Epidemiology of injecting drug use, prevalence of injecting-related harm, and exposure to behavioural and environmental risks among people who inject drugs: a systematic review

Louisa Degenhardt, Paige Webb, Samantha Colledge-Frisby, Jeremy Ireland, Alice Wheeler, Sophie Ottaviano, Alex Willing, Abe Kairouz, Evan B Cunningham, Behzad Hajarizadeh, Janni Leung, Lucy T Tran, Olivia Price, Amy Peacock, Peter Vickerman, Michael Farrell, Gregory J Dore, Matthew Hickman, Jason Grebely**

Summary

Background People who inject drugs are exposed to various and changing risk environments and are at risk of multiple harms related to injecting drug use (IDU). We aimed to undertake a global systematic review of the prevalence of IDU, key IDU-related harms (including HIV, hepatitis C virus [HCV], and hepatitis B virus [HBV] infection and overdose), and key sociodemographic characteristics and risk exposures for people who inject drugs.

Methods We systematically searched for data published between Jan 1, 2017, and March 31, 2022, in databases of peer-reviewed literature (MEDLINE, Embase, and PsycINFO) and grey literature as well as various agency or organisational websites, and disseminated data requests to international experts and agencies. We searched for data on the prevalence, characteristics, and risks of people who inject drugs, including gender, age, sexuality, drug-use patterns, HIV, HCV, and HBV infections, non-fatal overdose, depression, anxiety, and injecting-related disease. Additional data were extracted from studies identified in our previous review. Meta-analyses were used to pool the data where multiple estimates were available for a country. We present country, regional, and global estimates for each variable examined.

Findings We screened 40 427 reports published between 2017 and 2022, and the 871 eligible reports identified were added to the 1147 documents from the previous review. Evidence of IDU was documented in 190 of 207 countries and territories, and 14·8 million people (95% uncertainty interval [UI] 10·0–21·7) aged 15–64 years globally were estimated to inject drugs. Existing evidence suggests that there might be 2·8 million (95% UI 2·4–3·2) women and 12·1 million (95% UI 11·0–13·3) men who inject drugs globally, and that 0·4% (95% CI 0·3–1·3) of people who inject drugs identify as transgender. The amount of available data on key health and social risks among people who inject drugs varied widely across countries and regions. We estimated that 24·8% (95% CI 19·5–31·6) of people who inject drugs globally had experienced recent homelessness or unstable housing, 58·4% (95% CI 52·0–64·8) had a lifetime history of incarceration, and 14·9% (95% CI 8·1–24·3) had recently engaged in sex work, with substantial geographical variation. Injecting and sexual risk behaviour varied considerably geographically, as did risks of harms. Globally, we estimated that 15·2% (95% CI 10·3–20·9) of people who inject drugs are living with HIV, 38·8% (95% CI 31·4–46·9) have current HCV infection, 18·5% (95% CI 13·9–24·1) have recently overdosed, and 31·7% (95% CI 23·6–40·5) have had a recent skin or soft tissue infection.

Interpretation IDU is being identified in a growing number of countries and territories that comprise more than 99% of the global population. IDU-related health harms are common, and people who inject drugs continue to be exposed to multiple adverse risk environments. However, quantification of many of these exposure and harms is inadequate and must be improved to allow for better targeting of harm-reduction interventions for these risks.

Funding Australian National Health and Medical Research Council.

Lancet Glob Health 2023; 11: e659–72

Published Online March 27, 2023 https://doi.org/10.1016/S2214-109X(23)00057-8

See Comment page e630

*Joint senior authors

National Drug and Alcohol Research Centre (Prof L Degenhardt PhD, P Webb BPsych[Hons], S Colledge-Frisby PhD, J Ireland MPH, S Ottaviano MPH, L T Tran BPsychSci[Hons], O Price MPH, A Peacock PhD, Prof M Farrell FRCP) **and Kirby Institute** (A Wheeler BPsych[Hons], A Willing BAdvSci[Hons], A Kairouz BPsych[Hons], E B Cunningham PhD, B Hajarizadeh PhD, Prof G J Dore PhD, Prof J Grebely PhD), **University of New South Wales, Sydney, NSW, Australia; National Drug Research Institute Melbourne, Curtin University, Melbourne, VIC, Australia** (S Colledge-Frisby); **National Centre For Youth Substance Use Research, University of Queensland, St Lucia, QLD, Australia** (J Leung PhD); **Population Health Science, Bristol Medical School, University of Bristol, Bristol, UK** (Prof P Vickerman PhD, Prof M Hickman PhD)

Correspondence to: Prof Louisa Degenhardt, National Drug and Alcohol Research Centre, University of New South Wales, Sydney, 2052, NSW, Australia **l.degenhardt@unsw.edu.au**

Introduction

People who inject drugs face multiple and multilevel risks and adverse outcomes. Risk environments are dynamic, and occur at both the micro and macro levels; they can be social, physical, economic, or political in nature,[1,2] and can affect risk behaviour and the likelihood of harms. There is increasing recognition that to reduce drug-related harms requires modifying social and structural risks and individual behaviours.

Transmission of blood-borne viruses—including HIV, hepatitis C virus (HCV), and hepatitis B virus (HBV)—through injection equipment as a consequence of injecting drug use (IDU) is a leading contributor to morbidity and mortality.[3] Although blood-borne viruses

Research in context

Evidence before this study

In 2017, we conducted systematic reviews to estimate the global prevalence of injecting drug use (IDU), and of HIV, hepatitis C virus (HCV), and hepatitis B virus (HBV) infection among people who inject drugs. Although there are annual updates from agencies such as the UN Office on Drugs and Crime and the European Monitoring Centre on Drugs and Drug Addiction, these focus on a limited number of countries or rely on reporting from member states, do not involve systematic reviews of evidence, and do not adhere to GATHER guidelines. Global targets for reductions in HIV and viral hepatitis due to IDU have been developed and increasing drug-dependence treatment coverage has been listed as one of the UN Sustainable Development Goals. Therefore, updated estimates are crucial. Global reviews of the data on exposure to risk environments, individual risk behaviours, and a wider range of health harms are necessary to ascertain the health needs of people who inject drugs and consider what risk behaviours and environments should be addressed.

Added value of this study

This study updates estimates of the number of people who inject drugs at the country, regional, and global levels using a multistage systematic review of peer-reviewed and grey literature. Importantly, this review also substantially expands its focus. We present the first global-level, regional-level, and country-level review of people of diverse sexual orientation and gender who inject drugs; present multiple patterns of injecting and non-injecting drug use; report on a wide range of individual-level risk behaviours; report on exposure to risk environments (eg, incarceration and homelessness); and report data on the prevalence of a range of health harms that deserve global attention in the same manner as HIV, HCV, and HBV. Importantly, our review highlights the consistently high levels of exposure to substantial risk faced by people who inject drugs. Our review also provides additional data on a range of characteristics, risk, and exposures that might be associated with IDU risk, including factors beyond the individual level, highlighting the clear need to address structural and environmental drivers of susceptibility, risk, and harm.

Implications of all the available evidence

IDU has now been documented in 190 countries and territories, and HIV and HCV infection are highly prevalent among many populations of people who inject drugs. Despite signals of multiple risks at multiple levels for people who inject drugs, existing data on such risks are patchy for many countries and territories. More comprehensive surveys of people who inject drugs that cover a wide range of personal, social, and environmental characteristics are needed.

are crucial health issues, other potential health harms faced by people who inject drugs, including overdose, other injecting-related diseases[4] such as endocarditis, and other physical and mental health problems, must be considered. These harms are increased among people who inject drugs compared with those who do not, but have been the subject of relatively little global attention.

People who inject drugs can be exposed to various risk environments[2] that might increase the risks of all the harms mentioned above; experiences of homelessness,[5] arrest,[6] incarceration,[7,8] and sex work[9] can increase exposure to blood-borne viruses and elevate the risks of harms to physical and mental health. Age,[10] gender,[11] and types of drugs used[12–14] can mediate the exposure to, and effects of, these risk environments, and might require different treatment and harm-reduction responses.

See Online for appendix

We have previously conducted systematic reviews to examine these risks.[15–17] However, surveillance capacity has been enhanced in many countries, and drug markets[18] and risk environments are subject to change. Additionally, targets for reductions in HIV and viral hepatitis[19,20] and drug-dependence treatment coverage[21] need to be reviewed against current data, and the scope needs to be widened on potential harms. Therefore, an updated and more comprehensive systematic review is necessary.

We did a global systematic review of peer-reviewed and grey literature to examine the prevalence of injecting drug use; the sociodemographic characteristics of people who inject drugs; patterns of drug use among people who inject drugs, both injecting and via other routes; engagement in various risk behaviours; exposure to physical and structural risk environments, including homelessness, arrest, incarceration, and sex work; and current blood-borne virus and other health harms, including non-fatal overdose, injection-related diseases, and mental health problems among people who inject drugs.

Methods

Search strategy and selection criteria

We conducted a systematic review using methods consistent with previous global reviews[15–17] and in accordance with PRISMA[22] and GATHER[23] guidelines (appendix p 4). The review protocol was registered on PROSPERO (CRD42020173337). There were several stages to the literature search, with no limitations on language.

We searched electronic peer-reviewed literature databases (MEDLINE, Embase, and PsycINFO) using a comprehensive set of search terms developed in consultation with a specialist drug and alcohol librarian. This included a set of terms for IDU, epidemiology research, blood-borne viruses, and harm reduction measures for people who use drugs. Searches were conducted on June 3, 2021, and were limited to reports published from Jan 1, 2017 onwards (ie, from the year of

the previous reviews, because studies published before 2017 that met our inclusion criteria could be obtained from our previous reviews).[15–17] An updated search was done on April 1, 2022, and was limited to reports published between June 3, 2021, and March 31, 2022 (appendix p 6). Systematic reviews we identified were excluded, but were manually searched for relevant original papers or reports within them.

