

HIV/AIDS among female sex workers, injecting drug users and men who have sex with men in Lebanon: results of the first biobehavioral surveys

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Objectives: To measure HIV prevalence and associated risk factors among female sex workers, injecting drug users (IDUs) and men who have sex with men (MSM) in Lebanon and the prevalence of hepatitis B virus and hepatitis C virus among IDUs.

Methods and design: A cross-sectional survey of 135 female sex workers, 81 IDUs and 101 MSM was recruited using respondent-driven sampling. A structured interview was conducted by members of nongovernmental organizations working with these populations and blood was collected for serological testing.

Results: HIV prevalence was 3.7% among MSM but no HIV cases were detected among female sex workers or IDUs. Among IDUs, prevalence of hepatitis C virus antibody was 51% and prevalence of hepatitis B virus surface antigen was 5%. Three-quarters of MSM had nonregular male sexual partners during the last year but only 39% reported using a condom every time. There was evidence of overlapping HIV risk: 36% of MSM and 12% of IDUs reported that they had sold sex. Previous testing for HIV was lowest among MSM (at 22%) despite their having the highest level both of knowledge about HIV and of perception of being at risk of HIV infection (67%).

Conclusion: Prevention efforts at greater scale are needed to reach these at-risk populations in Lebanon. These should target MSM in particular, including access to HIV testing, but will need to address and overcome stigma. For IDUs, surveillance and prevention efforts should integrate both hepatitis C virus and HIV.

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Introduction

The level of the HIV/AIDS epidemic in Lebanon is currently reported to be low, with an estimated adult prevalence of 0.1% [1]. It is particularly important in settings in which HIV is of low prevalence to have an understanding of infection and risk behavior dynamics in at-risk populations in which HIV transmission tends to be concentrated; preventing HIV among these groups can

also help to curb the spread of HIV to the general population. In Lebanon, as in many other countries of the Middle East, however, these same populations are not only hidden but also engaged in behaviors considered illegal that are highly stigmatized and, therefore, difficult to reach through surveys.

Lebanon has relatively few organizations working to address HIV among these at-risk populations and lacks

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information on which to plan interventions among these groups. Until recently, Lebanon relied upon case reporting and estimation for its HIV data and had not conducted any HIV biological surveys. There are several reasons that available estimates may underestimate the epidemic, including the low number and accessibility of voluntary counseling and testing (VCT) centers prior to 2008 when 20 centers were opened. Second, although HIV/AIDS is a reportable disease in Lebanon, problems in reporting of HIV cases by private physicians have been identified [2]. It is vital to establish HIV and related behavioral trends among vulnerable groups in low-prevalence epidemics in order to develop informed, evidence-based HIV responses, in which priorities are based on valid biological and behavioral data.

As a collaboration between an academic institution, the National AIDS Programme and local nongovernmental organizations (NGOs), we conducted the first biobehavioral survey in Lebanon on HIV to establish prevalence levels of HIV among female sex workers (FSWs), injecting drug users (IDUs) and men who have sex with men (MSM) as well as hepatitis B virus (HBV) and hepatitis C virus (HCV) among IDUs, and associated behavioral risk factors among these populations. The study team consisted of researchers at the American University of Beirut and staff members of six community-based NGOs serving the study populations. In addition to obtaining HIV prevalence and behavioral data, one of the study aims was to enable the NGOs to serve as VCT centers by building their capacity for research and counseling and testing.

Methods

Study participants

We conducted a biobehavioral survey of FSWs, IDUs and MSM in the greater Beirut area of Lebanon between August 2007 and July 2008. Given the hidden nature of the risk groups under study, respondent-driven sampling (RDS) was chosen as the method of sampling. To be included, participants needed to be residents of Lebanon, at least 16 years old and engaged in an HIV risk behavior within the past 12 months (i.e., women who had sold sex, men who had injected drugs or men who had sex with a man). The team initially aimed to survey female IDUs as well but none of the NGOs working with IDUs could identify a female IDU RDS seed willing to participate in the survey. We excluded participants who were not capable of understanding the informed consent in Arabic or English.

