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NEW EVIDENCE ON THE HIV EPIDEMIC IN LIBYA

SDC1- Details on methods

Study design and participants.

We implemented a cross-sectional study among people who inject drugs (PWID) in Tripoli, Libya applying RDS, which is an established peer-driven chain-referral method using information about participants' personal network sizes and recruitment patterns to compute weighted population proportion estimates and confidence intervals^{1,2}.

Male and female PWIDs were eligible to join the study if they had engaged in injection drug use during the past month, resided, worked or studied in Tripoli, were at least 15 years old, had a valid referral coupon and were able to understand and provide informed consent prior to enrolment. (The mapping of populations most vulnerable to HIV in cities other than Tripoli showed that the network size of PWID seemed to be too small for a successful implementation of an RDS study with a target sample size of >300³).

Study procedures

During the planning stage of the survey we conducted a mapping exercise of PWIDs and interviewed stakeholders in Tripoli. Eighteen study staff (organised in two shifts) were trained during an 18-day workshop in Tripoli and assigned to different roles in the study team. The team conducted the study at a single site during 17 Jul-19 Sep 2010 (the study would have been completed in an even shorter time period, had it not included the month of Ramadan during which recruitment slowed down).

Sampling began with seven initial participants (or seeds) identified during outreach work. The seeds initiated the recruitment chains by handing over up to three recruitment coupons to their peers and referring them to the study site. Confirmation of eligibility included the inspection of PWID stigmata ('track marks'), and (if in doubt) the demonstration of detailed knowledge of injection procedures⁴. Upon enrolment, participants responded to a standardized questionnaire through a face-to-face interview, received pre-test counselling, underwent blood draws, were given the opportunity to see a doctor for Sexually Transmitted Infections (STI), and had the option to obtain HIV rapid test results and post-test counselling during the first visit, and HBV and HCV results (available within two days) during a second visit. They then received a primary financial compensation (35 LD or 15£) to cover their time and transportation. An additional secondary compensation payment (12 LD or 6.2£) was given at a later stage for each peer they recruited. Participant recruitment continued until the estimated sample size was exceeded⁵. In total 369 participants were screened, of which 336 were eligible and

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enrolled into the study. Results are presented for 328 respondents, excluding the seven seeds and one participant with too much missing data.

Network characteristics

Despite intensified outreach work we were only able to recruit one female seed, and enrol five female PWID. Recruiters explained the dearth of females as reflecting the relatively small number of female PWID in Tripoli, and their female peers' fear of stigma and discrimination if identified as PWID. In contrast, most PWIDs had no difficulties in recruiting male peers. It took respondents only a median of 2 days (IQR=1;3) until their first, 2 days (IQR=2;4) until their second, and 3 days (IQR=2;5) until their third coupon was distributed. We had asked respondents to wait for one day until giving out the first coupon, to ensure it was given to a person with reciprocal relationship. Reported recruiter-recruit relationships were highly reciprocal with about 95% of recruited peers indicating that they would also have given a coupon to the same person who gave them their coupon. Reported personal network sizes between recruiter and recruits in our sample were mildly positively correlated (Pearson correlation coefficient = 0.0253) in line with observations in some social networks⁶. Overlap between different most vulnerable populations was assessed during screening and showed that more than one third (n=114/328, 34.8%) of PWID indicated that they were acquainted with at least one female sex worker (FSW) and about one fifth (n=62/327, 19.0%) with at least one man who has sex with men (MSM); 12.8% (n=42/328) of PWID reported being acquainted with 6 or more FSW and 5.5% (n=18/328) knew at least 6 MSM. Most eligible PWID (n=253/328, 77.1%) were acquainted with 11 or more PWID, and as many as 71.0% (n=233/328) knew 11 or more persons living with HIV.

Measures

Structured questionnaires assessed IDU-related and sexual risk behaviours, HIV-related knowledge, access to services for HIV prevention and care, and other contextual and socio-demographic factors. Questions were based on internationally recognized and standardized indicators and instruments^{7,8}, or were previously applied in other countries by one of the experts, further improved and adapted to the local context. RDS-specific questions elicited information on personal network size, and reciprocity of the relationship between recruiter and recruit^{1,2,9,10}. The questionnaires were translated from English into Libyan colloquial Arabic and French, back-translated for verification, and refined during pre-testing.

Venous blood samples were drawn by qualified nurses. HIV rapid tests were performed at the study site following a three-serial-testing strategy¹¹ using Determine HIV-1/2 Kit (Inverness Medical Innovations) for initial HIV antibody-detection, and subsequently Uni-Gold-HIV-Kit (Trinity Biotech) and Bioline-HIV-1/2 Kit (Standard Diagnostics) to confirm reactive results. Blood samples

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for HBV- and HCV-testing were transferred daily to a central reference laboratory, where HBV-surface-antigen (HBsAg) and HCV-antibodies were determined by automated microparticle-enzyme-immunoassay (AxSym/Abbot Diagnostics). Positive results were followed-up with enzyme-linked-fluorescent-assay to test for HBsAg and anti-HBV-core-antigen (VIDAS, Biomérieux) and with line-immunoassay to confirm anti-HCV (INNO-LIA-HCV/AbIII, Innogenetics).

Data analysis

Double entry of the data was performed with EpiInfo v3.5.1 and pre-processing was done in SPSS version 18 and R v.2.11.1. The RDS procedure generates recruiter-recruit pairs, final sample proportions for the relevant variables and the social network size of each participant¹². We explicitly excluded all the seeds from the following analysis.

