



# Symptom-Based Versus Laboratory-Based Diagnosis of Five Sexually Transmitted Infections in Female Sex Workers in Iran

Armita Shahesmaeili<sup>1</sup> · Mohammad Karamouzian<sup>1,2</sup> · Mostafa Shokoohi<sup>1,3</sup> · Kianoush Kamali<sup>4</sup> · Noushin Fahimfar<sup>4</sup> · Seyed Alireza Nadjji<sup>5</sup> · Hamid Sharifi<sup>1</sup> · Ali Akbar Haghdoost<sup>1</sup> · Ali Mirzazadeh<sup>1,6</sup> 

Published online: 9 May 2018  
© Springer Science+Business Media, LLC, part of Springer Nature 2018

## Abstract

Among 1337 Iranian adult female sex workers in 2015, we assessed the diagnostic value of 4 self-reported sexually transmitted infection (STIs) symptoms for detecting laboratory-confirmed gonorrhea, chlamydia, trichomoniasis, human papillomavirus (HPV), and syphilis. While 37.7% reported vaginal discharge (VD), 25.9% reported pain or burning (P/B), 3.0% reported genital ulcers (GU), and 1.4% reported genital warts (GW), the prevalence of laboratory-confirmed syphilis, gonorrhea, chlamydia, trichomoniasis, and HPV was 0.4, 1.3, 6.0, 11.9, and 41.9%, respectively. The sensitivity of VD was 40.3% for detecting trichomoniasis, 37.5% for chlamydia, and 37.5% for gonorrhea. The sensitivity of P/B ranged from 12.5% for gonorrhea to 25.2% for trichomoniasis. The sensitivity of GU and GW was very low for 5 STIs. The sensitivity of all symptoms combined was also lower than 50%. Among asymptomatic participants, 41.2% tested positive for HPV, 11.8% for trichomoniasis, and less than 6.6% for other STIs. Symptom-based case management and surveillance of STIs can lead to misclassification of a large proportion of cases.

**Keywords** Sexually transmitted infections · Symptoms · Diagnostic values · Female sex workers

## Introduction

Sexually transmitted infections (STIs) are a major public health concern worldwide. Youth and high-risk populations have usually been considered to be at an elevated risk for getting an STI [1]. An estimated 357 million new, curable STIs (e.g., syphilis, gonorrhea, chlamydia) occurred around the world in 2012 [2]. This is of particular concern, as untreated STIs may result in infertility, ectopic pregnancy, preterm labor, fetal and neonatal death, cancer, and increased risk for HIV acquisition and transmission [3]. Screening, diagnosis, and treatment of infected individuals have been reported to be the most effective strategies in controlling STIs [4].

STIs are usually diagnosed through 2 main approaches: laboratory-based and symptom-based. Laboratory-based STI tests are the gold standard for diagnosis; however, they are often expensive, require training and infrastructure, and may not be available in resource-limited settings [5]. Symptom-based diagnosis relies on self-reported symptoms and medical history and can be done with limited training; however, it is less specific and can lead to under- or over-diagnosis of STIs [6].

✉ Ali Mirzazadeh  
Ali.Mirzazadeh@ucsf.edu

<sup>1</sup> HIV/STI Surveillance Research Center, and WHO Collaborating Center for HIV Surveillance, Institute for Futures Studies in Health, Kerman University of Medical Sciences, Kerman, Iran

<sup>2</sup> School of Population and Public Health, University of British Columbia, Vancouver, BC, Canada

<sup>3</sup> Epidemiology & Biostatistics, Schulich School of Medicine & Dentistry, The University of Western Ontario, London, Canada

<sup>4</sup> Department of Epidemiology and Biostatistics, School of Public Health, Tehran University of Medical Sciences, Tehran, Iran

<sup>5</sup> Virology Research Center, National Institute of Tuberculosis and Lung Diseases (NRITLD), Shahid Beheshti University of Medical Sciences, Tehran, Iran

<sup>6</sup> Department of Epidemiology and Biostatistics, Institute for Global Health Sciences, University of California, San Francisco, San Francisco, CA, USA

Most laboratory-based STI tests are time-consuming and often delay treatment initiation, given that results are often unavailable at the same visit as the test. Relying on laboratory-based diagnosis for STI management in female sex workers (FSW) is even more challenging, as they are a hard-to-reach population [7, 8]. Indeed, the requirement that an FSW return to an STI clinic to collect her laboratory-based test results and start treatment, if necessary, has been shown to create barriers to STI testing uptake among FSW [5]. Given the higher prevalence of STI among FSW, compared with the general population [9, 10], some health care providers may fear losing an infected FSW in follow-up visits and therefore may initiate STI treatment based merely on STI-associated symptoms.

