

ORIGINAL ARTICLE

Injection drug use, sexual risk, violence and STI/HIV among Moscow female sex workers

Michele R Decker,^{1,2} Andrea L Wirtz,^{2,3} Stefan D Baral,^{2,3} Alena Peryshkina,⁴ Vladimir Mogilnyi,⁴ Rachel A Weber,³ Julie Stachowiak,² Vivian Go,³ Chris Beyrer^{2,3}

¹Department of Population, Family and Reproductive Health, Johns Hopkins Bloomberg School of Public Health, Baltimore, Maryland, USA

²Center for Public Health and Human Rights, Johns Hopkins Bloomberg School of Public Health, Baltimore, Maryland, USA

³Department of Epidemiology, Johns Hopkins Bloomberg School of Public Health, Baltimore, Maryland, USA

⁴AIDS Infoshare, Moscow, Russia Federation

Correspondence to

Dr Michele R Decker, Johns Hopkins Bloomberg School of Public Health, 615N. Wolfe St., E4142, Baltimore, MD 21212, USA; mdecker@jhsph.edu

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ABSTRACT

Background/objectives The HIV prevalence in Eastern Europe and Central Asia continues to increase. While injection drug use (IDU) is leading factor, heterosexual transmission is on the rise. Little is known about female sex workers (FSWs) in the region despite the central role of commercial sex in heterosexual sexually transmitted infection (STI)/HIV transmission globally. The authors evaluated the prevalence of STI/HIV among Moscow-based FSWs and potential risk factors including IDU, sexual risks and violence victimisation.

Methods Moscow-based FSWs (n=147) completed a clinic-based survey and STI/HIV testing over an 8-month period in 2005.

Results HIV prevalence was 4.8%, and 31.3% were infected with at least one STI including HIV. Sexual behaviours significantly associated with STI/HIV included anal sex (adjusted odds ratio (AOR) 3.48), high client volume (three or more clients daily, AOR 2.71), recent *subbotnik* (sex demanded by police; AOR 2.50) and regularly being presented with more clients than initially agreed to (AOR 2.45). Past year experiences of physical violence from clients and threats of violence from pimps were associated with STI/HIV (AOR 3.14 and AOR 3.65, respectively). IDU was not significantly associated with STI/HIV. Anal sex and high client volume partially mediated the associations of abuse with STI/HIV.

Conclusions Findings illustrate substantial potential for heterosexual STI/HIV transmission in a setting better known for IDU-related risk. Many of the STI/HIV risks observed are not modifiable by FSWs alone. STI/HIV prevention efforts for this vulnerable population will benefit from reducing coercion and abuse perpetrated by pimps and clients.

INTRODUCTION

The HIV burden in Eastern Europe and Central Asia has steadily increased in recent years.¹ The Russian Federation borders on a generalised epidemic with a population prevalence of 1.0% (95% CI 0.9% to 1.2%).² Official registration data from 2010 indicated over 38 000 prevalent cases in Moscow,³ the largest city of the Federation and the political and economic hub. The continued rise of HIV parallels the increase in sexually transmitted infections (STIs), most notably syphilis and Chlamydia, in the years following the fall of the Soviet Union,^{4 5} which subsequently stabilised to approximately 78.5 and 100.8 per 100 000, respectively, by 2004.⁶

Russia's epidemic is largely concentrated among vulnerable populations.^{2 7} Injection drug use (IDU),

responsible for over half of all new infections, has been considered the primary driver.⁸ Sexual transmission is increasingly common and contributes approximately one-third of new HIV cases.^{8 9} These data illustrate the need to understand female sex workers (FSWs). To date, FSWs in Russia have largely been investigated as a subset of IDUs,^{10–13} with far less is known about FSWs more generally, including their sexual risks for HIV and the STIs that can facilitate HIV acquisition.

