectors at three Ukraine sites. *AIDS* 2006;20:2217–23.
52. Rhodes T, Platt L, Maximova S, *et al.* Prevalence of HIV, hepatitis C and syphilis among injecting drug users in Russia: a multi-city study. *Addiction* 2006;101:252–66.
53. Sanchez JLTC, Bautista CT, Botros BA, *et al.* High HIV prevalence and risk factors among injection drug users in Tashkent, Uzbekistan, 2003–2004. *Drug Alcohol Depend* 2006;82:S15–22.
54. Shapatava ENK, Tsertsvadze T, del Rio C. Risk behaviors and HIV, hepatitis B, and hepatitis C seroprevalence among injection drug users in Georgia. *Drug Alcohol Depend* 2006;82:S35–8.
55. Stvilia K, Tsertsvadze T, Sharvadze L, *et al.* Prevalence of hepatitis C, HIV, and risk behaviors for blood-borne infections: a population-based survey of the adult population of Tbilisi, Republic of Georgia. *J Urban Health* 2006;83:289–98.
56. Gyarmathy VA, Li N, Tobin KE, *et al.* Unprotected sex in heterosexual partnerships of injecting drug users in St. Petersburg, Russia. *AIDS Behav* 2011;15:58–64.
57. Taran YS, Johnston LG, Pohorila NB, *et al.* Correlates of HIV Risk among injecting drug users in sixteen Ukrainian cities. *AIDS Behav* 2011;15:65–74.
58. Dershem L, Tabatadze M, Tsereteli N, *et al.* *Characteristics, high-risk behaviors and knowledge of STI/HIV/AIDS, and STI/HIV prevalence of facility-based female sex workers in Batumi, Georgia: 2004–2006. Report on two behavioral surveillance surveys with a biomarker component for the SHIP Project*. (Tbilisi), Georgia: Save the Children, September, 2007.
59. Uuskula A, McNutt LA, Dehovitz J, *et al.* High prevalence of blood-borne virus infections and high-risk behaviour among injecting drug users in Tallinn, Estonia. *Int J STD AIDS* 2007;18:41–6.
60. Wilson TESA, Zilmer K, Kalikova N, *et al.* The HIV prevention needs of injection drug users in Estonia. *Int J STD AIDS* 2007;18:389–91.
61. Abdala N, Krasnoselskikh TV, Durante AJ, *et al.* Sexually transmitted infections, sexual risk behaviors and the risk of heterosexual spread of HIV among and beyond IDUs in St. Petersburg, Russia. *Eur Addict Res* 2008;14:19–25.
62. Gambashidze N, Sikhariidze Z, Piralishvili G, *et al.* Evaluation of pilot methadone maintenance therapy in Georgia (Caucasus). *Georgian Med News* 2008;7–8:160–1.
63. Inogamov ZI. *State of the HIV epidemic in the Republic of Uzbekistan Results of the SS in 2007: the results of sentinel surveillance of HIV infection among injecting drug users in 14 sentinel sites of the Republic of Uzbekistan, 2007*. Tashkent, Uzbekistan, 2008.
64. Kuniholm MH, Aladashvili M, Rio CD, *et al.* Not all injection drug users are created equal: heterogeneity of HIV, hepatitis C virus, and hepatitis B virus infection in Georgia. *Subst Use Misuse* 2008;43:1424–37.
65. Platt L, Rhodes T, Hickman M, *et al.* Changes in HIV prevalence and risk among new injecting drug users in a Russian city of high HIV prevalence. *J Acquir Immune Defic Syndr* 2008;47:623–31.
66. Raj A, Cheng DM, Krupitsky EM, *et al.* Correlates of any condom use among Russian narcology patients reporting recent unprotected sex. *AIDS Behav* 2008;13:310–17.
67. SOCIS-CSPS IIHAAIU. *Monitoring the behaviour of injecting drug users*. Kyiv, Ukraine, 2008.
68. Todadze KLG. Implementation of drug substitution therapy in Georgia. *Cent Eur J Public Health* 2008;16:121–3.
69. UNGASS. ed. Country progress report: Republic of Armenia. 2008.
70. UNGASS. ed. Republic of Belarus: National Report on the Implementation of the Declaration of Commitment on HIV/AIDS. Minsk, Belarus, 2008.