In Iran, where the prevalence of STIs ranges widely, from 1.4% for gonorrhea to 20% for chlamydia [11–13], the diagnosis and management of STIs rely on the symptom-based approach. However, our understanding of the validity of this approach in Iran remains limited. Moreover, the findings of studies on the validity of self-reported STI symptoms in developing settings are mixed and not entirely applicable to Iran. This is due in part to the dissimilar prevalence of STI symptoms among FSW across different settings; for example, STI prevalence is 75.1% in El Salvador [14] and 56% in India [15], which leads to different positive predictive values (from 25 to 83%) and negative predictive values (from 56 to 98%) [15]. Furthermore, the sociocultural context of Iran differs greatly from other developing settings, and the stigma around reporting STI symptoms is more pronounced. For example, in our study of FSW in 3 cities in 2012, we found that only 63.9% of those who had STI symptoms had reported them [16]. Therefore, we used data from the second round of Iran's national biobehavioral surveillance survey (2015) among FSW to evaluate the diagnostic characteristics of 4 main STI symptoms to diagnose 5 common laboratory-confirmed STIs. The results of our study have significant implications for future STI research among FSW, as well as evaluation of the STI surveillance system in Iran.

## Methods

### Study Sample

Between January and August 2015, a facility-based and outreach-based (recruitment at street venues by an outreach team) sample of 1337 FSW was recruited at 20 sites in 13 cities in Iran. Facilities were selected among nongovernmental organizations and sexually transmitted disease clinics serving vulnerable women. Eligible participants were Iranian women aged  $\geq 18$  years who resided or worked in the city where the study was implemented, and who self-reported having vaginal, anal, or oral sex with more than 1

male client in exchange for money, goods, drugs, or a favor during the previous year.

### Data Collection

Data were collected through face-to-face interviews using a structured risk assessment questionnaire. Information was gathered regarding sociodemographic characteristics of FSW, their sexual risk behaviors, and their current STI-associated symptoms. To evaluate the validity of symptom-based management of STIs among this population, we asked participants to report whether they had any symptom of vaginal discharge, genital pain or burning, genital ulcers, or genital warts at the time of the study. A list of STI symptoms was read to the participants, and the interviewer marked any they mentioned from the list. We also asked for other nonspecific symptoms in an open question. For the diagnosis of syphilis, rapid diagnostic tests (SD BIOLINE HIV/Syphilis Duo rapid test, Standard Diagnostics Inc., Gyeonggi-do, South Korea) were used, and participants who had a reactive result in the first rapid test underwent a second rapid test (Alere Syphilis RPR). If both tests were reactive, the patient was considered to be a positive case. In the case of a reactive result for the first test and a nonreactive result for the second test, diagnosis was confirmed by running an enzyme-linked immunosorbent assay. Diagnosis of gonorrhea, chlamydia, trichomoniasis, and human papillomavirus [17] was based on a polymerase chain reaction test using self-administered vaginal swabs.

### Data Analysis

Descriptive statistics (e.g., mean, median, frequencies, percentages) were used to summarize the data. We defined the diagnostic characteristics of STI-associated symptoms by 4 indicators:

- *Sensitivity (i.e., true positive rate)* the probability of having an STI-associated symptom among participants who had a laboratory-confirmed STI.
- *Specificity (i.e., true negative rate)* the probability of having no STI-associated symptom among participants who had no laboratory-confirmed STI.
- *Positive predictive value* the probability of having an STI among participants who reported an STI-associated symptom.
- *Negative predictive value* the probability of having no STI among participants who reported no STI-associated symptom.

The 95% confidence intervals for STI prevalence and the 4 indicators above were estimated using the exact binomial

method [18]. STATA v.13.1 (StataCorp, College Station, TX, USA) was used to analyze the data.

