

Association of HIV infection and partner's injection drug use among female sex workers in Dar es Salaam: A respondent-driven sampling survey

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BACKGROUND

In Tanzania, data on female sex workers (FSW) are lacking, though sex work is relatively common in Dar es Salaam.

METHODS

In 2010, we conducted a cross-sectional study using respondent-driven sampling (RDS) to assess HIV prevalence and associated risk behaviors among FSW in Dar es Salaam. Information on socio-demographic characteristics and sexual and drug risk behaviors was collected through face-to-face interviews. The primary outcome variable was HIV infection determined using an HIV rapid test.

RESULTS

A total of 537 self-identified FSW were recruited into the study. The adjusted estimated prevalence of HIV infection in the target population was 31.4% (95% CI: 25.6-38.5). HIV prevalence was relatively high (46.9% [95% CI: 31.5-61.4]) among FSW who suspected their sexual partners injected drugs; the adjusted odds ratio (AOR) of HIV infection among women who suspected their partners injected drugs was 3.3. HIV prevalence did not differ by partner type, but condom use did differ by partner type (31.6% with non-paying steady partners, 65.4% with one-time partners, and 59.4% with non-paying casual partners). In addition, each additional year of sex slightly increased risk of HIV infection among FSW (AOR: 0.09).

CONCLUSION

Results of this study suggest public health interventions, such as safe injection practices for partners of FSW who inject drugs, condom promotion, and target prevention programs for younger FSW, would reduce HIV infections.

Key words: HIV, Sex Worker, Intravenous Drug Abuse, Tanzania, Respondent-driven sampling

INTRODUCTION

In Tanzania, adult HIV prevalence is estimated at 5.1% (95% CI: 4.66-5.66) (National Bureau of Statistics Tanzania, 2012). Dar es Salaam has one of the highest HIV prevalence rates in Tanzania at 7.0%; 8.2% among women aged 15-49 and 5.3% among men of the same age group (National Bureau of Statistics Tanzania, 2012). Evidence

suggests that specific populations are at increased risk for HIV infection, including people who inject drugs (PWID), men who have sex with men (MSM), and female sex workers (FSW) (National AIDS Control Programme Tanzania Ministry of Health and Social Welfare, 2010). In 2012, behavioral surveillance surveys among PWID, MSM, and FSW in Zanzibar found a disproportionately high preva-

lence of HIV in these groups (11.3%, 2.6%, and 19.3%, respectively) (Zanzibar AIDS Control Programme, 2007).

As a group, FSW are at disproportionately high risk for HIV infection because they have multiple sexual partners and may not use a condom at every encounter. They may have an important role in the introduction and reseeding of HIV into the general population (Morison et al., 2001). Several countries with low HIV prevalence showed rapid increases in HIV infection among FSW well before similar increases were seen in the general population (Ghys, Jenkins, & Pisani, 2001).

In Tanzania, data on FSW are lacking even though, similar to other large East African cities, sex work is relatively common in Dar es Salaam and has been documented in other locations throughout the country. Convenience samples of female bar workers in Moshi and Mbeya have found high proportions of women engaged in informal commercial sex work and prevalence of HIV infection ranging from 19-68%. One respondent-driven sampling (RDS) survey of sex workers in Zanzibar, a semi-autonomous region in Tanzania, found an HIV prevalence of 10.8%, and the proportion of FSW who had used a condom with their last client was 55.7% (Ao, Sam, Masenga, Seage, & Kapiga, 2006; Kapiga et al., 2002; Riedner et al., 2003; Zanzibar AIDS Control Programme, 2007). However, overall there is very little information available on HIV and sexually transmitted infections (STI) prevalence and risk factors among at-risk populations in Tanzania.

In high-income countries, there has long been an epidemiologic connection between sex work and injection drug use (Kral et al., 2001). PWID frequently practice sex work to provide cash to purchase drugs, or in exchange for drugs. In the United Kingdom, for instance, up to 80% of street-level prostitution is driven by the need to finance drug addiction. This has also been reported from Dar es Salaam, Tanzania, where 82% of female PWID reported their major source of income was trading sex for money (Strathdee et al., 2011; Williams et al., 2007). FSW who inject drugs are at higher risk for HIV than those who do not (Des Jarlais et al., 2012, Strathdee et al., 2011). Additionally, FSW who do not inject drugs but whose steady male partners are PWID are also at higher risk for HIV (Des Jarlais et al., 2012). This association, however, has not been reported from sub-Saharan Africa where injection drug use is a relatively more recent phenomenon than in other parts of the world.