Grey literature and online databases identified as sources of papers or reports on IDU and blood-borne viruses[24] were systematically searched via their own search function or a Google advanced search (appendix p 12). These sources included websites of drug surveillance systems, regional harm-reduction networks, and country-specific ministries of health.

We searched key documents by relevant international agencies, including World Drug Reports from the UN Office on Drugs and Crime (UNODC),[18] Global State of Harm Reduction reports from Harm Reduction International,[25] and reports from the European Monitoring Centre on Drugs and Drug Addiction,[26] WHO, UNAIDS, and The Global Fund to Fight AIDS, Tuberculosis and Malaria. We contacted members of these organisations directly when additional information was required, and liaised with those agencies up until completion of the review. Reports were received from UNAIDS, WHO, and UNODC staff.

Data were also requested from experts in December, 2021, via a viral email distribution process and social media. This process comprised initial emails sent to key experts and organisations, and posts on Twitter and Facebook (appendix p 44). We also engaged in ongoing consultation with our networks to obtain and verify evidence and data.

Screening and data extraction

An Endnote 20 library was created to catalogue papers and reports, with removal of duplicates. We had members proficient in reading English, French, Farsi, and Mandarin; other languages were read via Google Translate or the Microsoft Word 365 translate function. Initial screening of titles and abstracts was done by two reviewers (LD, PW, SC-F, JI, AWh, SO, AWi, AK, EBC, LTT, OP, or JG), with discrepancies resolved via consensus. Full-text reviews were independently conducted by two reviewers (LD, PW, JI, AWh, SO, AWi, AK, EBC, OP, or JG). Papers and reports were excluded if they met any of the following: samples sizes under n=40; cohort studies without baseline data; case control studies; non-original works (eg, reviews or editorials); papers with insufficient methodological details; and papers including a subpopulation (eg, all HIV positive individuals or prison samples).

Data from eligible studies were extracted into a purpose-built database using Microsoft Access 365 at the city, subnational, or country levels, and double-checked for accuracy. Countries and regional groupings were based on those used by UNAIDS, WHO, and UNODC.[15–17] All extracted data were categorised by country. Data on studies estimating the prevalence of IDU were extracted. From eligible surveys of people who inject drugs, we extracted the following: sociodemographic and risk variables (gender [note: we have chosen to use the term gender throughout; however, this term might refer to either gender or sex as this distinction was not always clear], age, and lesbian, gay, or bisexual [LGB] sexuality); patterns of drug use and risk (recent injecting risk, recent and lifetime sharing and reusing of needles, sexual risk, and types of drugs injected and used through other routes); exposure to risk environments (unstable housing or homelessness, recent and lifetime incarceration and arrest, and recent involvement in sex work); and harms experienced by people who inject drugs (HIV antibody prevalence, HCV antibody prevalence [indicating previous HCV exposure], HCV RNA prevalence [indicating current HCV infection], HBsAg prevalence [indicating current HBV infection], prevalence of non-fatal overdose, prevalence of injection-related diseases, and prevalence of mental health problems). Risk environment exposure and drug use characteristics within 1 year were considered recent. We combined all newly identified data with the database from our previous review[17] and extracted all new variables from studies identified in our previous review. Details of all variables extracted are provided in the appendix (p 58).

Analysis of prevalence of IDU and blood-borne viruses

We used an approach consistent with the methods used in earlier reviews[15–17] (appendix pp 48–85). Estimates of the prevalence of IDU were graded by study method quality, with higher-grade estimates selected over lower-grade estimates, while also seeking to maximise geographical coverage of estimates within a country. The proportions were pooled across studies within a given country via random-effects meta-analyses with use of the metaprop command in Stata (version 14). Metaprop allows meta-analyses of proportions for binomial data. CIs were computed with use of the exact method (Clopper-Pearson interval method) based on the binomial distribution. The double arcsine transformation method was used (ftt command) because it is the preferred method for addressing the problem of variance instability. If we located no estimate of IDU prevalence of the same or higher quality since our previous review,[15] the estimate from the previous review was used again. Based on the extracted data, estimates were generated by PW, and independently reviewed by LD. External checks were made with specific requests to experts in countries where additional data or clarification of identified data were required. All authors finally reviewed all selected estimates. Once the estimates had been generated, consultation with UN agency staff at a global level was done to ensure that we had not missed any estimates.

Eligible data on the prevalence of HIV antibody, HBsAg, HCV antibody, and HCV RNA among people

who inject drugs were selected and estimates were pooled for each country (see appendix p 55 for decision rules around selection of estimates). On the basis of these extracted data, initial calculations of country-level prevalence estimates were made in accordance with agreed decision rules around the selection of estimates, approaches to pooling estimates within country, and determination of uncertainty intervals (UIs) around estimates. Estimates of the prevalence (%) of blood-borne viruses among people who inject drugs were pooled via random-effects models. We also made estimates of current HCV infection using HCV RNA prevalence, in countries where these data were available, or HCV antibody prevalence, assuming a 25% clearance rate, as we have done previously.[27]

To estimate the number of people who inject drugs living with blood-borne viruses, we multiplied IDU prevalence out of the whole population of a country by the proportion of each blood-borne virus variable among people who inject drugs. We then multiplied this product by the size of the country's population of people aged 15–64 years to obtain the number of people who inject drugs with blood-borne viruses. 95% UIs were estimated using Monte Carlo simulation, taking 100 000 draws, because, when we estimated the number of people who inject drugs with blood-borne viruses in the whole population, we considered the uncertainty of the IDU prevalence and the blood-borne virus prevalence extracted. A binomial distribution was used because our parameters of interest were proportions (product of IDU proportion among whole populations and blood-borne virus proportion among people who inject drugs). Estimated sample sizes were derived on the basis of 95% CIs and SEs of proportion estimates in each country. The simulated UIs for the estimated number of people who inject drugs with blood-borne viruses (population size) incorporated the uncertainty of IDU and blood-borne virus estimates. In certain cases, this method resulted in an upper confidence limit of 0 being calculated for some countries, in which case the country-level upper confidence limit of the estimated number of people who inject drugs was multiplied by the upper confidence limit of the blood-borne virus prevalence estimate and imputed as the upper confidence limit.

Analysis of prevalence of characteristics, risk, and harm among people who inject drugs

Eligible data on the characteristic, risk, and harm variables among people who inject drugs were extracted and, where multiple estimates were available, pooled for each country. We report pooled estimates of the percentage of people who inject drugs who were young (aged <25 years); had unstable housing or were homeless (currently or recently [including all estimates except those listed as lifetime estimates]); had a lifetime or recent (defined as 3–12 months previously) experience of police arrest; had a lifetime or recent (defined as 3–12 months previously) history of incarceration; and had recently engaged in sex work. We also report pooled estimates of the percentage of people who inject drugs who had recently engaged in injecting and sexual risk behaviour. We also extracted data on the reported main drug injected, as well as other patterns of drug use including non-injecting drug use. Data on a wide range of other physical and mental health harms were also extracted. Calculations of country-level prevalence estimates were made in a similar way to the estimation for blood-borne virus.

Regional and global estimates

Following the collation of country-specific estimates, regional and global estimates were derived. Region-specific, weighted estimates were made using all the observed estimates and 95% CIs of estimates in each country within that region and deriving a weighted estimate and UIs, accounting for country population size. UN Population Division estimates of country population size (people aged 15–64 years) were used,[28] unless estimates pertained to cities or where UN estimates were unavailable, in which case other sources were used. Regional estimates were then used to estimate the global prevalence (appendix p 83).

Role of the funding source

The funders of the study had no role in study design, data collection, data analysis, data interpretation, or writing of the report.

Results

We screened 40 427 papers or reports published between 2017 and 2022, among which 871 eligible reports were identified and added to the 1147 documents from the previous review.[17] The study flowchart is shown in the appendix (p 85), along with further detail on the eligible studies that contributed to the review for each measure, and the increase in availability of evidence since 2007 and since 2017 (appendix pp 86–89).

Evidence of IDU was documented in 190 of 207 countries and territories (hereafter referred to as countries for simplicity). These countries contain 99·4% of the world's population aged 15–64 years. Ten additional countries (appendix pp 94–97) were represented here compared with the previous review:[17] eight in sub-Saharan Africa and two in the Caribbean. An additional 19 countries (including 11 in sub-Saharan Africa; appendix pp 94–97) now have an estimate of IDU prevalence since the previous review, such that 102 countries (87% of the world population aged 15–64 years) have an IDU prevalence estimate.

