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Research Article

Genital Tract Infections, Bacterial Vaginosis, HIV, and Reproductive Health Issues among Lima-Based Clandestine Female Sex Workers

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Sociodemographic and behavioral characteristics of 212 Peruvian female sex workers (FSWs) were analyzed. The association between genital tract infections (GTIs) and risk factors by multivariate analysis was evaluated. Eighty-eight percent of FSWs were diagnosed with at least one GTI (HSV-2 80.1%, BV 44.8%, candidiasis 9.9%, syphilis seropositivity 9.4%, *Trichomonas vaginalis* 2.4%, HIV seropositivity 2.4%). Reported condom use with clients was nearly universal (98.3%), but infrequent with husband/regular partners (7.3%). In multivariate analysis BV was negatively associated with more consistent condom use (PRR = 0.63, 95% CI, 0.42–0.96). Many had not visited a Sexually Transmitted Infection (STI) clinic or been tested for HIV in the past year (40.6%, 47.1%, resp.). Nonclient contraceptive use was low (57%) and induced abortion was common (68%). High GTI burden and abortions suggest that a services-access gap persists among marginalized FSWs. Continued health outreach programs and integrating family planning and reproductive health services into existing STI clinic services are recommended.

1. Introduction

To address the perceived public health threat from the human immunodeficiency virus (HIV) epidemic in Peru, studies were conducted in the 1990s to characterize the sexual practices and prevalence of genital tract infections (GTIs—sexually transmitted infections and bacterial vaginosis) and HIV among female sex workers (FSWs) and their clients. Results suggested that the relatively high percentage of men (44–59%) interacting with FSWs could serve as a bridge in the transmission of sexually transmitted infections (STIs) to the general public [1–3]. These findings also concluded, however, that while the HIV prevalence among FSWs in Peru was higher than that of the general population, the estimates for this at-risk population were relatively low for a concentrated epidemic setting and the rate of ongoing transmission was considered slow [2, 4]. Consequently the focus on prevention programs targeting FSWs has somewhat diminished.

The validity of periodic STI/HIV surveillance surveys that continue to report HIV prevalence among FSWs has been a lingering question. It has been the norm to rely on a convenience sample of women who attend free government STI clinics although it is known that a segment of the FSW

population does not access or underutilizes these services [5, 6]. Concern regarding a sudden and hidden spread of HIV and STIs among FSWs is periodically raised due to on-going bridge potential from the sexual networks of bisexual men [7–9]. Moreover, as poor healthcare-seeking behavior can prolong the infectious period for curable STIs, transmission patterns may change quickly among FSWs who have unprotected sex, are new to this occupation, and/or are less accustomed to seeking and receiving medical services for STIs [10, 11].

In collaboration with the General Directorate of Epidemiology at the Ministry of Health (MoH) of Peru, the Asociación Civil Impacta Salud y Educación (hereafter referred to as IMPACTA), a local nongovernmental organization, conducted a cross-sectional study on clandestine FSWs to serve as a followup to a comparable study of this vulnerable FSW subpopulation [4]. For over 100 years female sex work in Peru was tolerated and controlled with required worker registration, mandatory periodic clinical exams of FSWs to maintain a valid health license, and an informal recognition of sex work venues. In 1993 FSWs were no longer required to register, and in 1997 periodic exams became voluntary. The term clandestine originally referred to women who did not register, but currently refers to women who never or seldom use free public health STI services for recommended, periodic health checks and who frequent commercial sex venues that are not recognized and not commonly accessed by government STI prevention outreach programs.

The purpose of this study was to provide a profile of GTI prevalence, sexual health status, and health-seeking behaviors amongst clandestine FSWs in Peru.

2. Methods

2.1. Study Design and Recruitment. For this descriptive, cross-sectional study a convenience sample of clandestine FSWs based in Lima, Peru was recruited in 2002 and 2003. Participants self-identified as FSW and were initially approached at their clandestine sex workplaces by peer educators who served as study recruiters. Behavioral surveys and a clinical examination including GTI testing were conducted at an IMPACTA clinic in a discreet and accessible location.