Moscow is home to an estimated 120 000 FSWs,¹⁴ of whom approximately 4.5% were HIV infected.⁷ This heterogeneous population includes Moscovites, other Russian natives and immigrants.¹⁵ FSWs are often found in street-based *tochkas*¹⁵ or roadside locations where clients negotiate with FSWs from their cars. *Tochkas* are not fixed venues, per se, thus tend to lack formal covering and seating. FSWs can also work in more elite venues, such as saunas, brothels and hotels,¹⁵ with varying STI/HIV risks across this relative hierarchy.¹³ Prostitution and pimping are subject to small fines or short-term detention, often under the guise of charges unrelated to prostitution (eg, disorderly conduct).¹⁶

The tight control that police and pimps wield over sex work in Moscow is considered an HIV risk source,¹⁷ in that FSWs may not have sufficient control or agency with which to refuse unwanted or unsafe sex. Pimps and clients perpetrate harassment, physical and sexual violence and other forms of coercion against FSWs.^{15 17 18} Several forms of coercive sexual risk have been noted in this setting; for example, police often exploit the illegal nature of sex work in a practice referred to as *subbotnik*, wherein police demand sex in exchange for leniency towards pimps and FSWs.¹⁷ Because this practice has not been found to be exclusively forced, it is best considered a coercive form of sexual risk reflecting the underlying power imbalance between police and FSWs. Other qualitative evidence indicates that FSWs may be 'bought' by one client and subsequently presented with many additional men.¹⁷ The prevalence and STI/HIV impact of coercive sexual risk and violence against FSWs have yet to be quantitatively examined in the Russian context, despite links of violence and STI/HIV among sex workers in other settings.^{19–21} Moreover, because violence alone cannot directly cause STI/HIV, understanding associations of violence and STI/HIV requires investigation of plausible indirect risk pathways.

Against this backdrop, our study draws on baseline data from a planned cohort study to

estimate the prevalence of STI/HIV among Moscow FSWs and evaluates risk factors including substance use, sexual risk and violence.

METHODS

In preparation for proposed HIV prevention research among sex worker in Russia, a cross-sectional survey was conducted from February to September 2005 in collaboration with AIDS Info-share (AI). AI is a Moscow-based NGO whose work includes providing HIV-related education, outreach and testing to FSWs. The non-governmental SANAM clinic was home to all study procedures. SANAM serves FSWs and other marginalised groups, provides services to those who lack local residency papers and thus cannot access other health services and holds a waiver that allows anonymous STI/HIV testing without the name-based reporting requirement. The study was intended as the first phase of a prospective cohort but retention issues surfaced.

Eligible participants were 17–40 years of age, involved in sex work (ie, receiving money, drugs or other valuables in exchange for sex) and intending to remaining in Moscow for at least 12 months. Participants were recruited through publicity and outreach activities of AI, through chain-referral sampling, where *mammachkas* (madames) and FSWs invited other FSWs to participate, and through the client population of SANAM. On arrival to the SANAM clinic, determination of eligibility and informed consent occurred in a private area of the clinic. Participants then completed an interviewer-administered survey and provided blood samples for rapid serological testing and cervical swabs for wet mount microscopy analysis for STI/HIV assessment. Following data collection, participants were compensated the ruble equivalent of US\$20 for the 2.5 h visit. HIV pre- and post-counselling was provided by onsite psychologists. Participants were informed of test results, received free STI treatment and were treated according to Russian standard of care as determined by the Russian Federation Ministry of Health.

Informed by formative and qualitative research,¹⁷ the survey was developed in English and translated into Russian. Survey data were self-reported; single items assessed *demographics*, that is, age, nationality, educational attainment and relationship status; *working conditions*, that is, venue, days per week worked, duration of sex work involvement; lifetime history of IDU; *sexual risks*, that is, high client volume, defined as an average of three or more clients per working day, frequency of vaginal sex with clients, consistent condom use for vaginal sex, defined as answering 'always' to frequency of condom use during vaginal sex, anal sex; *coercive sexual risks*, that is, participation in *subbotnik* in the 3 months prior to the survey and frequency of being presented with more clients than initially agreed to (responses of 'always' or 'often' were classified as regularly experiencing this risk); and *violence*, that is, past year experiences of physical violence from clients, physical or sexual violence from pimps and threats of physical violence from pimps. Participants self-defined their experiences of *subbotnik*, violence and threats, that is, no definitions were provided.