Globally, in 2021, an estimated 14·8 million (95% UI 10·0–21·7) people injected drugs, amounting to approximately 0·29% (95% CI 0·20–0·43) of people aged 15–64 years (table 1). Regionally, prevalence varied from 0·10% (0·03–0·15) in the Middle East and north Africa to 1·38% (0·73–2·65) in North America (table 1). Estimated country-level prevalence of IDU varied considerably, with

	All		Women		Men	
	Population prevalence of IDU, %	Estimated number of people who inject drugs	Population prevalence of IDU, %	Estimated number of women who inject drugs	Population prevalence of IDU, %	Estimated number of men who inject drugs
Eastern Europe	1·08% (0·77–1·43)	2 282 500 (1 634 500–3 031 500)	0·54% (0·47–0·60)	581 500 (513 500–653 000)	1·64% (1·54–1·75)	1 701 000 (1 594 000–1 810 500)
Western Europe	0·35% (0·25–0·47)	991 000 (708 000–1 332 500)	0·15% (0·13–0·19)	215 500 (177 000–261 000)	0·55% (0·47–0·63)	775 500 (670 000–896 000)
East and southeast Asia	0·24% (0·18–0·29)	3 820 500 (2 945 500–4 701 000)	0·07% (0·06–0·08)	547 500 (465 000–635 500)	0·40% (0·37–0·43)	3 273 000 (3 059 500–3 497 000)
South Asia	0·14% (0·12–0·15)	1 749 000 (1 540 500–1 960 000)	<0·01% (<0·01–0·01)	27 000 (14 500–42 500)	0·26% (0·24–0·28)	1 722 000 (1 584 500–1 869 000)
Central Asia	0·51% (0·34–0·71)	241 000 (162 000–338 500)	0·15% (0·12–0·20)	37 000 (28 000–47 500)	0·86% (0·76–0·98)	204 000 (178 500–230 000)
Caribbean	0·31% (0·21–0·45)	96 000 (65 500–140 500)	0·12% (0·09–0·16)	17 500 (12 500–23 000)	0·60% (0·46–0·76)	78 500 (60 500–99 000)
Latin America	0·15% (0·08–0·21)	606 000 (347 000–873 500)	0·06% (0·04–0·09)	133 500 (93 000–180 500)	0·23% (0·18–0·29)	472 500 (366 500–591 500)
North America	1·38% (0·73–2·65)	3 316 000 (1 747 000–6 369 500)	0·84% (0·81–0·87)	1 007 000 (971 000–1 043 500)	1·92% (1·88–1·95)	2 309 000 (2 265 500–2 352 500)
Pacific Island states and territories*	..	..	..	..	..	..
Australasia	0·62% (0·44–0·79)	121 500 (86 000–155 000)	0·43% (0·39–0·48)	42 000 (38 000–46 500)	0·81% (0·74–0·89)	79 000 (71 500–86 500)
Sub-Saharan Africa	0·21% (0·11–0·38)	1 258 500 (662 500–2 238 500)	0·05% (0·03–0·07)	136 000 (81 000–203 500)	0·38% (0·31–0·48)	1 123 000 (909 000–1 390 500)
Middle East and north Africa	0·10% (0·03–0·15)	320 000 (106 000–486 000)	0·01% (<0·01–0·01)	10 500 (5 000–19 500)	0·18% (0·11–0·27)	309 000 (186 500–456 000)
Global	0·29% (0·20–0·43)	14 825 000 (10 019 500–21 660 500)	0·11% (0·10–0·13)	2 760 000 (2 400 500–3 164 000)	0·49% (0·44–0·54)	12 065 000 (10 957 000–13 311 000)

Data are % (95% CI), or point estimate (95% uncertainty interval). Estimates are for people aged 15–64 years. Numbers are rounded to the nearest 500. See appendix for estimates from the 2017 review[17] (p 85), country-level estimates of IDU prevalence (pp 90–93), and country-level pooled estimates of the percentage of people who inject drugs who are women, which informed these regional estimates (pp 153–235). IDU=injecting drug use. *No estimates of the prevalence of IDU were located for Pacific Island states and territories.

Table 1: **Estimates of the prevalence of IDU and number of people who inject drugs, by female and male gender, regionally and globally**

higher prevalence estimates in eastern Europe and the USA (figure; table 1; country-level estimates are provided in the appendix [p 90]).

An estimated 2·8 million (95% UI 2·4–3·2) women inject drugs globally, compared with 12·1 million (11·0–13·3) men (table 1; see appendix pp 92–239 for country-specific estimates). The proportion of people who inject drugs who are women varied substantially across regions, with the highest proportions found in North America (30·4% [95% CI 29·4–31·4]) and Australasia (34·8% [33·6–36·0]), in contrast to 1·6% (0·9–2·4) in South Asia (table 2; see appendix pp 92–239 for country-specific estimates). The proportion of young people (aged <25 years) among people who inject drugs was 23·9% (95% CI 18·5–29·9) globally, and was lowest in Australasia (6·5% [5·2–7·9]), central Asia (14·4% [11·7–17·4]), western Europe (15·1% [12·0–18·8]), and North America (15·4% [11·2–20·2]), and much higher in Latin America (43·4% [34·7–52·4]).

Information on people who inject drugs identifying as transgender or LGB was missing from most countries. In studies from 24 countries, the pooled global estimate of the proportion of people who inject drugs who identified as transgender was 0·4% (95% CI 0·3–1·3; table 2), ranging at the country level from 0·0% (in several countries, such as Nigeria) to 2·5% (1·3–4·0; Sierra Leone; appendix pp 155–159). Studies from 32 countries suggested that the pooled global estimate of the proportion of people who inject drugs identified as LGB was 8·9% (6·8–11·8; table 2), ranging at the country level from 0·2% (0·1–0·4; Georgia) to 30·6% (26·7–34·7; Malaysia; appendix pp 155–159).

In all regions, opioids were typically the main drug injected; globally, we estimated that 83·4% (95% CI 78·5–87·2) of people who inject drugs were mainly injecting opioids (table 3), with the highest proportions estimated in the Middle East and north Africa (96·2% [94·8–97·2]) and sub-Saharan Africa (91·9% [89·0–94·1]). Regionally, the Caribbean and Australasia had the highest proportions of people who inject drugs reporting stimulants as their main drug injected (table 3), with a wide range observed at the country level (eg, 0·3% [<0·1–1·7] in Sri Lanka *vs* 92·8% [88·0–96·1] in Puerto Rico; appendix pp 167–171). Data on recent

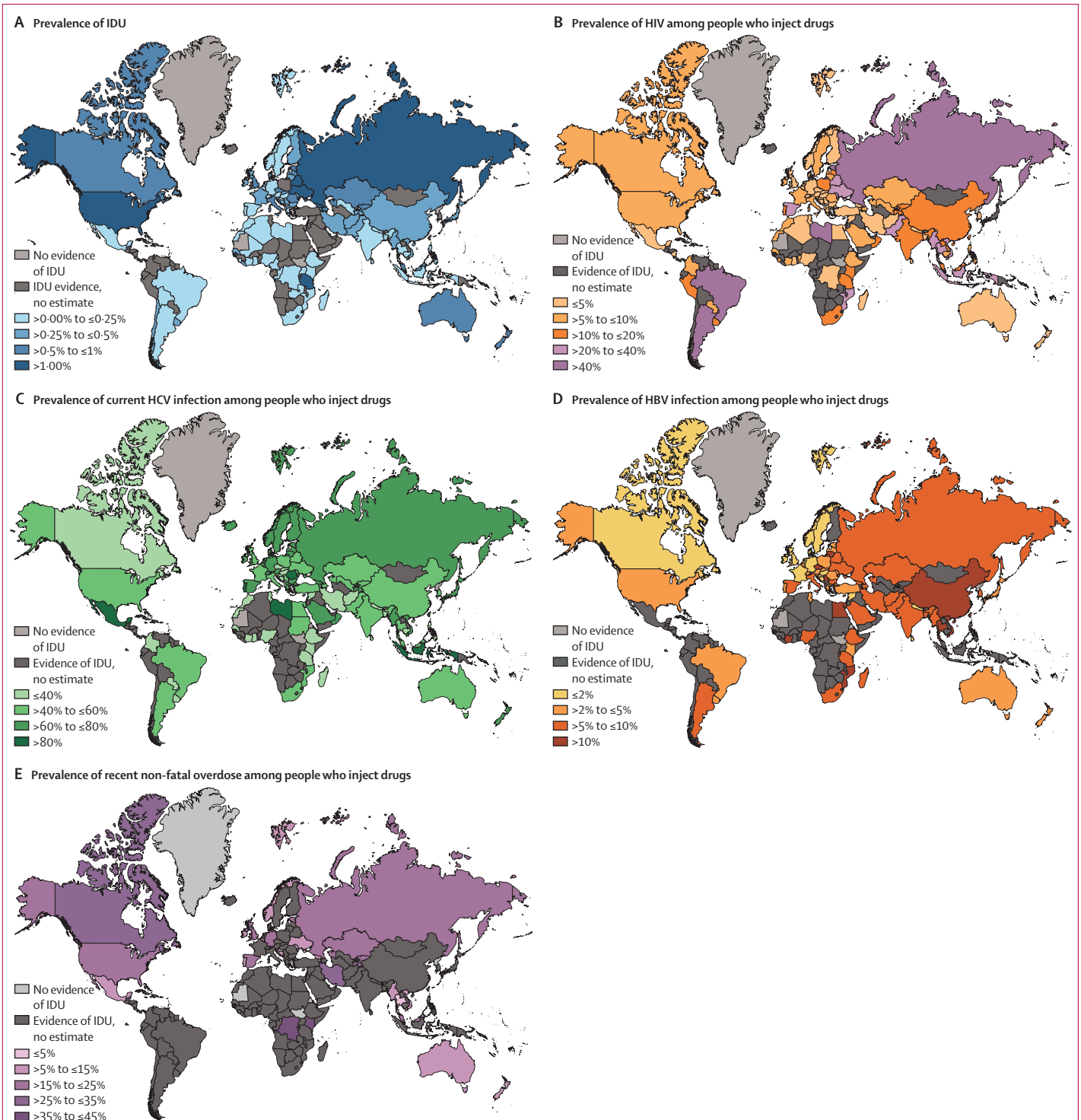

Figure: **Maps of the prevalence of IDU among people aged 15–64 years (A) and of HIV (B), current HCV infection (C), HBV infection (D), and recent non-fatal overdose (E) among people who inject drugs, by country or territory**

Data were obtained from studies published between 2008 and 2022; the actual years vary by country. Figures were generated in Tableau using background maps supplied by OpenStreetMap. IDU=injecting drug use. HCV=hepatitis C virus. HBV=hepatitis B virus.