To optimize inclusion we used two primary recruitment strategies. First, over a nine-month period, weekly open-house sessions were hosted at the clinic site for members of the clandestine sex work community. Four trained peer educators made several weekly visits to network with sex workers and venue gatekeepers. This resulted in the identification of 75 clandestine sex work venues, including streets or parks and other commercial sex venues not formally recognized by the Peruvian government. Secondly, women who attended open houses were briefed on the study, encouraged to participate and asked to refer their colleagues who might be eligible for the study. This strategy, considered a form of snowball sampling, is frequently used to recruit members of hard-to-reach populations [12, 13].

2.2. Inclusion Criteria. Sample selection criteria were tailored to be consistent with the national definition of a sex worker and intentionally sought to include a high-risk subpopulation of FSW. Women were eligible if they were 18–59 years of age, had not participated in the government's HIV sentinel surveillance survey during the past year, had pursued periodic medical attention for GTIs fewer than twice during the past four months, had at least nine clients during the last work week, and reported problems with condom use at any time during the last six months (problems were defined as a condom breaking, falling off, or not being used). Women who were currently pregnant were excluded from the analysis.

2.3. Study Procedures: Instruments and Data Collection. Written informed consent was obtained from all participants after the study was explained, and eligibility was confirmed based on study inclusion and exclusion criteria. A trained female counselor administered the behavioral health questionnaire to participants prior to the medical exam. The behavioral survey was developed based on questionnaires previously used in international, regional, and local studies.

A female gynecologist performed the pelvic examinations and specimen collections. Vaginal fluid from the upper lateral wall of the vagina was collected with a cotton swab and prepared for wet mount and Gram stain evaluation. Gram stain was used to diagnose bacterial vaginosis (BV) on basis of the Nugent score criteria [14]. *Trichomonas vaginalis* was detected using the wet mount examination and the In-Pouch TV culture system (Biomed). Candidiasis was evaluated based on the wet mount examination looking for pseudohyphae and/or blastoconidia blastospores. Anal specimens were not collected.

Finally, a 10 cc venous blood sample was collected to conduct serological tests for *Treponema pallidum* (syphilis) using rapid plasma reagin (RPR—nosticon II Kit; Biomerieux) and *T. pallidum* microhemagglutination assays (MHA-TP) confirmatory tests (Biomerieux). To detect HIV antibodies the enzyme-linked immunosorbent assay (ELISA) was used (Vironostika HIV Uni-Form Ag/Ab kit; Biomerieux) together with Western blot assay to confirm positive results (Genetic System HIV-1 Western Blot kit; Biorad). ELISA was also used to diagnose herpes simplex virus type 2 (HSV-2 genital herpes; Herpes Select 2 ELISA IGG; Focus Diagnostic). All microscopy was performed at the screening site and all other testing was done at the IMPACTA Central Laboratory.

A follow-up visit was scheduled after two weeks to provide the results of laboratory tests, as well as HIV and STI post-test counseling. All participants received STI educational materials and condoms. Participants with STI diagnosis received syndromic or etiologic management per MoH guidelines.

2.4. Ethical Issues and Informed Consent. IMPACTA Community Advisory Board provided input and recommendations for educational materials and study design and implementation. The study protocol was reviewed and approved

by the General Epidemiology Program of the MoH of Peru. The IMPACTA Bioethics Institutional Committee reviewed and approved all ethical aspects of protocol, study informed consent, outreach strategies, and educational materials. In addition, the University of Washington IRB reviewed and approved the data analysis proposal.

2.5. Statistical Analysis. Statistical analyses were conducted using Stata IC 10 [15]. We used descriptive statistics to assess the range, mean, and standard deviation of sociodemographic, behavioral, and clinical exam variables. The open-ended question regarding location of work yielded qualitative responses; these were subsequently categorized as street/park, house of appointments, brothel, and other.