Biological samples were screened for antibodies to HIV-1/2 using ELISA (Abbott Laboratories, Abbott Park, IL, USA). ELISA was repeated for positive or equivocal results. Positive HIV samples were de-identified and sent for confirmatory Western Blot (Vektor, The State Research Center of Virology and Biotechnology, Novosibirsk region, Russia) testing. Samples were screened for gonorrhoea and Chlamydia with direct fluorescent assays (Niarmedik, based in Moscow, Russia). Wet

mount microscopy confirmed gonorrhoea results. Syphilis screening was conducted with rapid plasma reagent assays to detect history of infection (RPR; Niarmedik, Moscow, Russia), with confirmatory testing via passive haemagglutination reaction assays (PHAR; LUES) to detect recent infection.

All procedures were approved by Institutional Review Boards at the Johns Hopkins Bloomberg School of Public Health in Baltimore, Maryland, USA, and the Third Medical and Stomatology Institute of Moscow, Russian Federation.

Analysis

Prevalence estimates for each STI, including HIV, were calculated; differences in STI/HIV prevalence were assessed via χ^2 analysis and logistic regression followed by post-hoc exploratory mediation analysis. Given the relatively small number of HIV cases, an STI/HIV outcome was constructed to reflect any STI infection, including HIV. Descriptive statistics were calculated; differences in STI/HIV prevalence based on demographics, working conditions and STI/HIV risk factors (ie, IDU, sexual risk and violence victimisation) were evaluated via χ^2 analyses, and logistic regression models were constructed to illustrate ORs and 95% CIs. Models for STI/HIV risk factors were adjusted for demographic characteristics identified in χ^2 analyses as significantly relevant to the STI/HIV outcome at $p < 0.05$. A floating sample size was used to accommodate small amounts of missing data, generally $< 5\%$.

Post-hoc cross-sectional mediation analyses were conducted to explore indirect pathways linking pimp threats and client physical violence with STI/HIV. Potential mediators were selected based on statistical significance ($p < 0.05$ in adjusted analyses) and plausibility as potential indirect influences on STI/HIV. Specifically, posited mediators for pimp threats were those that could generate additional income, that is, higher client volume and anal sex; and posited mediators for client physical violence were anal sex, often qualitatively reported as having been obtained via force or coercion and more clients waiting than initially agreed to. Analyses followed the Baron and Kenney methodology.²² Associations were evaluated between (1) the independent variable (pimp threats and client violence) and dependent variable (STI/HIV; findings presented in table 1), (2) the independent variable and the proposed mediator (sexual risk factors; evaluated via χ^2 analysis and presented in table 2) and (3) the proposed mediator and the dependent variable (presented in table 2). Stata V.9 was used for all analyses.²³

RESULTS

Recruitment procedures generated 200 eligible participants approached, of whom 150 participated. Of the 150, three participants were later excluded based on either identifying as a *mammachka* or not providing complete information about her role in the sex industry, resulting in a final sample size of 147.

STI/HIV prevalence and demographic characteristics, working conditions and associations with STI/HIV

Just under one-third of the sample (31.3%; 46/147) tested positive for STI or HIV (table 1). HIV prevalence was 4.8% (7/147); the most prevalent STI was Chlamydia (15.0%; 22/147), followed by syphilis (11.6%; 17/147) and gonorrhoea (6.8%; 10/147).

Participants ranged in age from 17 to 40 years; over half (53.7%) were over age 22. Over half (57.1%) worked at a street-based *tochka*, while 42.9% worked at a non-street-based venue. STI/HIV was more prevalent among immigrant FSWs relative to native-born Russians (42.6% vs 17.4%, respectively, OR 3.67 (95% CI 1.71 to 7.90)).