Study procedures

All those involved in data collection received extensive training on the research instruments; the RDS methodology, including coupon management, HIV testing, HIV

awareness, communication skills, pretest and posttest counseling and relevant ethical issues. The study team identified seeds based on information obtained from NGOs working with the study populations and members of the populations about stratification of the groups, and developed a recruitment protocol. Seeds received three coupons (with contacts for relevant NGO study sites) for recruiting members of their networks. Interviews were either conducted at the NGO sites or at an agreed mutually convenient site by trained interviewers from the concerned NGO. All study participants were tested for HIV, and IDUs were also tested for HBV and HCV. We screened for both group membership and study eligibility prior to the interview. Participants received counseling before and after biological testing. Initially, dried blood spot (DBS) samples were taken for laboratory-based testing; however, because many participants did not return in 2 weeks for their test results, we, therefore, offered rapid testing as well. At the conclusion of the survey and test, participants were told when and where they could receive their test results or were given the results of the rapid test and were paid their primary incentive to cover their time and transportation. For each person recruited, recruiters were offered a secondary incentive. As the study proceeded and recruitment was slow, the study team made the HIV test optional for participants, and administered the behavioral survey to those who consented to respond to the survey but not to have an HIV test. Staff at the study sites followed the recommended coupon-management system for RDS. Regular quality control visits were conducted to ensure appropriate data collection and coupon management.

Laboratory methods

Peripheral blood was collected by finger prick for DBS samples. Genetic System rLAV EIA (Bio Rad Laboratories, Inc., Berkeley, California, USA) was used for detection of anti-HIV type 1 antibodies by ELISA. Samples testing positive were confirmed using 'Calypte HIV-1 BED Incidence EIA' (Calypte Biomedical Corporation, Portland, Oregon, USA). For IDU blood samples only, HBV surface antigen was tested and, for positive samples, anti-HBV core antigen was detected using modified ELISA protocols for Monolisa HBsAg ULTRA and Monolisa anti-HBc PLUS (Bio Rad Laboratories, Inc.). Eluates were also tested for anti-HCV antibody by ELISA, using a modified protocol for Ortho HCV 3.0 SAVE (Ortho Clinical Diagnostics, Inc., Johnson & Johnson, Raritan, New Jersey, USA). HCV genotyping of all HCV-positive IDU samples was conducted.

Measures, data entry and analysis

The behavioral survey focused on risk behaviors, the sociodemographic background of participants, prior testing for HIV and knowledge and attitudes about HIV. The questionnaires were developed in English,

based on previous biobehavioral surveys used internationally, adapted to the Lebanese context and translated into Lebanese colloquial Arabic, back-translated for verification and pilot-tested with members of the target populations.

Data from the behavioral survey and from the biological testing were linked and entered into SPSS (SPSS Inc., Chicago, Illinois, USA) and analyzed in RDSAT 5.6 for descriptive statistics. Adjusted frequency distributions were calculated along with 95% confidence intervals.

Ethical considerations

The Institutional Review Board at the American University of Beirut approved the study protocol. Study participants gave a separate oral consent for both biological test and behavioral survey. No personally identifying information was collected at any point in the study. Respondents were interviewed in a private space and were assured that all information and discussions remained confidential and that their participation was voluntary. At the conclusion of the survey and test, study

participants were given HIV prevention material tailored to risk behavior [3]. All study participants who tested positive for HIV, HBV or HCV were referred to appropriate clinics for clinical evaluation and treatment, if found necessary.

Results

Overall, the final sample for the behavioral survey included 135 FSWs, 81 IDUs and 101 MSM. Equilibrium (the point at which subsequent recruitment does not alter the point estimates of the main variables of interest in RDS) was reached for key demographic variables. Table 1 provides the population estimates concerning sociodemographic characteristics of each group. The MSM population was youngest, with 64% under the age of 25 years, as opposed to 42% of the FSWs and 17% of the IDUs. The MSM population also had higher levels of education, as 57% had at least some university education, as opposed to 10% of FSWs and 4%

Table 1. Sociodemographic characteristics, HIV/hepatitis prevalence and experience of HIV testing, at-risk populations in Beirut, Lebanon.