Descriptive statistical methods were used to explore candidate risk factors for BV, *T. pallidum*, and HSV-2 genital herpes. Candidate risk factors and potential confounders were assessed individually in relationship to all GTI outcomes with a sample size of 20 or more. In general covariates included age, level of education, marital status, number of dependents, estimated income from sex work, years as sex worker, work venue, number of clients in the past week, condom use and problems with condom use with 3 most recent sex partners, use of hormonal contraceptives, use of lubricants, anal sex, and months since last clinic visit. Factors associated with a GTI outcome with $P \leq 0.1$ using bivariate Poisson and logistic regression were considered for multivariate regression modeling. Pearson's correlation coefficient was used to evaluate collinearity of covariates. Confounders were included in these models when they changed the magnitude of association of primary interest by at least 10%.

Multivariate modeling was carried out using either logistic regression to estimate odds ratios (ORs) or Poisson regression to estimate prevalence rate ratios (PRRs). Poisson regression with robust variance estimation was used for outcomes with an overall prevalence greater than 10% which was the case for BV and for HSV-2 seropositivity [16, 17].

3. Results

3.1. Demographics and Sex Work Characteristics and Reproductive Health. Overall 212 of 226 female study participants recruited from 75 work locations met all inclusion criteria and were willing to be tested for all GTIs. Over half of the recruited women came from the two neighboring city districts of La Victoria (38%) and Lima Cercado (downtown Lima; 28%).

The age of recruited women ranged from 18 to 53 years; the mean age was 28 (SD = 7.0) (Table 1). Participants attained a mean of nine years of education (SD = 3.1); 41% of the women had completed at least a secondary-level education, that is, eleven or more years of education. Roughly 44% of the women were born outside of Lima. Only 31% lived with a husband or male partner, while over 90% reported being responsible for dependents.

The mean age at first sexual intercourse was 15.6 (SD = 2.5). The age for the first sex work transaction ranged from 12 to 48; the mean age was 23.5 (SD = 6.1). The mean duration acknowledged sex work was 4.5 years (SD = 4.6);

Table 1: Demographic, sex behavior, and reproductive health characteristics of 212 clandestine female sex workers: Lima, Peru, 2003.

	$N = 212$	(%) or mean ± SD
Age		28.0 ± 7.0
Years of education		
None	3	(1.4)
1–6	39	(18.4)
7–10	84	(39.6)
11 (completed secondary education)	58	(27.4)
≥12	28	(13.2)
Years of education		9.1 ± 3.1
Born outside of Lima	93	(43.9)
Living with spouse or male partner	66	(31.1)
Number of dependents		
0	20	(9.4)
1-2	101	(47.6)
≥3	91	(42.9)
Age at 1st sexual intercourse		15.6 ± 2.5
Age at 1st sex work transaction		23.5 ± 6.1
Years since self-identification as sex worker		4.5 ± 4.6
Workdays per week, SD		5.5 ± 1.3
Number of clients in past 7 days[a]		31.1 ± 25.5
Type of sex work place		
Street or street park	107	(50.5)
House of appointments	51	(24.1)
Brothel	39	(18.4)
Massage parlor	7	(3.3)
Other	8	(3.8)
Description of second job other than sex work[b] ($N = 59$)		
Vendor	18	(8.5)
Paid employee	15	(7.1)
Provide service assistance	14	(6.6)
Produce products for sale	10	(4.7)
Other	1	(0.5)
No uterus/does not menstruate	5	(2.4)
Contraceptive method ($N = 207$)		
No contraceptive method	88	(42.5)
Tubal ligation	22	(10.6)
Condom	20	(9.7)
Oral contraceptive	77	(37.2)
Pregnancies		
0	10	(4.7)
1-2	94	(44.3)
≥3	108	(50.9)
Induced abortions[c] ($N = 202$)		
0	65	(30.7)
1	78	(36.8)
2	37	(17.5)
≥3	22	(10.4)

[a]Study participation criteria required a minimum of 9 partners in the past week. [b]Among 59 respondents; one observation missing. [c]Among 202 women who have been pregnant.