Table 1 Demographic characteristics, working conditions, IDU, sexual risk and violence victimisation among Moscow FSWs and associations with STI/HIV (N=147)

	Sample, % (n)	HIV, % (n)	Gonorrhoea, % (n)	Syphilis, % (n)	Chlamydia, % (n)	STI/HIV infected (any)	
						% (n)	OR (95% CI)
Total	100.0	4.8 (7)	6.8 (10)	11.6 (17)	15.0 (22)	31.3 (46)	—
Demographics							
Age (range 17–40 years)							
17–21	46.3 (68)	2.9 (2)	4.4 (3)	7.4 (5)	19.1 (13)	30.9 (21)	Ref
22–40	53.7 (79)	6.3 (5)	8.9 (7)	15.2 (12)	11.4 (9)	54.4 (25)	1.04 (0.51 to 2.09)
Nationality							
Native Russian	46.9 (69)	1.5 (1)	4.4 (3)	4.4 (3)*	8.7 (6)*	17.4 (12)**	Ref
Immigrant†	53.1 (78)	7.7 (6)	9.0 (7)	18.0 (14)	20.5 (16)	43.6 (34)	3.67 (1.71 to 7.90)
Highest level of education attained							
Up to some secondary	26.5 (39)	5.1 (2)	7.7 (3)	12.8 (5)	25.6 (10)*	34.8 (16)	Ref
Finished secondary/up to university	73.5 (108)	4.6 (5)	6.5 (7)	11.1 (12)	11.1 (12)	27.8 (30)	0.55 (0.26 to 1.19)
Has a boyfriend, partner or spouse‡							
No	53.1 (77)	5.2 (4)	6.5 (5)	18.2 (14)*	15.6 (12)	37.7 (29)	Ref
Yes	46.9 (68)	4.4 (3)	7.4 (5)	4.4 (3)	14.7 (10)	25.0 (17)	0.55 (0.27 to 1.13)
Working conditions							
Work venue							
Street <i>tochka</i>	57.1 (63)	7.1 (6)	7.1 (6)	11.9 (10)	19.1 (16)	35.7 (16)	1.63 (0.79 to 3.36)
Non-street venue (hotel, sauna, agency, salon, club)	42.9 (84)	1.6 (1)	6.4 (4)	11.1 (7)	9.5 (6)	25.4 (30)	Ref
Days per week worked (mean 4.9)							
≥5 days	35.4 (52)	3.9 (2)	9.6 (5)	9.6 (5)	5.8 (3)*	25.0 (13)	Ref
<5 days	64.6 (95)	5.3 (5)	5.3 (5)	12.6 (12)	20.0 (19)	34.7 (33)	1.60 (0.75 to 3.40)
Duration of involvement in sex work‡							
≤6 months	26.7 (39)	0*	10.3 (4)	10.3 (4)	25.6 (10)	38.5 (15)	2.32 (0.81 to 6.67)
7–12 months	17.1 (25)	0	0	12.0 (3)	12.0 (3)	24.0 (6)	1.17 (0.34 to 4.06)
13–24 months	22.6 (33)	3.0 (1)	0	6.1 (2)	15.2 (5)	21.2 (7)	Ref
>24 months	33.6 (49)	12.2 (6)	12.2 (6)	16.3 (8)	8.2 (4)	36.7 (18)	2.16 (0.78 to 5.96)
Associations with STI/HIV							
	Sample, % (n)	HIV, % (n)	Gonorrhoea, % (n)	Syphilis, % (n)	Chlamydia, % (n)	STI/HIV infected (any) % (n)	AOR (95% CI)§
IDU							
History of IDU							
No	82.3 (121)	3.3 (4)	6.6 (8)	10.7 (13)	14.9 (18)	29.8 (36)	Ref
Yes	17.7 (26)	11.5 (3)	7.7 (2)	15.4 (4)	15.4 (4)	38.5 (10)	1.42 (0.57 to 3.56)
Sexual risk							
High client volume							
No (2 or less per working day)	63.9 (94)	5.3 (5)	6.4 (6)	6.4 (6)	10.6 (10)	23.4 (22)**	Ref
Yes (3 or more per working day)	36.1 (53)	3.8 (2)	7.6 (4)	20.8 (11)	22.6 (12)	45.3 (24)	3.01 (1.40 to 6.48)
Has vaginal sex with ≥80% of clients‡							
No	11.1 (16)	5.3 (1)	10.5 (2)	18.8 (3)	21.1 (4)	37.5 (6)	Ref
Yes	88.9 (128)	4.7 (6)	6.3 (8)	10.2 (13)	14.1 (18)	30.5 (39)	0.49 (0.15 to 1.59)
Consistent condom use for vaginal sex							
Consistent	78.9 (116)	3.5 (4)	6.0 (7)	12.1 (14)	12.9 (15)	28.5 (33)	Ref
Inconsistent	21.1 (31)	9.7 (3)	9.7 (3)	9.7 (3)	22.6 (7)	41.9 (13)	2.24 (0.93 to 5.41)
Anal sex‡							
No	61.0 (75)	4.0 (3)	5.3 (5)	9.3 (7)	9.3 (7)*	22.7 (17)**	Ref
Yes	39.0 (48)	6.3 (3)	8.3 (4)	16.7 (8)	25.0 (12)	45.8 (22)	3.48 (1.50 to 8.04)
Coercive sexual risk							
<i>Subbotnik</i> (past 3 months)‡							
No	63.4 (90)	3.3 (3)	6.7 (6)	10.0 (9)	7.8 (7)**	22.2 (20)**	Ref
Yes	36.6 (52)	7.7 (4)	7.7 (4)	11.5 (6)	26.9 (14)	44.2 (23)	2.50 (1.17 to 5.37)
Regularly presented with more clients than agreed to‡							
No	55.9 (80)	5.0 (4)	1.3 (1)**	6.3 (5)*	15.0 (12)	21.3 (17)**	Ref
Yes	44.1 (63)	4.8 (3)	12.7 (8)	19.1 (12)	14.3 (9)	42.9 (27)	2.45 (1.13 to 5.24)
Violence							
Client physical violence (past 12 months)‡							
No	24.1 (34)	5.9 (2)	2.9 (1)	5.9 (2)	8.8 (3)	14.7 (5)*	Ref
Yes	75.9 (107)	4.7 (5)	8.4 (9)	13.1 (14)	16.8 (18)	36.5 (39)	3.14 (1.09 to 8.99)
Pimp physical violence (past 12 months)‡							
No	91.8 (134)	5.2 (7)	7.5 (10)	11.2 (15)	12.7 (17)**	29.9 (40)	Ref
Yes	8.2 (12)	0	0	16.7 (2)	41.7 (5)	50.0 (6)	2.10 (0.61 to 7.27)

