BMJ Open

HIV and syphilis seroprevalence and related unsafe sexual behaviours among people who inject drugs in Georgia: a cross-sectional study

Maia Kajaia ,[1] Mamuka Djibuti ,[2] Jack A DeHovitz ,[3] George Kamkamidze,[4] Davit Baliashvili ,[2] Marika Kochlamazashvili,[4] Giorgi Kanchelashvili,[4] Maia Butsashvili[4]

To cite: Kajaia M, Djibuti M, DeHovitz JA, *et al*. HIV and syphilis seroprevalence and related unsafe sexual behaviours among people who inject drugs in Georgia: a cross-sectional study. *BMJ Open* 2025;**15**:e103983. doi:10.1136/bmjopen-2025-103983

► Prepublication history and additional supplemental material for this paper are available online. To view these files, please visit the journal online (https://doi.org/10.1136/bmjopen-2025-103983).

Received 20 April 2025
Accepted 03 November 2025

[1]Ivane Javakhishvili Tbilisi State University, Tbilisi, Georgia
[2]Partnership Research Action Health (PRAH), Tbilisi, Georgia
[3]SUNY Downstate Health Sciences University, New York, New York, USA
[4]Health Research Union (HRU), Tbilisi, Georgia

Correspondence to
Dr Maia Kajaia;
maiko.kajaia@gmail.com

ABSTRACT

Objective To provide the first national estimate of syphilis prevalence among people who inject drugs (PWID) in Georgia, alongside updated HIV prevalence and associated risk behaviours, and to identify factors associated with infection.

Design Cross-sectional Integrated Bio-Behavioural Surveillance Survey conducted in 2022. Respondent-driven sampling was used to recruit PWID. Data were collected through standardised face-to-face interviews using structured questionnaires, and venous blood samples were collected for laboratory testing. HIV was diagnosed by serology, and syphilis was assessed using a two-step algorithm (Rapid Plasma Reagin screening with Treponema pallidum haemagglutination assay confirmation). Logistic regression models were applied to identify correlates of infection.

Setting The study was conducted in community settings across seven major cities of Georgia that represent the main urban centres with large PWID populations. Survey implementation was supported by local peer-led and community-based harm reduction organisations with established trust and access to PWID networks, facilitating participant recruitment and ensuring feasibility.

Results HIV prevalence was 0.9% and syphilis prevalence 2.1%. Coinfection with HIV and syphilis was observed in 0.2% of participants. HIV infection was significantly associated with longer duration of injection drug use (adjusted OR (aOR) 0.2; 95% CI 0.5 to 0.9) and lack of access to HIV prevention services (aOR 2.8; 95% CI 1.1 to 7.8). Syphilis prevalence was significantly lower among PWID who had not had casual or paid sex in the past year (OR 0.06; 95% CI 0.02 to 0.2). Unsafe sexual behaviours were common: 25.8% reported sex with a casual partner in the past year, 12.3% reported a paid partner, and only around half used condoms consistently with these partners.

Conclusions Despite a relatively low HIV prevalence, syphilis prevalence among PWID in Georgia highlights ongoing sexual risk behaviours. Current harm reduction programmes primarily address injection-related risks, with limited sexually transmitted infection (STI) prevention efforts. Expanding sexual health interventions within harm reduction services, including STI screening, structured counselling and safe sex education, is essential to reduce STI transmission and improve health outcomes among PWID.

STRENGTHS AND LIMITATIONS OF THIS STUDY

⇒ This is the first national-level biobehavioural survey among people who inject drug (PWID) in Georgia, providing comprehensive data on syphilis prevalence.
⇒ Recruitment was conducted through respondent-driven sampling, supported by peer-led harm reduction organisations, improving feasibility and participant trust.
⇒ Face-to-face interviews on sensitive topics may have introduced social desirability and recall bias, with potential underreporting or misremembering of behaviours.
⇒ The cross-sectional design allows identification of associations but does not permit conclusions about causality or directionality.
⇒ The predominantly male sample reflects the actual gender distribution of PWID in Georgia, but the limited number of female participants may restrict generalisability to women.

INTRODUCTION

HIV/AIDS remains a major global public health challenge, with an estimated 39.9 million people living with HIV in 2023, including 1.3 million new infections and 630 000 AIDS-related deaths occurring that year alone.[1 2] Injection drug use is a significant driver of the HIV epidemic, increasing the risk of HIV infection by 35 times compared with the general population. Globally, 10% of new HIV cases occur among people who inject drugs (PWIDs).[3] In Eastern Europe and Central Asia (EECA), the HIV epidemic continues to expand, making it the only region where both new HIV infections and AIDS-related deaths have increased. Between 2010 and 2022, new HIV cases in the region

surged by 49%, while AIDS-related deaths increased by 46%. HIV in EECA is primarily concentrated among key populations, with a median HIV prevalence of 7.2% among PWID.[4]

Although HIV acquisition among PWID has historically been attributed to parenteral exposures resulting from unsafe injection practices, sexual transmission accounts for a substantial proportion of HIV infections within this population.[5 6] Injection drug use impairs sexual judgement and elevates the risks associated with sexual activity, putting PWID at increased risk for sexually transmitted infections (STIs). Multiple studies demonstrated that there is a significant association between injection drug use and STIs.[7–10] PWID often face a higher risk of engaging in unsafe sexual behaviour including unprotected sex, multiple partners, trading sex for drugs or money which places them at increased risk for STIs including HIV infection and syphilis. In addition, STIs increase the risk of sexual transmission of HIV.[11–16] Despite these risks, comprehensive interventions addressing sexual risk behaviours remain insufficient in many settings.

In Georgia, HIV prevalence is estimated at 0.4% among the general adult population, with cases primarily concentrated in key populations.[17] The country has one of the highest rates of injection drug use globally, with 2.23% of the 18–64 year-old population estimated to be PWID.[18 19] According to the Georgian AIDS and Clinical Immunology Research Center, 32.6% of all HIV cases in the country occur among PWID.[20] While significant efforts have been made to reduce HIV transmission through harm reduction programmes in Georgia, including needle and syringe programmes and opioid substitution therapy (OST), there is limited understanding of how sexual risk behaviours contribute to HIV and STI transmission among PWID.