	Countries with at least one study of people who inject drugs (estimates)	Women		Transgender people		LGB people		Young people*	
		Countries reporting (estimates)	Proportion among people who inject drugs, %	Countries reporting (estimates)	Proportion among people who inject drugs, %	Countries reporting (estimates)	Proportion among people who inject drugs, %	Countries reporting (estimates)	Proportion among people who inject drugs, %
Eastern Europe	17 (388)	17 (249)	25·5% (22·8–28·3)	0 (0)	..	8 (28)	2·0% (0·8–3·8)	14 (173)	37·5% (31·6–43·6)
Western Europe	28 (487)	25 (239)	21·7% (19·5–24·2)	4 (5)	0·2% (<0·1–4·7)	2 (3)	3·8% (1·4–9·9)	19 (118)	15·1% (12·0–18·8)
East and southeast Asia	13 (406)	11 (169)	14·3% (12·3–16·5)	4 (6)	0·1% (0·1–0·9)	4 (4)	13·6% (10·5–17·8)	8 (83)	18·6% (12·1–26·3)
South Asia	8 (440)	8 (166)	1·6% (0·9–2·4)	4 (6)	0·3% (0·1–0·4)	4 (43)	6·8% (4·0–10·3)	8 (169)	33·9% (29·5–38·4)
Central Asia	3 (12)	3 (12)	15·4% (12·1–19·2)	0 (0)	..	0 (0)	..	2 (4)	14·4% (11·7–17·4)
Caribbean	1 (7)	1 (5)	18·1% (15·8–20·6)	1 (3)	0·4% (0·3–0·9)	1 (2)	9·8% (7·7–12·3)	1 (2)	19·8% (15·2–25·0)
Latin America	4 (34)	3 (25)	22·0% (17·4–27·0)	2 (2)	0·1% (<0·1–0·8)	3 (7)	5·3% (3·4–7·8)	2 (7)	43·4% (34·7–52·4)
North America	2 (442)	2 (352)	30·4% (29·4–31·4)	2 (73)	0·8% (0·6–1·0)	2 (54)	13·7% (11·9–15·6)	2 (100)	15·4% (11·2–20·2)
Pacific Island states and territories	0 (0)	0 (0)	..	0 (0)	..	0 (0)	..	0 (0)	..
Australasia	2 (270)	2 (265)	34·8% (33·6–36·0)	2 (109)	0·5% (0·3–0·7)	2 (222)	12·9% (11·4–14·6)	1 (101)	6·5% (5·2–7·9)
Sub-Saharan Africa	23 (115)	21 (84)	10·8% (7·2–15·2)	5 (7)	0·5% (0·2–2·6)	6 (9)	2·0% (1·2–3·0)	17 (58)	21·7% (14·7–29·8)
Middle East and north Africa	15 (55)	10 (26)	3·4% (2·2–5·6)	0 (0)	..	0 (0)	..	8 (16)	37·6% (34·2–41·5)
Global	116 (2656)	103 (1592)	18·6% (16·6–20·8)	24 (211)	0·4% (0·3–1·3)	32 (372)	8·9% (6·8–11·8)	82 (831)	23·9% (18·5–29·9)

Data are number of countries (number of estimates), or % (95% CI) among people who inject drugs. See appendix (pp 153–164) for country-level estimates of these characteristics and the sources for those estimates. LGB=lesbian, gay, or bisexual. *People younger than 25 years.

Table 2: **Number of countries with data and proportions of women, transgender people, LGB people, and young people among people who inject drugs**

stimulant and opioid use (not necessarily via injecting) and other drug use are presented in the appendix (pp 167–171).

Injecting risk and sexual behaviour data among people who inject drugs were more scarce (table 3; country-level data shown in appendix pp 167–182), but some clear patterns emerged. People generally reported higher rates of reusing their own needle than of using a needle or syringe after someone else (appendix p 250; country-level data shown in appendix pp 167–171). Globally, an estimated 45·0% (95% CI 33·1–55·8) of people who inject drugs reported recent reuse of their own needle or syringe, with considerable variation at the country level, from 3·5% (1·6–6·0; in Myanmar) to 76·1% (64·4–86·1; in Pakistan). Globally, 28·3% (22·8–34·4) were estimated to have engaged in recent receptive syringe sharing (table 3; appendix p 251) and 30·0% (23·5–37·5) in distributive needle sharing, and substantial variation was observed across regions and countries (appendix pp 167–171).

Data on sexual behaviour among people who inject drugs were scarce. Globally, 55·4% (95% CI 47·6–62·9) of people who inject drugs were estimated to have had a recent regular sexual partner, and 35·9% (30·6–41·5) had a recent casual sexual partner (appendix p 250). 17·0% (12·2–22·7) had recently paid to have sex with someone, with those levels highest among countries in sub-Saharan Africa (35·5% [28·0–43·7]) and lowest in South Asia (12·1% [8·5–16·7]; appendix p 250). An estimated 20·6% (12·3–31·0) of people who inject drugs had had recent unprotected sex with a casual partner (table 3), with the lowest proportion in Australasia (9·4% [8·5–10·3]) and highest in Latin America (23·3% [15·7–32·5]); country estimates ranged from 3·5% (2·7–4·3; Viet Nam) to 72·3% (48·8–90·8; Azerbaijan; appendix pp 155–159).

The extent of exposure to risk environments also varied substantially. The proportion of people who inject drugs who had recent involvement in sex work was 14·9% (95% CI 8·1–24·3) globally and ranged from 6·1% (4·0–9·1; western Europe) to 21·4% (11·3–33·8; Latin America; table 3; country data appendix pp 155–159). The proportion who had recently experienced homelessness or unstable housing was 24·8% (19·5–31·6) globally and ranged from 8·7% (5·9–12·2; east and southeast Asia) to 54·1% (50·5–57·7; North America; table 4; country data appendix pp 155–159). Incarceration and arrest (table 4; appendix p 250, country data appendix pp 178–182) also varied widely across countries and regions, but was generally high; for example, the proportion with a lifetime history of incarceration was 58·4% (52·0–64·8) globally and ranged at the regional level from 27·2% (20·6–34·6; eastern Europe) to 79·2% (73·2–84·6; North America).

Studies in 35 countries examined the prevalence of recent non-fatal overdose among people who inject drugs. Globally, 18·5% (95% CI 13·9–24·1) of people

	Opioids as main drug injected		Stimulants as main drug injected		Frequent injecting		Recent* receptive syringe sharing		Recent* unprotected sex with casual partner		Recent* sex work	
	Countries reporting (estimates)	Proportion among people who inject drugs, %	Countries reporting (estimates)	Proportion among people who inject drugs, %	Countries reporting (estimates)	Frequent injecting, %	Countries reporting (estimates)	Proportion among people who inject drugs, %	Countries reporting (estimates)	Proportion among people who inject drugs, %	Countries reporting (estimates)	Proportion among people who inject drugs, %
Eastern Europe	11 (123)	82·8% (73·2–89·7)	10 (107)	11·7% (9·8–13·7)	16 (83)	46·6% (34·2–59·8)	14 (85)	24·4% (19·0–30·3)	10 (62)	19·7% (15·9–23·6)	9 (33)	10·5% (4·7–18·9)
Western Europe	18 (49)	76·9% (64·5–86·3)	12 (35)	17·3% (8·0–30·0)	18 (83)	47·6% (39·5–55·6)	13 (47)	16·8% (13·7–20·8)	2 (6)	20·3% (9·1–36·5)	13 (34)	6·1% (4·0–9·1)
East and southeast Asia	6 (20)	86·0% (85·3–86·6)	3 (5)	21·7% (20·0–23·3)	10 (70)	73·4% (64·1–81·8)	8 (55)	25·7% (18·4–33·8)	4 (30)	21·8% (12·5–32·8)	6 (22)	17·7% (5·4–34·9)
South Asia	6 (41)	88·7% (82·6–93·4)	3 (7)	24·1% (12·1–38·6)	8 (102)	72·4% (65·0–79·0)	8 (137)	26·1% (20·9–31·9)	3 (58)	21·9% (16·7–27·6)	5 (18)	11·9% (8·0–17·5)
Central Asia	3 (4)	87·7% (84·7–90·3)	0 (0)	..	1 (1)	87·4% (79·1–92·7)	3 (5)	45·6% (41·8–49·4)	1 (1)	20·5% (12·6–30·0)	0 (0)	..
Caribbean	1 (1)	85·6% (81·1–89·0)	1 (1)	36·0% (31·7–40·6)	1 (3)	93·2% (84·4–98·6)	1 (4)	27·2% (18·8–36·5)	0 (0)	..	1 (2)	14·4% (8·6–22·1)
Latin America	2 (4)	89·3% (80·2–95·8)	2 (4)	25·0% (5·8–51·6)	2 (14)	89·6% (80·8–94·6)	2 (12)	57·1% (48·4–67·5)	1 (1)	23·3% (15·7–32·5)	2 (6)	21·4% (11·3–33·8)
North America	2 (87)	74·8% (70·7–78·7)	2 (88)	26·5% (22·5–30·8)	2 (125)	67·6% (62·6–72·4)	2 (128)	31·8% (29·5–34·2)	2 (6)	22·0% (9·6–38·0)	2 (82)	17·1% (13·3–21·3)
Pacific Island states and territories	0 (0)	..	0 (0)	..	0 (0)	..	0 (0)	..	0 (0)	..	0 (0)	..
Australasia	2 (120)	61·9% (58·6–65·2)	2 (117)	31·9% (29·1–34·8)	2 (222)	46·2% (43·9–48·5)	2 (221)	15·1% (13·7–16·6)	1 (40)	9·4% (8·5–10·3)	2 (49)	7·4% (6·1–8·8)
Sub-Saharan Africa	11 (21)	91·9% (89·0–94·1)	8 (14)	9·4% (6·8–12·7)	13 (28)	53·1% (42·2–63·6)	12 (33)	30·3% (21·0–40·6)	7 (21)	13·1% (7·0–22·1)	12 (27)	19·6% (11·1–31·3)
Middle East and north Africa	4 (6)	96·2% (94·8–97·2)	2 (2)	16·8% (13·0–21·3)	4 (5)	50·9% (46·0–55·8)	3 (8)	26·5% (18·7–36·4)	1 (1)	21·1% (12·7–31·4)	2 (2)	7·8% (5·1–11·2)
Global	66 (476)	83·4% (78·5–87·2)	45 (380)	20·4% (15·5–26·2)	77 (736)	64·7% (56·3–72·6)	68 (735)	28·3% (22·8–34·4)	32 (226)	20·6% (12·3–31·0)	54 (275)	14·9% (8·1–24·3)