Our aim was to measure the prevalence of HIV among FSW in Tanzania and to identify factors associated with prevalent HIV infection.

METHODS

Study design

We conducted a cross-sectional survey of FSW in Dar es Salaam in 2011 using RDS, a chain referral sampling method designed to reduce the biases generally associated with other chain referral methods and to yield

a probability-based sample (Heckathorn, 2002). In the field of HIV epidemiology, this sampling method has been widely used to sample hard-to-reach and hidden populations such as FSW, PWID, and MSM (Malekinejad et al., 2008). RDS recruitment begins with individuals, called seeds, who are selected purposively from the target population to initiate recruitment. Each study participant is then asked to recruit a specified number of their peers to enroll in the study, and recruitment continues until the sample size is reached.

Setting

Dar es Salaam is the largest city in Tanzania and its commercial hub. Dar es Salaam has an estimated population of 5 million and is a destination for large numbers of internal migrants. Nationally, it has the sixth highest HIV prevalence of any region, estimated to be 6.99% in the 15-to-49-year-old population (National Bureau of Statistics Tanzania, 2012).

Sample size, study population, and procedures

We estimated the sample size to be 500 or more based on a design effect of 2.0 using HIV prevalence estimates among FSW in Zanzibar (Zanzibar AIDS Control Programme, 2007). At study inception, we enrolled six purposively selected seeds identified through a formative assessment and chosen based on desired characteristics (e.g., age, where they worked, and income level). Because two seeds did not recruit peers, five seeds were added during the study. Each participant was given three coupons, each valid for two weeks, to refer their peers to the study. We provided 8000 TSH (~5 USD) as a primary incentive and 4000 TSH (~2.5 USD) as a secondary incentive for each recruit who came and completed the study. Eligible women were those aged 15 years and above who had exchanged vaginal or anal intercourse for money in the past six months, had lived in Dar es Salaam for the prior three months, were willing to participate, and possessed a valid coupon. We interviewed participants at two fixed study sites. Participants who presented a valid recruitment coupon to the study site were screened for eligibility and asked to provide informed consent for a face-to-face interview in a private room. Interviews were conducted in Kiswahili. Interviewers administered questionnaires to participants on network size, socio-demographic characteristics, sexual and drug risk behaviors, HIV knowledge, and access to and utilization of HIV and healthcare services. The study lasted for 12 weeks between May 2010 and July 2010, during which the study reached equilibrium on HIV status, the main outcome. Equilibrium (i.e., stability in the samples) is a point at which homophily biases can be estimated and weighted corrections assigned. We provided STI treatment and referral for HIV care for all those who were found positive for HIV infection.

Laboratory tests

We tested for HIV infection using a serial algorithm consistent with Tanzanian national guidelines. All specimens were screened onsite using an HIV rapid test, SD Bioline HIV-1/2 3.0 (Standard Diagnostics, Kyonggi-do, South Korea), and positive specimens were confirmed using the Determine HIV1/2 rapid test (Abbott Diagnostic Division, Hoofddorp, The Netherlands). For discordant specimens, a Unigold rapid test (Trinity Biotech, Bray, Ireland) was used as the tie breaker. Rapid tests were done onsite, and all other tests were sent to the National Health Laboratory Quality Assurance and Training Centre at the National Institute for Medical Research in Dar es Salaam for quality controls.

Data management and analysis

Double entry of data was done in a Microsoft Office Access 2007 database. Consistency checks and analysis of variable frequencies were performed to check validity and logic of all variables in the dataset. In order to estimate the population size of FSW in Dar es Salaam, we used the unique object multiplier method, which assumes that the number of FSW who appear at selected locations over a specified time frame is equal to the total size of the estimated population multiplied by the proportion of the population who attended the study. We visited venues in Dar es Salaam where FSW congregate and handed out a handkerchief (i.e., a unique object) two weeks prior to starting the study, and during the study visit they were asked if they received that object. Using simple math, we were able to calculate the proportion of FSW that was captured both at the venue and in the study, and thus estimate the population size.

Analysis required software with the ability to weight network size and recruitment patterns to produce prevalence estimates. We calculated adjusted prevalence estimates and 95% confidence intervals (CI) using RDSAT 5.6 (www.respondentdrivensampling.org). Our primary outcome variable was HIV infection. Our primary predictor variables were socio-demographic factors and risk behaviors such as condom use, time in sex work, and drug use. We exported individualized RDSAT weights into STATA 10.0 (Stata Corporation, College Station, TX, USA) to conduct multivariate analysis. We included all factors with *p*-values less than 0.20 in bivariate analysis in the model and used backward stepwise regression until the best fit model was found.