Injection drug use in Georgia is overwhelmingly concentrated among men. National surveys and qualitative research consistently show that women account for only a very small proportion of PWID. This imbalance is shaped not only by actual patterns of drug use but also by powerful sociocultural and structural barriers that limit the visibility of women. Stigma around female drug use, fear of family rejection or loss of child custody and the absence of gender-sensitive harm reduction and treatment services all contribute to women's underrepresentation in surveillance and service data.[21–23]

PWID in Georgia can access HIV prevention services through Georgian Harm Reduction Network centres, where a range of free services is available. These include screening for HIV, hepatitis B and C, syphilis and tuberculosis; provision of sterile paraphernalia (such as syringes of various sizes, needles, butterfly needles, alcohol pads, tourniquets, Naloxone, injection solutions, condoms and lubricants); distribution of printed information, education and communication (IEC) materials (flyers, leaflets, brochures and booklets) on HIV/AIDS; and informational-educational sessions on HIV/AIDS. The minimal package of services includes receiving at least one of the available services, while the full package involves accessing all of them free of charge.

The burden of syphilis among PWID in Georgia remains unknown. Nationally, syphilis remains one of the most common STIs, with an incidence of 29.6 per 100 000 population in 2021,[24] yet no data exist on syphilis prevalence among PWID. This knowledge gap is particularly concerning given that syphilis enhances HIV transmission risk and serves as a marker for high-risk sexual behaviours.[25] Understanding the burden of syphilis in this population is critical for informing targeted interventions to reduce STI transmission and improve sexual health services within harm reduction programmes.

Since 2002, Integrated Bio-Behavioural Surveillance Surveys (IBBSS) have been conducted in Georgia among PWID to estimate HIV prevalence, assess risk behaviours and evaluate the effectiveness of harm reduction programmes. These surveys are conducted once every 4 years. However, previous IBBSS did not include syphilis testing, leaving a critical gap in understanding the sexual health risks faced by PWID.

This study reports findings from the 2022 IBBSS among PWID conducted in seven major cities of Georgia, providing updated estimates of HIV prevalence and, for the first time, syphilis prevalence in this population. The study also examines HIV-related unsafe sexual behaviours to better understand the drivers of HIV and syphilis transmission. Given the gaps in sexual health services within harm reduction programmes, the results of this study provide a strong evidence base for developing targeted interventions aimed at reducing sexual risk behaviours and improving STI prevention among PWID in Georgia.

METHODS

The study design was cross-sectional and included both behavioural and biomarker components. The behavioural component consisted of face-to-face interviews with participants using a specially designed structured questionnaire. The biomarker component involved blood testing of participants for HIV infection, syphilis, hepatitis B and hepatitis C (with the results of this HBV and HCV testing to be reported elsewhere).

The study was conducted in seven major cities of Georgia: Tbilisi (capital city), Gori, Rustavi, Telavi, Batumi, Zugdidi and Kutaisi. These sites were selected to ensure consistency with all previous IBBSS rounds conducted since 2002, thereby allowing comparability of results across time. They represent the country's largest urban centres with historically high concentrations of PWID and established harm reduction services and thus serve as appropriate sentinel sites for monitoring trends in HIV and other infections among PWID. Sample size calculation was done by the methodology for descriptive studies for the expected proportion 0.50 (maximising the sample size), degree of accuracy (margin of error) ±0.05, the confidence level 95% and corresponding populations size. By this approach, it has been estimated that

at least 2000 individuals should participate in the study, including 380 PWID in Tbilisi and 270 PWID in each other city. Selection of potential study participants was performed according to the following inclusion criteria: age ≥18 years, drug injection practice during the last 30 days, residence in the selected city, ability to answer the questionnaire prepared in Georgian language, willingness and ability to give informed consent for study participation, consent to participate in both components of the study.

Participants in the study were recruited through respondent-driven sampling (RDS), a method in which individuals recruit others to participate. Rooted in social network theory, RDS is a form of non-probability 'snowball sampling' that incorporates mathematical modelling to adjust for biases and weigh the sample.[26–28] While RDS was originally developed to generate population-based estimates, studies have shown that it often fails to achieve this goal, leading to biased results. These biases stem from factors such as the influence of the initial seed sample, network homophily and preferential recruitment, which limit the accuracy of RDS-derived estimates. Despite these methodological challenges, RDS remains widely used worldwide, particularly in epidemiological studies involving hard-to-reach populations at high risk for HIV and other infectious diseases.[29–31]

RDS sampling began with the purposive selection of 'seeds'—the initial study participants representing the target population. In addition to meeting the study's inclusion and exclusion criteria, several other factors were considered when selecting these individuals. Specifically, 'seeds' were chosen for their ability to reach diverse groups of PWID, ensuring a more representative sample. Consideration was also given to variations in age, social background and geographical characteristics to enhance the diversity of the recruited participants. Study participant recruitment followed a double incentive system, offering both a primary reward for participation and a secondary reward for recruiting other PWID into the study. Participants received a primary incentive of 20 GEL (approximately US$7) for their own involvement, while they earned an additional 10 GEL (approximately US$3.5) for each new respondent they successfully recruited. Before inclusion in the study, each potential participant underwent a verification procedure, which allowed the study team to verify that the individual met study inclusion criteria. The procedure included an informal interview with the potential study subject about drug prices, slang names, preparation and injection techniques. In addition, objective signs of injecting drug use were assessed. During the study enrolment, each participant was assigned a 15-digit unique identification code, generated from reported identifiers. This code was recorded in the identification database to avoid duplication of the study subjects.

Data collection was carried out through individual, face-to-face interviews by specially trained interviewers. The survey tool was a structured questionnaire from previous IBBSS, with minor adaptations for the present study (online supplemental file 1). The following information was collected from the study participants: sociodemographic characteristics; history of drug use and unsafe behaviour related to drug use; sexual history and unsafe sexual behaviour; knowledge, attitudes and risk perceptions on HIV, and use of HIV preventive programmes.

After completing the behavioural component, the study participants were asked to provide blood samples voluntarily. HIV screening was conducted on blood samples of all study participants (2005 samples in total). Rapid tests (On Site HIV1/2 Ab Plus Combo Rapid test, CTK Biotech) or enzyme immunoassay (Abbott, HIV Ag/Ab Combo Reagent Kit, ARCHITECT i1000SR) were used for HIV screening. Confirmatory testing for HIV infection was performed at the Centre for Infectious Pathology, AIDS and Clinical Immunology. To optimise resources while ensuring reliable prevalence estimates, syphilis testing was conducted on a randomly selected subset of 1000 samples. The traditional diagnostic algorithm was applied, starting with the Rapid Plasma Reagin test for initial screening. If a sample tested positive, a confirmatory treponemal test—Treponema pallidum haemagglutination assay was performed to verify the results. Confirmatory laboratory test results were notified to the study participants within 1 week. Study participants who were diagnosed with HIV infection or syphilis by confirmatory testing were referred to appropriate diagnostic and treatment facilities.