From the referral chains, the transition matrix A is constructed, with each element a_{ij} representing the proportion of the sample with characteristic i that recruit individuals with characteristic j . From A , we can estimate the expected sample proportions by assuming that the RDS chains are Markovian (i.e. that the characteristic of the recruit is only dependent on the characteristic of the recruiter); the stationary distribution of this Markov process then corresponds to the expected sample proportions¹³. We consider that the chain has reached equilibrium (that is, the point at which the sample proportion changes minimally with continued recruitment) when the expected sample proportions are within 1% of the measured sample proportions.

We used three methods (RDSI/DS, RDSII and RDSII/DA) to estimate representative population proportions from the sample data. The first, referred to as the RDSI/DS estimator¹, involves adjusting the transition matrix to account for differential recruitment success and using the reciprocity assumption to derive a matrix of smoothed adjusted transition probabilities. This matrix, together with the average personal network size and the population proportion estimates of each characteristic, p_i , forms a set of equations that can then be solved for p_i . The second method, known as the RDSII estimator¹⁴, weights the sample proportions of individuals within each characteristic group by the ratio of the estimated average network size of the total population and the estimated average network size of individuals within that characteristic group. This does not take into account the effect of differential recruitment success of individuals with different characteristics. The third estimator, the RDSII/DA estimator¹⁴, accounts for biases imparted by heterogeneous recruitment success of different groups by weighting the equilibrium proportion, rather than the sample proportion, by the same ratio of network sizes¹⁴.

The confidence intervals were estimated using a resampling procedure⁵. This method uses the transition matrix A and the social network size distribution for each group to generate a set of replicate referral chains stochastically. All three RDS estimates described above were calculated for

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each of 1000 replicates and we report the 95% confidence interval as the 2.5th and 97.5th percentiles of the distribution.

While the RDS Analysis Tool (RDSAT) is traditionally used for the analysis of RDS-collected data, it does not allow for the calculation of RDSII estimates or confidence intervals. Instead, we developed programs in MATLAB (v. 2010b) to analyse the data and ensure robustness of results. Population proportions were estimated using all three different estimators, although we report only RDSII/DA in the main text with the other two reported in the Supplementary Material for completeness. All code is available upon request. We used R-Graphviz v.1.27.0 to visualize the chain referral^{9,15}

We performed a multivariate logistic regression analysis to identify statistically significant correlates of HIV infection. The analysis was conducted in Stata v.12 using RDSAT-generated survey weights for HIV infection¹⁶. Due to sample size limitations the number of variables that could be included into a final adjusted model was restricted. The decision not to include specific variables was based on statistical significance (variables associated with HIV infection at $p < 0.2$ in univariate regression analysis were included) and strong correlation ($p < 0.01$) between variables (for example the indicators 'Ever shared needles' and 'Shared needles at last injection' were too strongly correlated to be both included).

Ethical considerations

The Liverpool School of Tropical Medicine Research Ethics Committee and the Libyan National Ethics Review Committee approved the study. The Libyan Ministry of Security endorsed the study and ordered police to refrain from raiding PWIDs at and near the study site. All study participants provided oral informed consent prior to participating in interviews and blood draws. To protect anonymity we did not collect personal identifying information from the participants, but linked questionnaires and laboratory results through code-numbers. All study participants who tested positive for HIV, HBV or HCV were referred to appropriate clinics for free clinical evaluation and treatment if necessary.

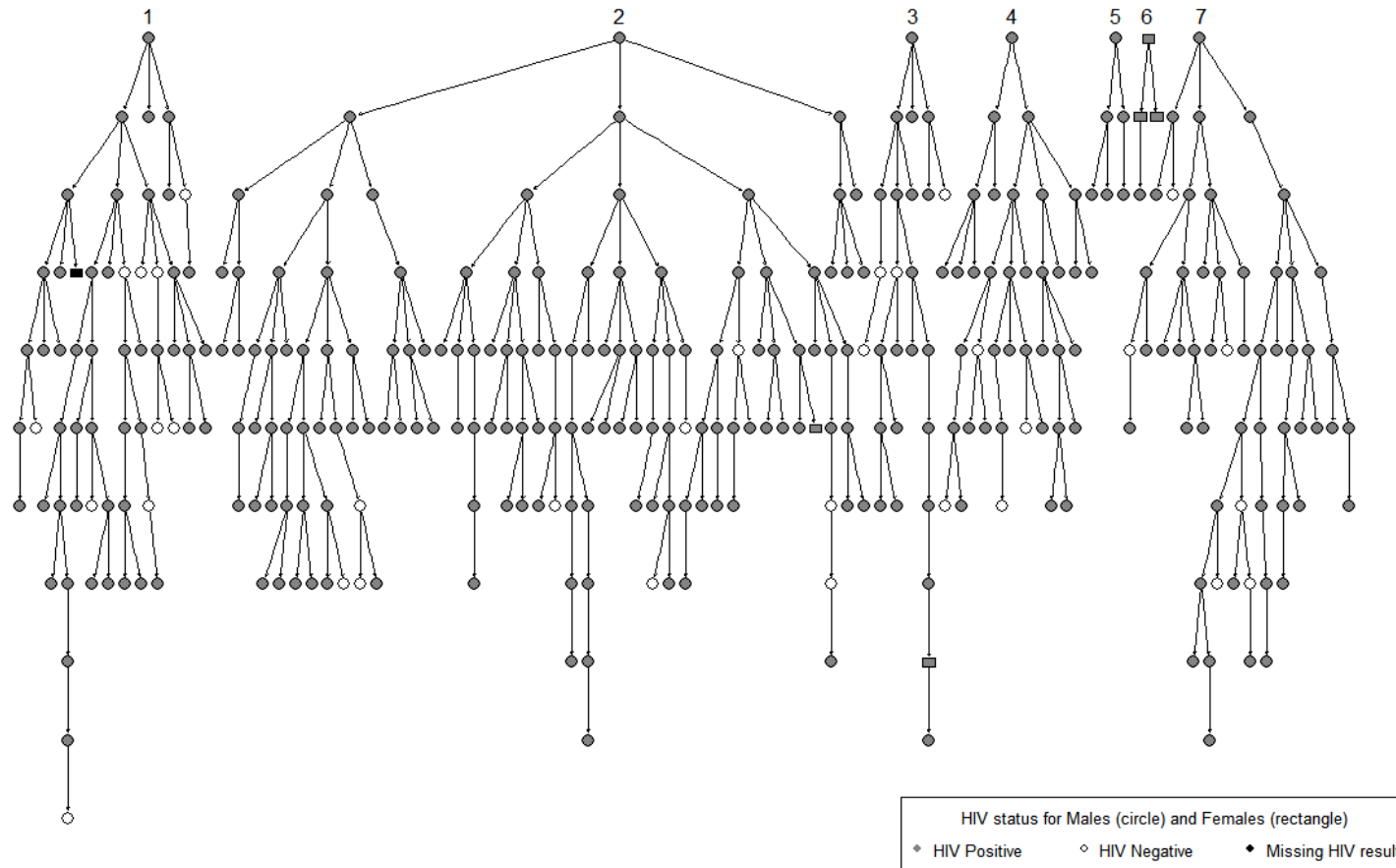
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SDC 2 - Figure S1. Recruitment tree showing HIV status of PWID study participants in Tripoli, 2010