	Female sex workers, <i>N</i> = 135		Injecting drug users, <i>N</i> = 81		MSM, <i>N</i> = 101	
	% (95%CI) ^a	<i>n/N</i>	% (95%CI) ^a	<i>n/N</i>	% (95%CI) ^a	<i>n/N</i>
Age (years)						
16–24	0.42 (0.33–0.55)	62/135	0.17 (0.06–0.34)	15/81	0.64 (0.50–0.76)	66/101
25 or above	0.58 (0.45–0.67)	73/135	0.83 (0.66–0.94)	66/81	0.36 (0.24–0.50)	35/101
Education						
None, elementary	0.51 (0.36–0.66)	49/124	0.53 (0.34–0.69)	33/68	0.11 (0.03–0.23)	14/100
Elementary, intermediate	0.23 (0.14–0.32)	28/124	0.33 (0.21–0.57)	23/68	0.18 (0.08–0.33)	17/100
Intermediate, secondary	0.16 (0.09–0.25)	31/124	0.10 (0.03–0.13)	9/68	0.14 (0.07–0.23)	21/100
Some University	0.01 (0.00–0.03)	1/124	0.02 (0.00–0.03)	2/68	0.15 (0.07–0.26)	13/100
University	0.09 (0.04–0.17)	15/124	0.02 (0.00–0.06)	1/68	0.42 (0.21–0.59)	35/100
Nationality						
Lebanese	0.26 (0.12–0.39)	35/135	0.95 (0.88–0.99)	76/81	0.73 (0.51–0.89)	77/101
Ever married	0.60 (0.46–0.70)	76/135	0.33 (0.14–0.52)	35/81	0.06 (0.01–0.12)	7/101
Current marital status						
Single	0.43 (0.35–0.58)	60/134	0.67 (0.46–0.86)	46/81	0.94 (0.89–0.99)	94/101
Married	0.10 (0.03–0.18)	14/134	0.21 (0.07–0.34)	20/81	0.04 (0.00–0.08)	4/101
Separated	0.04 (0.01–0.04)	3/134	0.05 (0.00–0.13)	5/81	0.02 (0.00–0.05)	3/101
Divorced	0.40 (0.30–0.51)	53/134	0.06 (0.01–0.20)	9/81		
Widowed	0.03 (0.00–0.06)	4/134	0.02 (0.00–0.06)	1/81		
HIV-positive	0	0/95	0	0/81	0.037 (0.00–0.06)	1/83
Hepatitis C-positive (only for IDUs)	—		0.51 (0.33–0.74)	43/81	—	
Hepatitis B-positive (only for IDUs)	—		0.05 (0.00–0.11)	2/81	—	
Testing						
Ever tested for HIV	0.79 (0.68–0.89)	108/134	0.61 (0.40–0.78)	51/79	0.22 (0.12–0.39)	26/100
Why tested						
Mandatory	0.86 (0.76–0.95)	88/100	0.88 ^b	31/35	0.30 (0.09–0.65)	4/18
Voluntary	0.15 (0.04–0.24)	12/100	0.13 ^b	4/35	0.70 (0.35–0.91)	14/18
Received results						
Yes	0.99 (0.97–1.00)	100/101	0.80 (0.69–1.00)	34/35	1.00 (1.00–1.00)	18/18
Last time tested						
within last year	0.82 (0.71–0.94)	86/101	0.44 (0.18–0.68)	16/35	0.35 (0.06–0.54)	6/18
1–2 years ago	0.07 (0.01–0.11)	6/101	0.28 (0.06–0.49)	10/35	0.56 (0.17–0.92)	10/18
>2 years ago	0.11 (0.03–0.22)	8/101	0.28 (0.11–0.61)	9/35	0.08 (0.00–0.52)	2/18
Perceives self to be at risk of HIV	0.44 (0.32–0.53)	54/132	0.50 (0.30–0.65)	39/79	0.67 (0.46–0.77)	53/81

CI, confidence interval.

^aPopulation estimates and 95% confidence intervals.

^bConfidence intervals were not generated by RDSAT.

of IDUs. Almost all the IDUs were of Lebanese nationality (95%) as compared with 73% of MSM and only 26% of FSWs.

Concerning marital status, 60% of FSWs had ever been married, but only 10% of overall were currently married with 44% having been separated or divorced, 33% of IDUs were ever married with only 20% currently married and 6% of MSM had ever married with only 4% currently married.

HIV testing and HIV/hepatitis B virus/hepatitis C virus prevalence

One MSM tested positive for HIV, leading to a population prevalence of 3.7%. No HIV cases were found among the FSWs or IDUs. Among IDUs, 51% tested positive for HCV antibody and 5% tested positive for HBV surface antigen (Table 1). The distribution of HCV genotypes among IDUs was as follows: genotype 3 was predominant (57%) followed by genotype 1 (21%) and genotype 4 (18%) and one sample showed mixed genotypes (1 and 3) (4%).

With respect to previous HIV testing, 79% of FSWs and 61% of IDUs had been tested as compared with only 22% of MSM. Among all three groups, almost all those who were tested had received their results. Overall, 88% of IDUs and 86% of FSWs had taken the HIV test as part of a mandatory requirement as opposed to only 30% of MSM. Among those who had tested previously, over 80% of the FSWs had been tested within the last year (with 99% receiving their results) compared with 44% (80% receiving results) of the IDUs and 33% (with 100% receiving results) of the MSM (Table 1). When asked whether they felt they were at risk for HIV, 67% of MSM stated they were as opposed to 50% of IDUs and 44% of FSWs (Table 1).

Risk behaviors

Risk behaviors are provided separately for each population (Tables 2–4). Thirty-six percent of FSWs had sexual intercourse before the age of 16 years and 63% of the FSWs stated they had been under 18 years of age. Almost all of the FSWs had sold sex in the last month (97%), and the majority (96%) had five or more clients in

Table 2. Risk behaviors and risk factors, female sex workers, Beirut, Lebanon.