71. Abel-Ollo K, Rahu M, Rajaleid K, *et al.* Knowledge of HIV serostatus and risk behaviour among injecting drug users in Estonia. *AIDS Care* 2009;21:851–7.
72. Beyrer C, Patel Z, Stachowiak JA, *et al.* Characterization of the emerging HIV type 1 and HCV epidemics among injecting drug

- users in Dushanbe, Tajikistan. *AIDS Res Hum Retroviruses* 2009;25:853–60.
73. Dumchev KV, Soldyshev R, Qian H-Z, *et al*. HIV and hepatitis C virus infections among Hanka injection drug users in central Ukraine: a cross-sectional survey. *Harm Reduct J* 2009;6:23.
 74. Expanding Network for Comprehensive and Coordinated Action on HIV/AIDS prevention among IDUs and Bridging Population (ENCAP). Prevalence of HIV and other infections and risk behaviour among Injecting Drug Users in Latvia, Lithuania and Estonia in 2007, 2009.
 75. Gyarmathy VA, Li N, Tobin KE, *et al*. Correlates of unsafe equipment sharing among injecting drug users in St. Petersburg, Russia. *Eur Addict Res* 2009;15:163–70.
 76. Kryukova V. Overview of epidemiological situation & national response to HIV-infection epidemic in Central Asian countries. 4th Central Asian HIV Partnership Forum, 2009.
 77. Niccolai LM, Shcherbakova IS, Toussova OV, *et al*. The potential for bridging of HIV transmission in the Russian Federation: sex risk behaviors and HIV prevalence among drug users (DUs) and their non-DU sex partners. *J Urban Health* 2009;86(suppl 1):131–43.
 78. UNGASS, ed. UNGASS Country Progress Report: Latvia. 2010.
 79. Abdala NWE, Toussova OV, Krasnoselskikh TV, *et al*. Comparing sexual risks and patterns of alcohol and drug use between injection drug users (IDUs) and non-IDUs who report sexual partnerships with IDUs in St. Petersburg, Russia. *BMC Public Health* 2010;10:676.
 80. Federal Service for Surveillance of Consumer Rights Protection and Human Well-Being Ministry of Health and Social Development of the Russian Federation. Country Progress Report of the Russian Federation on the Implementation of the Declaration of Commitment on HIV/AIDS. Moscow, 2010.
 81. Kechin EA. Studies conducted within the National System for monitoring and evaluation of HIV/AIDS in the Republic of Belarus in 2009: a collection of articles. In: Kechin EA. Minsk: State Republican Center of Hygiene, Epidemiology and Public Health, 2010.
 82. Pohorila N, Taran Y, Kolodiy I, *et al*. *Behavior monitoring and HIV-infection prevalence among injection drug users*. Kyiv: ICF 'International HIV/AIDS Alliance in Ukraine', 2010.
 83. Soliev A. Analysis on epidemiological situation and responses based on second generation sentinel surveillance system among injecting drug users, Tajikistan, Kazakhstan, Kyrgyzstan, 2006–2009, 2010.
 84. UNGASS, ed. UNGASS Country Progress Report: Republic of Armenia. 2010.
 85. UNGASS. UNGASS Country Progress Report: Georgia, 2010.
 86. UNGASS, ed. UNGASS Country Progress Report: Estonia. 2010.
 87. UNGASS. UNGASS Country Progress Report: Azerbaijan. 2010.
 88. Uuskula A, McMahon JM, Raag M, *et al*. Emergent properties of HIV risk among injection drug users in Tallinn, Estonia: synthesis of individual and neighbourhood-level factors. (Special Issue: Epidemiology and prevention of STDs: the role of emergent properties and structural patterns.). *Sex Transm Infect* 2010;86(suppl 3):iii79–84.