Note: After wave four the number of recruitment coupons given to participants was reduced from three to two; graph generated using R-Graphviz v.1.27.0¹

Reference:

1. Frost SD, Brouwer KC, Firestone Cruz MA, et al. Respondent-driven sampling of injection drug users in two U.S.-Mexico border cities: recruitment dynamics and impact on estimates of HIV and syphilis prevalence. *J Urban Health*. Nov 2006;83(6 Suppl):i83-97.

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SDC 3 - Revised annex tables

Table S1 – Socio-demographic characteristics of PWID in Tripoli, Libya, 2010

Sociodemographic indicators	n*	RDSII/DA estimate†		RDS I/DS estimate‡		RDS II estimate^	
		%	95% CI	%	95% CI	%	95% CI
Gender							
Male	323	98.7	(96.4, 100)	98.4	(95.6,100)	98.9	(96.2,99.9)
Female	5	1.3	(0, 3.6)	1.6	(0,4.3)	1.1	(0.1,3.8)
Age							
15-19	0	0.0	(0, 0)	0.0	(0,0)	0.0	(0,0)
20-24	1	0.0	(0, 0)	0.0	(0,0)	0.1	(0,0)
25-29	10	2.9	(0.3, 1.1)	3.2	(1.3,5.2)	2.9	(0.3,1.1)
30-34	53	14.5	(11.8, 22.9)	14.9	(10.9,19.2)	13.9	(11.5,23.6)
35-39	112	36.9	(26.2, 38.3)	35.5	(30.5,40.4)	36.3	(26.1,38)
40-44	93	27.0	(25.4, 39.5)	29.4	(24.7,34.3)	26.9	(25.6,39.5)
45-49	47	15.7	(9.2, 18.5)	12.9	(9.3,16.7)	16.6	(8.8,18.9)
≥ 50	12	2.9	(1.3, 7.2)	4.0	(1.6,6.9)	3.4	(1.3,7.2)
Civil status							
Married, living with spouse	25	9.1	(5.4, 13.7)	12.2	(8,16.5)	9.3	(5.5,13)
Married, living with other sexual partner	0	0.0	(0, 0)	0.0	(0,0)	0.0	(0,0)
Married, not living with spouse/other sexual partner	9	2.8	(1, 4.8)	2.9	(1.3,4.8)	2.8	(1,4.9)
Not married, living with sexual partner	4	1.8	(0, 4.9)	2.6	(0,7.2)	1.2	(0,5.3)
Not married, not living with sexual partner	290	86.3	(80.9, 91)	82.4	(0,87.2)	86.8	(80.9,90.9)
Education level							
Never attended School	3	0.7	(0,1.7)	0.9	(0,2.1)	0.6	(0,1.7)
Primary incomplete	14	4.2	(1.5,7.7)	4.1	(0,6.3)	4.4	(1.5,7.7)
Primary (Year 1-6)	13	4.1	(1.8,7)	4.6	(2.3,7.3)	4.3	(1.8,7)
Middle incomplete	75	23.6	(18.1,29.5)	26.4	(5.1,31.3)	24.1	(18.1,29.5)
Middle (Year 7-9)	45	11.6	(8.1,15.4)	15.5	(11.8,26.5)	11.4	(8.1,15.4)