Risk behavior/factor	Population estimates (95%CI)	n/N
Age at first sexual intercourse (years)		
11–15	0.36 (0.25–0.45)	45/134
16–17	0.27 (0.19–0.36)	35/134
18 or more	0.37 (0.28–0.48)	54/134
No. of clients last month		
<5	0.04 (0.00–0.09)	4/114
≥5	0.96 (0.91–1.00)	110/114
Sold sex last month	0.97 (0.91–1.00)	128/134
Regular male client		
Sex with regular male client in last month	0.81 (0.73–0.90)	97/116
Condom use with regular male client in last month		
Every time	0.91 (0.82–0.97)	74/84
Most of the time	0.08 (0.02–0.16)	7/84
Sometimes	0.02 (0.00–0.04)	2/84
Never	0.00 ^a	1/84
Who initiated condom use with regular male client in last month		
Respondent	0.68 (0.56–0.78)	56/81
Client	0.01 (0.00–0.03)	1/81
Both	0.30 (0.21–0.44)	24/81
Condom use last time with regular male partner	0.92 (0.89–0.98)	108/117
Regular noncommercial male sexual partner		
Have regular noncommercial male sexual partner	0.39 (0.28–0.46)	55/134
Sex with regular noncommercial male sexual partner in the last month	0.82 (0.67–0.98)	17/21
Condom use with regular noncommercial male sexual partner in last month		
Every time	0.64 (0.31–0.97)	7/16
Most of the time	0.00 (0.00–0.00)	0/16
Sometimes	0.02 (0.00–0.05)	1/16
Never	0.34 (0.28–0.67)	8/16
Condom use last time with regular noncommercial male sexual partner	0.48 (0.23–0.89)	8/20
Nonregular male client		
Sex with nonregular male client in last month	0.90 (0.83–0.98)	120/134
Condom use with nonregular male client in last month		
Every time	0.98 (0.96–1.0)	106/107
Most of the time	0.02 (0.00–0.04)	1/107
Condom use last time with nonregular male client	0.96 (0.93–1.00)	129/133
Wanted to use condom with nonregular client but it was not used (past month)	0.35 (0.22–0.44)	36/107
Ever injected drugs	0.00 ^a	0/135
Ever imprisoned	0.21 (0.09–0.31)	26/135

^aNo confidence interval was generated by RDSAT.

Table 3. Risk behaviors and risk factors, injecting drug users, Beirut, Lebanon.

Risk behaviors/factors	Population estimates (95%CI)	n/N
Age at first injection		
14–19	0.24 (0.10–0.43)	22/79
20–25	0.31 (0.17–0.45)	26/79
>25	0.45 (0.25–0.65)	31/79
Injected in the past month	0.82 (0.65–0.91)	71/81
How many times injected in the past month		
0	0.19 (0.11–0.37)	10/81
1–4 times	0.29 (0.14–0.40)	17/81
5 or more times	0.52 (0.35–0.66)	54/81
How often new unused needles used while injecting		
Never	0.14 (0.01–0.25)	9/81
Sometimes	0.33 (0.17–0.43)	28/81
Most of the times	0.30 (0.20–0.47)	28/81
Always	0.24 (0.14–0.41)	16/81
Shared needle last time injected	0.21 (0.09–0.29)	15/81
Sex partner ever injected drugs	0.27 (0.18–0.48)	17/72
Ever bought sex	0.50 (0.35–0.69)	46/81
Ever sold sex	0.12 (0.03–0.19)	11/81
Number of regular noncommercial female sex partners in the past year		
0	0.34 (0.25–0.52)	20/81
1–4 times	0.65 (0.47–0.74)	57/81
5 or more times	0.02 (0.00–0.03)	4/81
Currently have a regular noncommercial female sex partner	0.52 (0.37–0.65)	50/81
Last month use of condom with regular noncommercial female sex partner		
Every time	0.32 (0.18–0.71)	8/20
Sometimes	0.00 ^a	0/20
Never	0.68 (0.29–0.82)	12/20
Condom use last time with regular noncommercial female sex partner	0.43 (0.25–0.69)	
Condom use last time with regular noncommercial female sex partner through the entire intercourse	0.50 (0.20–0.76)	11/20
Number of nonregular noncommercial female sex partner in the past year		
0	0.60 (0.50–0.78)	44/78
1–4	0.20 (0.08–0.29)	19/78
5 or more	0.20 (0.09–0.29)	15/78
Last month sexual relation with nonregular noncommercial female sex partner	0.39 ^a	5/15
Last month use of condom with nonregular noncommercial female sex partner		
Every time	0.43 ^a	
Sometimes	0.21 ^a	
Never	0.36 ^a	
Condom use last time with nonregular noncommercial female sex partner	0.45 (0.13–0.61)	7/15
Number of nonregular noncommercial male sex partner in the past year		
0	0.99 (0.95–1.00)	80/81
1–4	0.01 (0.00–0.05)	1/81
Tattoo	0.79 (0.61–0.89)	65/81
Ever imprisoned	0.85 (0.77–0.95)	69/81
Ever injected drug while in prison	0.03 (0.00–0.11)	3/62