 89. Family Health International (FHI). Albania—Behavioral and Biological Surveillance Study Report, 2006.
 90. UNGASS, ed. National AIDS Program: UNGASS Country Progress Report: Albania. 2010.
 91. UNICEF. *Biological and behavioural survey among injection drug users*. Bosnia and Herzegovina: UNICEF Bosnia and Herzegovina, 2007.
 92. Bačak V, Midžić D, Puhalo A, *et al*. Report on behavioral and biological surveillance among injection drug users in Bosnia and Herzegovina, 2009: a respondent driven sampling survey, 2009.
 93. Vassilev ZP, Hagan H, Lyubenova A, *et al*. Needle exchange use, sexual risk behaviour, and the prevalence of HIV, hepatitis B virus, and hepatitis C virus infections among Bulgarian injection drug users. *Int J STD AIDS* 2006;17:621–6.
 94. UNGASS, ed. Country Progress Report on Monitoring the Declaration of Commitment on HIV/AIDS: Republic of Bulgaria. 2010.
 95. Gjenero-Margan I, Kolari B. Epidemiology of HIV infection and AIDS in Croatia—an overview. *Coll Antropol* 2006;11–16.
 96. Begovac J, Zekan S, Skoko-Poljak D, *et al*. Twenty years of human immunodeficiency virus infection in Croatia—an epidemic that is still in an early stage. *Antropol* 2006;30:17–23.
 97. UNGASS, ed. UNGASS Country Progress Report: Republic of Croatia. 2010.
 98. Bruckova MBC, Graham RR, Maly M, *et al*. Short report: HIV infection among commercial sex workers and injecting drug users in the Czech Republic. *Am J Trop Med Hyg* 2006;75:1017–20.
 99. Gyarmathy AV, Neaigus A, Ujhelyi E. Vulnerability to drug-related infections and co-infections among injecting drug users in Budapest, Hungary. *Eur J Public Health* 2009;19:260–5.
 100. Rác J, Gyarmathy VA, Neaigus A, *et al*. Injecting equipment sharing and perception of HIV and hepatitis risk among injecting drug users in Budapest. *AIDS Care Psychol Socio-Med Aspects AIDS/HIV* 2007;19:59–66.
 101. UNGASS, ed. UNGASS Country Progress Report: Hungary. 2010.
 102. Family Health International (FHI) I. Behavioural and Biological Survey Kosovo 2006, 2006.
 103. UNGASS, ed. UNGASS Country Progress Report: Republic of Macedonia. 2010.
 104. UNGASS, ed. UNGASS Country Progress Report: Montenegro. 2010.
 105. United Nations Office on Drugs and Crime (UNODC). HIV, HBV and HCV Behavioral Surveillance Survey among Injecting Drug Users in Bucharest, Romania. Bucharest, 2010.
 106. UNGASS, ed. UNGASS Country Progress Report: Republic of Serbia. 2010.
 107. Judd A, Rhodes T, Johnston LG, *et al*. Improving survey methods in sero-epidemiological studies of injecting drug users: a case example of two cross sectional surveys in Serbia and Montenegro. *BMC Infect Dis* 2009;9:14.
 108. UNGASS, ed. UNGASS Country Progress Report: Slovenia. Turkey, 2010.
 109. ICON Institute for Public Health. *Operational Research on key STIs and HIV in Turkey*. Ankara, Turkey, 2007.
 110. Gyarmathy VA, Neaigus A, Li N, *et al*. Liquid drugs and high dead space syringes may keep HIV and HCV prevalence high—a comparison of Hungary and Lithuania. *Eur Addict Res* 2010;16:220–28.
 111. Chikovani I, Bozicevic I, Gogvadze K, *et al*. Unsafe injection and sexual risk behavior among injecting drug users in Georgia. *J Urban Health-Bulletin NY Acad Med* 2011;88:736–48.
 112. Scutelnicuic O, Iiinschi E. Assessment of Risk of HIV infection among Most at Risk Adolescents. Chisinau: Ministry of Health of the Republic of Moldova, National Center of Health Management Monitoring and Evaluation of National Health Programmes, National Drug Observatory, 2009.