Table 2: STI/HIV and bacterial vaginosis prevalence among 212 clandestine female sex workers: Lima, Peru, 2003.

	$N = 212$	(%)	95th CI
HIV[a,b]	5	(2.4)	(0.3–4.4)
Trichomonas vaginalis[c]	5	(2.4)	(0.3–4.4)
Treponema pallidum [a,d] (syphilis)	20	(9.5)	(5.5–13.5)
HSV-2[a,e] (genital herpes)	169	(80.1)	(74.7–85.5)
Candidiasis[a,f]	21	(10.0)	(5.9–14.0)
Bacterial vaginosis[g]			
Normal flora	83	(39.2)	(32.5–45.8)
Intermediate flora	34	(16.0)	(11.1–21.0)
BV	95	(44.8)	(38.0–51.6)

[a] $N = 211$. [b]ELISA and Western blot assay. [c]Wet mount and In Pouch TV. [d]Rapid plasma reagin (RPR), MHA-TP confirmed. [e]ELISA. [f]Wet mount analysis. [g]Nugent score method.

29% self-identified as a sex worker for less than a year. Five women reported 100 partners or more in the past work week. Consistent with this skewed distribution, the median number of partners in the past week was 24 (IQR = 15, 40), while the mean was 31 (SD = 25.5).

FSWs reported the street or park as the most common work venue (51%). Sex venues traditionally sanctioned by the Peruvian government, such as house of appointments and brothels, were less common among this population. A smaller percentage of FSWs identified massage parlors as their work venue and a few reported establishing contacts with clients by telephone and internet.

Ninety-three women reported not using a contraceptive method; among these, 5 women reported not using contraception because they did not menstruate or have a uterus. Among 207 women, 37% reported relying on oral contraceptives, while only 10% identified using condoms as a contraceptive method. The average number of pregnancies was 2.5 (SD = 1.3). Among 202 women who had been pregnant, 68% reported ever having had an induced abortion while 11% reported having had 3 or more.

3.2. Prevalence of GTIs. Clinical and laboratory examination results indicated an HIV seroprevalence of 2.4% in this population (Table 2). Overall, 80.1% were HSV-2 seropositive. All 20 syphilis and all 5 HIV-seropositive cases were also HSV-2 seropositive. Forty-five percent were diagnosed with BV defined as a Nugent score between 7 and 10. Four of the 5 HIV-positive cases were also BV positive compared to 44% of the HIV-negative FSWs. The 5 women diagnosed with *T. vaginalis* were also diagnosed with BV. Nine percent were seropositive for syphilis and 9.9% were diagnosed with candidiasis. Overall, 88% were diagnosed with at least one GTI, primarily due to high HSV-2 levels; 36.7% were coinfected with two different GTI and another 11.5% were infected with three or more.

The majority of women (69%) reported knowing of an HIV testing site, and 153 (73%) had ever tested for HIV in the past (Table 3). Of these, however, 27% had not tested in over a year. One hundred thirty-three of those who tested did so voluntarily (87%); among these women 116 reported knowing their HIV test results which represent 55% of all study participants.

Table 3: Knowledge of STI symptoms, self-reported symptoms, and response to symptoms; HIV testing history and treatment-seeking behaviors among 212 clandestine female sex workers: Lima, Peru, 2003.