^aNo confidence interval was generated by RDSAT.

the last month (Table 2). Eighty-one percent of FSWs had sex with a regular male client in the last month, and 90% with a nonregular male client. With respect to condom use, 91% of the FSWs stated that they used condoms every time they had sex with their regular male clients, and 98% had done so with their nonregular male clients. And, 92 and 98% stated that they used a condom the last time they had sex with their regular male clients and nonregular male client, respectively. However, in apparent discrepancy with these high percentages, 35% of FSWs stated that they had wanted to use a condom with their nonregular male client, but it had not been used (in response to a separate question). Thirty-nine percent of FSWs had a regular noncommercial sex partner, and 82% of these had had sex with him in the last month. Sixty-

four percent of the respondents stated they always use condoms with their noncommercial partner. However, in apparent contrast, only 48% stated that they had used condoms with their noncommercial partner the last time they had sex. None of the FSWs stated that they had ever injected drugs, and 21% had ever been imprisoned.

The majority of IDUs (52%) had injected five or more times in the last month (Table 3). Only 24% stated that they used new needles every time they inject, and 21% had shared a needle the last time they injected. A quarter of the IDUs stated that they were under 20 years of age when they had first injected drugs. Half of the IDUs stated they had ever bought sex, and 12% that they had ever sold sex. Two-thirds of the IDUs responded that they

Table 4. Risk behaviors and risk factors, men who have sex with men, Beirut, Lebanon.

Risk behaviors/factors	Population estimates (95%CI)	n/N
Age at first sexual intercourse (anal; years)		
9–15	0.28 (0.16–0.39)	29/93
16–17	0.24 (0.12–0.37)	23/93
18 or more	0.48 (0.38–0.60)	41/93
Ever had anal sex with man met over internet	0.63 (0.42–0.79)	65/101
Physical or sexual abuse in last year	0.02 (0.00–0.04)	3/101
Ever sold sex	0.36 (0.19–0.58)	35/101
Regular male client		
Have regular male clients	0.27 (0.12–0.49)	28/101
Condom use with regular male client in last month		
Every time	0.73 ^a	13/18
Most of the time	0.05 ^a	1/18
Sometimes	0.14 ^a	2/18
Never	0.09 ^a	2/18
Condom use last time with regular male client	0.70 ^a	15/19
Regular noncommercial male sex partner		
No of regular noncommercial male partner last year		
0	0.64 (0.43–0.81)	65/99
1–4	0.36 (0.18–0.56)	33/99
5 or more	0.01 (0.00–0.03)	1/99
Have currently regular noncommercial male sex partner	0.23 (0.13–0.42)	20/101
Sex with regular noncommercial male sex partner in last month	0.86 (0.69–1.00)	9/10
Condom use with regular noncommercial male sex partners in past month		
Every time	0.63 ^a	4/9
Most of the time	0.11 ^a	2/9
Sometimes	0.08 ^a	1/9
Never	0.18 ^a	4/9
Condom use last time with noncommercial sex partner	0.46 ^a	4/10
Nonregular noncommercial male sex partner		
Had nonregular noncommercial male sex partners in the last year	0.73 ^a	69/101
Condom use with nonregular noncommercial male sex partners in last month		
Every time	0.39 ^a	5/25
Most of the time	0.20 ^a	5/25
Sometimes	0.15 ^a	12/25
Never	0.27 ^a	3/25
Condom use last time with nonregular noncommercial sex partner	0.67	33/56
Number of noncommercial nonregular male sex partners in last year		
1–4	0.62 (0.35–0.78)	20/56
5 or more	0.38 (0.22–0.66)	36/56
Ever injected drugs	0	0/101
Ever imprisoned	0.05 (0.01–0.13)	5/101

^aConfidence intervals were not generated by RDSAT.

had at least one regular noncommercial sex partner (and 50% currently have one), and 40% had at least one nonregular noncommercial sex partner in the last year. With respect to condom use, 32% stated that they used condoms every time they had sex in the last month with a regular noncommercial sex partner, and 43% stated they did so every time they had sex with a nonregular noncommercial sex partner. Less than half of IDUs (43%) used a condom the last time they had sex with a regular noncommercial sex partner and 45% did so with a nonregular noncommercial sex partner. The vast majority of IDUs had ever been imprisoned (85%) and 3% stated that they had injected while in prison.