Continued

Table 1 Continued

	Sample, % (n)	HIV, % (n)	Gonorrhoea, % (n)	Syphilis, % (n)	Chlamydia, % (n)	STI/HIV infected (any)	
						% (n)	AOR (95% CI)§
Pimp sexual violence (past 12 months)‡							
No	96.5 (137)	4.4 (6)	7.3 (10)	11.0 (15)	14.6 (20)	30.7 (42)	Ref
Yes	3.5 (5)	0	0	0	40.0 (2)	40.0 (2)	1.93 (0.28 to 13.45)
Pimp threats of physical violence (past 12 months)‡							
No	89.7 (122)	1.6 (2)	6.6 (8)	9.8 (12)	14.8 (18)	27.9 (34)**	Ref
Yes	10.3 (14)	21.4 (3)	14.3 (2)	21.4 (3)	21.4 (3)	64.3 (9)	3.65 (1.09 to 12.19)

*p<0.05; **p<0.01.

†Countries of origin: Ukraine (36.7%), Moldova (4.8%), Belarus (3.4%), Tajikistan (0.7%), Uzbekistan (2.7%), other (4.8%).

‡Floating sample size accommodated missing data.

§Adjusted for immigrant status.

AOR, adjusted odds ratio; FSWs, female sex workers; IDU, injection drug use; STI, sexually transmitted infection.

IDU, sexual risk, violence and associations with STI/HIV

IDU history was reported by 17.7% of the sample, such experiences were not associated with STI/HIV. Significant STI/HIV risk factors included high client volume (adjusted odds ratio (AOR) 3.01, 95% CI 1.40 to 6.48), anal sex (AOR 3.48, 95% CI 1.50 to 8.04), *subbotnik* in the past 3 months (AOR 2.50, 95% CI 1.17 to 5.37), regularly being presented with more clients than initially agreed to (AOR 2.45, 95% CI 1.14 to 5.25) and past year experiences of client-perpetrated physical violence (AOR 3.14, 95% CI 1.09 to 8.99) and pimp threats (AOR 3.65, 95% CI 1.09 to 12.19).