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Higher incomplete	42	13.7	(9.5,19.7)	14	(10.5,18.2)	13.7	(9.5,19.6)
Higher (Year 10-12)	50	14.1	(9.3,18.8)	11.5	(8.4,15)	13.9	(9.3,18.8)
Above higher	40	14.1	(8.5,19.9)	10.4	(7.2,13.9)	13.5	(8.5,19.9)
Technical school	46	14	(9.1,18.5)	12.5	(8.7,16)	14.1	(9.1,18.5)
Main source of income/ employment							
None	90	28.9	(21.8, 35.6)	24.6	(19.9, 29.7)	29.1	(21.7, 35.6)
Social Allowance	53	15.4	(10.8, 21)	17.1	(12.7, 21.2)	15.5	(10.8, 21.1)
Mechanic/factory worker/labourer/fisherman	25	7.7	(4.2, 11.7)	4.8	(2.9, 6.9)	7.8	(4.2, 11.7)
Professional/businessman	8	2.4	(0.6, 4.7)	2.7	(1, 5)	2.4	(0.6, 4.7)
Driver	25	8.2	(4.5, 12.4)	8.9	(5.5, 12.5)	7.8	(4.5, 12.4)
Security/watchman/police	113	33.6	(27, 41)	38.1	(32.3, 44.2)	33.7	(27, 41)
Hawker/street vendor/casual labourer	4	1.0	(0.1, 2.2)	1.2	(0.3, 2.4)	0.9	(0.1, 2.2)
Other	9	2.7	(0.8, 5.2)	2.5	(1.1, 4.1)	2.7	(0.8, 5.2)
No response	1	0.0	(0, 0.1)	0.1	(0, 0.2)	0.0	(0, 0.1)

* Sample size n out of total of N=328 (seeds not included)

† Population estimates computed using RDSII/DA estimator method¹ - same results as in manuscript table 1

‡ Population estimates computed using RDSI/DS estimator method²

^ Population estimates computed using RDSII estimator method¹

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Table S2 - Prevalence of HIV and other infections among injecting drug users in Tripoli, Libya, 2010

Biological indicators	n*	RDSII/DA estimate†		RDS I/DS estimate‡		RDS II estimate^	
		%	95% CI	%	95% CI	%	95% CI
HIV infection							
Yes	294	87.1	(81.5, 91.9)	88.3	(84, 92)	87.6	(81.3, 91.9)
No	33	12.9	(8, 18.3)	11.7	(8, 15.9)	12.2	(8.1, 18.7)
Missing data	1	0.0	(0, 0)	0.0	(0, 0)	0.1	(0, 0)
Hepatitis C infection							
Yes	310	94.2	(90.8, 96.7)	91.8	(87.9, 95.1)	94.0	(91.1, 96.8)
No	6	2.2	(0.6, 4.4)	3.6	(1.2, 6.7)	2.2	(0.6, 4.4)
Missing data ^l	12	3.7	(1.5, 6.5)	4.6	(2.4, 7.4)	3.8	(1.6, 6.5)
Hepatitis B infection							
Yes	16	4.5	(2.1, 7.4)	5.3	(3, 8.1)	4.6	(2.1, 7.4)
No	300	91.7	(87.7, 94.8)	89.9	(86.2, 93.3)	91.6	(87.6, 94.9)
Missing data ^l	12	3.7	(1.6, 6.7)	4.7	(2.4, 7.5)	3.8	(1.5, 6.5)
HIV/Hepatitis C co-infection							
Yes	283	83.2	(77.1, 88.8)	83.6	(79.3, 88.1)	83.9	(77, 88.6)
No	33	13.3	(8.3, 19.1)	11.9	(7.9, 16.1)	12.3	(8.3, 19.2)
Missing data ^l	12	3.5	(1.4, 6.3)	4.5	(2, 6.8)	3.8	(1.4, 6.4)
HIV/Hepatitis B co-infection							
Yes	15	4.2	(2, 6.8)	4.8	(2.6, 7.2)	4.2	(2, 6.9)
No	301	92.1	(88.1, 95.1)	90.4	(87, 93.7)	92.0	(88.4, 95.3)
Missing data ^l	12	3.7	(1.5, 6.8)	4.7	(2.4, 7.5)	3.8	(1.6, 6.4)

* Sample size n out of total of N=328 (seeds not included)

† Population estimates computed using RDSII/DA estimator method¹ - same results as in manuscript table 1

‡ Population estimates computed using RDSI/DS estimator method²

^ Population estimates computed using RDSII estimator method¹

^l Data missing due to laboratory error

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Table S3 - Drug use and IDU-related risk factors among PWID in Tripoli, Libya, 2010