Study participation was voluntary. Each potential study participant was informed about the purpose, objectives, methods, procedures, risks and benefits of the study. All individuals who agreed to participate in the study signed an informed consent form and then were enrolled in the study.

Data entry, management and statistical analysis were performed using statistical software SPSS V.22. Descriptive statistical methods were used to characterise the variables studied in the target populations. The study variables were compared between different study groups using χ^2 test for categorised data. A binary logistic regression model was used for multivariable analysis to identify independent predictors of some outcome variables. We constructed the model using stepwise regression, evaluating each variable for its individual contribution. unremarkable variables were initially removed but were reintroduced if they later showed a stronger ability to explain variance in the dependent variable. The inclusion and exclusion of variables were determined based on p values. We present both unadjusted and adjusted ORs (aORs) with 95% CIs, considering a p value of <0.05 as statistically significant. Analyses of syphilis prevalence and its correlates were restricted to the 1000 participants who were randomly selected for syphilis testing. The RDS–Modified (RDS-MOD) approach was used to estimate population parameters (estimate, 95% CI) by assigning a single normalised weight to each participant.[26] This method converts RDS data into clustered data to account for recruitment-related associations, applying the Taylor

series linearisation method for CIs. RDS-MOD allows diverse statistical analyses using standard software. Calculations were performed in R using the Survey package (V.4.1-1) for complex survey analysis. Weights were generated based on the assumption that recruiters select participants independently, proportional to their network size, as proposed in previous studies.[27] Recruitment networks were converted into clusters by removing seeds and treating remaining branches as clusters.[26] The RDS-MOD approach produces results comparable to RDS-II and enables analytical estimation of point estimates and CIs.[28]

Patient and public involvement

Patients or members of the public were not involved in the design, or conduct, or reporting, or dissemination plans of our research.

RESULTS

In total, 2,005 PWID participated in the study and the number of participants according to cities was distributed as follows: Tbilisi—380, Zugdidi—275 and all other cities—270 each. The median age of study subjects was 44 years (IQR: 29–59 years). Most of the respondents were males (n=1977, 98.6%) and ethnically Georgian (n=1826, 91.1%). Almost half of the surveyed PWID were married (49.1%, n=985) and only 38.2% (n=766) completed university. More than half of the study participants were unemployed (n=1177, 58.7%). Ever being imprisoned was reported by 51.3% (n=1029) of the study subjects of whom 22.5% (n=232) were using drugs in prison (table 1).

Among the interviewed PWID 25.8% (n=498) claimed to have had sex with a casual sexual partner in the last 1 year among whom only 46.4% (n=231) reported consistent condom use and 28.1% (n=140) did not use a condom at last sexual contact. During the past 12 months, 12.3% (n=238) of the study participant PWID had a paid sexual partner (either having paid for sex or having been paid for sex). Among these, 58.8% (n=140) used condoms consistently, and 11.3% (n=27) did not use a condom during the last intercourse. 1.3% (n=25) of the study subjects ever had sex with a same-sex partner. 6.5% (n=131) of the study participants reported having anal sex with any sexual partner in the past 12 months, and only 46.6% (n=61) of them used a condom during the last anal sex (table 2).

Among study participants, the awareness of measures to prevent the sexual transmission of HIV was high. The majority (88.1%, n=1766) recognised that having one HIV negative and monogamous sexual partner reduces the risk of HIV transmission. Additionally, 90.3% (n=1810) acknowledged that consistent condom use during every sexual encounter is an effective prevention strategy. However, despite this high level of awareness, 31.2% (n=625) did not perceive themselves to be at risk of HIV infection (table 2).

Table 1 Characteristics of the study sample

	Total sample (N=2005)		Subsample (N=1000)	
Characteristic	**N**	**%**	**N**	**%**
Median age (IQR)	44 (29–59)		45 (38–53)	
Gender				
Male	1977	98.6	989	98.9
Female	28	1.4	11	1.1
Ethnicity				
Georgian	1826	91.1	927	92.7
Other	179	8.9	73	7.3
Marital status				
Married	985	49.1	502	50.2
Other	1020	50.9	498	49.8
Education				
High school/ vocational college	1227	61.2	611	61.1
University	766	38.2	386	38.6
Employment				
Employed	723	36.1	382	38.2
Unemployed	1177	58.7	610	61.0
Student/retired/ person with disability				
Residence				
Tbilisi	380	19.0	220	22.0
Gori	270	13.5	130	13.0
Telavi	270	13.5	129	12.9
Zugdidi	275	13.7	130	13.0
Batumi	270	13.5	130	13.0
Kutaisi	270	13.5	130	13.0
Rustavi	270	13.5	131	13.1
Ever been imprisoned				
Yes	1029	51.3	526	51.2
No	942	47.0	474	47.4
Refused to answer	34	1.7	14	1.4
Used drugs while being imprisoned				
Yes	232	22.5	130	25.4
No	346	33.6	151	29.5
Refused to answer	451	43.8	231	45.1

Our survey found that in the past 12 months, 61.9% (n=1241) of participants received the minimal package of HIV prevention services, while only 30.9% (n=619) accessed the full package. The majority of surveyed PWID (82.3%, n=1651) knew where to obtain free HIV testing, and 84.1% had been tested for HIV at least once.