Ethical considerations

According to Tanzanian law, subjects from 15 to 18 years old may be considered emancipated minors and are able to provide consent to participate in a study. This study was approved by the National Institute for Medical Research, the Committee for Human Research at the University of California, San Francisco, and the U.S. Centers for Disease Control and Prevention.

RESULTS

A total of 537 FSW participated in the study from two sites in Dar es Salaam. Almost all (490, 91.2%) women attended the study site that their recruiter had attended. The maximum number of waves (rounds of referrals) of recruitment was 16, and mean number of waves was 5.7 for the whole study. Nineteen participants did not consent to blood drawing and are excluded from estimates of HIV infection. The estimated size of the FSW population in Dar es Salaam using the unique object multiplier method was 7,500 (range 5,000–10,000).

The median age of participants was 29 years old (interquartile range [IQR]: 23–36 years), and 40.3% were between 25 and 34 years old (Table 1). The majority (72.9%) of participants had attended some or completed primary school. Most (57.9%) had never been married, 32.7% were divorced or separated, and 8.7% were widowed. The median age of sexual debut was 17 years of age (IQR: 15–18). The median duration of sex work was three years (IQR: 2–6), and the median number of clients on the last day worked was three (IQR: 2–4). The most common reason given by FSW for entering into sex work was the need for money to support their family or to pay off debts (71.0%). HIV prevalence was 31.4% (95% CI: 25.6–38.5) among the study population of FSW.

Nearly all (97.8%) of FSW ever had one-time clients, 81.1% ever had regular commercial clients, and 72.6% ever had steady partners. Ever having casual, nonpaying partners (20.4%) was reported less frequently (Table 2). HIV prevalence did not differ by partner type, but condom use did differ by partner type. Consistent condom use in the past 30 days with non-paying steady partners was 31.6% compared to 65.4% with one-time partners and 59.4% with non-paying casual partners (Table 2).

Reported alcohol and non-injection drug use in the past 30 days were 67.7% and 84.1%, respectively. FSW rarely reported injecting drugs themselves (1.3%) but often suspected their partners were PWID (49.1% [95% CI: 43.8–55.5]). Only six FSW reported injecting drugs, and all six were infected with HIV. In bivariate analysis, HIV prevalence was higher among FSW who suspected that partners injected drugs, 46.9% (95% CI: 31.5–64.1) as compared to the 23.2% (95% CI: 16.5–29.4) of FSW who did not suspect that their partners injected drugs.

In a multivariate model, adjusting for demographic and behavioral characteristics, the adjusted odds ratio (AOR) of HIV infection among women who suspected that their partners injected drugs was 3.2 (95% CI: 1.66–6.72) (2.3 times greater) and was 0.09 times higher per additional year of sex work (AOR 1.09 [95% CI: 1.03–1.2]) (Table 3). In addition, being older was significantly associated with HIV infection (AOR 1.6 [95% CI 1.2–2.3]). Factors which were not significant at the *p*<0.05 level and which were excluded from the best fit model during stepwise regression were having a steady partner, having used non-injection drugs in the past 30 days, and having a partner who used non-injection drugs in the past 30 days.

Table 1. Demographic characteristics and HIV status, respondent-driven sample of FSW, Dar es Salaam, Tanzania, 2011