Post-hoc cross-sectional mediation analyses

Anal sex emerged as a mediator of client physical violence and STI/HIV; anal sex tended to be more common among those exposed to client violence and was significantly associated with STI/HIV in the final mediation model (AOR 3.12, 95% CI 1.32 to 7.40; table 2), while client violence attenuated into non-significance. High client volume emerged as a potential mediator of pimp threats and STI/HIV; high client volume was associated with pimp threats and remained associated with STI/HIV in the final model (AOR 3.01, 95% CI 1.34 to 6.78), while pimp threats attenuated into non-significance. Anal sex tended to be more common for FSWs exposed to pimp threats, however, the final mediation model suggested independent pathways for these risk mechanisms.

DISCUSSION

Overall, just under one in three Moscow-based FSWs in our sample (31.5%) tested positive for STI/HIV, illustrating the need

for continued prevention efforts. Prevalent STI/HIV was associated with sexual risk (ie, high client volume, anal sex), coercive sexual risk (ie, *subbotnik* and being regularly presented with more clients than agreed to) and violence victimisation (ie, physical violence from clients and pimp threats). The relevance of these data are underscored by the dearth of STI/HIV data for Moscow-based FSWs, coupled with the rising concern for heterosexual HIV transmission within Russia.

Immigrant status was the only demographic characteristic associated with STI/HIV. Immigrant FSWs' heightened STI/HIV risk may reflect lack of official residency papers,¹⁵ which effectively prevents women from receiving medical care and other services¹⁷ and other social vulnerabilities associated with immigration (eg, social and linguistic isolation, client perceptions of vulnerability). Additionally, this subgroup may include individuals who entered sex work via force or coercion, that is, sex trafficking,^{15 24} which has been linked with HIV risk.^{20 25}

Surprisingly, IDU was not significantly associated with STI/HIV. Limitations on statistical power afforded by our sample size may be partially responsible, particularly as the difference in prevalence was in the expected direction (ie, 38.5% STI/HIV infected among IDUs relative to 29.8% among non-IDUs). A similar lack of association was reported among male sex workers in Moscow.²⁶ The observed IDU prevalence (17.7%) is low relative to prior estimates for Russia^{11 27}; this discrepancy may reflect characteristics and biases of the current sample or real differences in Moscow's IDU patterns relative to earlier periods and the rest of the Russian Federation.

STI/HIV among FSWs was significantly associated with sexual risk, including coercive sexual risk. High client volume

Table 2 Exploratory mediation of associations of client violence and pimp threats with STI/HIV by sexual risk factors

Independent variable	Distribution of potential sexual risk mediators over independent variable				Exploration of mediation models		
	Potential sexual risk mediator	Among exposed to independent variable %	Among unexposed to independent variable %	p Value*		AOR (95% CI)†	AOR (95% CI)‡
Pimp threats (p12m)	Anal sex	66.7	37.6	0.053	Pimp threat	3.65 (1.09 to 12.19)	4.68 (1.05 to 20.73)
	High client volume	64.3	34.4	0.029	Anal sex	3.48 (1.50 to 8.04)	3.00 (1.22 to 7.39)
					Pimp threat	3.65 (1.09 to 12.19)	2.82 (0.83 to 9.56)
Client physical violence (p12m)	Anal sex	43.8	24.1	0.059	3+ clients per day	3.01 (1.40 to 6.48)	3.01 (1.34 to 6.78)
					Client violence	3.14 (1.09 to 8.99)	1.95 (0.64 to 5.94)
	More clients waiting	48.1	27.3	0.035	Anal sex	3.48 (1.50 to 8.04)	3.12 (1.32 to 7.40)
					Client violence	3.14 (1.09 to 8.99)	2.44 (0.83 to 7.19)
	More clients waiting				2.45 (1.14 to 5.25)	2.06 (0.93 to 4.57)	

Bold values indicate statistical significance of the proposed mediator on the outcome in the final model at p<0.05.

* χ^2 p value.

†Model reflects STI/HIV as a function of the independent variable denoted, adjusted for immigrant status.