Table 2 Unsafe sexual behaviour, prevention services uptake, risk self-perception and awareness of measures to prevent sexual transmission of HIV among study participants (N=2005)

Characteristic	Descriptive statistics		RDS-MOD		
				95% CI	
	N	%	%	Lower	Upper
Had sex with casual sexual partner in the last 12 months	498	25.8	25.2	21.2	29.7
Used condom at last sex with casual sexual partner	358	71.9	71.6	64.1	78.0
Always used condom with casual sexual partner(s) in the last 12 months	231	46.4	45.1	33.8	56.8
Had sex with paid sexual partner in the last 12 months	238	12.3	12.2	7.9	18.2
Used condom at last sex with paid sexual partner	211	88.7	89.7	86.1	92.5
Always used condom with paid sexual partner(s) in the last 12 months	140	58.8	58.0	50.5	65.2
Ever had same-sex sexual partner	25	1.3	1.5	0.7	3.2
Had anal sex with any sexual partner during the last 12 month	131	6.5	6.9	4.5	10.5
Used condom at last anal sex	61	46.6	47.0	31.1	63.5
Received minimal package of HIV preventive services in the last 12 months	1241	61.9	60.0	58.9	63.2
Received full package of HIV preventive services in the last 12 months	619	30.9	29.1	27.5	32.6
Ever tested for HIV	1687	84.1	86.7	81.0	90.9
Tested for HIV in the last 12 months	752	37.5	36.9	34.7	39.4
Knows where to get free HIV testing	1651	82.3	81.2	79.3	83.1
Do not consider themselves under the risk of HIV infection	625	31.2	33.5	29.1	36.7
Awareness of measures to prevent sexual transmission of HIV					
Having one HIV negative and devoted sexual partner decreases the risk of HIV transmission	1766	88.1	87.8	83.4	91.4
Condom use during each sexual contact decreases the risk of HIV transmission	1810	90.3	92.3	89.2	94.5

RDS-MOD, Respondent-Driven Sampling–Modified.

However, only 37.5% (n=752) reported being tested for HIV within the past 12 months (table 2).

The overall prevalence of HIV infection among PWID in the study was 0.9% (n=19), while syphilis prevalence was higher at 2.1% (n=21). Coinfection with HIV and syphilis was observed in 0.2% (n=5) of participants. HIV prevalence varied by location, ranging from 0% in Kutaisi to 2.5% in Zugdidi. Similarly, syphilis prevalence ranged from 0.8% in Kutaisi to 3.8% in Zugdidi, indicating geographical differences in infection rates among PWID (table 3).

Bivariate analysis revealed that the level of education, duration of injection drug use and using HIV preventive services in the last 12 months were statistically significantly associated with positive HIV status. The prevalence of HIV infection was higher among PWID with low levels of education (1.3%) compared with those who had a university degree (0.4%) (OR 3.2; 95% CI 1.1 to 11.2). Study participants who injected drugs for less than 20 years had a lower chance of being HIV infected (0.3%) than those whose duration of injection drug use was ≥20 years (1.3%) (OR 0.2; 95% CI 0.5 to 0.9). PWID who did not receive HIV preventive services were more likely to be HIV positive (1.6%) compared with those who received the above-mentioned services (0.6%) (OR 2.8; 95% CI 1.1 to 7.1). Multivariable analysis of HIV prevalence showed that lower duration of injection drug use (aOR 0.2; 95% CI 0.5 to 0.9; p=0.03) and not using HIV preventive programmes (aOR 2.8; 95% CI 1.1 to 7.8; p=0.03) are independent predictors of HIV positive status among PWID (table 4).

We also analysed syphilis prevalence by different characteristics and found that having casual and/or paid sex in the last 12 months was statistically significantly associated with increased risk of syphilis among PWID. Specifically, study participants who reported having casual and/or paid sexual partner(s) during the past 1 year had higher odds of being positive for syphilis (6.0%), compared with those who did not have sex with such type of sexual partner (0.4%) (OR 0.06; 95 CI 0.02 to 0.2). A difference was observed in syphilis positivity based on condom use at last sex with a casual or paid partner, though it was not statistically significant. Participants who did not use a condom at last sexual intercourse had a higher syphilis positivity rate (10%) compared with those who used a condom (4.5%) (table 5).

DISCUSSION

The HIV prevalence in our study was 0.9% among PWID, which is lower than the prevalence reported in previous IBBSS conducted in Georgia, where it was slightly

Table 3 HIV and syphilis seroprevalence among PWID (N=2005 for HIV prevalence; N=1000 for syphilis prevalence)

	Descriptive statistics		RDS-MOD		
				95% CI	
Result	N	%	%	Lower	Upper
HIV infection	19	0.9	0.9	0.5	1.4
Syphilis	21	2.1	1.7	0.9	2.9
HIV and syphilis coinfection	5	0.2	0.3	0.1	0.8
HIV prevalence by cities					
Tbilisi	2	0.5	0.4	0.1	1.2
Gori	4	1.5	1.7	0.9	3.3
Rustavi	1	0.4	0.5	0.05	4.5
Telavi	2	0.7	0.4	0.03	4.2
Batumi	3	1.1	1.2	0.5	2.9
Zugdidi	7	2.5	2.8	1.4	5.6
Kutaisi	0	0.0	0	0.0	0.0
Syphilis prevalence by cities					
Tbilisi	5	2.3	1.4	0.6	3.1
Gori	2	1.5	1.1	0.09	11.4
Rustavi	2	1.5	1.1	0.08	14.5
Telavi	4	3.1	3.2	0.5	16.6
Batumi	2	1.5	1.5	0.6	3.8
Zugdidi	5	3.8	4.0	0.7	20.1
Kutaisi	1	0.8	0.9	0.08	9.3

PWID, people who inject drug; RDS-MOD, Respondent-Driven Sampling–Modified.

above 2% in 2015 and 2017.[32 33] Our findings indicate a decreasing trend in HIV prevalence among PWID in the country. Compared with broader regional estimates, our study results remain significantly lower. The median HIV prevalence for EECA between 2018 and 2022 was reported at 7.2%,[34] placing Georgia in a lower-prevalence category. In neighbouring countries, HIV prevalence among PWID varies substantially. In Armenia, the HIV prevalence was 2.6% in 2021, reflecting an increase from previous years,[35] while Azerbaijan reports an HIV prevalence of 6.9% among PWID.[36] These figures are significantly higher than our study findings, highlighting the variability of HIV prevalence across the South Caucasus region, which may be attributed not only to differences in harm reduction service availability and healthcare infrastructure but also to broader sociopolitical and policy environments that shape programme access and continuity.