	N	% (95% CI)*	HIV+ (N)	HIV Prevalence % (95% CI)
All participants	537	100	172	31.4 (25.6-38.5)
Age				
15-24 years	172	35.6 (27.1, 43.9)	17	8.1 (3.6, 13.3)
25-35 years	209	40.3 (34.0, 47.1)	79	42.2 (32.3, 53.4)
36-50 years	141	21.9 (16.7, 28.5)	68	47.3 (34.2, 60.2)
>50 years	15	2.2 (0.7, 4.3)	8	52.2 (17.6, 97.4)
Median age: 29 years (IQR: 23-36)				
Education				
No formal education	38	7.7 (4.1, 12.0)	16	30.8 (12.6, 56.8)
Completed or some primary education	404	72.9 (67.1, 78.1)	130	31.6 (24.4, 38.5)
Completed or some secondary education	92	19.4 (14.8, 24.6)	26	37.1 (20.6, 52.6)
Marital Status				
Currently married/cohabitating	6	0.8 (0.2, 2.0)	1	n/a
Divorced/separated	200	32.7 (26.1, 40.2)	72	38.6 (27.9, 48.5)
Widowed	54	8.7 (5.0, 11.0)	31	43.6 (30.2, 68.6)
Never married	271	57.9 (50.5, 66.1)	66	25.7 (17.8, 34.1)
Age at first sex				
<10 years	3	0.3 (0.0, 0.8)	2	67.6 (0.0, 100.0)
10-15 years	181	36.1 (28.9, 40.4)	52	28.4 (20.1, 40.1)
16-20 years	319	59.9 (55.5, 67.4)	108	33.2 (25.0, 42.3)
>20 years	24	3.7 (2.2, 5.4)	6	25.7 (6.3, 48.0)
Median age at sexual debut: 17 years (IQR: 15-18)				
Reason for entering sex work				
Need money to support family/pay debt	391	71.0 (67.0, 76.8)	124	32.6 (25.1, 40.3)
Well paid/extra income for luxuries	58	10.8 (7.4, 14.5)	21	24.3 (11.8, 39.5)
Abandoned by husband/parents/siblings	34	7.4 (4.4, 11.1)	14	45.6 (20.6, 69.2)
Other reasons	53	10.9 (6.8, 13.1)	13	24.5 (12.6, 41.8)
No of clients on last day of sex work				
1 client	121	22.4 (17.2, 28.1)	36	32.3 (20.0, 47.1)
2-4 clients	276	55.9 (48.8, 61.6)	83	27.5 (20.0, 36.6)
>5 clients	128	21.7 (17.0, 28.1)	50	40.9 (26.7, 53.5)

*RDSAT-adjusted population estimates

Table 2. Risk behaviors and HIV status, respondent-driven sample of FSW, Dar es Salaam, Tanzania, 2011

	N	% (95% CI)*	HIV+ (N)	HIV Prevalence % (95% CI)
Ever had partner type				
Steady partner				
Yes	393	72.6 (66.3, 78.2)	130	32.5 (25.1, 40.5)
No	141	27.4 (21.9, 33.7)	40	26.6 (16.2, 38.4)
Casual sex partner				
Yes	96	20.4 (15.0, 24.4)	32	32.7 (21.3, 48.4)
No	439	79.6 (75.6, 85.0)	30	31.4 (18.3, 45.2)
Regular client				
Yes	437	81.1 (75.6, 85.5)	141	30.6 (23.7, 38.6)
No	96	18.2 (13.9, 23.6)	30	31.4 (18.3, 45.2)
One-time client				
Yes	525	97.8 (96.2, 99.2)	168	31.2 (24.9, 38.2)
No	9	2.2 (0.9, 3.8)	3	33.9 (0.0, 70.0)
Condom use by partner type in the last 30 days				
Steady partner				
Always	79	31.6 (22.4, 38.1)	23	31.8 (18.7, 53.1)
Most of the time	11	6.1 (2.5, 10.4)	4	16.3 (0.0, 45.0)
Occasionally	37	12.9 (8.5, 18.1)	10	21.1 (6.5, 41.7)
Never	135	49.5 (42.4, 59.4)	39	30.7 (17.7, 43.4)
Casual non-paying client				
Always	40	59.4 (42.7, 69.6)	10	20.3 (8.0, 40.9)
Most of the time	9	12.2 (5.0, 22.5)	5	48.4 (9.1, 88.1)
Occasionally	10	11.7 (4.6, 21.9)	5	49.3 (14.8, 90.2)
Never	17	16.7 (9.3, 28.3)	3	11.4 (0.0, 30.0)
Regular client				
Always	291	69.3 (61.2, 76.0)	94	32.5 (23.7, 41.5)
Most of the time	42	10.7 (6.9, 15.4)	15	29.8 (10.7, 51.3)
Occasionally	64	14.5 (10.4, 19.3)	23	33.5 (19.8, 50.1)
Never	14	5.5 (2.1, 10.3)	2	7.7 (0.0, 29.8)
One-time client				
Always	349	65.4 (57.5, 71.5)	117	34.9 (26.9, 43.0)
Most of the time	71	16.5 (12.1, 22.2)	16	20.3 (7.0, 36.5)
Occasionally	76	15.7 (11.1, 21.8)	28	27.3 (14.7, 40.5)
Never	10	2.4 (0.9, 4.1)	2	10.3 (0.0, 44.3)

Table 2 (Cont.). Risk behaviors and HIV status, respondent-driven sample of FSW, Dar es Salaam, Tanzania, 2011