IDU-related indicators	n*	RDSII/DA estimate†		RDS I/DS estimate‡		RDS II estimate^	
		%	95% CI	%	95% CI	%	95% CI
Age at first injection							
10-14	1/328	0.3	(0, 1)	0.6	(0, 1.7)	0.3	(0, 1.2)
15-19	37/328	10.9	(6.4, 15.8)	10.9	(0, 14.4)	11.3	(6.8, 15.9)
20-24	110/328	31.7	(24.9, 38.8)	30.7	(8.4, 35.6)	31.4	(25.8, 38.9)
25-29	92/328	30.0	(23, 36.7)	24.1	(20.2, 34.3)	29.7	(23.2, 36.1)
30-34	61/328	19.5	(14.2, 24.7)	23.3	(18.6, 28.2)	19.0	(14.1, 24.4)
35-39	23/328	7.1	(3.8, 11.1)	10.2	(5.9, 26.5)	7.2	(3.8, 10.7)
40-44	2/328	0.0	(0, 0)	0.0	(0, 0)	0.6	(0, 0)
Missing data	2/328	0.4	(0, 1.8)	0.2	(0, 13.5)	0.4	(0, 1.7)
Years of injecting							
< 10 years	65/328	18.3	(13.5,23)	21.8	(17.4,26.5)	18.2	(13.5,22.9)
10-15 years	149/328	47.1	(41.3,54.2)	47.1	(42.2,51.9)	46.8	(41.3,54.2)
> 15 years	112/328	34.2	(27.3,40.4)	30.8	(25.9,35.8)	34.6	(27.3,40.4)
Don't know/no response	2/328	0.4	(0,1.2)	0.2	(0,0.6)	0.4	(0,1.2)
Injected following drug(s) in past month:[‡]							
White heroin	87/328	22	(16.3,28)	22.8	(17.9,28)	21.7	(16.4,28)
Brown sugar heroin	30/328	8	(4.8,11.3)	6.5	(4.5,8.5)	8	(4.8,11.3)
Subutex (Buprenorphine)	288/328	89.1	(84.6,92.8)	87.7	(83.6,91.4)	89.1	(84.5,92.8)
Brown and subutex	7/328	1.3	(0.5,2.6)	2	(0.6,3.7)	1.3	(0.5,2.6)
Tranquilizers (e.g. Trimadol, Valium, Robinal)	16/328	4.7	(2.1,8.5)	4.4	(2.2,6.7)	4.8	(2.1,8.5)
Artan	6/328	1.8	(0.4,4.2)	2	(0.7,3.7)	1.8	(0.4,4.2)
Ecstasy	1/328	0.1	(0,0.5)	0.2	(0,0.7)	0.1	(0,0.5)
Morphine	4/328	1.4	(0.1,3.9)	1.3	(0.3,2.7)	1.4	(0.2,3.9)
Other	0/328	0.0	(0, 0)	0.0	(0, 0)	0.0	(0, 0)
Type of drugs injected most often in past month							
White heroin	37/328	9.6	(5.9, 14)	9.8	(6.4, 13.7)	9.4	(6, 14.1)
Brown sugar heroin	7/328	2.3	(0.5, 4.7)	1.6	(0.5, 2.8)	2.4	(0.5, 4.7)

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Subutex (Buprenorphine)	269/328	84.4	(78.8, 89)	83.2	(78.5, 87.6)	84.6	(78.7, 89)
Brown sugar or white heroin and Subutex	10/328	2.3	(0.9, 4)	3.6	(1.7, 5.7)	2.3	(0.9, 4)
Other	4/328	1.0	(0, 2.1)	1.1	(0, 2.3)	1.0	(0.1, 2.1)
No response	1/328	0.4	(0, 1.2)	0.7	(0, 2.1)	0.4	(0, 1.2)
Frequency of injection drug use during past month							
Less than once per week	27/328	9.2	(5.4, 13.2)	10.9	(7.1, 14.7)	9.4	(5.5, 13.2)
1-6 times a week	91/328	36.6	(29.6, 43.6)	41.2	(35.3, 46.7)	36.4	(29.8, 43.7)
At least once a day	210/328	54.2	(47.6, 61.3)	48.0	(42.4, 53.7)	54.2	(47.6, 61.4)
Ever overdosed	142/328	40.9	(34.2, 48.1)	37.1	(31.6, 42.5)	41.2	(33.7, 47.9)
Arrested during last 12 months for being on drugs or in possession of drugs or syringe	44/328	14.1	(9.2,19.3)	12.8	(9.2,16.5)	14.1	(9.2,19.3)
Ever shared needles/syringes	283/328	85.1	(80.1, 89)	86.0	(82.4, 89.2)	85.2	(80.3, 89.2)
Shared needle last time injected	70/328	18.2	(13, 23.9)	20.0	(15.3, 25.3)	19.0	(12.8, 24.3)
Shared needles in past month with ¹ :							
Respondent's usual sex partner	7/328	1.1	(0.2,2.5)	1.1	(0.3,1.9)	1.1	(0.2,2.5)
A sex partner that respondent did not know	1/328	0.3	(0,1.2)	0.6	(0,1.8)	0.3	(0,1.2)
A friend	99/328	25.9	(19.7,32)	27.6	(22.5,33.1)	26.6	(19.7,32)
A dealer	30/328	6.2	(3.3,9.2)	5.3	(3.3,7.2)	6.3	(3.3,9.3)
A professional injector	47/328	11.6	(7.5,16.3)	11.8	(8.3,16)	11.8	(7.5,16.3)
Someone in shooting gallery	51/328	12.5	(7.8,17.4)	11.6	(8.1,15.5)	13	(7.8,17.4)
A fellow prisoner	39/328	11.1	(6.7,15.7)	9	(6,11.8)	11.2	(6.7,15.7)
Frequency of needle sharing during past month							
Always	9/328	3.0	(0.8, 6.2)	4.6	(1.8, 8.3)	3.6	(0.8, 6.1)
Most times	25/328	4.8	(2.7, 7.5)	6.0	(3.8, 8.9)	5.0	(2.9, 7.6)
Occasionally	82/328	21.0	(15.3, 26.2)	22.2	(18.1, 26.6)	21.4	(15.7, 25.9)
Never	212/328	71.1	(64.3, 78.2)	67.1	(60.7, 73.1)	70.0	(64.3, 77.3)
Frequency of cleaning used needles in past month							
Always	101/116	86.2	(76, 93.5)	86.2	(79, 92.8)	86.0	(76.6, 93.1)
Most times	5/116	6.2	(0.9, 14.2)	7.3	(1.6, 13.6)	6.4	(1.1, 13.9)
Occasionally	5/116	1.9	(0.3, 4.7)	1.9	(0.4, 3.9)	1.9	(0.3, 4.8)
Never	5/116	5.6	(0.8, 13.5)	4.7	(1, 8.8)	5.8	(0.9, 12.8)