	$N = 212$	(%)
Knowledge of female symptoms of STI[a]		
Lower abdominal pain	61	(28.8)
Vaginal discharge	147	(69.3)
Malodorous discharge	75	(35.4)
Burning pain while urinating	45	(21.2)
Genital ulcer	50	(23.6)
Swollen pelvic lymph nodes	1	(0.5)
Genital itching	70	(33.0)
Genital warts	42	(19.8)
Reported symptoms in past 12 months		
Yellow vaginal discharge	160	(75.5)
Genital ulcer	25	(11.8)
Do not know	1	(0.5)
No symptoms reported	49	(23.1)
Both vaginal discharge and genital ulcer	162	(76.4)
Care seeking behaviors among 162 women who reported symptoms[b]		
Sought help at a pharmacy	89	(54.9)
Sought help in public clinic	48	(29.6)
Took medicine available at home	13	(8.0)
Traditional healer	10	(6.2)
Sexual behaviors among 162 women who reported symptoms[b]		
Told sex partner	67	(41.4)
Avoided sex	90	(55.6)
Used condoms with clients[c]	140	(86.4)
Used condoms with stable partner	33	(20.4)
Know of an HIV testing site[d]	145	(68.7)
Had HIV test in the past[e]	153	(72.9)
Test taken voluntarily[f]	133	(86.9)
Received HIV test results among all those who tested[g]	133	(86.9)
Received HIV test results following voluntary testing[h]	116	(87.2)
Months since last HIV test[f]		
0–3 months	32	(20.9)
4–6 months	43	(28.1)
≥7 months	78	(51.0)

[a] Participants were prompted to name any signs or symptoms they associated with STI. [b]Participants were allowed to report more than one treatment-seeking behavior. [c]No distinction made between casual and regular (caserito) client. [d]One missing observation. [e]One missing observation and one do not know response. [f]Among 153 women who reported taking an HIV test in the past; women who took test voluntarily do not match all women who received HIV results. [g]Three required to take test did not know their results. [h]Among 133 women who tested voluntarily.

Table 4: Unadjusted and adjusted analyses of relationships between individual behavioral characteristics and risk of bacterial vaginosis among 212 clandestine female sex workers: Lima, Peru, 2003.

	BV – $n = 117$	BV + $n = 95$				
	(%) or mean ± SD	(%) or mean ± SD	Unadjusted		Adjusted	
			OR	95% CI	PRR[a]	95% CI
Years of education	9.6 ± 2.9	8.6 ± 3.3	**0.95**	(0.89, 1.00)	**0.97**	(0.91, 1.04)
Condom use with past 3 partners			**0.59**	(0.39, 0.89)	**0.64**	(0.42, 0.98)
0–2 partners	21 (18)	37 (39)				
All partners	96 (82)	58 (61)				
Used lubricant	69 (59)	40 (42)	**0.69**	(0.46, 1.03)	**0.83**	(0.53, 1.32)
Had problems using condom[b]	31 (26)	45 (47)	**1.61**	(1.07, 2.40)		
Street-based sex work	50 (43)	57 (60)	**1.47**	(0.98, 2.22)	**1.19**	(0.73, 1.94)

[a]Prevalence rate ratios (PRRs) associated with all covariates included in final multivariate models are reported. [b]Condom broke, slipped, or fell off.

3.3. Knowledge of HIV/Genital Tract Infections and Accessing Health Care. Study participants were asked to describe symptoms or signs they recognized as a GTI among women and men. The majority mentioned vaginal discharge (69%) and 24% recognized genital ulcers as signs of a female GTI (Table 3). Urethral secretions (62%) and genital ulcers (45%) were the two most common signs mentioned for a male GTI.

To probe healthcare-seeking behaviors, FSWs were first asked whether they had experienced two GTI symptoms in the previous 12 months; overall, 76% reported vaginal discharge, and 12% reported a genital ulcer (Table 3); 23 of the women who reported a genital ulcer also reported vaginal discharge. A total of 162 (76%) women who reported either vaginal discharge or a genital ulcer were then asked questions regarding healthcare-seeking and sexual behaviors in response to these conditions. The majority of women reported seeking help from a pharmacy (55%). Nearly 30% sought help in a public clinic. Roughly 20% of the women provided qualitative responses describing other first recourse behaviors including doing nothing, consulting with friends, and following their standard intravaginal regimen of washing or using herbs. Thirty-eight percent of the 162 FSWs with vaginal symptoms reported never having visited an STI clinic or no visits in the past year; furthermore 41% indicated they had informed their sexual partner and 56% reporting abstaining from sex.