In Eastern Europe, the HIV epidemic among PWID remains substantial. Ukraine has seen a decline in HIV prevalence among PWID from 27% in 2007 to 19% in 2020.[37] Despite the decline, the prevalence remains substantially higher than in Georgia, illustrating the persistent impact of injection drug use on HIV transmission. Russia exhibits an even more concerning picture, with HIV prevalence among PWID ranging from 30.4% nationally to as high as 75.2% in specific regions such as Kemerovo.[38 39] These large disparities highlight the impact of national policies; for example, the absence of OST in Russia and disruptions to HIV prevention services in Ukraine contrast with Georgia's comparatively stable harm reduction infrastructure. Our findings are further supported by a systematic review on HIV among PWID in Central and EECA, which reported that HIV prevalence varies widely, with generally low or medium prevalence (<5%) in Central Europe but high prevalence (>10%) in Eastern Europe.[40] Although Kazakhstan, Lithuania and Georgia were previously classified as having a medium-level epidemic (2%–5%), our findings suggest that Georgia's HIV prevalence among PWID is even lower than previously estimated. This suggests that policy and programme responses in Georgia may have contributed to a relatively favourable trajectory, although ongoing funding and political support remain critical for sustaining progress.

Similarly, a recent German study reported slightly higher HIV prevalence of 2.7%, which exceeds our study's estimate.[41] A study from the Pilsen Region of the Czech Republic (2003–2018) reported an HIV prevalence of 0.26% among PWID, which is two-thirds lower than Georgia's HIV prevalence.[42] These European comparisons illustrate that methodological differences, such as survey design, sampling and diagnostic approaches, may also influence observed prevalence and should be considered when interpreting cross-country comparisons.

Our study found an overall syphilis prevalence of 2.1% among PWID in Georgia, with city-specific rates ranging from 0.8% in Kutaisi to 3.8% in Zugdidi. As there are no available data from neighbouring countries, we rely on findings from other geographic areas for comparison. Notably, studies from Europe have reported similar prevalence rates. For instance, the German study referred to previously reported an identical syphilis prevalence of 2.1% among PWID.[41] Similarly, a study from the Czech Republic found a comparable syphilis prevalence of 1.82%, though it also reported a significantly lower HIV prevalence of 0.26%, contrasting with our study's 0.9% HIV prevalence.[42] However, our findings do not align with estimates from Asia, where higher levels of syphilis prevalence among PWID have been reported. In southwest China, syphilis prevalence among PWID fluctuated between 3.6% and 5.7% in multiple surveillance rounds conducted between 2010 and 2017, while a 2017 study in Cambodia reported a syphilis prevalence of 3.8%, similar to the rate observed in Zugdidi but higher than Georgia's overall prevalence.[43 44] Our findings also contrast with broader low-income and middle-income country (LMIC) estimates, where syphilis prevalence among PWID is significantly higher. A systematic review of LMICs (1995–2007) estimated a median syphilis prevalence of 11.1% (IQR: 6.3%–15.3%), notably higher than our findings.[7] Our study also diverges from findings in the USA, where syphilis prevalence among PWID is higher and shows notable gender disparities. A national US study

Table 4 Bivariate and multivariate analysis of HIV seroprevalence among PWID (N=2005)

Characteristics	Positive HIV status		OR; 95% CI	P value	aOR; 95% CI	aP value
	N	%				
Age						
≤35 years old	2	0.5	0.4 (0.09 to 1.8)	0.2		
>35 years old	17	1.1				
Marital status						
Married	9	0.9	1.0 (0.4 to 2.6)	0.8		
Other	10	1.0				
Level of education						
High school/vocational school	16	1.3	3.3 (1.1 to 11.5)	0.04	3.2 (1.1 to 11.2)	0.06
University	3	0.4				
Residence						
Tbilisi	2	0.5	1.9 (0.4 to 8.6)	0.3		
Other	17	1.0				
History of imprisonment						
Yes	11	1.1	0.7 (0.3 to 1.9)	0.6		
No	8	0.8				
Duration of injection drug use						
<20 years	2	0.3	0.2 (0.04 to 0.8)	0.01	0.2 (0.5 to 0.9)	0.03
≥20 years	17	1.3				
Frequency of injection						
Daily or more	6	0.9	0.7 (0.2 to 2.0)	0.5		
Less than daily	13	1.1				
Ever shared needle/syringe						
Yes	7	1.4	0.5 (0.2 to 1.4)	0.2		
No	12	0.8				
Safe injection practices at last injection						
Yes	11	1.0	0.9 (0.3 to 2.3)	0.9		
No	8	0.9				
Injecting drugs (during the last 6 months)						
Alone/with regular injecting partners	17	1.1	0.3 (0.07 to 1.4)	1.3		
With different injecting partners	2	0.4				
Had casual or paid sex partner during the last 12 months						
Yes	8	1.3	0.6 (0.2 to 1.6)	0.3		
No	11	0.8				
Used condom at last sex with any partner						
Yes	8	1.3	0.6 (0.2 to 1.5)	0.3		
No	11	0.8				
Received HIV preventive services in the last 12 months						
Yes	7	0.6	2.8 (1.1 to 7.1)	0.02	2.8 (1.1 to 7.8)	0.03
No	12	1.6				

aOR, adjusted OR; PWID, people who inject drug.

reported syphilis diagnoses in 7.0% of female PWID and 3.3% of male PWID, suggesting a greater overall burden compared with Georgia.[10] While the LMI study also highlighted gender disparities, with syphilis prevalence of 4.0% among males and 19.9% among females,[7] our study did not disaggregate syphilis prevalence by gender due

Table 5 Bivariate analysis of syphilis seroprevalence among PWID (N=1000)

Characteristics	Positive syphilis test result		OR; 95% CI	P value
	N	%		
Age				
≤35 years old	4	2.0	0.9 (0.3 to 2.8)	0.9
>35 years old	17	2.1		
Marital status				
Married	9	1.8	1.3 (0.5 to 3.2)	0.4
Other	12	2.4		
Level of education				
High school/ vocational school	16	2.6	2.0 (0.7 to 5.6)	0.1
University	5	1.3		
Residence				
Tbilisi	5	2.3	0.9 (0.3 to 2.4)	0.8
Other	16	2.1		
History of imprisonment				
Yes	13	2.5	0.6 (0.2 to 1.6)	0.3
No	8	1.7		
Had casual or paid sex partner during the last 12 months				
Yes	18	6.0	0.06 (0.02 to 0.2)	<0.0001
No	3	0.4		
Used condom at last sex with casual or paid sex partner				
Yes	10	4.5	2.3 (0.9 to 6.1)	0.07
No	8	10.0		
Always used condom with casual or paid sex partner during the last 12 months				
Yes	6	4.1	1.9 (0.7 to 5.4)	0.1
No	12	7.8		
Received HIV preventive programme services in the last 12 months				
Yes	10	1.7	1.5 (0.6 to 3.6)	0.3
No	11	2.6		

PWID, people who inject drug.

to the overwhelmingly male composition of our sample (98.6%). The similarity of syphilis prevalence in Georgia to that in certain European settings may reflect comparable levels of service coverage, while contrasts with Asian and LMIC contexts highlight the influence of structural and programmatic differences across regions. Future research should explore gender-specific risk factors for syphilis among the small proportion of female PWID in Georgia.