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Agent usually used for cleaning needles							
Water	93/111	81.6	(70.3, 89.9)	84.1	(76.1, 91)	82.0	(70.3, 90.6)
Bleach	8/111	8.5	(3, 15.8)	9.7	(3.6, 16.1)	8.4	(3.2, 15.5)
Alcohol/ Lemon/ Other	10/111	9.9	(2.8, 19.5)	6.2	(2.4, 10.4)	9.6	(2.8, 19.4)
Shared drugs in past month in the following situation where lots of other people inject/ get injected ^l :							
Shooting galleries	116/328	27.4	(20.7,33.5)	23.9	(19.5,28.6)	27.8	(20.7,33.6)
Prison	8/328	2	(0.4,4.7)	1.4	(0.5,2.7)	2	(0.4,4.7)
Injections by professional injectors/dealers	76/328	19	(14.1,24.1)	19.7	(15.2,24.4)	19	(14.1,24.1)
Shared drugs in a high equipment sharing situation ^{††} at least once in the last month							
Shared equipment or drew up a drug solution from a common container the last time when sharing drugs	92/142	66.9	(57.1, 75.8)	67.4	(61.6, 72.2)	65.1	(58.7, 71.7)

* Sample size N does not include seeds

† Population estimates computed using RDSII/DA estimator method¹ - same results as in manuscript table 2

‡ Population estimates computed using RDSI/DS estimator method²

[^] Population estimates computed using RDSII estimator method¹

^lMultiple responses possible

^{††} High equipment sharing situation, such as shooting galleries, prison or as injection by a dealer

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Table S4 - Sexual behaviour and risk factors among PWID in Tripoli, Libya, 2010

Sexual risk related indicators	n*	RDSII/DA estimate†		RDS I/DS estimate‡		RDS II estimate^	
		%	95% CI	%	95% CI	%	95% CI
Ever had sex	250/328	77.0	(70, 82.4)	80.1	(75, 85)	76.7	(70, 82.9)
Age at first sexual intercourse							
< Age 15	8/250	4.9	(0.9, 11.2)	2.8	(1, 4.9)	4.7	(0.8, 10.6)
15-19	106/250	41.0	(32.9, 48.3)	39.3	(32.9, 45.8)	40.3	(32.5, 48.8)
20-24	77/250	31.0	(23.8, 39.1)	30.7	(24.4, 36.4)	31.6	(23.7, 38.8)
≥ Age 25	50/250	19.8	(14, 26.2)	24.1	(18.2, 30.7)	20.0	(13.6, 27)
no response	9/250	3.4	(1, 6.6)	3.1	(1.4, 5.1)	3.4	(1.1, 6.6)
Number of sexual partners in past month							
0 partners	192/250	77.1	(69.4, 83.7)	76.6	(70.7, 82.2)	77.5	(69.2, 83.3)
1 partner	47/250	17.1	(11.6, 23.4)	18.6	(13.7, 24)	17.0	(11.8, 23.8)
≥ 2 partners	11/250	5.8	(2, 10.7)	4.8	(2.1, 7.8)	5.5	(2, 10.9)
Had sexual intercourse during last month	58/250	22.9	(16.5, 30.4)	23.4	(18, 29.5)	22.5	(16.5, 30.2)
Used a condom during last sexual intercourse	39/58	65.7	(49.2, 82.8)	71.8	(58.4, 84)	67.0	(48.4, 81.4)
Had sexual intercourse with regular partner	40/58	73.1	(58.5, 84.9)	75.5	(64.1, 84.7)	74.0	(58.2, 85)
Used a condom	26/40	59.8	(40.2, 79.4)	62.2	(45.1, 79.1)	61.3	(40, 80.8)
Had sexual intercourse with non-regular partner	17/58	27.8	(14.6, 44.9)	24.3	(13.7, 36.5)	28.9	(13.9, 43.5)
Used a condom	9/17	47.7	(21.2, 78.3)	57.9	(34.8, 77.4)	47.4	(21.7, 76.5)
Had sexual intercourse with commercial partner ^l	11/58	19.6	(9, 32.8)	20.2	(10.7, 30.1)	18.7	(8.9, 33)
Used a condom	8/11	79.7	(43.8, 100)	81.3	(58.4, 100)	77.1	(46.3, 100)
Reported any STI symptoms, incl. genital discharge and/or ulcer/ sores in past year (if ever having had sex)	28/250	12.1	(7.2, 18.2)	12.8	(8.3, 17.9)	12.0	(7.3, 18.1)
Has been forced to have sexual intercourse in past year	13/328	4.5	(1.7, 7.9)	3.2	(1.4, 5.4)	4.2	(1.7, 8)
Experienced physical violence in past year because of being PWID	33/328	8.5	(5.3, 12.9)	9.0	(6.2, 12)	8.5	(5.1, 12.8)

* Sample size N does not include seeds

† Population estimates computed using RDSII/DA estimator method¹ - same results as in manuscript table 2

‡ Population estimates computed using RDSI/DS estimator method², ^ Population estimates computed using RDSII estimator method¹

^l Commercial partner selling or buying sex in exchange for money or drugs

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Table S5 - Access to services, knowledge and attitudes related to HIV among PWID in Tripoli, Libya, 2010