3.4. Condom Use. Seventy-three percent of women reported using a condom consistently during the last sex acts with each of their 3 most recent sex partners; another 26% indicated using a condom with one or two of their recent partners, while 3 women never used a condom. We aggregated the data to identify differences in condom use by type of sexual partner. Of the of 635 sex partners described by study participants 64% were casual clients, 27% were regular clients (caseritos), 5% were husbands or stable partners, and 4% were significant friends. FSWs reported using condoms during nearly all sex acts (98.3%) with a recent casual and regular (caserito) client (99% and 97%, resp.). In contrast, condoms were used in just 12% of sex acts with significant friends and 3% of sex acts with husbands or stable partners. Among women who reported using condoms with the past 3 sex partners, 12% reported having experienced condom slippage and/or breakage.

3.5. Risk Factors Associated with BV, HSV-2, and Syphilis. Table 4 presents unadjusted and adjusted PRR for risk factors associated with BV. In an unadjusted model, BV was positively associated with working in a street or park-based venue (PRR = 1.47) and with condom use problems (PRR = 1.61) while negatively associated with more years of education (PRR = 0.95), more consistent condom use (PRR = 0.59), and lubricant use (PRR = 0.69). In multivariate analysis, however, only consistent condom use was statistically significant (PRR = 0.64, 95% CI, 0.42–0.98).

Table 5 represents unadjusted PRR and OR of risk factors associated with HSV-2 and syphilis, respectively. Women with HSV-2 were marginally more likely to be older (PRR = 1.14).

Out of 20 women found to be seropositive for syphilis, none had evidence of a recent infection (VDRL titre ≥ 1 : 16). As indicated in Table 5 bivariate analysis revealed that syphilis-seropositive women tended to work in a street or park setting as compared to all other workplaces (OR = 4.49), have fewer years of education (OR = 0.87), be older, and have a greater number of years of experience in sex work (OR = 1.14 and OR = 1.13 for each additional year, resp.). Only age and workplace persisted in their independent association with syphilis seropositivity by multivariate analysis (age: OR = 1.12, 95% CI, 1.05–1.19; street or park versus other workplace: OR = 4.12, 95% CI, 1.45–13.15). Moderate-to-high levels of collinearity between several of the correlates seen in bivariate analyses, for example, age and numbers of years in sex work, likely precluded our ability to assess the independent effects of these factors in our modest sized sample. We did not detect an association between syphilis seropositivity and any of the measures of condom use

Table 5: Bivariate analyses of relationships between individual behavioral characteristics and risk of HSV-2 herpes and syphilis, among 212 clandestine female sex workers: Lima, Peru, 2003.

	HSV-2 seropositivity				Syphilis seropositivity[a]					
	HSV-2 − $n = 42$	HSV-2 + $n = 169$	$N = 211$		MHA-TP− $n = 191$	MHA-TP + $n = 20$	$N = 212$			
Characteristic			Unadjusted		(%) or	(%) or	Unadjusted		Adjusted	
	mean ± SD	mean ± SD	PRR	95% CI	Mean ± SD	mean ± SD	OR	95% CI	OR	95% CI
Years of education					9.3 ± 3.1	7.7 ± 3.3	**0.87**	(0.76, 0.99)		
Age	24.1 ± 4.4	29.0 ± 7.3	**1.02**	(1.00, 1.04)	27.4 ± 6.9	33.7 ± 6.6	**1.12**	(1.05, 1.20)	**1.12**	(1.05, 1.19)
Years in sex work					4.0 ± 4.4	7.7 ± 6.5	**1.13**	(1.04, 1.23)		
Had problems using condom[b]					90 (47)	16 (80)	**4.49**	(1.45, 13.92)	**4.12**	(1.29, 13.15)

[a]MHA-TP confirmed. [b]Prevalence rate ratios (PRRs) associated with all covariates included in final multivariate models are reported.

captured under this study. This may be because none of the 20 seropositive women had serological evidence consistent with a recent infection.