In bivariate analysis, our study found that lower education level, longer duration of injection drug use and lack of access to HIV preventive services were significantly associated with increased HIV prevalence among PWID. These findings are consistent with a previous study conducted in Georgia between 2014 and 2015, where HIV prevalence among PWID was 2.2%, and factors such as longer duration of drug use and lack of preventive programme coverage were also identified as significant predictors of HIV infection.[32] In both studies, the longer history of drug injection was linked to higher HIV risk, underscoring the cumulative exposure to unsafe injection practices over time. Additionally, our findings regarding the protective effect of HIV preventive services align with the 2015 study, which similarly found that individuals not reached by preventive programmes were at greater risk of HIV infection. The associations of lower education levels, longer duration of injection drug use and lack of access to HIV preventive services with HIV seroprevalence are also found in studies conducted in other countries. In Pakistan, both longer injection duration and lower education were highlighted as significant predictors of HIV infection among PWID.[45] Similarly, in India, recent studies demonstrated that lower education levels and longer duration of drug injection were strongly associated with HIV seropositivity among PWID, also pointing to the protective effect of harm reduction programmes, which aligns with our finding that PWID who used HIV preventive services had significantly lower odds of HIV infection compared with those who did not.[46 47] In Iran, a multivariable analysis similarly demonstrated that a longer injection career and lack of access to harm reduction services were key factors driving higher HIV prevalence among PWID.[48] These consistent findings across different contexts highlight the global importance of addressing structural determinants, such as education and access to preventive services, in reducing HIV transmission among PWID populations.

In our study, we did not find a significant association between the history of incarceration and HIV seroprevalence among PWID. This contrasts with findings from a large European study that showed a strong and significant association between incarceration history and HIV prevalence among PWID across multiple countries.[49] The lack of a significant association between incarceration history and HIV seroprevalence in our study may be partly due to the relatively low HIV prevalence among our study participants or the potential underreporting of incarceration history, which could limit our ability to detect such associations.

Our study also identified a significant association between casual and/or paid sex (including both having paid for sex and having been paid for sex) and increased prevalence of syphilis among PWID, with inconsistent condom use further exacerbating this risk. These results are consistent with other research highlighting the role of sexual risk behaviours in syphilis transmission. A study in Tijuana, Mexico, demonstrated higher syphilis incidence among individuals exchanging sex for drugs, money or goods.[50] Similarly, in Cambodia, syphilis prevalence was linked to transactional sex, further supporting the vulnerability of this group.[44] These findings align with global research showing that unsafe sexual behaviours are major contributors to syphilis transmission among PWID.

Importantly, the dynamics of transactional sex among PWID are shaped not only by individual behaviour but also by broader social and structural contexts. Power imbalances, economic dependence and stigma surrounding both drug use and sex work may limit the ability of individuals to negotiate condom use, thereby amplifying their vulnerability to STIs. The intersection of drug use and sexual risk behaviours is further compounded by poverty, stigma and limited access to sexual health services. To address these issues, it is essential to integrate STI screening and sexual health services into harm reduction programmes, promote condom use and reduce stigma through outreach and peer-led interventions.[51]

This study has several limitations. First, data were collected through face-to-face interviews, which may introduce social desirability bias, a common issue in research involving sensitive topics such as sexual behaviour. Participants may have underreported stigmatised activities or over-reported normative behaviours if they perceived their actual actions as socially unacceptable. Second, the findings rely on self-reported data, which is inherently subject to recall bias. Participants may have had difficulty accurately recalling details about their sexual behaviour over the past 12 months, potentially affecting the reliability of the responses. Third, recruitment through RDS may have introduced selection bias, as participation depended on peer networks and willingness to recruit, which could limit representation of more hidden or socially isolated PWID. However, efforts were made to reduce this bias through careful seed selection and collaboration with peer organisations to reach diverse groups. Fourth, cross-sectional study design limits the ability to establish causal relationships. This design was chosen deliberately to ensure comparability with previous Bio-Behavioural Surveillance Surveys conducted in Georgia, thereby allowing assessment of trends over time. While the study identifies significant associations between risk factors and infection prevalence, it does not allow for conclusions about causality or directionality of these relationships. Fifth, the study sample was predominantly male, reflecting the actual gender distribution of PWID in Georgia, where drug use remains overwhelmingly male-dominated. This suggests that the study is representative of the population rather than influenced by recruitment bias. However, the limited number of female participants may impact the generalisability of the findings, as risk behaviours and prevention needs could differ among female PWID. Finally, the data collection process involved collaboration with peer organisations that have longstanding relationships with the PWID community in Georgia, which facilitated recruitment and likely improved participant trust and disclosure.

CONCLUSIONS

This study represents the first national-level effort to estimate the prevalence of syphilis among PWID in Georgia, providing essential insights into the burden of syphilis and HIV, as well as associated risk behaviours in this key population. The results reflect current syphilis infection, in line with the testing algorithm applied, and lifetime exposure may therefore be underestimated. Our findings highlight substantial unsafe sexual behaviours, with many PWID engaging in unprotected sex with casual and paid sexual partners.

The low HIV prevalence observed in our study may indicate the effectiveness of existing HIV prevention and harm reduction strategies in Georgia. However, this finding, when compared with neighbouring countries with higher HIV rates, underscores the need for sustained vigilance and proactive prevention efforts. Despite the availability of harm reduction services, gaps remain in addressing sexual risk behaviours among PWID. Additionally, structured counselling on reducing sexual risk behaviours is not included in the current harm reduction services. Although condoms are distributed, there is no formal guidance to ensure their consistent and effective use. Addressing these gaps is essential to enhancing comprehensive HIV and STI prevention efforts. In line with a person-centred approach to healthcare and prevention, greater integration of peer and community organisations into the design and delivery of public health policies may further strengthen the effectiveness and acceptability of HIV and syphilis prevention strategies among PWID. Given these gaps, the results of this study warrant the development and testing of targeted interventions to reduce sexual risk behaviours and increase condom use among PWID in Georgia. While the findings are broadly relevant to similar settings with high drug use prevalence and established harm reduction services, generalisability may be limited in contexts where gender distribution, service coverage or sociopolitical environments differ significantly.