 113. Platt L, Bobrova N, Rhodes T, *et al*. High HIV prevalence among injecting drug users in Estonia: implications for understanding the risk environment. *AIDS* 2006;20:2120–3.
 114. Gyarmathy V, Neaigus A. Marginalized and socially integrated groups of IDUs in Hungary: potential bridges of HIV infection. *J Urban Health* 2005;82:iv101–12.
 115. Márványkóvi F, Melles K, Rác J. Sex and drugs: the correlations of injecting drug users' risk perception and behavioral patterns. *Subst Use Misuse* 2009;44:569–77.
 116. Colfax G, Santos G-M, Chu P, *et al*. Amphetamine-group substances and HIV. *Lancet* 2010;376:458–74.
 117. Griffiths P, Mravcik V, Lopez D, *et al*. Quite a lot of smoke but very limited fire—the use of methamphetamine in Europe. *Drug Alcohol Rev* 2008;27:236–42.
 118. Grund J-P, Zabransky T, Irvin K, *et al*. Stimulant use in central and eastern Europe: how recent social history shaped current drug consumption patterns. In: Pates R, Riley D, eds. *Interventions for amphetamine misuse*. Oxford: Wiley Blackwell, 2009.
 119. Booth R, Dvoryak S, Anderson C, *et al*. Police brutality is independently associated with sharing injection equipment among injection drug users in Odessa, Ukraine. XVIII International AIDS Conference; Vienna, Austria, 2010.
 120. Cooper H, Moore L, Gruskin S, *et al*. The impact of a police drug crackdown on drug injectors' ability to practice harm reduction: A qualitative study. *Soc Sci Med* 2005;61:673–84.
 121. Niccolai LM, Toussova OV, Verevchkin SV, *et al*. High HIV prevalence, suboptimal HIV testing, and low knowledge of HIV-positive serostatus among injection drug users in St. Petersburg, Russia. *AIDS Behav* 2010;14:932–41.
 122. Des Jarlais DC, Grund J-P, Zadoretzky C, *et al*. HIV risk behaviour among participants of syringe exchange programmes in central/eastern Europe and Russia. *Int J Drug Policy* 2002;13:165–74.
 123. Stachowiak JATF, Strathdee SA, Stibich MA, *et al*. Marked ethnic differences in HIV prevalence and risk behaviors among injection drug users in Dushanbe, Tajikistan, 2004. *Drug Alcohol Depend* 2006;82:S7–14.
 124. Robbins CL, Zapata L, Kissin DM, *et al*. Multicity HIV seroprevalence in street youth, Ukraine. *Int J STD AIDS* 2010;21:489–96.
 125. Platt L, Rhodes T, Lowndes CM, *et al*. Impact of gender and sex work on sexual and injecting risk behaviors and their association

- with HIV positivity among injecting drug users in an HIV epidemic in Togliatti City, Russian Federation. *Sex Trans Dis* 2005;32:605–12.
126. Platt L, Rhodes T, Judd A, *et al*. Effects of sex work on the prevalence of syphilis among injection drug users in 3 Russian cities. *Am J Public Health* 2007;97:478–85.
 127. Uusküla A, Des Jarlais D, Kals M, *et al*. Outcomes of large-scale syringe exchange in Tallinn, Estonia. XVIII International AIDS Conference. Vienna, Austria, 2010.
 128. Platt L, Rhodes T, Hickman M, *et al*. Changes in HIV prevalence and risk among new injecting drug users in a Russian City of high HIV prevalence. *J Acquir Immune Defic Syndr* 2008;47:623–31.
 129. Wiessing L, Likatavicius G, Klempova D, *et al*. Associations between availability and coverage of HIV-prevention measures and subsequent incidence of diagnosed HIV infection among injection drug users. *Am J Public Health* 2009;99:1049–52.
 130. Vickerman P, Hickman M, Rhodes T, *et al*. Model projections on the required coverage of syringe distribution to prevent HIV epidemics among injecting drug users. *J Acquir Immune Defic Syndr* 2006;42:355–61.