Data are number of countries (number of estimates), or % (95% CI) among people who inject drugs. See appendix (pp 165–174) for country-level estimates of these characteristics and the sources for those estimates. *Recent refers to behaviours within the past 12 months.

Table 3: **Evidence on drug use, injecting risk, and sexual behaviours among people who inject drugs**

who inject drugs were estimated to have had a recent non-fatal overdose, and this proportion was fairly consistent across regions, with the exception of Australasia (8·8% [7·3–10·6]) and sub-Saharan Africa (41·5% [37·4–45·6]; figure; table 4). 41·7% (34·7–49·5) of people who inject drugs globally were estimated to have had a non-fatal overdose in their lifetime (appendix pp 178–182). From the few data on skin and soft tissue infections that were available, we estimated 31·7% (23·6–40·5) people who inject drugs to have had a recent skin and soft tissue infection (table 4), and this proportion varied at the country level from 1·2% (0·0–5·2; in Armenia) to 64·4% (61·8–66·9; in Indonesia; appendix pp 178–182). Few countries had assessed depression and anxiety among people who inject drugs (≤12 countries, depending upon the measure), but the data that were available suggested very high levels of both conditions, whether measured by self-reporting or a validated scale (table 4; appendix pp 178–182).

Many countries had studies quantifying the prevalence of HIV, HCV, or HBV (table 5; appendix pp 92–154), with several new estimates from sub-Saharan African countries. Prevalence data on blood-borne virus infections were available for HIV in 114 countries, HCV in 106 countries, and HBV in 83 countries (collectively covering >89% of the estimated global population of people who inject drugs). We estimated that 2·3 million (95% UI 1·5–3·1) people who inject drugs globally are living with HIV, amounting to 15·2% (95% CI 10·3–20·9) of all people who inject drugs. Considerable regional variation was found in HIV prevalence among people who inject drugs, from 1·1% (95% CI 0·8–1·6) in Australasia to 34·2% (26·0–42·5) in eastern Europe, in addition to further variation between countries within these regions (figure). We estimated that 38·8% (31·4–46·9) of people who inject drugs globally have current HCV infection, equating to 5·8 million (95% UI 4·6–7·0) people. The regions with the highest prevalence of current HCV infection were eastern

	Current or recent* homelessness or unstable housing		Recent† arrest		Recent† incarceration		Recent† non-fatal overdose		Recent† skin and soft tissue infections		Recent† depression (self-reported)		Recent† anxiety (self-reported)	
	Countries reporting (estimates)	Proportion among people who inject drugs, %	Countries reporting (estimates)	Proportion among people who inject drugs, %	Countries reporting (estimates)	Proportion among people who inject drugs, %	Countries reporting (estimates)	Proportion among people who inject drugs, %	Countries reporting (estimates)	Proportion among people who inject drugs, %	Countries reporting (estimates)	Proportion among people who inject drugs, %	Countries reporting (estimates)	Proportion among people who inject drugs, %
Eastern Europe	12 (36)	9·7% (4·1–20·4)	3 (7)	60·3% (49·8–70·1)	3 (20)	15·2% (12·5–18·2)	7 (44)	15·5% (7·0–26·8)	1 (3)	32·0% (23·6–41·1)	0 (0)	..	0 (0)	..
Western Europe	22 (139)	25·4% (20·8–30·4)	4 (4)	39·2% (31·7–47·0)	4 (12)	28·8% (24·3–33·8)	11 (58)	16·1% (13·1–19·8)	9 (40)	44·5% (36·7–52·5)	1 (1)	62·9% (53·1–71·4)	1 (1)	62·0% (57·6–66·3)
East and southeast Asia	6 (15)	8·7% (5·9–12·2)	1 (2)	40·4% (35·2–45·5)	3 (5)	33·6% (28·2–39·7)	4 (7)	11·3% (7·4–16·6)	1 (1)	33·8% (25·7–42·6)	2 (2)	24·8% (21·4–28·5)	1 (1)	66·2% (61·6–70·7)
South Asia	6 (82)	30·1% (22·0–38·8)	2 (2)	24·0% (21·3–26·9)	5 (17)	12·2% (8·6–16·4)	1 (2)	20·0% (15·5–25·4)	3 (3)	14·4% (12·4–16·7)	2 (2)	57·8% (53·8–61·9)	1 (1)	66·4% (61·8–70·8)
Central Asia	2 (2)	14·3% (11·7–17·2)	0 (0)	..	0 (0)	..	3 (3)	25·5% (21·8–29·6)	0 (0)	..	0 (0)	--	0 (0)	..
Caribbean	1 (2)	28·0% (23·3–34·0)	0 (0)	..	1 (1)	27·7% (23·8–32·1)	1 (1)	20·7% (15·2–27·1)	0 (0)	..	1 (1)	65·3% (54·9–74·3)	0 (0)	..
Latin America	2 (9)	25·1% (17·7–33·5)	1 (4)	40·6% (33·6–47·8)	1 (3)	34·8% (28·2–41·4)	1 (2)	16·8% (12·6–21·8)	0 (0)	..	0 (0)	..	0 (0)	..
North America	2 (167)	54·1% (50·5–57·7)	2 (14)	35·6% (31·9–39·4)	2 (48)	41·5% (38·2–44·8)	2 (38)	20·0% (16·3–23·8)	1 (15)	35·0% (23·7–47·1)	2 (4)	74·6% (61·4–85·7)	1 (2)	76·1% (71·2–80·7)
Pacific Island states and territories	0 (0)	..	0 (0)	..	0 (0)	..	0 (0)	..	0 (0)	..	0 (0)	..	0 (0)	..
Australasia	2 (131)	17·8% (15·6–20·2)	2 (116)	32·7% (29·9–35·5)	2 (102)	9·9% (8·4–11·5)	2 (167)	8·8% (7·3–10·6)	1 (114)	7·3% (6·7–7·9)	1 (112)	29·3% (27·8–30·9)	1 (112)	20·9% (19·5–22·5)
Sub-Saharan Africa	6 (12)	21·9% (8·6–39·8)	5 (5)	60·1% (55·9–64·2)	0 (0)	..	2 (5)	41·5% (37·4–45·6)	0 (0)	..	1 (2)	50·8% (42·7–57·9)	1 (1)	52·6% (48·1–57·0)
Middle East and north Africa	3 (10)	9·7% (6·2–13·8)	0 (0)	..	0 (0)	..	1 (1)	18·5% (13·7–24·3)	1 (1)	31·6% (23·3–40·6)	0 (0)	..	0 (0)	..
Global	64 (605)	24·8% (19·5–31·6)	20 (154)	42·0% (36·5–47·4)	21 (208)	29·2% (25·2–33·6)	35 (328)	18·5% (13·9–24·1)	17 (177)	31·7% (23·6–40·5)	10 (124)	54·2% (45·9–61·5)	6 (118)	66·8% (62·1–71·2)

Data are number of countries (number of estimates), or % (95% CI) among people who inject drugs. See appendix (pp 153–185) for country-level estimates of these characteristics and the sources for those estimates. *Includes all estimates except lifetime estimates. †Recent refers to occurrences within the past 12 months; for arrest and incarceration, occurrence within the past 3 months were excluded.