## Results

### Characteristics of the Sample

A total of 1337 FSW were recruited for this study. The response rate to the questions about STI symptoms was very high (1195/1337 = 90%). Moreover, 99% of the study participants also agreed to be tested for STI. The mean (standard deviation) age of participants was 35.6 (9.3) years, 10.1% of participants were illiterate, around half (52.6%) were divorced, and 8.1% reported having a temporary marriage. (A man and an unmarried woman can enter into a temporary marriage contract [*sigheh*] in which both parties agree on the period of the relationship and the amount of compensation to be paid to the woman. This arrangement requires no witnesses and no registration.) Median (first quartile [Q1], third quartile [Q3]) ages at first vaginal sex and at sex-work debut were 17.0 (15.0, 22.0) and 25.0 (20.0, 30.0) years, respectively. Median (Q1, Q3) number of clients in the past month was 3 (1, 7), and only 32.9% of participants reported consistent condom use in the previous month (Table 1).

### STI-Associated Symptoms and STIs Prevalence

Overall, 49% of the FSW had at least 1 STI. Excessive vaginal discharge was the most prevalent symptom (37.7%). Other symptoms were pain or burning (25.9%), genital ulcers (3.0%), and genital warts (1.4%). About 47% of participants reported at least 1 of the 4 STI-associated symptoms (Table 2).

The prevalence of HIV was 2.1% (95% confidence interval [CI] 0.9–4.6). The prevalence of laboratory-based syphilis, gonorrhea, chlamydia, trichomoniasis, and HPV was 0.4, 1.3, 6.0, 11.9, and 41.9%, respectively.

### Sensitivity of STI-Associated Symptoms

Overall, individual STI-associated symptoms had a low sensitivity for detecting STI (ranging from 0 to 40%). While around 25% of FSW diagnosed with trichomoniasis or HPV reported having genital pain or burning, these symptoms were reported in less than 17% of cases for the other 3 STIs (Table 3). Moreover, genital ulcers was reported by only 4% of FSW diagnosed with HPV, while none of the FSW who had syphilis reported this symptom. Excessive vaginal discharge was the symptom most frequently reported by FSW who had been diagnosed with any of the 5 STIs; it was around 40% for FSW with gonorrhea, chlamydia, trichomoniasis or HPV. Genital warts

**Table 1** Sociodemographic characteristics of 1337 female sex workers in Iran, 2015

Variables <sup>a</sup>	Frequency	(%)
Age (years)		
18–44	1117	83.7
> 45	218	16.3
Age, N/mean (standard deviation)	1335	35.6 (9.3)
Highest education level		
Illiterate	135	10.1
Can read and write	115	8.6
Primary school (grades 1–5)	258	19.3
Middle school (grades 6–8)	343	25.6
High school (grades 9–12)	128	9.6
Acquired diploma	274	20.5
University	84	6.3
Ever married		
Yes	1252	93.6
No	85	6.4
Current marital status		
Single	85	6.4
Married	440	33.0
Divorced	702	52.6
Temporarily married (i.e., <i>sigheh</i> )	108	8.1
Age at first vaginal sex, median	1323	17.0
Age at first commercial sex, median	1323	25.0
Number of clients in last month, median	1307	3.0
Frequency of condom use in last month		
Always	341	32.9
Often	281	27.1
Sometimes	225	21.7
Never	191	18.4

<sup>a</sup>Data is n (%) unless specified

**Table 2** Point prevalence of laboratory-confirmed STIs and self-reported symptoms among female sex workers in Iran, 2015

Symptom/STI	N	(%)	95% CI
Self-reported symptoms (n = 1195)			
Pain or burning	309	25.9	17.8–36.0
Genital ulcers	36	3.0	1.9–4.8
Excessive vaginal discharge	450	37.7	29.2–47.0
Genital warts	17	1.4	0.6–3.3
Other nonspecific symptoms	240	20.1	14.4–27.3
Any of the 4 specific symptoms	561	46.9	36.7–57.4
Types of STI (n = 1318)			
Syphilis	6	0.4	0.1–1.4
Gonorrhea	17	1.3	0.7–2.5
Chlamydia	79	6.0	3.9–9.1
Trichomoniasis	157	11.9	8.5–16.5
Human papilloma virus (HPV)	552	41.9	38.3–45.5

**Table 3** Accuracy of 4 symptoms in diagnosing 5 sexually transmitted infections among 1337 female sex workers in Iran, 2015