 131. Heimer R. Community coverage and HIV prevention: assessing metrics for estimating HIV incidence through syringe exchange. *Int J Drug Policy* 2008;19(suppl 1):65–73.
 132. Sarang A, Rhodes T, Platt L. Access to syringes in three Russian cities: implications for syringe distribution and coverage. *Int J Drug Policy* 2008;19(suppl 1):25–36.
 133. Presidential Decree. State Anti-Drug Policy Strategy of the Russian Federation in the Period until 2020, 2010.
 134. Varban M, Dovbakh A, Maksymenko K. Violence of sexual partner as a vulnerability factor of female IDU to HIV infection. XVIII International AIDS Conference; Vienna, Austria, 2010.
 135. Wall M, Schmidt E, Sarang A, *et al*. Sex, drugs and economic behaviour in Russia: a study of socio-economic characteristics of high risk populations. *Int J Drug Policy* 2011;22:133–9.
 136. Rhodes T, Sarang A, Simic M. Police violence and 'fear-based policy' as barriers to HIV prevention: qualitative case studies in Russia and Serbia. XVIII International AIDS Conference; Vienna, Austria, 2010.
 137. Rhodes T, Prodanovic A, Zikic B, *et al*. Trust, disruption and responsibility in accounts of injecting equipment sharing and hepatitis C risk. *Health Risk Soc* 2008;10:221–40.
 138. Burris S, Blankenship KM, Donoghoe M, *et al*. Addressing the 'risk environment' for injection drug users: the mysterious case of the missing cop. *Milbank Q* 2004;82:125–56.
 139. Dolan K, Kite B, Black E, *et al*. HIV in prison in low-income and middle-income countries. *Lancet Infect Dis* 2007;7:32–41.
 140. Jürgens R, Ball A, Verster A. Interventions to reduce HIV transmission related to injecting drug use in prison. *Lancet Infect Dis* 2009;9:57–66.
 141. Des Jarlais DC, Bramson H, Wong C, *et al*. Meta-analysis of the international literature on racial/ethnic disparities in HIV infection among IDUs: first results. XVIII International AIDS Conference; Vienna, Austria, 2010.
 142. Ursan M, Bocai A, Iliuta C, *et al*. Harm reduction initiative for roma injecting drug users. International Harm Reduction Conference; Bangkok, 2009.
 143. Bobrova N, Rhodes T, Power R, *et al*. Barriers to accessing drug treatment in Russia: a qualitative study among injecting drug users in two cities. *Drug Alcohol Depend* 2006;82:S57–63.
 144. Wagner KD, Davidson PJ, Pollini RA, *et al*. Reconciling incongruous qualitative and quantitative findings in mixed methods research: exemplars from research with drug using populations. *Int J Drug Policy* 2012;23:54–61.
 145. Beyrer C, Razak MH, Lisam K, *et al*. Overland heroin trafficking routes and HIV-1 spread in south and south-east Asia. *AIDS* 2000;14:75–83.
 146. United Nations Office on Drugs and Crime (UNODC). World Drug Report 2010. Sales No. E.10.XI.13 ed: United Nations Publication, 2010.
 147. Tumanov T, Asadulov K, Chariev N. Analysis of epidemiological situation and response measures based on the data from second generation system sentinel surveillance among injecting drug users in the Republic of Tajikistan in 2009. Dushanbe, 2010.
 148. Ismailova A. Epidemiological surveillance of HIV infection in Kyrgyz Republic. 2009.
 149. United Nations Office on Drugs and Crime (UNODC) Regional Office for Central Asia. Illicit Drug Trends in Central Asia, 2008.
 150. Rhodes T. Risk environments and drug harms: a social science for harm reduction approach. *Int J Drug Policy* 2009;20:193–201.
 151. Van Den Berg C, Smit C, Van Brussel G, *et al*. Full participation in harm reduction programmes is associated with decreased risk for human immunodeficiency virus and hepatitis C virus: evidence from the Amsterdam Cohort Studies among drug users. *Addiction* 2007;102:1454–62.