Table 4: **Evidence on exposure to risk environments and other health harms among people who inject drugs**

	HIV positive		Current HCV infection (HCV RNA positive)		Previous HCV infection (anti-HCV antibody positive)		Current HBV infection (HBsAg positive)	
	Prevalence among people who inject drugs, %	Estimated number of people who inject drugs	Prevalence among people who inject drugs, %	Estimated number of people who inject drugs	Prevalence among people who inject drugs, %	Estimated number of people who inject drugs	Prevalence among people who inject drugs, %	Estimated number of people who inject drugs
Eastern Europe	34·2% (26·0–42·5)	780 000 (588 500–971 500)	48·4% (42·1–54·7)	1 105 000 (960 500–1 259 000)	66·8% (57·4–75·3)	1 524 000 (1 305 000–1 739 000)	7·5% (5·4–9·8)	172 000 (124 000–226 500)
Western Europe	5·1% (3·6–7·0)	51 000 (32 500–73 500)	38·1% (33·1–43·2)	377 500 (302 000–466 000)	56·3% (51·2–61·3)	557 500 (461 500–668 000)	2·7% (0·7–5·0)	26 500 (7000–50 500)
East and southeast Asia	14·5% (8·9–21·4)	554 000 (319 500–814 000)	40·1% (25·6–56·2)	1 531 000 (1 040 000–2 067 500)	55·0% (36·5–73·5)	2 099 500 (1 555 500–2 644 500)	16·1% (7·7–26·8)	614 000 (278 500–993 500)
South Asia	16·5% (11·9–21·8)	288 000 (203 000–380 500)	34·5% (28·0–41·5)	604 000 (480 500–735 500)	47·9% (27·0–67·9)	837 000 (597 000–1 085 000)	6·6% (4·5–9·2)	115 500 (76 500–160 500)
Central Asia	10·2% (7·1–14·5)	24 500 (17 500–32 500)	39·3% (35·5–43·1)	94 500 (80 500–110 000)	55·5% (50·9–60·1)	133 500 (114 500–154 000)	8·1% (5·2–11·6)	19 500 (12 000–28 500)
Caribbean*	13·2% (8·9–18·2)	12 500 (7500–19 000)	43·6% (36·6–51·0)	41 500 (29 000–52 500)	58·7% (48·2–69·0)	56 000 (41 000–74 500)	..	..
Latin America	31·5% (14·3–49·1)	191 000 (115 500–278 500)	43·7% (38·9–48·6)	265 000 (199 500–339 000)	57·8% (52·7–63·1)	350 500 (268 000–443 500)	2·6% (1·4–3·9)	16 000 (7500–26 500)
North America	5·9% (4·6–7·3)	194 000 (150 500–241 000)	42·5% (39·6–45·4)	1 409 000 (1 311 000–1 508 500)	52·7% (45·7–59·7)	1 748 000 (1 517 000–1 978 500)	4·5% (2·8–6·9)	150 500 (88 500–222 000)
Pacific Island states and territories*	..	..	..	..	..	..	..	..
Australasia	1·1% (0·8–1·6)	1500 (1000–2000)	24·4% (20·4–28·6)	29 500 (23 500–36 000)	56·3% (51·6–61·0)	68 500 (60 000–77 500)	3·7% (2·3–5·2)	4500 (2500–6500)
Sub-Saharan Africa	11·2% (5·4–19·0)	140 500 (61 000–244 000)	15·3% (9·3–23·1)	192 000 (98 500–303 000)	20·6% (12·9–30·2)	259 500 (143 500–400 000)	6·9% (4·1–10·5)	86 500 (47 000–137 500)
Middle East and north Africa	4·1% (2·5–6·8)	13 500 (4500–27 500)	30·5% (26·2–35·2)	97 500 (57 500–148 500)	43·5% (35·7–51·5)	139 000 (80 000–214 000)	7·5% (5·8–9·5)	24 000 (14 000–37 000)
Global	15·2% (10·3–20·9)	2 253 500 (1 503 000–3 090 500)	38·8% (31·4–46·9)	5 756 000 (4 586 000–7 041 000)	52·5% (40·7–64·3)	7 786 000 (6 149 000–9 500 500)	8·4% (4·7–13·0)	1 239 000 (662 500–1 905 000)

Data are % (95% CI), or point estimate (95% uncertainty interval). Numbers are rounded to the nearest 500. See appendix (pp 89–93) for country-level HIV, HCV, and HBsAg estimates. HBV=hepatitis B virus. HCV=hepatitis C virus. *No estimates of the prevalence of HIV, HCV RNA, anti-HCV antibodies, or HBsAg among people who inject drugs were located for Pacific Island states and territories, or for the prevalence of HBsAg among people who inject drugs in the Caribbean, so the weighted observed global prevalence was used here.

Table 5: **Regional and global estimates of people who inject drugs who are HIV positive, have current or previous HCV infection, and are HBsAg positive**

Europe, Latin America, the Caribbean, and North America (figure; table 5). 8·4% (95% CI 4·7–13·0) of people who inject drugs were estimated to have current HBV infection (as indicated by HBsAg positivity), equating to 1·2 million (95% UI 0·7–1·9) people (table 5). The regions and countries with the highest estimated prevalence of HBV infection were mostly in Asia and eastern Europe (figure). Additional information on chronic conditions, other drug use, and risk behaviours are provided in the appendix (pp 249–251).

Discussion

There are an estimated 14·8 million people who inject drugs in 190 countries holding more than 99% of the world population. The number of countries with evidence of IDU increased from 148 in 2007[15] to 190 in 2022, with increases largely in low-income and middle-income countries. The increase in the available evidence meant that less imputation of regional and global estimates was required. Clear geographical variation was found in the age and gender profiles of people who inject drugs: on average people who inject drugs in high-income countries were older and had a higher proportion of women as compared with those in LMICs. We expanded key indicators in the current review versus the 2017 review to include a wider range of demographics, risks, and harms (eg, sexuality, gender, sexual risk behaviours, patterns of drug use, overdose, and mental and physical health harms). We estimated that one in 11 people who inject drugs globally identifies as LGB and 0·4% as transgender.

Drug injecting, drug use patterns, and exposure to adverse risks varied substantially geographically. For example, globally more than 80% of people who inject drugs primarily injected opioids, but in several countries, such as the Czech Republic, more than 80% primarily injected stimulants. This presents challenges given the little available evidence of interventions that are effective in addressing dependent stimulant use[29] compared with opioid use.[30] Similarly, the need for high availability of needle and syringe provision probably varies geographically given the large variation in frequency of injecting across countries.

Although we have presented regional estimates from previous reviews in addition to those of the current review (appendix p 90), caution is needed when interpreting changes in the estimated prevalence and size of the population of people who inject drugs. Even for countries that had new estimates since the previous review, direct comparison was often hampered because the methodology changed, making it difficult to attribute any changes in estimates to changes in the population as opposed to altered methods.

We found variation across regions in the prevalence of recent exposure to incarceration (range 9·9–41·5%), homelessness or unstable housing (8·7–54·1%), and sex work (6·1–21·4%) among people who inject drugs. All of these exposures are associated with greater transmission of blood-borne viruses[31–33] and poorer physical and mental health outcomes.[34–37] The available evidence suggests that these adverse exposures might be higher in high-income countries, including those in North America.

To our knowledge, this is the first comprehensive updated global review of the prevalence of injecting drug use and drug-related harm since evidence presented in 2017,[17] which also updates estimates generated by the Global Burden of Diseases, Injuries, and Risk Factors (GBD) study,[3,38,39] and could inform UN agencies' estimates of injecting drug use and burden of disease.[18] Other recent reviews have either used the data we collated in 2017 (such as those by Tran and colleagues[24] and Colledge and colleagues[40,41]) or updated only a small proportion of the evidence presented here.

Overall, there were no substantial reductions in the prevalence of injecting drug use or drug-related harm—such as HIV, HCV, and HBV—compared with the previous review, which has implications for global and national policymakers. There is clearly a need for ongoing efforts to sustain efforts to reduce harms among people who inject drugs.

This review also extended global evidence on key characteristics and potential adverse exposures (including gender and sexuality, sexual risk behaviours, a wide range of drug use behaviours, and physical health conditions). Our review of new indicators, including mental and physical health problems, revealed gaps in the evidence base. For example, although they are rarely measured in studies of people who inject drugs compared with other outcomes, anxiety and depression are high among people who inject drugs (for example, the GBD 2019 study estimated an age-standardised prevalence of 3·44% [95% UI 3·10–3·82] for depressive disorders in the general population globally,[42] compared with a prevalence of 66% in studies that used validated scales to assess depression in people who inject drugs in this review).

There are a number of limitations related to the nature of the data used in this review. First, IDU is a comparatively rare exposure and has associated stigma, meaning that traditional general survey methods are unlikely to capture the frequency or prevalence of exposure or harm; therefore, we must rely on a mixture of indirect methods and specific surveys of people who inject drugs. We observed an increase in studies using indirect methods to estimate the prevalence of IDU. These studies involve different sources of data to indirectly estimate the total number of people who inject drugs, such as using multiplier methods, back-projection, and capture–recapture methods.[43] Nonetheless indirect estimation can be biased and needs to be corroborated where possible with other evidence. Few countries had ongoing programmes to update the evidence on the prevalence of IDU.[44]

There is scope to improve the quality of estimates of IDU prevalence. For example, for Russia, we had to base our estimate on a study with incomplete information on the exact methodology. It appeared to be based on an indirect estimation approach; however, we could not obtain the original report to review the full study details. As expected, this national estimate was far lower than several very high prevalence estimates made in specific Russian cities with public health problems with IDU (eg, Togliatti).[45,46] Nonetheless, the lack of clear and robust methodology in the estimate for Russia is just one example. Exceptions to this were some countries in western and eastern Europe in particular, where consistent approaches to estimating IDU prevalence have been implemented over time, and it seems that the prevalence of IDU has declined (eg, Netherlands and Spain).[47]

Second, data on the characteristics of people who inject drugs were often sparse. The characteristics on which we focused are important in terms of considering service provision, considering the scale of risk and intervention needs, and in understanding the structural and environmental risks often faced by people who inject drugs, but many surveys assess few, if any, of these aspects. It would be of benefit if future studies considered including a more comprehensive assessment of these aspects of the lives and experiences of people who inject drugs, and paid attention to recruiting unbiased samples.

Third, there is a paucity of data on the uptake of direct-acting antiviral treatment, so it is difficult to fully account for the effect of HCV treatment on the prevalence of active HCV infection. We believe that this effect is relatively small given that high-income countries where HCV treatment is likely to have had a sizable impact on the ratio of antibody positivity to RNA positivity are commonly the same countries with direct measures of HCV RNA (eg, Australia, the USA, Canada, and Germany).