Indicators related to access and knowledge	n*	RDSII/DA estimate†		RDS I/DS estimate‡		RDS II estimate^	
		%	95% CI	%	95% CI	%	95% CI
Can always access new, unused needles/syringes when needed	298/328	91.8	(87.8, 95.2)	93.2	(90.6, 95.4)	91.0	(87.5, 95.1)
Where can you obtain new, unused needles/ syringes? ¹							
Pharmacy	318/328	96.8	(93.5, 99)	97.0	(94.9, 98.8)	96.8	(93.4, 98.9)
Health Worker	0/328	0	(0, 0)	0.0	(0, 0)	0.0	(0, 0)
Hospital	5/328	1.3	(0.3, 2.7)	2.1	(0.4, 4.1)	1.3	(0.3, 2.7)
Relatives, friends	50/328	14.2	(10.7, 20.1)	15.2	(11.5, 18.8)	14.1	(10.2, 19.7)
Other drug users, dealer, theft	6/328	1.1	(0.4, 2.2)	1.7	(0.6, 3.2)	1.1	(0.4, 2.2)
Has been given sterile needles/syringes in past year	138/328	37.4	(30.5, 43.8)	40.3	(35.5, 45.4)	37.4	(30.5, 43.8)
Who has given you sterile needles/ syringes? ¹							
NCDC, Outreach worker, peer educator	0/138	0.0	(0, 0)	0.0	(0, 0)	0.0	(0, 0)
Pharmacist	2/138	2.2	(0, 6.4)	3.8	(0, 9.6)	2.2	(0, 6.4)
Friend	112/138	80.9	(73, 87.4)	74.2	(66.5, 81.4)	80.8	(73, 87.4)
Another drug user, dealer	26/138	18.1	(10.6, 26.4)	24.1	(16, 32.8)	18.2	(10.6, 26.4)
Other	3/138	2.5	(0, 5.8)	3.9	(0, 8.1)	2.5	(0, 5.7)
Ever received drug treatment or help due to injecting drug use?	212/328	59.6	(52.5, 66.9)	62.5	(56.4, 68.2)	60.0	(52.6, 66.9)
Where did you receive treatment or help last time?							
El Irada clinic (only psychiatric clinic in Benghazi that offered drug treatment to PWID)	114/212	52.9	(43.1, 60.9)	55.4	(48.7, 62.7)	52.9	(42.7, 61.1)
Tajoura drug rehabilitation centre, where drug users receive psychological help	11/212	3.4	(1.3, 8.4)	2.7	(1.1, 4.6)	3.6	(1.3, 8.4)
Former drug treatment department at Tripoli El Ziad psychiatric hospital (closed in 2004)	57/212	28.7	(20.7, 38)	27.3	(20.2, 34.4)	28.3	(20.1, 37.4)
Abroad	10/212	2.9	(1, 5.4)	3.4	(1.4, 6.2)	3.1	(1, 5.6)
Other	14/212	8.7	(3.6, 14.1)	7.8	(3.8, 12)	8.7	(3.5, 14.1)
No response	6/212	3.4	(0.9, 7)	3.5	(1.1, 6.2)	3.3	(0.9, 6.8)
What kind of treatment or help have you received last time? ¹							
Outpatient counselling or self help group	5/212	2.5	(0.5, 4.5)	4.4	(0.9, 8.4)	2.4	(0.5, 4.5)

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Detoxification	131/212	62.5	(55.6, 68.7)	54.9	(45.3, 63.6)	54.9	(45.3, 63.6)
Maintenance	3/212	1.0	(0, 2.3)	0.7	(0, 1.8)	0.7	(0, 1.8)
Residential rehabilitation	112/212	56.5	(48.7, 65.9)	56.0	(49.5, 62.5)	56.8	(48.5, 65.3)
Cold Turkey	10/212	4.6	(1.6, 8.9)	2.7	(1.1, 4.7)	4.5	(1.5, 8.9)
Other	6/212	4.1	(0.6, 8.8)	5.8	(1, 13.9)	4.0	(0.4, 8.9)
Can obtain a condom every time when needed	288/328	88.2	(83, 92.1)	87.5	(83.8, 91)	88.2	(82.9, 91.9)
Has been given condoms in past 12 months through an outreach service, drop-in centre or health facility	11/328	2.6	(1.1, 4.7)	2.9	(1.3, 4.5)	2.6	(1, 4.9)
Knows where to go for receiving an HIV test	315/328	95.1	(92.1, 97.7)	96.2	(94, 97.9)	95.0	(91.8, 97.6)
Received an HIV test in past 12 months and knows results	188/328	51.5	(44.3, 58.3)	51.3	(45.6, 57.1)	51.7	(44.4, 58.9)
Voluntarily underwent an HIV test in past 12 months, and knows results	110/328	28.5	(23, 35.3)	32.0	(26.6, 37.6)	28.7	(23.2, 35.3)
Knows where to receive STI treatment	185/328	54.6	(47.3, 61)	54.3	(48.7, 59.5)	54.6	(47.4, 61)
PWIDs who correctly identify ways to prevent sexual transmission of HIV <u>and</u> who reject major misconceptions about HIV transmission**	160/328	45.0	(37, 51.2)	42.7	(36.9, 48)	45.4	(37.3, 51.5)
STI-related knowledge: Correctly identified at least two common signs/symptoms of STIs in both men and women	18/328	4.6	(2.3, 7.3)	5.4	(3.1, 8.3)	4.7	(2.4, 7.4)
Absence of HIV-related stigma††	186/328	54.6	(47.1, 62.1)	51.2	(45.3, 57.4)	55.2	(47.1, 61.9)

* Sample size N does not include seeds

† Population estimates computed using RDSII/DA estimator method¹

‡ Population estimates computed using RDSI/DS estimator method²

^ Population estimates computed using RDSII estimator method¹

‡ Multiple responses possible

** Percentage of PWID who know that a healthy-looking person can transmit HIV and that a person can get HIV by getting injections with a needle that was already used by someone else, and who reject the misconceptions that HIV can be transmitted by shaking hands with someone infected, by sharing a meal with someone infected and through mosquito bites.