 152. Grund J-P, Coffin P, Jauffret-Roustide M, *et al*. The fast and furious—cocaine, amphetamines and harm reduction. In: Rhodes T, Hedrich D, eds. *Harm reduction: evidence, impacts and challenges*. Luxembourg: Publications Office of the European Union, 2010:191–232.
 153. Rhodes T, Hedrich D. Harm reduction and the mainstream. In: Rhodes T, Hedrich D, eds. *Harm reduction: evidence, impacts and challenges*. Luxembourg: Publications Office of the European Union, 2010:462.
 154. Kimber J, Palmateer N, Hutchinson S, *et al*. Harm reduction among injecting drug users—evidence of effectiveness. In: Rhodes T, Hedrich D, eds. *Harm reduction: evidence, impacts and challenges*. Luxembourg: Publications Office of the European Union, 2010:462.
 155. Palmateer N, Kimber J, Hickman M, *et al*. Evidence for the effectiveness of sterile injecting equipment provision in preventing hepatitis C and human immunodeficiency virus transmission among injecting drug users: a review of reviews. *Addiction* 2010;105:844–59.
 156. Greenwald G. Drug Decriminalization in Portugal: Lessons for Creating Fair and Successful Drug Policies: The Cato Institute, 2009.
 157. Jürgens R. 'Nothing about us without us'—Greater, meaningful involvement of people who use illegal drugs: A public health, ethical, and human rights imperative, International edition. Toronto: Canadian HIV/AIDS Legal Network, International HIV/AIDS Alliance, Open Society Institute, 2008.
 158. European Union (EU). EU Drugs Strategy (2005–2012). In: Secretariat G. 2004.
 159. UNAIDS. Practical guidelines for intensifying HIV prevention: towards universal access. Geneva: UNAIDS, 2007.
 160. UNAIDS/WHO. Guidelines for Second Generation HIV Surveillance: The Next Decade. Geneva, Switzerland, 2000:48.
 161. Tilson H, Aramrattana A, Bozette S. Preventing HIV infection among injecting drug users in high-risk countries: an assessment of the evidence. Washington, DC: Institute of Medicine, 2007.
 162. Williams AB, McNelly EA, Williams AE, *et al*. Methadone maintenance treatment and HIV type 1 seroconversion among injecting drug users. *AIDS Care Psychol Socio-Med Aspects AIDS/HIV* 1992;4:35–41.
 163. Metzger DS. Human immunodeficiency virus seroconversion among intravenous drug users in- and out-of-treatment: an 18-month prospective follow-up. *J Acquir Immune Defic Syndr* 1993;6:1049–56.
 164. Moss AR, Vranizan K, Gorter R, *et al*. HIV seroconversion in intravenous drug users in San Francisco, 1985–1990. *AIDS* 1994;8:223–32.
 165. Hartel DM, Schoenbaum EE. Methadone treatment protects against HIV infection: two decades of experience in the Bronx, New York City. *Public Health Reports (Washington, DC: 1974)* 1998;113(suppl 1):107–15.
 166. Serpelloni G, Carrieri MP, Rezza G, *et al*. Methadone treatment as a determinant of HIV risk reduction among injecting drug users: a nested case-control study. *AIDS Care: Psychol Socio-Med Aspects AIDS/HIV* 1994;6:215–20.
 167. Novick DM, Joseph H, Scott Croxson T, *et al*. Absence of antibody to human immunodeficiency virus in long-term, socially rehabilitated methadone maintenance patients. Chicago, IL: American Medical Association, 1990.
 168. Rhoades HM, Creson D, Elk R, *et al*. Retention, HIV risk, and illicit drug use during treatment: methadone dose and visit frequency. *Am J Public Health* 1998;88:34–9.
 169. World Health Organisation (WHO) UNODaCU, Joint United Nations Programme on HIV/AIDS (UNAIDS). Interventions to Address HIV in Prisons: HIV Care, Treatment and support. Evidence for Action Technical Papers, 2007.
 170. Larisa P. Drug Users, HIV-positive Prisoners. Examples of adequate influence over changes in national policy on harm reduction programs in Moldovan prisons. XVIII International AIDS Conference; Vienna, Austria, 2010.