Contributors MKa: development of the research idea, data analysis, original drafting of the manuscript. MD: development of research idea, supervision of research, review and editing of the manuscript. JAD: review and editing of the manuscript. GKam: data analysis, review and editing of the manuscript. DB: data analysis. MKo: data collection, administration of the project. GKan: data collection, data management. MB: development of the research idea, supervision of the research, review and editing of the manuscript. MKa is the guarantor and accepts full responsibility for the work, had access to the data and controlled the decision to publish.

Funding Research reported in this publication was supported by the Fogarty International Center and the National Institute of Alcohol Abuse and Alcoholism of the National Institutes of Health under Award Number D43TW011532.

Disclaimer The content is solely the responsibility of the authors and does not necessarily represent the official views of the National Institutes of Health.

Competing interests None declared.

Patient and public involvement Patients and/or the public were not involved in the design, or conduct, or reporting, or dissemination plans of this research.

Patient consent for publication Consent obtained directly from patient(s).

Ethics approval Study approval for the ethical conduct of the research was obtained from the IRB of National Center for Disease Control and Prevention of Georgia (IRB00002150; Approval N: 2023-003). All procedures performed were in accordance with the ethical standards of the institutional review board and with the 1964 Declaration of Helsinki and its later amendments or comparable ethical standards. Participants gave informed consent to participate in the study before taking part.

Provenance and peer review Not commissioned; externally peer reviewed.

Data availability statement Data are available on reasonable request. The data that support the findings of this study are available from the corresponding author on reasonable request.

ORCID iDs
Maia Kajaia https://orcid.org/0000-0002-0270-607X
Mamuka Djibuti https://orcid.org/0000-0002-1614-854X
Jack A DeHovitz https://orcid.org/0000-0001-7307-0614
Davit Baliashvili https://orcid.org/0000-0001-8390-3325

REFERENCES

1 UNAIDS, Global HIV & AIDS statistics. Fact sheet. 2024. Available: https://www.unaids.org/en/resources/fact-sheet
2 WHO. HIV/AIDS Key Facts, 2024. Available: https://www.who.int/news-room/fact-sheets/detail/hiv-aids
3 In Danger: UNAIDS Global AIDS Update, 2022. Available: https://www.unaids.org/en/resources/documents/2022/in-danger-global-aids-update
4 UNAIDS Data, 2023. Available: https://www.unaids.org/sites/default/files/media_asset/data-book-2023_en.pdf
5 Dumchev K, Sazonova Y, Shulga L, *et al*. Sexual transmission is a significant driver of HIV epidemics among people who inject drugs. *International Journal of Drug Policy* 2022;100:103493.
6 Strathdee SA, Sherman SG. The role of sexual transmission of HIV infection among injection and non-injection drug users. *J Urban Health* 2003;80:iii7–14.
7 Coffin LS, Newberry A, Hagan H, *et al*. Syphilis in drug users in low and middle income countries. *Int J Drug Policy* 2010;21:20–7.
8 Khan MR, Berger A, Hemberg J, *et al*. Non-injection and injection drug use and STI/HIV risk in the United States: the degree to which sexual risk behaviors versus sex with an STI-infected partner account for infection transmission among drug users. *AIDS Behav* 2013;17:1185–94.
9 Hwang L, Ross MW, Zack C, *et al*. Prevalence of Sexually Transmitted Infections and Associated Risk Factors among Populations of Drug Abusers. *CLIN INFECT DIS* 2000;31:920–6.
10 Brookmeyer KA, Haderxhanaj LT, Hogben M, *et al*. Sexual risk behaviors and STDs among persons who inject drugs: A national study. *Prev Med* 2019;126:105779.
11 Fleming DT, Wasserheit JN. From epidemiological synergy to public health policy and practice: the contribution of other sexually transmitted diseases to sexual transmission of HIV infection. *Sex Transm Infect* 1999;75:3–17.
12 Hayes R, Watson-Jones D, Celum C, *et al*. Treatment of sexually transmitted infections for HIV prevention: end of the road or new beginning? *AIDS* 2010;24 Suppl 4:S15–26.
13 Peterman TA, Newman DR, Maddox L, *et al*. Extremely High Risk for HIV following a diagnosis of syphilis, men living in Florida, 2000-2011. *Pub Health Rep* 2014;129:164–9.
14 Pathela P, Braunstein SL, Blank S, *et al*. HIV incidence among men with and those without sexually transmitted rectal infections: estimates from matching against an HIV case registry. *Clin Infect Dis* 2013;57:1203–9.
15 Cohen MS, Council OD, Chen JS. Sexually transmitted infections and HIV in the era of antiretroviral treatment and prevention: the biologic basis for epidemiologic synergy. *J Int AIDS Soc* 2019;22 Suppl 6:e25355.
16 Cohen MS. Sexually transmitted diseases enhance HIV transmission: no longer a hypothesis. *Lancet* 1998;351 Suppl 3:5–7.
17 UNAIDS. Country Progress Report – Georgia. Global AIDS Monitoring, 2020. Available: https://www.unaids.org/sites/default/files/country/documents/GEO_2020_countryreport.pdf
18 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.
19 Population size estimation of PWID in Georgia. Study Report, 2022. Available: https://hru.ge/en/projects/6-aiv_shidsis-gavrtselebis-mkhriv-magali-riskis-qtsevis-mqone-jgupshi-narkotikebis-ineqtsiuri-gzit-momkhmareblebis-sarisko-qtsevebis-da-populatsiis-raodenobis-gansazgvra
20 Infectious Diseases, AIDS and Clinical Immunology Research Center. HIV/AIDS Epidemiology in Georgia, Available: https://www.aidscenter.ge/epidsituation_eng.html
21 Otiashvili D, Kirtadze I, Otiashvili T, *et al*. Barriers to treatment access for women who use drugs in Georgia. *J Subst Abuse Treat* 2013;45:257–62.
22 Chikovani I, Otiashvili D, Tabatadze M, *et al*. Women who inject drugs in Georgia: Invisibility, double stigma and structural violence. *Drugs Educ Prev Policy* 2013;20:333–40.
23 Otiashvili D, Kirtadze I, O'Grady KE, *et al*. Access to treatment for substance-using women in the Republic of Georgia: socio-cultural and structural barriers. *Int J Drug Policy* 2013;24:566–72.
24 National Centers for Disease Control and Public Health of Georgia. Statistical reference book of healthcare, 2021. Available: https://test.ncdc.ge/pages/user/News.aspx?ID=ea1784b5-d3d0-4dd9-b29f-1369f5d6bbec
25 Gong HZ, Zheng HY, Wan X, *et al*. Effect of syphilis infection on HIV acquisition: a systematic review and meta-analysis. *Sex Transm Infect* 2021;97:525–33.
26 Selvaraj V, Boopathi K, Paranjape R, *et al*. A single weighting approach to analyze respondent-driven sampling data. *Indian J Med Res* 2016;144:447–59.
27 Salganik MJ, Heckathorn DD. 5. Sampling and Estimation in Hidden Populations Using Respondent-Driven Sampling. *Sociol Methodol* 2004;34:193–240.
28 Volz E, Heckathorn DD. Probability based estimation theory for respondent-driven sampling. *J Off Stat* 2008;24:79–97.
29 Crawford FW, Aronow PM, Zeng L, *et al*. Identification of Homophily and Preferential Recruitment in Respondent-Driven Sampling. *Am J Epidemiol* 2018;187:153–60.
30 Gile KJ, Handcock MS. Respondent-Driven Sampling: An Assessment of Current Methodology. *Sociol Methodol* 2010;40:285–327.
31 McCreesh N, Frost SDW, Seeley J, *et al*. Evaluation of respondent-driven sampling. *Epidemiology (Sunnyvale)* 2012;23:138–47.
32 Shengelia N, Chikovani I, Sulaberidze L. Human immunodeficiency virus prevalence and risk determinants among people who inject drugs in the Republic of Georgia. *J Infect Dev Ctries* 2017;11:772–80.
33 Curatio International Foundation. HIV risk and prevention behaviors among people who inject drugs - integrated bio-behavioral surveillance survey in seven cities of georgia. study report. 2017. Available: https://curatiofoundation.org/wp-content/uploads/2018/02/PWID-IBBS-Report-2017-ENG.pdf
34 UNAIDS epidemiological estimates. Regional Fact Sheet. Eastern Europe and central Asia, 2023. Available: https://thepath.unaids.org/wp-content/themes/unaids2023/assets/files/regional_fs_eastern_europe_central_asia.pdf
35 National Center for Infectious Diseases of Armenia. Integrated bio-behavioral surveillance surveys and key population size estimations among people who inject drugs, female sex workers, men who have sex with men and transgender persons. 2021. Available: https://ncid.am/uploads/shared-files/Armenia_IBBS-2021_ENG.pdf
36 UNAIDS data, 2019. Available: https://www.unaids.org/sites/default/files/media_asset/2019-UNAIDS-data_en.pdf
37 Dumchev K, Kovtun O, Salnikov S, *et al*. Integrated biobehavioral surveillance among people who inject drugs in Ukraine, 2007-2020. *Int J Drug Policy* 2025;144:104319.
38 Plavinskiy SL, Ladnaya NN, Zaytseva EE, *et al*. HIV PREVALENCE AMONG VULNERABLE GROUPS IN RUSSIA - RESULTS OF AN INTEGRATED BIO-BEHAVIORAL SURVEY. *Journal of Microbiology, Epidemiology and Immunobiology* 2018;95:10–8.
39 Larney S. A global picture of injecting drug use, hiv and anti-hcv prevalence among people who inject drugs, and coverage of harm reduction interventions. Drug and Alcohol Connections; 2017. Available: https://www.connections.edu.au/researchfocus/global-picture-injecting-drug-use-hiv-and-anti-hcv-prevalence-among-people-who-inject