STI lab results	Pain or burning % (95% CI)	Genital ulcers % (95% CI)	Excessive vaginal discharge % (95% CI)	Genital warts % (95% CI)	Any of the 4 symptoms % (95% CI)
<b>Syphilis</b>					
Sensitivity	16.7 (0.4–64.1)	0.0 (0.0–45.9)	33.3 (4.3–77.7)	0.0 (0.0–45.9)	33.3 (4.3–77.7)
Specificity	74.1 (71.5–76.6)	97.0 (95.8–97.9)	62.3 (59.5–65.1)	98.6 (97.7–99.2)	53.0 (50.1–55.9)
PPV <sup>a</sup>	0.3 (0.0–1.8)	0.0 (0.0–9.7)	0.4 (0.05–1.6)	0.0 (0.0–19.5)	0.4 (0.04–1.30)
NPV <sup>b</sup>	99.4 (98.7–99.8)	99.5 (98.9–99.8)	99.5 (98.6–99.9)	99.5 (98.9–99.8)	99.4 (98.4–99.8)
<b>Gonorrhea</b>					
Sensitivity	12.5 (1.5–38.3)	6.25 (0.1–30.2)	37.5 (15.2–64.6)	0.0 (0.0–20.6)	50.0 (24.7–76.3)
Specificity	74.2 (71.6–76.7)	97.0 (95.8–97.9)	62.4 (59.6–65.2)	98.5 (97.7–99.1)	53.2 (50.3–56.1)
PPV	0.7 (0.0–2.38)	2.8 (0.0–14.5)	1.4 (0.5–2.9)	0.0 (0.0–19.5)	1.5 (0.6–2.8)
NPV	98.4 (97.3–99.1)	98.7 (97.8–99.3)	98.6 (97.5–99.3)	98.6 (97.8–99.2)	98.7 (97.5–99.4)
<b>Chlamydia</b>					
Sensitivity	13.9 (6.9–24.1)	4.2 (0.9–11.7)	37.5 (26.4–49.7)	0.0 (0.0–4.9)	38.9 (27.6–51.1)
Specificity	73.6 (70.9–76.2)	97.0 (95.8–97.9)	62.4 (59.5–65.3)	98.5 (97.5–99.1)	52.6 (49.6–55.6)
PPV	3.3 (1.6–6.02)	8.3 (1.7–22.5)	6.1 (4.0–8.8)	0.0 (0.0–19.5)	5.1 (3.4–7.3)
NPV	92.9 (91.0–94.5)	93.9 (92.4–95.3)	93.9 (91.9–95.5)	93.8 (92.2–95.1)	93.0 (90.7–94.8)
<b>Trichomoniasis</b>					
Sensitivity	25.2 (18.2–33.2)	2.9 (0.8–7.2)	40.3 (32.1–48.9)	0.71 (0.0–3.9)	46.0 (37.6–54.7)
Specificity	74.3 (71.6–77.0)	96.9 (95.7–97.9)	62.8 (59.8–65.7)	98.5 (97.5–99.1)	53.0 (49.9–56.1)
PPV	11.6 (8.2–15.8)	11.1 (3.1–26.1)	12.7 (9.7–16.1)	5.9 (0.1–28.7)	11.6 (9.0–14.6)
NPV	88.1 (85.8–90.2)	88.2 (86.1–90.0)	88.7 (86.2–90.9)	88.1 (86.1–89.9)	88.0 (85.2–90.4)
<b>Human papilloma-virus (HPV)</b>					
Sensitivity	24.8 (21.1–28.9)	4.0 (2.5–6.1)	36.8 (32.5–41.2)	2.2 (1.1–3.9)	46.7 (42.2–51.2)
Specificity	73.9 (70.4–77.2)	97.7 (96.2–98.7)	61.9 (58.1–65.5)	99.1 (98.1–99.7)	53.1 (49.3–56.9)
PPV	40.9 (35.3–46.7)	55.6 (38.1–72.1)	41.2 (36.5–45.9)	64.7 (38.3–85.8)	41.9 (37.8–46.2)
NPV	57.5 (54.2–60.8)	58.4 (55.4–61.2)	57.4 (53.7–61.0)	58.3 (55.4–61.1)	57.8 (53.8–61.7)

<sup>a</sup>PPV: positive predictive value

<sup>b</sup>NPV: negative predictive value

was reported by only 2.2% of FSW who had HPV. Less than 50% of FSW diagnosed with any of 5 STIs reported having at least 1 STI symptom. The minimum sensitivity observed was for syphilis (33.3%), and the maximum sensitivity was for gonorrhea (50.0%).