4. Discussion

This study adds evidence of considerable burden of infection with some but not all GTIs and HIV among a subpopulation of Peruvian FSWs.

There are several limitations to our study; principally that interpretation is based on cross-sectional data which precludes evaluation of the temporal relationship between risk factors and GTIs. The statistical power to understand relationships with some correlates, particularly for HSV-2, was limited as the sample size was small. Participants were asked sensitive questions regarding their behaviors and thus their responses may have been affected by recall and social desirability biases. Because we followed international standards for framing these questions and used rigorously trained interviewers, we believe these effects were minimized. The generalizability of study results to other clandestine FSWs is likely limited due to the snowball sampling methods and recruitment efforts which favored the adjacent neighborhoods of Lima Cercado (downtown Lima) and La Victoria. Participation bias may also have occurred if recruitment efforts predominantly captured women with existing conditions or pressing health concerns.

Our data revealed that the HIV seroprevalence of 2.4% in this study was lower than two historical estimates: one study reported a 9.6% seroprevalence among 146 clandestine FSWs, compared to an estimate of 0.3% among 5,827 registered FSWs [18]; in a second unpublished study researchers found a 5% seroprevalence of 311 clandestine sex workers in Lima, Peru [4]. Our data highlight effective efforts by the Peruvian public health community to stave off widespread HIV transmission in this vulnerable population. Nonetheless, despite nearly universal condom use with clients, FSWs had an elevated risk of HIV infection in comparison to the general population of women who reported HIV seroprevalence consistently well below 1% for the same time period [19].

This study also documents prevalence rates of concern for other GTIs. Participants had an HSV-2 seroprevalence rate of 80% which is similar to an estimate from a 1992 Peruvian study of registered and unregistered FSWs [20], but much higher compared to a 2002 estimate of 20% among women in the general population reported in a study of three Peruvian coastal cities [21]. Bivariate analyses reported here show increasing risk of infection at older ages. No association with condom use was detected, consistent with the assessment that condom use is less effective against HSV-2 acquisition compared to other STIs [22]. Evidently previous public health interventions were unsuccessful at preventing the steady accumulation of HSV-2 infections among FSWs. Over the past 10 years there have been no HSV-2-related public health interventions for FSWs. Furthermore, the BV prevalence of 44.8% identified here is the highest estimate reported to date in Peru and considerably higher than a comparable estimate of 20% among FSWs [23], yet similar to the range of estimates reported for Central American FSWs [24]. In our study women with BV were more likely to be diagnosed with another GTI, and BV diagnosis was independently associated with lack of condom use, associations which are consistent with other studies [25–29].

Our estimate of 9% syphilis seroprevalence is comparable with an 11% estimate from the mid-1990s [4], but higher than the 3.3% reported earlier that decade [2] and 4.1% identified among primarily registered sex workers [30]. Our study reports no evidence of recent syphilis, consistent with an interpretation of low frequency of transmission. The prevalence rate of 2% for *T. vaginalis* was lower than 4.1% among 916 FWS reported previously [30].