We are likely to have missed some studies in our literature search. To address this as much as possible, we liaised directly with WHO, The Global Fund, UNODC, and UNAIDS staff, and with many researchers across our networks globally. We encourage feedback via email, as well as enquiries from researchers interested in collaboration.

IDU has been documented in most countries. By focusing on the characteristics and a range of health outcomes of people who inject drugs, wide variation in these features, and data availability, across countries and regions is apparent. Wide variations between countries with regard to the types of drugs used and injected, frequency of injecting, and levels of injecting and sexual risk were observed. These variations must be considered in policy and service planning, and have important implications for the types of interventions required in a given country. People who inject drugs are often exposed to varied risk environments, and the extent of this exposure varies across countries in ways that must also be considered in efforts to reduce harms among people who inject drugs. These harm-reduction methods must also address structural and environmental factors that predispose people who inject drugs to elevated risks of harm.

There is a need to simultaneously address other drivers of susceptibility and risk and tackle the multiple syndemics that affect people who inject drugs. Our review of existing characteristics of these populations suggests considerable cause for concern—across multiple indicators, about the level of exposure to high-risk environments among people who inject drugs, and about the level of engagement in risk behaviours of these populations in some countries. For example, the very high levels of injecting risk behaviour recorded among people who inject drugs in Brazil might be related to the absence of needle and syringe programmes in that country.[48] We estimated that 58·4% of people who inject drugs globally reported a lifetime history of exposure to incarceration, where high levels of risk often occur in terms of drug use and other risks to wellbeing,[7,49] although prisons can also drive improvements in the health of people who use drugs through delivery of key interventions.[50–52]

Finally, HIV and HCV prevalence remain high among people who inject drugs, which suggests that, globally at least, substantial improvements in harm reduction coverage and prevention of drug-related harm have not been made. Investment in harm reduction activities, such as needle and syringe programmes and opioid agonist treatment (which has multiple effects, reducing HIV and HCV transmission, non-fatal and fatal overdose, and probably also injection-related diseases),[30,53] and provision of treatment and care for those who are living with HIV[54] and HCV[55] are imperative. These interventions should also widen beyond individual-level interventions to address these environmental risks and social inequities that often intersect.[1] Examples include supervised injection facilities (ie, to reduce the risks of the injecting environment), addressing legal barriers to the use of drugs and of injection equipment, and facilitating access to services that address social and economic wellbeing. Our examinations of the current levels of coverage of these interventions for people who inject drugs are published separately.[48]

For **feedback and enquiries regarding our reviews** contact global.reviews@unsw.edu.au

Contributors
LD conceived of the scope of the review with JG, MH, AP, and SC-F. Data analysis and estimate generation were done by PW, JI, SC-F, SO, JL, and LD. Maps were generated by SO. LD drafted the first iteration of the manuscript. All authors made substantial contributions to critical review, editing, and revision of the manuscript. All authors approved the final version of the manuscript. LD, MH, PW, SC-F, and JI accessed and verified the data underlying the study; LD, PW, and MH reviewed IDU prevalence; LD, JI, SO, and PW verified final characteristics data; and a large group of people extracted and double-checked the data. All authors had full access to all the data in the study and had final responsibility for the decision to submit for publication.

Declaration of interests
In the past 3 years, LD and MF have received investigator-initiated untied educational grants for studies of opioid medications in Australia from Indivior and Seqirus. AP has received investigator-initiated untied educational grants from Seqirus. JG is a consultant or advisor and has received research grants from AbbVie, bioLytical, Camurus, Cepheid, Gilead Sciences, Hologic, Indivior, and Merck or MSD. GJD has received research grants from AbbVie, Gilead Sciences, and Merck or MSD. EBC has received funding from the Canadian Network on Hepatitis C. These companies and organisations had no knowledge of or role in the design, conduct, interpretation, or publication of these findings. All other authors declare no competing interests.

Data sharing
Researchers wishing to undertake additional analyses of the data are invited to contact the corresponding author. Enquiries from researchers interested in collaboration can be sent to global.reviews@unsw.edu.au.

Acknowledgments
This review was supported by the Australian National Health and Medical Research Council (NHMRC) ASCEND programme (grant 1150078), an NHMRC investigator grant (1176131), the National Drug and Alcohol Research Centre (NDARC), University of New South Wales (UNSW) Sydney, and partly funded by a US National Institute of Allergy and Infectious Diseases grant (R01AI147490 RFA-AI-18-026). LD is supported by an NHMRC senior principal research fellowship (1135991). SC-F acknowledges funding from the UNSW Scientia scholarship programme, and the National Drug Research Institute Melbourne. AP, GJD, and JG (1176131) are supported by NHMRC investigator grant awards. JL is supported by an NHMRC Emerging Leader fellowship. MH and PV acknowledge support from the UK National Institute for Health and Care Research (NIHR) Health Protection Research Unit (HPRU) in Behavioural Science and Evaluation and NIHR programme grant EPIToPe. PV acknowledges support from the HPRU in STIs and blood-borne viruses and the US National Institute on Drug Abuse (grant number R01 DA037773-01A1). PW acknowledges support from an Australian Government research training program scholarship as well as an NDARC higher degree research scholarship. LTT and OP acknowledge support from an NHMRC PhD scholarship as well as an NDARC higher degree research scholarship. NDARC, the Kirby Institute, and NCYSUR are funded by the Australian Government Department of Health. The views expressed in this publication do not necessarily represent the position of the Australian Government. We thank the people who assisted with searches for and extraction of data from the eligible papers in this review: Brodie Clark (National Drug and Alcohol Research Centre, University of New South Wales, Sydney, NSW, Australia); MJ Stowe (Kirby Institute, University of New South Wales, Sydney, NSW, Australia); Aaron Lim, Adam Trickey, Adelina Artenie, Clare French, Deborah Down, Hannah Fraser, Thomas Davies (Population Health Science, Bristol Medical School, University of Bristol, Bristol, UK); and Tesfa Mekonen Yimer (National Centre For Youth Substance Use Research, University of Queensland, St Lucia, QLD, Australia). We also thank the individuals who provided encouragement and support in various ways throughout the conduct of this review, including circulating requests for data, provision of contacts in countries and assistance with locating data: Andrew Scheibe (TB HIV Care and University of Pretoria, Hatfield, South Africa); Angela Me, Monica Ciupagea (UNODC); Annette Verster, Niklas Luhmann, Virginia MacDonald (WHO); and Keith Sabin (UNAIDS). We acknowledge the detailed review and feedback on IDU prevalence estimates provided by Kamran Niaz (UNODC) in particular. Assistance in sourcing and verifying

data was provided by individuals from government, non-government, and research organisations, for which we are thankful (individuals are listed in the appendix [p 374]).

Editorial note: The Lancet Group takes a neutral position with respect to territorial claims in published maps, text, and appendices.

References

1 Collins AB, Boyd J, Cooper HLF, McNeil R. The intersectional risk environment of people who use drugs. *Soc Sci Med* 2019; **234:** 112384.

2 Rhodes T. The 'risk environment': a framework for understanding and reducing drug-related harm. *Int J Drug Policy* 2002; **13:** 85–94.

3 Degenhardt L, Charlson F, Stanaway J, et al. Estimating the burden of disease attributable to injecting drug use as a risk factor for HIV, hepatitis C, and hepatitis B: findings from the Global Burden of Disease Study 2013. *Lancet Infect Dis* 2016; **16:** 1385–98.

4 Larney S, Peacock A, Mathers BM, Hickman M, Degenhardt L. A systematic review of injecting-related injury and disease among people who inject drugs. *Drug Alcohol Depend* 2017; **171:** 39–49.

5 Eckhardt B, Winkelstein ER, Shu MA, et al. Risk factors for hepatitis C seropositivity among young people who inject drugs in New York City: implications for prevention. *PloS One* 2017; **12:** e0177341.

6 Wood EF, Werb D, Beletsky L, et al. Differential experiences of Mexican policing by people who inject drugs residing in Tijuana and San Diego. *Int J Drug Policy* 2017; **41:** 132–39.

7 Larney S, Kopinski H, Beckwith CG, et al. Incidence and prevalence of hepatitis C in prisons and other closed settings: results of a systematic review and meta-analysis. *Hepatology* 2013; **58:** 1215–24.

8 Genberg BL, Astemborski J, Vlahov D, Kirk GD, Mehta SH. Incarceration and injection drug use in Baltimore, Maryland. *Addiction* 2015; **110:** 1152–59.

9 Blouin K, Leclerc P, Morissette C, et al. Sex work as an emerging risk factor for human immunodeficiency virus seroconversion among people who inject drugs in the SurvUDI network. *Sex Transm Dis* 2016; **43:** 648–55.

10 Barrett D, Hunt N, Stoicescu C. Injecting drug use among under-18s: a snapshot of available data. London: Harm Reduction International, 2013. https://hri.global/wp-content/uploads/2013/12/injecting_among_under_18s_snapshot_WEB.pdf (accessed Aug 5, 2022).

11 Springer SA, Larney S, Alam-Mehrjerdi Z, Altice FL, Metzger D, Shoptaw S. Drug treatment as HIV prevention among women and girls who inject drugs from a global perspective: progress, gaps, and future directions. *J Acquir Immune Defic Syndr* 2015; **69** (suppl 2)**:** S155–61.

12 Kozlov AP, Shaboltas AV, Toussova OV, et al. HIV incidence and factors associated with HIV acquisition among injection drug users in St Petersburg, Russia. *AIDS* 2006; **20:** 901–06.

13 Zule WA, Desmond DP. An ethnographic comparison of HIV risk behaviors among heroin and methamphetamine injectors. *Am J Drug Alcohol Abuse* 1999; **25:** 1–23.