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†† Percentage of PWID who would be willing to share a meal with a person who has HIV or AIDS, would be willing to care at their house for a male or female relative who is ill with HIV and who would buy food from a shopkeeper or food seller who has HIV

NCDC = National Centre for Diseases Control

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Table S6- Univariate and multivariate logistic regression[†] showing factors associated with HIV-seropositivity among PWID in Tripoli, Libya, 2010

Factors‡	Crude OR	95% CI	P-value	AOR ¹	95% CI	P-value
<i>Sociodemographics</i>						
Age						
<35 years	1.0	-	-	1.0	-	-
≥ 35 years	1.6	(0.6, 4.1)	0.326	0.8	(0.2, 2.7)	0.702
Civil status						
Unmarried	1.0			1.0		
Married	0.4	(0.2, 1.3)	0.124	0.3	(0.1, 0.8)	0.025*
Education level						
Less than higher education completed	1.0			1.0		
Higher education completed (incl. techn. school) or above	0.4	(0.2, 1.1)	0.064	0.4	(0.1, 1.1)	0.071
Main source of income/ employment						
None or social allowance	1.0	-	-			
Any type of work	0.5	(0.2, 1.4)	0.205			
<i>IDU-related risk factors</i>						
Age at first injection						
<25 years	1.0	-	-			
≥ 25 years	0.3	(0.1, 0.7)	0.005**			
Years of injecting						
< 10 years	1.0	-	-	1.0	-	-
10-15 years	2.3	(0.9, 6.0)	0.092	2.4	(0.9, 6.8)	0.093
> 15 years	6.0	(1.7, 21.6)	0.006**	7.9	(2.2, 27.7)	0.001**
Don't know/no response						
Type of drugs injected most often in past month						
Other than Subutex only (e.g. white heroin, brown sugar Heroin, or combinations)	1.0	-	-			
Subutex only	1.2	(0.4, 3.5)	0.718			
Frequency of injection drug use during past month						
< 1x/day	1.0	-	-			
≥ 1x/day	1.5	(0.6, 3.6)	0.328			

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Arrested during last 12 months for any reason						
no	1.0	-	-	1.0	-	-
yes	0.5	(0.2, 1.1)	0.092	0.5	(0.2, 1.4)	0.179
Shared needle last time injected						
no	1.0	-	-	1.0	-	-
yes	5.2	(1.1, 24.0)	0.034*			
Ever shared needles/syringes						
no	1.0	-	-	1.0	-	-
yes	3.3	(1.2, 8.6)	0.016*	3.7	(1.3, 10.9)	0.015*
Injected at shooting gallery in the past month						
no	1.0	-	-			
yes	1.1	(0.4, 3.0)	0.777			
Received injections by professional injectors/dealer in past month						
no	1.0	-	-	1.0	-	-
yes	2.3	(0.8, 6.9)	0.140	2.5	(0.7, 8.8)	0.144
Ever received drug treatment or help due to injecting drug use?						
no	1.0	-	-	1.0	-	-
yes	2.8	(1.2, 6.8)	0.022*	3.0	(1.1, 8.6)	0.036*
Sexual behaviour and risk factors						
Ever had sex						
no	1.0	-	-			
yes	1.1	(0.4, 2.9)	0.912			
Age at first sexual intercourse						
< Age 18	1.0	-	-			
≥ Age 18	0.9	(0.3, 3.0)	0.907			
Number of sexual partners in past month						
0 partners	1.0	-	-	1.0	-	-
1 partner	1.6	(0.4, 5.6)	0.503	3.1	(0.7, 14.2)	0.149
≥ 2 partners	0.3	(0.1, 1.5)	0.140	0.5	(0.1, 2.0)	0.294
Had sexual intercourse during last month						
no	1.0	-	-			

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yes	0.8	(0.3, 2.4)	0.744
Used a condom during last sexual intercourse in past month			
no	1.0	-	-
yes	3.3	(0.5, 22.5)	0.227
n/a			
Had sexual intercourse with commercial partner in past month			
no	1.0	-	-
yes	3.6	(0.4, 31.3)	0.243
Reported any STI symptoms, incl. genital discharge and/or ulcer/ sores in past year (if ever having had sex)			
no	1.0	-	-
yes	2.0	(0.6, 7.4)	0.289
Has been forced to have sexual intercourse in past year			
no	1.0	-	-
yes	0.5	(0.1, 2.7)	0.426

† RDSAT-weighted data³ excluding seeds, n=328

‡ The following variables could not be included in the logistic regression analysis, because of zero cells (no observations in some of the categories resulting from stratification by HIV status): Gender, Injected in prison in the past month, Used a condom at last sex with commercial partner in past month

§ Those variables were included in final adjusted model that were associated with HIV infection at $p < 0.2$ in univariate analysis (with exception of the age variable, which was added despite being associated at $p > 0.2$, because we thought it an important possible confounder. Leaving the age variable out of the model did not lead to any significant differences of results). If some predictor variables were strongly correlated with one another ($p < 0.01$), only one of these was chosen (i.e. 'Ever shared needles' rather than 'Shared needles at last injection', and 'Years of injection' rather than 'Age of first injection' was chosen)

Crude OR= unadjusted Odds Ratio, AOR = Adjusted Odds Ratio

* $p < 0.5$, ** $p < 0.01$

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