‡Model reflects STI/HIV as a function of both independent variable and sexual risk mediator, adjusted for immigrant status.

AOR, adjusted odds ratio; STI, sexually transmitted infection.

conferred a threefold increased risk for STI/HIV, potentially reflecting direct risk through increased potential exposure to infection and indirect risk via vaginal irritation prompting increased risk of STI/HIV acquisition when exposed. Associations of anal sex with STI/HIV likely reflect the transmission efficiency of receptive anal intercourse.²⁸ Coercive sexual risks (ie, recent *subbotnik* and regularly presented with more clients than initially agreed to) were significantly associated with STI/HIV. Echoing evidence from other settings,^{19 21 29} STI/HIV was significantly associated with abuse in the forms of client physical violence and pimp threats. Taken together, these results suggest that the most common STI/HIV risks to FSWs may not be modifiable by FSWs alone. Rather, reducing STI/HIV risk for FSWs additionally requires reducing the abuse and coercion perpetrated by pimps, clients and police.

Because violence alone cannot directly cause STI/HIV, potential indirect mechanisms linking abuse with STI/HIV were explored. Anal sex emerged as a mediator of client physical violence and STI/HIV; prior qualitative evidence³⁰ highlights the plausibility of this potential pathway. High client volume mediated pimp threats and STI/HIV; FSWs may take on additional risk in response to non-violent coercion, perhaps to generate income. The only prior mediation investigation of violence and STI/HIV among FSWs identified IDU as a mediator.²¹ The current lack of association of IDU with STI/HIV contraindicated similar analyses; similarly, inconsistent condom use was not associated with STI/HIV and was thus not considered as a mediator. Cross-sectional findings should be interpreted with caution.

Several additional limitations should be considered. Generalisability to broader FSW populations may be limited by the clinic-based nature of the study, the outreach to potential participants via methods including chain referral and the eligibility requirement of intending to remain in Moscow for 1 year. The relatively small sample size limited statistical power and may be partially responsible for the lack of significant findings concerning IDU and inconsistent condom use. The cross-sectional design limits causal inference, particularly for the post-hoc mediation analysis. Small amounts of missing data were accommodated with a floating sample size; anal sex findings should be interpreted with caution as over 10% did not provide valid data. However, sensitivity analyses confirmed the direction and nature of all findings when non-responders were considered with the referent group. Participants' definitions of *subbotnik*, threats and violence may have varied within the sample. STI and HIV outcomes were grouped for analysis based on the relatively small number of HIV cases. All data are self-reported and may suffer inaccuracies stemming from social desirability, recall bias, intentional distortions or non-candid responses. The sample was heterogeneous but did not include FSWs working in railways or truck stops or those under 17. Data were not collected concerning sexual violence from clients, condom use errors, condom failure and intentional condom sabotage. Finally, low retention rates stymied the planned cohort.

Findings illustrate prevalent STI/HIV among Moscow FSWs, with sexual risk and violence victimisation associated with infection. The GLOBUS initiative has provided HIV prevention for FSWs and other vulnerable groups in 10 of Russia's 83 regions since 2004, yet is drawing to a close at the end of 2011. Findings clearly illustrate the need for continued STI/HIV intervention for FSWs to buffer against sexual risk and ensure access to STI/HIV testing and treatment. Current evidence linking STI/HIV with coercive sexual risk and violence bolsters international concern³¹ for the scope and health impact of

Key messages

- ▶ Approximately one-third of Moscow female sex worker (FSW) tested positive for at least one sexually transmitted infection (STI).
- ▶ Anal sex, coercive sex and violence were common and were significantly associated with STI/HIV.
- ▶ Sexual risk reduction efforts targeting FSWs alone may not be sufficient, given associations of STI/HIV with coercive sex and violence.

violence against FSWs. In a region with an expanding epidemic and primarily known for IDU-related HIV risk, FSWs emerge as a high-risk group with regard to heterosexual STI/HIV transmission.

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Competing interests None.

Ethics approval Johns Hopkins Bloomberg School of Public Health.

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Michele R Decker, Andrea L Wirtz, Stefan D Baral, et al.

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