14 Kaye S, Darke S. A comparison of the harms associated with the injection of heroin and amphetamines. *Drug Alcohol Depend* 2000; **58:** 189–95.

15 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.

16 Nelson PK, Mathers BM, Cowie B, et al. Global epidemiology of hepatitis B and hepatitis C in people who inject drugs: results of systematic reviews. *Lancet* 2011; **378:** 571–83.

17 Degenhardt L, Peacock A, Colledge S, et al. Global prevalence of injecting drug use and sociodemographic characteristics and prevalence of HIV, HBV, and HCV in people who inject drugs: a multistage systematic review. *Lancet Glob Health* 2017; **5:** e1192–207.

18 UN Office on Drugs and Crime. World Drug Report 2022. Vienna: United Nations, 2022. https://www.unodc.org/unodc/data-and-analysis/world-drug-report-2022.html (accessed Aug 5, 2022).

19 WHO. Global health sector strategy on viral hepatitis 2016–2021. Geneva: World Health Organization, 2016. http://apps.who.int/iris/bitstream/10665/246177/1/WHO-HIV-2016.06-eng.pdf?ua=1 (accessed June 5, 2017).

20 UNAIDS. 90-90-90 An ambitious treatment target to help end the AIDS epidemic, 2014.

21 UN. Resolution adopted by the General Assembly on 25 September 2015. 70/1. Transforming our world: the 2030 Agenda for Sustainable Development. New York: United Nations, 2015. https://www.un.org/en/development/desa/population/migration/generalassembly/docs/globalcompact/A_RES_70_1_E.pdf (accessed July 22, 2021).

22 Moher D, Liberati A, Tetzlaff J, Altman DG. Preferred Reporting Items for Systematic reviews and Meta-Analyses: the PRISMA statement. *Ann Intern Med* 2009; **151:** 264–69, W64.

23 Stevens GA, Alkema L, Black RE, et al. Guidelines for Accurate and Transparent Health Estimates Reporting: the GATHER statement. *Lancet* 2016; **388:** e19–23.

24 Tran LT, Nicholas T, Degenhardt L. Searching the grey literature to access research on illicit drug use, HIV and viral hepatitis: an update. Technical report number 341. Sydney: National Drug and Alcohol Research Centre, University of NSW, 2020. https://ndarc.med.unsw.edu.au/sites/default/files/ndarc/resources/Searching%20the%20grey%20literature%20to%20access%20research%20on%20illicit%20drug%20use%20HIV%20and%20viral%20hepatitis%20An%20update.pdf (accessed July 22, 2022).

25 Harm Reduction International. The global state of harm reduction—2021 update. London: Harm Reduction International. https://hri.global/reports/2021-annual-report/ (accessed June 29, 2022).

26 European Monitoring Centre for Drugs and Drug Addiction. Statistical bulletin 2021. Lisbon: European Monitoring Centre for Drugs and Drug Addiction, 2021. https://www.emcdda.europa.eu/data/stats2021_en (accessed Aug 5, 2022).

27 Grebely J, Larney S, Peacock A, et al. Global, regional, and country-level estimates of hepatitis C infection among people who have recently injected drugs. *Addiction (Abingdon, England)* 2018.

28 UN Department of Economic and Social Affairs. World population prospects 2022: summary of results. New York: United Nations, 2022. https://www.un.org/development/desa/pd/sites/www.un.org.development.desa.pd/files/wpp2022_summary_of_results.pdf (accessed Aug 5, 2023).

29 Farrell M, Martin NK, Stockings E, et al. Responding to global stimulant use: challenges and opportunities. *Lancet* 2019; **394:** 1652–67.

30 Degenhardt L, Grebely J, Stone J, et al. Global patterns of opioid use and dependence: harms to populations, interventions, and future action. *Lancet* 2019; **394:** 1560–79.

31 Stone J, Artenie A, Hickman M, et al. The contribution of unstable housing to HIV and hepatitis C virus transmission among people who inject drugs globally, regionally, and at country level: a modelling study. *Lancet Public Health* 2022; **7:** e136–45.

32 Arum C, Fraser H, Artenie AA, et al. Homelessness, unstable housing, and risk of HIV and hepatitis C virus acquisition among people who inject drugs: a systematic review and meta-analysis. *Lancet Public Health* 2021; **6:** e309–23.

33 Stone J, Fraser H, Lim AG, et al. Incarceration history and risk of HIV and hepatitis C virus acquisition among people who inject drugs: a systematic review and meta-analysis. *Lancet Infect Dis* 2018; **18:** 1397–409.

34 Dumont DM, Brockmann B, Dickman S, Alexander N, Rich JD. Public health and the epidemic of incarceration. *Annu Rev Public Health* 2012; **33:** 325–39.

35 Millan-Alanis JM, Carranza-Navarro F, de León-Gutiérrez H, et al. Prevalence of suicidality, depression, post-traumatic stress disorder, and anxiety among female sex workers: a systematic review and meta-analysis. *Arch Women Ment Health* 2021; **24:** 867–79.

36 Tweed EJ, Thomson RM, Lewer D, et al. Health of people experiencing co-occurring homelessness, imprisonment, substance use, sex work and/or severe mental illness in high-income countries: a systematic review and meta-analysis. *J Epidemiol Community Health* 2021; **75:** 1010–18.

37 Gutwinski S, Schreiter S, Deutscher K, Fazel S. The prevalence of mental disorders among homeless people in high-income countries: an updated systematic review and meta-regression analysis. *PloS Med* 2021; **18:** e1003750.

38 Degenhardt L, Charlson F, Ferrari A, et al. The global burden of disease attributable to alcohol and drug use in 195 countries and territories, 1990–2016: a systematic analysis for the Global Burden of Disease Study 2016. *Lancet Psychiatry* 2018; **5:** 987–1012.

39 Murray CJL, Aravkin AY, Zheng P, et al. Global burden of 87 risk factors in 204 countries and territories, 1990–2019: a systematic analysis for the Global Burden of Disease Study 2019. *Lancet* 2020; **396:** 1223–49.

40 Colledge S, Leung J, Larney S, et al. Frequency of injecting among people who inject drugs: a systematic review and meta-analysis. *Int J Drug Policy* 2020; **76:** 102619.

41 Colledge S, Peacock A, Leung J, et al. The prevalence of non-fatal overdose among people who inject drugs: a multi-stage systematic review and meta-analysis. *Int J Drug Policy* 2019; **73:** 172–84.

42 Ferrari AJ, Santomauro D, Mantilla Herrera A, et al. Global, regional, and national burden of 12 mental disorders in 204 countries and territories, 1990–2019: a systematic analysis for the Global Burden of Disease Study 2019. *Lancet Psychiatry* 2022; **9:** 137–50.

43 Hickman M, Taylor C, Chatterjee A, et al. Estimating the prevalence of problematic drug use: a review of methods and their application. *Bull Narc* 2002; **LIV:** 15–32.

44 Jones HE, Hickman M, Welton NJ, De Angelis D, Harris RJ, Ades AE. Recapture or precapture? Fallibility of standard capture-recapture methods in the presence of referrals between sources. *Am J Epidemiol* 2014; **179:** 1383–93.

45 Rhodes T, Platt L, Judd A, et al. Hepatitis C virus infection, HIV co-infection, and associated risk among injecting drug users in Togliatti, Russia. *Int J STD AIDS* 2005; **16:** 749–54.

46 Platt L, Hickman M, Rhodes T, et al. The prevalence of injecting drug use in a Russian city: implications for harm reduction and coverage. *Addiction* 2004; **99:** 1430–38.

47 Barrio Anta G, Oliva J, Bravo MJ, De Mateo S, Domingo-Salvany A. Estimating the prevalence of drug injection using a multiplier method based on a register of new HIV diagnoses. *Eur J Public Health* 2011; **21:** 646–48.

48 Colledge-Frisby S, Ottaviano S, Webb P, et al. The global coverage of interventions to prevent and manage drug-related harms among people who inject drugs: a multi-stage systematic review of the evidence. *Lancet Glob Health* 2023; published online March 27. https://doi.org/10.1016/S2214-109X(23)00058-X.

49 Altice FL, Azbel L, Stone J, et al. The perfect storm: incarceration and the high-risk environment perpetuating transmission of HIV, hepatitis C virus, and tuberculosis in Eastern Europe and Central Asia. *Lancet* 2016; **388:** 1228–48.

50 WHO. Consolidated guidelines on HIV prevention, diagnosis, treatment and care for key populations. Geneva: World Health Organization, 2014. https://www.who.int/publications/i/item/9789241507431 (accessed Aug 5, 2022).

51 Rich JD, Beckwith CG, Macmadu A, et al. Clinical care of incarcerated people with HIV, viral hepatitis, or tuberculosis. *Lancet* 2016; **388:** 1103–14.

52 Kamarulzaman A, Reid SE, Schwitters A, et al. Prevention of transmission of HIV, hepatitis B virus, hepatitis C virus, and tuberculosis in prisoners. *Lancet* 2016; **388:** 1115–26.

53 Colledge-Frisby S, Jones N, Larney S, et al. The impact of opioid agonist treatment on hospitalisations for injecting-related diseases among an opioid dependent population: a retrospective data linkage study. *Drug Alcohol Depend* 2022; **236:** 109494.

54 UN. Declaration of commitment on HIV/AIDS—United Nations General Assembly special session on HIV/AIDS. New York: United Nations, 2001. https://data.unaids.org/publications/irc-pub03/aidsdeclaration_en.pdf (accessed Aug 5, 2023).

55 Dore GJ, Feld JJ. Hepatitis C virus therapeutic development: in pursuit of "perfectovir". *Clin Infect Dis* 2015; **60:** 1829–36.