When MSM were asked about their age at first anal intercourse, 52% stated they had been under 18 years of age (Table 4). Overall 63% of MSM reported having had sex with a man they met over internet. About three quarters (73%) of the MSM had at least one nonregular noncommercial sex partner (38% had five or more), and

37% had at least one regular noncommercial sex partner in the last year (1% had five or more). With respect to condom use, 63% of MSM used a condom every time they had sex with a regular noncommercial partner, but only 39% did so every time they had sex with nonregular noncommercial sex partners in the last month. When asked about the last time they had sex, 46% stated they had used a condom with a regular noncommercial sex partner, and 67% had used a condom with a nonregular noncommercial sex partner. Thirty-six percent of MSM had ever sold sex, and 27% had a regular male client. Almost three quarters (73%) used a condom when having sex with clients in the last month, and 70% did so the last time they had sex with a male client. None of the MSM had ever injected drugs, and 5% had ever been imprisoned.

Knowledge and attitudes

Knowledge about HIV was relatively high in all three most at-risk groups (Table 5), but generally highest among MSM. With respect to condom use, 85% of

Table 5. Knowledge about and attitudes toward HIV among at-risk groups in Beirut, Lebanon.

	Female sex workers Population estimates (95%CI)		Injecting drug users Population estimates (95%CI)		MSM Population estimates (95%CI)	
		<i>n/N</i>		<i>n/N</i>		<i>n/N</i>
Knowledge						
Cannot tell someone has HIV just by looking at them	0.63 (0.53–0.72)	83/135	0.72 (0.53–0.86)	56/73	0.94 (0.86–0.98)	88/97
Having sex with only one partner reduces risk	0.85 (0.81–0.92)	116/135	0.97 (0.92–0.99)	68/74	0.81 (0.64–0.92)	69/88
Cannot get infected with HIV from toilets	0.63 (0.53–0.72)	79/133	0.62 (0.37–0.76)	36/53	0.89 (0.74–0.96)	87/101
Using condoms during vaginal sex reduces HIV transmission	0.88 (0.83–0.94)	117/134	0.86 (0.72–0.95)	68/77	0.85 (0.72–0.95)	79/92
Mosquitoes do not transmit HIV	0.49 (0.39–0.59)	65/135	0.38 (0.19–0.52)	24/47	0.88 (0.77–0.95)	84/94
Sharing needles while injecting drugs increases risk	0.91 (0.84–0.96)	123/134	0.97 (0.95–1.00)	73/75	0.98 (0.94–1.00)	90/91
Using condoms during anal sex prevents HIV transmission	0.68 (0.60–0.78)	86/124	0.84 (0.67–0.96)	56/63	0.96 (0.89–0.99)	85/89
Attitudes						
A condom should be used when having sex	0.98 (0.95–0.99)	122/126	0.89 (0.74–0.97)	68/76	1.00 ^a	89/91
Family member infected should be kept a secret	0.51 (0.35–0.62)	56/120	0.54 (0.39–0.66)	44/80	0.91 (0.80–0.97)	65/72
Would take care of an HIV-infected relative	0.67 (0.53–0.76)	88/131	0.87 (0.77–0.94)	68/80	0.95 (0.86–1.00)	63/70
Would tell family if infected with HIV	0.56 (0.44–0.71)	71/119	0.91 (0.85–0.98)	71/81	0.28 (0.09–0.47)	12/47

^aConfidence intervals were not generated by RDSAT.

MSM, 86% of IDUs and 88% of FSWs were aware that using condoms during vaginal sex reduces the risk of HIV transmission. MSM reported almost universal (96%) awareness that using a condom during anal sex reduces the risk of HIV transmission. Additionally, 81% of MSM agreed that having sex with only one partner reduces risk compared with almost all (97%) of IDUs and 85% of the FSWs. Related to sharing of needles, 98% of MSM, 97% of IDUs and 91% of FSWs stated that this increases risk of transmission.

Regarding attitudes, all of the MSM, 98% of FSWs and 89% of IDUs responded that a condom should be used when having sex. MSM were least likely to tell a family member whether they were infected with HIV (28% compared with 56% of FSWs and 91% of IDUs) and most likely to state that whether a family member were infected with HIV, this should be kept a secret (91% compared with 51% of FSWs and 54% of IDUs).