### Specificity of STI-Associated Symptoms

The specificity of STI-associated symptoms was highest for genital warts (from 98.5 to 99.1%) and genital ulcers (from 96.9 to 97.7%). For excessive vaginal discharge, the specificity was around 62% for all diagnosed STIs, and for pain or burning it was around 74%. The specificity of combined STI-associated symptoms was about 53% for all diagnosed STIs.

### Positive Predictive Value (PPV)

PPV of genital warts was 64.7% for HPV. The probability of having gonorrhea, chlamydia, or trichomoniasis among FSW who had reported excessive vaginal discharge was 1.4, 6.1, and 12.7%, respectively. None of the individuals who reported genital ulcers or genital warts had syphilis. PPV of pain or burning ranged from 0.3% for syphilis to 40.9% for HPV. Considering any of the 4 symptoms, the PPV range was from 0.4% for syphilis to 41.9% for HPV.

### Negative Predictive Value (NPV)

Overall, 99.4% of FSW who had none of the four STI symptoms were not infected with syphilis. NPV of all symptoms was also high for gonorrhea (from 98.4 to 98.7%), chlamydia

(from 92.9 to 93.9%), and trichomoniasis (from 88.0 to 88.7%), but was lower for HPV (from 57.4 to 58.4%).

### STI Symptoms Among FSW Who Tested Negative for the 5 STIs

Among the 669 FSW who tested negative for all 5 STIs assessed in this study, 222 (33.2%) had vaginal discharge, 154 (23.0%) reported pain or burning, 13 (1.9%) had genital ulcers, and 5 (0.7%) had genital warts.

## Discussion

To the best of our knowledge, the current study is the first of its kind to assess the accuracy of symptom-based management of STIs among a large number of FSW in Iran. We found that around half of the FSW tested positive for at least 1 STI or reported at least 1 STI-associated symptom at the time of the study. The most prevalent STI was HPV, and the most common STI-associated symptom was excessive vaginal discharge. None of the 4 symptoms or combined STI-associated symptoms was sensitive enough for diagnosing the 5 STIs in this study. Therefore, symptom-based management of STIs among FSW resulted in missing the majority of infections. In contrast, as expected, specificity and NPV of the 4 symptoms were fairly high for ruling out any of the 5 STIs.

Among all of the symptoms, excessive vaginal discharge had the highest sensitivity but was reported by only one-third of the FSW who were diagnosed with an STI. Because vaginal discharge is uncommon in patients infected with syphilis or HPV [19], low sensitivity is reasonable for these infections. On the other hand, while vaginal discharge is often considered a key criterion for the symptom-based detection of gonorrhea, chlamydia, and trichomoniasis [19, 20], its sensitivity remained low for the diagnosis of these STIs in our study. This finding is in line with a meta-analysis that reported the pooled sensitivity of vaginal discharge for diagnosing gonorrhea to be as low as 30% [20]. Although the most common causes of genital ulcers are syphilis and herpes simplex virus [19] less than 10% of FSW who were infected with these STIs reported having genital ulcers. Moreover, the combination of all 4 symptoms did not significantly improve the diagnostic characteristics of the syndromic approach. The low sensitivity of symptoms is compatible with the existing body of evidence that suggests a high proportion of asymptomatic STI cases [21–24].

The high proportion of asymptomatic cases may be the result of both underreporting of symptoms among FSW and the asymptomatic nature of STIs. In a previous study on the accuracy of self-reported STI symptoms among Iranian FSW, underreporting of STI symptoms was estimated to be

around 36% [25]. Moreover, studies suggest that 60% to 70% of gonococcal and chlamydial infections are asymptomatic [26, 27].

In our study, the prevalence of STI among asymptomatic individuals (NPV) ranged from 0.4% for syphilis to 41.9% for HPV, highlighting the potential for missing a high proportion of asymptomatic cases when symptomatic management is the dominant approach. These asymptomatic cases are important because the women usually continue sex work without seeking appropriate treatments [21, 22] and consequently bridge the infection to the general population through their sexual networks [10, 28].