Our results suggest areas where efforts to build knowledge and awareness and to elicit sustained behavior change could further benefit sexual and reproductive health in this marginalized population. The high percentage of women who reported experiencing vaginal discharge or a genital ulcer in the past year likely does not capture the full range of GTI-related morbidity in this population as familiarity with the range of associated symptoms was low. A minority of FSWs recognized genital ulcers and malodorous vaginal discharge (Table 3) as GTI symptoms despite high prevalences of HSV-2 and BV. Moreover, nearly three-quarters of the women did not seek medical care as their first response to vaginal symptoms whereas pharmacies were the preferred source for medical attention suggesting that self-medication

and alternatives to specialized GTI services appear to be the preferred recourse. An underutilization of appropriate clinical services and an overreliance on informal sources of health care were further evidenced by findings indicating that 38% of participants with a history of vaginal symptoms reported never having visited an STI clinic or no visits in the past year; 27% had never tested for HIV and an additional 28% had not tested in the past year. Stigma, driven by discriminatory treatment and concerns for confidentiality, is a major reason for reluctance to use free STI clinic services [31]. Some in the Peruvian context have worked towards strengthening the capacity for pharmacies to provide information and medication based on syndromic STI case management approaches [32, 33]; however the effectiveness of these approaches for FSW populations has not been assessed.

Although clandestine FSW in this study reported nearly universal consistent condom use with either new or regular clients, much lower levels were reported for noncommercial sex partners such as a regular partner or "friend." Similar condom use differentials have been reported elsewhere in the region [24, 34]. Yet, of the 162 women who reported vaginal symptoms in this study, a minority informed their sexual partner and only 56% avoided sex. These findings highlight the need to address both the potential STI transmission to and the burden of STI among stable partners of FSWs, themselves a potential bridge population to lower risk segments of the general population [5].

The reproductive health profile of participants revealed an average of 2.5 pregnancies (SD = 1.3). Although reported condom use in the context of commercial sex was high, complementary use of contraceptive methods was lacking. Patterns indicate that condoms are perceived principally as STI prevention rather than a family planning method. An integral part of the STI prevention message is the distribution of free condoms at STI clinics. Thus survey response on condom use as a contraception method may reflect the lack of integration between STI prevention and family planning programs in Peru with respect to these interrelated behavior change objectives.

Abortion in Peru is illegal thus limiting our ability to understand the prevalence of unsafe abortions and their impact on maternal morbidity and mortality [35–37]. Previous studies estimated the Peruvian abortion rate to be one of the highest in Latin America [38, 39]. The 68% of ever pregnant women reporting having had at least one abortion is higher than the 53% reported for 514 Columbian FSWs [40]. Given the self-medication behavior through pharmacies as reported in our study and the availability of medications including mifepristone and misoprostol (RU486), it is plausible that medical abortions are becoming more widely used by this population [41]. This study supports the notion that FSWs are not only a vulnerable population due to GTI risk and their sequelae, but also because of an elevated risk of reproductive health problems. These risks likely arise from a constellation of disadvantages including limited access to reproductive health information, possible unmet demand for family planning methods and the cumulative effect of seeking to terminate unwanted pregnancies. (Public health polices related to FSWs have not changed in the past 10 years, and family planning is currently not included in the protocol of STI clinical exams for FSWs [42]. Requesting reproductive health information requires a separate appointment, often at a different clinic.).

5. Conclusion

The nearly universal condom use with clients reported in our study of a subpopulation of FSW who were relatively new to commercial sex or did not attend public STI clinics suggests a noteworthy achievement of a proactive approach to STI and particularly HIV prevention in Peru since the 1990s. Nonetheless, the high burden of some STIs, BV, and abortions in this population also indicates that a services-access gap likely persists. Furthermore, infrequent condom use with stable partners and other noncommercial partners presents a challenge and appears to be particularly worrisome potential source of infection/reinfection with GTI. These findings also justify renewed efforts to support outreach services to marginalized FSW populations with integrated behavior change messages that include building awareness of STI symptoms in men and women, promoting availability of free STI services and alternative HIV testing sites, and educating FSWs to differentiate appropriate healthcare-seeking behavior from inadequate self-medication patterns. Data reported here also highlight the urgent need both to integrate family planning and reproductive health services into existing client-friendly STI clinical services and to stay abreast of innovation in female-controlled methods that expand options to prevent pregnancy and STI, particularly during sex with those intimate or non-commercial partners who are unlikely to use condoms.

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