Discussion

This first biobehavioral survey in Lebanon among three at-risk groups detected HIV among MSM for a 3.7% prevalence (with an upper confidence limit that exceeds 5%), but no infections were detected among FSWs and IDUs. Although the HIV prevalence among MSM was found to be lower than that found in Egypt (6.3%) in 2006 [4] and in Sudan (7.8%) in 2007 among 'insertive' MSM [5], our findings point to the need to focus prevention and surveillance efforts on MSM who remain highly

stigmatized in Lebanon. Although Lebanese law does not explicitly outlaw male–male sex, a law referring to sexual acts that are 'against nature' is typically interpreted as rendering it illegal [6].

We found a high prevalence of HCV among IDUs at 51% and a 5% prevalence of HBV. Given the high cost of HCV treatment in Lebanon and the predominance of HCV genotype 3, which has a more favorable response to antiviral treatment than genotypes 1 and 4 [7], these findings point to the importance of broadening IDUs' access to screening for HCV as well as HIV.

All groups reported behaviors that put them at risk of HIV, but particularly IDUs and MSM; both groups have been less reached through HIV prevention efforts in Lebanon, as outreach efforts to these groups have been relatively recently initiated in the country. By contrast, there has been a longer history of prevention efforts among FSWs and together this may partly explain this finding. Less than a quarter of IDUs reported using new needles when they inject and a fifth reported sharing needles, risk factors not only for HIV but also for HCV, although the rate of sharing needles is lower than the 50% found among some other countries in the Middle East and North Africa region [8]. Just over a third of MSM had current regular male partners, whereas almost three quarters had nonregular noncommercial male partners over the previous year and more than a third of MSM reported having five or more nonregular partners in the last year. However, less than 40% of MSM reported using a condom every time with a nonregular male sexual partner.

Our study also provides evidence of overlapping risks between MSM and commercial sex and between injecting drug use and commercial sex. Over a third of MSM had ever sold sex, and over a quarter reported having regular male clients; half of the IDUs stated that they had ever bought sex, and 12% said that they had ever sold sex. However, there was little reported overlapping risk between injecting drug use and MSM contrary to some findings elsewhere in the Middle East and North Africa [8].

The fact that no cases of HIV were detected among IDUs and FSWs is perhaps surprising. However, this may be due either to the relatively small sample size of our study (discussed further below) or to the fact that HIV remains at relatively low prevalence among these two populations, despite risk behaviors reported among IDUs in particular. However, given the high HCV rates found among IDUs and the fact that more than a third of FSW had wanted to use a condom with their nonregular male client but had not, it is likely that HIV will spread rapidly among members of these groups once introduced. Moreover, if HIV were to spread among these at-risk groups, the latter could be significant bridges for infection to the general population. A fifth of IDUs are currently married and over half had a regular noncommercial female sex partner during the last year and only just over half reported using condoms the last time with that partner. As for FSWs, 10% were currently married and nearly 40% reported having regular male noncommercial partners but less than half reported using a condom the last time with that partner.

Knowledge about HIV was found to be generally good in these populations, but was significantly higher among MSM who were also more educated as a whole than the other two groups. Our seemingly contradictory findings that awareness about how to prevent HIV was high among MSM, yet at the same time they were engaged in risky behaviors, is confirmed by other evidence in Lebanon [6]. Attitudes toward use of condoms were generally positive. Perception of being at risk of HIV followed a similar pattern to knowledge in that a half of IDUs and less than a half of FSWs, but over two-thirds of MSM perceived themselves to be at risk of HIV infection. These proportions are higher than reported rates among at-risk populations in other countries of the Middle East [8], indicating possibly greater awareness. This may potentially be explained both by higher levels of education in Lebanon as a whole compared with other Middle Eastern countries, and the fact that Lebanese population has a high history of migration not only due partly to its history of civil war but also due to economic and education-related migration. Second, the study setting was the greater Beirut area, where educational levels are also higher and exposure to other countries is greater than the rest of the country. Finally, Lebanon has led a longstanding media and public education campaign on HIV/AIDS that has recently been intensified and this

may be the primary reason for higher levels of knowledge compared with other countries in the region.

The fact that among both FSWs and IDUs, over three-quarters of those who had tested previously had done so for mandatory reasons confirms findings at the regional level about the predominance of mandatory testing over voluntary testing [9]. In the case of FSWs, the fact that 80% of the sample was non-Lebanese and, although sex work itself is not legal in Lebanon, foreign workers of any category are HIV tested in order to obtain residence or a work permit in the country, explains this finding. In the case of IDUs, 85% of IDUs had been imprisoned, and prisons in Lebanon routinely test all prisoners upon incarceration.

There is an evident mismatch between perception of risk of HIV infection and actual experience of testing, particularly among MSM. Two-thirds of MSM perceived themselves to be at risk of HIV but less than a quarter had ever been tested for HIV. The lower testing rates reported by MSM may be explained by greater stigma associated with HIV for MSM, which could affect their access to services. This is corroborated by our results on attitudes, whereby of all at-risk groups, MSM reported being least likely to disclose their HIV-positive status to relatives, and by other evidence [6].