Used alcohol in the past 30 days				
Yes	360	67.7 (61.3, 72.8)	115	30.8 (23.3, 39.6)
No	175	32.3 (27.2, 38.7)	56	31.2 (21.9, 41.1)
Used non-injection drugs in the past 30 days				
Yes	53	84.1 (73.1, 97.6)	23	71.4 (54.1, 86.8)
No	32	15.9 (2.4, 26.9)	11	0.0 (0.0)
Ever injected drugs				
Yes	6	1.3 (0.3, 2.7)	6	100 (100, 100)
No	525	98.7 (97.3, 99.7)	162	29.7 (23.5, 36.7)
Any sex partners used drugs				
Yes	307	61.3 (56.1, 67.8)	44	29.9 (21.0, 43.3)
No	66	10.2 (7.3, 13.5)	75	27.2 (19.6, 34.7)
Don't know	155	28.5 (22.1, 33.5)	169	39.0 (23.7, 51.5)
Any sex partners injected drugs				
Yes	243	49.1 (43.8, 55.5)	30	46.9 (31.5, 64.1)
No	140	23.3 (17.9, 28.2)	86	23.2 (16.5, 29.4)
Don't know	146	27.6 (21.7, 33.5)	52	38.3 (26.0, 52.1)

*RDSAT-adjusted population estimates

Table 3. Factors associated with prevalent HIV infection in multivariate analysis, respondent-driven sample of FSW, Dar es Salaam, Tanzania, 2011

	OR (95% CI)	p value	AOR (95% CI)	p value
Age (categorical)*	2.5 (1.8, 3.3)	<0.01	1.6 (1.2-2.3)	<0.01
Non-injection drugs in past 30 days**	1.0 (0.9, 1.0)	0.06		
Duration in sex work	1.1 (1.0, 1.1)	<0.01	1.1 (1.0, 1.2)	<0.01
Partner used non-injecting drugs**	1.0 (1.0, 1.1)	0.13		
Partner who injects drugs	3.2 (1.6, 6.5)	<0.01	3.3 (1.7, 6.7)	<0.01

AOR, adjusted odds ratio

*Age categories: 15-24, 25-35, 36-50, >50 years

**Excluded from the best-fit model during stepwise regression because $p > 0.05$

DISCUSSION

More than one-third of FSW in Dar es Salaam were infected with HIV; that estimate is four times higher than the HIV prevalence among women in the general population in Dar es Salaam (8.2%) (National Bureau of Statistics Tanzania, 2012). HIV prevalence was highest (46.9%) among those who suspected that their partners injected drugs. This has not been previously reported in sub-Saharan Africa and may be a consequence of rising levels of drug use in Dar es Salaam, which has become a major way

station for drug trafficking from Central Asia to Europe and the Americas (United Nations Office on Drugs and Crime [UNODC], 2011).

There are some limitations to this study. RDS, while widely used for estimating burden of disease in hidden populations at high risk for HIV infection, remains controversial, and the external validity of estimates derived from RDS are not fully known (McCreesh, et al., 2012). Secondly, much of the data in this study was self-reported and subject to recall and social desirability bias. To the

extent that FSW minimized their self-reported behaviors, the likely direction of bias will be toward the null. Thus, our bivariate and multivariate analyses are conservative and would, if anything, underestimate risks. Finally, this is a cross-sectional study; thus, cause-effect relationships cannot be determined from our data. Nonetheless, our data suggest high HIV prevalence among FSW in Dar es Salaam and a previously unreported link with injection drug use among FSW partners and HIV.

Our findings have important ramifications for prevention and treatment programs that target FSW in Tanzania. We need to understand in much greater detail, and in a timely manner, the link between partners' injection drug use and risk of HIV among FSW. Potential interventions include HIV pre-exposure or post-exposure prophylaxis, depending on the situation and circumstances of sexual events for HIV-uninfected women; HIV counseling and testing and ART provision as appropriate for their partners; and increased access to drug treatment programs. In the meantime, promotion of 100% condom use, including with non-paying partners, remains an important prevention goal in this highly vulnerable population.

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CONFLICT OF INTEREST

The authors declare that they have no competing interests.

AUTHORS' CONTRIBUTIONS

NM, SW, and J Ndayongeje conceived and designed the study. VS, J Nondi, J Ndayongeje, SW, and NM carried out the data collection. WM, SW, VS, J Nondi,

and NM carried out the data analysis. SW, WM and NM drafted the manuscript. All authors read, revised and approved the final manuscript.

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