40 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.
41 Steffen G, Krings A, Zimmermann R. Prevalence of hepatitis B and C, HIV, and syphilis among people who inject drugs in Germany. *Eur J Public Health* 2022;32:ckac131.200.
42 Sekera JC, Frýbert J. Analysis of drug-related infectious diseases in people who inject drugs - Pilsen Region, 2003-2018. *Cent Eur J Public Health* 2022;30:13–9.
43 Jiang H, Zhang X, Zhang C, *et al*. Trends of HIV, hepatitis C virus and syphilis seroprevalence among injection and non-injection drug users in southwestern China, 2010-2017. *AIDS Care* 2024;36:612–7.
44 Yi S, Prem K, Chhoun P, *et al*. Syphilis infection among people who use and inject drugs in Cambodia: a cross-sectional study using the respondent-driven sampling method. *Int J STD AIDS* 2020;31:832–40.
45 Capelastegui F, Trickey A, Thompson LH, *et al*. Risk factors of HIV and variation in access to clean needles among people who inject drugs in Pakistan. *Pathog Glob Health* 2023;117:696–707.
46 Pachuau LN, Tannous C, Dhami MV, *et al*. HIV among people who inject drugs in India: a systematic review. *BMC Public Health* 2022;22:1529.
47 Pachuau LN, Tannous C, Chawngthu RL, *et al*. Changes in and Predictors of HIV among People Who Inject Drugs in Mizoram, Northeast India, from 2007 to 2021. *Int J Environ Res Public Health* 2023;20:5871.
48 Khezri M, Shokoohi M, Mirzazadeh A, *et al*. HIV Prevalence and Related Behaviors Among People Who Inject Drugs in Iran from 2010 to 2020. *AIDS Behav* 2022;26:2831–43.
49 Wiessing L, Kalamara E, Stone J, *et al*. Univariable associations between a history of incarceration and HIV and HCV prevalence among people who inject drugs across 17 countries in Europe 2006 to 2020 - is the precautionary principle applicable? *Euro Surveill* 2021;26:2002093.
50 Pines HA, Rusch ML, Vera A, *et al*. Incident syphilis infection among people who inject drugs in Tijuana, Mexico. *Int J STD AIDS* 2015;26:1022–7.
51 Dumchev K. Challenges of sexually transmitted infections and sexual health among people who inject drugs. *Curr Opin Infect Dis* 2022;35:55–60.