This first biobehavioral survey in Lebanon is critically important in providing baseline data on actual prevalence of HIV, HBV, HCV and behavioral risk factors on the basis of which to develop programs and monitor trends. These data will be a central element of the country's monitoring and evaluation framework for HIV/AIDS [2].

RDS was shown to be feasible in this context in that recruitment proceeded to enable equilibrium to be reached for key demographic variables, thus providing the first estimates of HIV prevalence among at-risk groups based on valid samples. Moreover, research participants proved to be willing to answer sensitive questions despite the high level of stigma associated with HIV and with HIV risk behaviors in Lebanon.

Limitations

There were several limitations to the study, which need to be borne in mind in conducting similar studies in this context. Recruitment of research participants proceeded slowly even after increasing both the primary and secondary incentives for the study [3]. The percentage of desired sample size reached for FSWs was 17%, whereas for IDUs, it was 28% and for MSM 19%. This contrasts with international experience, in which of those studies reviewed by Johnston *et al.* [10], 85% came within 90% of their desired sample size. A possible explanation for the

low percentage sample size achieved in our study is that the estimated sample sizes were originally very large because they were based on very low prevalence of HIV according to data available at the time. In contrast to the experience of Egypt, where RDS among at-risk groups recruited the projected sample in the expected time period [4], the slow recruitment in Lebanon may be due to the much smaller population size of Lebanon and the corresponding small networks combined with the strong stigma and fear of police repression faced by all three groups. Furthermore, fieldwork took place during a period of high political instability and periodic assassinations of public figures, which resulted in unexpected shutdowns across the country, thus affecting recruitment.

A further limitation is that a significant proportion of MSM declined HIV testing (18 of 101). Analysis of risk behaviors among those who opted out indicates a trend toward higher level of risk behaviors among those who opted out, but the difference was not statistically significant, possibly due to the small total sample size (data not shown).

The very high reported condom use by FSWs raises the question of potential reporting biases among this group, given that it is higher than that in an earlier study [11] that found approximately only a third out of a sample of 539 sex workers reported always using condoms with nonregular and regular clients. Data are not available from our study on the nationality of the non-Lebanese FSWs, but a separate question concerning the language the respondent is most comfortable speaking indicates that, out of 150 FSWs, 16 preferred English and nine preferred Russian (data not shown). We cannot establish whether the high proportion of foreigners among the FSWs sample is reflective of the general situation in Lebanon, given the lack of available studies in Lebanon but it is consistent with media reports [12].

Despite the above limitations, however, the study provides the first biobehavioral data on at-risk groups available in Lebanon that are likely to be much more representative of these populations than previous studies, which were not based on probability samples. We recommend that further biobehavioral surveys should be conducted combined with qualitative research to understand the nature of networks of at-risk populations and the barriers they face in accessing services.

Public health implications

Given the manifest presence of HIV among MSM, yet their high level of knowledge and risk perception, there is an urgent need to address efforts to overcome stigma associated with being an MSM and to reduce their evident reluctance to access services including HIV testing.

Although Lebanon is exceptional in the region for having an NGO, HELEM, founded in 2004 and actively promoting the rights and well being of MSM [6], prevention efforts among MSM need to be supported, so as to operate at greater scale with more outreach to the currently unreachable. The fact that the majority of MSM interviewed had had anal sex with a man they met over the internet suggests that the latter may be an effective way of disseminating health education messages to this group.

HIV prevention messages need to reach foreign sex workers in particular, who are likely to have less access to health services, given the privatized nature of the health sector in the country and their lower likelihood of having health insurance. For IDUs, our findings clearly underline the need to screen for HCV as well as HIV and to provide referral to free services providing HCV treatment, which are currently limited (although HIV treatment is provided free of charge to those who need it by the Lebanese government).

Our study shows clear evidence of overlapping risks but, with only one exception, NGOs working with these at-risk populations do not address these overlapping risks. Moreover, we found that risk behaviors start at a young age: more than a third of FSWs reported that their first intercourse was under the age of 16 years, a quarter of IDUs began injecting in the age group of 14–19 years and over a quarter of MSM had their first anal sex experience between the age of 9 and 15 years. This emphasizes the importance of finding ways to reach younger members of these populations who are currently unreachable with health education and surveillance programs.

Despite the establishment of VCT centers in Lebanon since January 2008, we found low levels of voluntary testing. Given the strong stigma associated with HIV and HIV risk behaviors in Lebanon, there is need to find ways to improve existing testing and health services to engender trust while simultaneously broadening access to surveillance, testing and, when needed, HIV treatment.

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Conflicts of Interest: None.

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