PPV of symptoms for all STIs in our study was very low. The highest PPV was for HPV (64.7%), which is likely due to the higher prevalence of HPV, compared with other STIs. Furthermore, we found that a considerable number of FSW reported STI symptoms while testing negative for the 5 assessed STIs. Other STIs such as genital herpes, which is relatively common among FSW (ranging from 82% prevalence in El Salvador [14] to 61% in Peru [29]), can partially explain this. Low PPV could also be attributed to the imperfect accuracy of self-reported STI symptoms and the laboratory processes and tests used for the 5 STIs. Therefore, some of the false positives for STI symptoms that we observed may not actually be false positives. Such false-positive cases for the 5 assessed STIs might be treated erroneously when symptom-based management is relied upon; as a consequence, overtreatment could result in side effects and antibiotic resistance [30].

We should acknowledge the limitations of this study. Although we recruited FSW at facilities and outreach locations, the generalizability of results is limited to FSW who had some access to care, either through the facilities or the outreach efforts. We collected our data as part of a nationwide biobehavioral surveillance survey of HIV/STI among FSW, which was not specifically designed to assess symptom-based management as a part of STI control strategy. To measure STI symptoms, we asked participants to report whether they had any symptoms of vaginal discharge, genital pain or burning, genital ulcers, or genital warts at the time of the study, which is just a point in time and might lead to misclassification bias. Moreover, we did not clinically examine for the presence of related signs of infection. Only women who agreed to be tested for STI were included in the analysis, vaginal swabs were self-administered, and some of the reported symptoms could have been caused by infections not measured in the study. We also did not verify our RPR positive results with participants' medical history. Our findings are also limited due to underreporting of STI symptoms and to social desirability bias.

Because the recommended approach is to use a sensitive test in the initial screening for an infection, followed by a more specific confirmatory test [31], symptom-based STI

management does not seem to be a good candidate for the screening of STIs among FSW. Our findings highlight the importance of using laboratory-based diagnosis for STIs, rather than relying on self-reported symptoms. However, while most STIs can be tested with rapid tests at clinical and nonclinical sites, future studies would benefit from examining the acceptability of these tests among FSW, as well as the cost-effectiveness of upgrading the surveillance system and its staff to be compatible with such testing. Indeed, the feasibility of such tests is questionable because of their high cost (each rapid test costs approximately \$70, and repeated testing is needed among this population). Therefore, primary prevention of STI seems to be the most practical approach in this setting. A meta-analysis on behavioral interventions among FSW in low- and middle-income countries reported that condom promotion and peer education are effective in reducing STI transmission among this subpopulation and their clients [32], which calls for further scale-up of safer-sex promotion in our study setting.

## Conclusions

Our study revealed low sensitivity and PPV of symptom-based management of STI among FSW in Iran. Although, historically, syndromic management has been considered an effective approach in settings where access to etiologic diagnosis is restricted, the utilization of this approach could be targeted to more-specific populations and settings. Future research should focus on the efficacy of clinical evaluation combined with symptom-based management. Given that many STI tests are now available as rapid point-of-care testing kits, a more feasible and accurate STI test-and-treat strategy could use these rapid tests instead of a symptom-based approach. Affordability and acceptability of such tests among FSW in developing settings, like Iran, need to be investigated in future studies. Given the considerable number of FSW population in Iran [33], harm reduction efforts need to focus on primary prevention of STI among FSW by scaling up free condom distribution, safer-sex promotion, and self-efficacy interventions for this marginalized population and their clients.

**Acknowledgements** The authors thank Dr. Parvin Afsar Kazerooni for her insightful comments on original draft of this paper. We would like to acknowledge supervisors and field staff from all collaborative universities who provided inputs to the study design and methods, assisted in data collection and implementation of the survey. Our gratitude also goes to the FSW who participated in the survey.

**Funding** The study was funded by the Global Fund to Fight AIDS, Tuberculosis and Malaria through UNDP Iran, and by Ministry of Iran. For this paper, we also received support from the University of

California, San Francisco's International Traineeships in AIDS Prevention Studies (ITAPS), U.S. NIMH, R25MH064712.

## Compliance with Ethical Standards

**Conflict of interest** All authors declare that they have no conflict of interest.

**Ethical Approval** All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

**Informed Consent** Informed consent was obtained from all individual participants included in the study. The study was anonymous, and no identifying information was collected during recruitment, informed consent, interview, or STIs testing. A unique identification code was provided to participants to help link survey responses to their test results. Participants were able to receive their STIs test results, post-test counseling, and referrals from the local testing and counseling center by providing their unique identification code. FSWs were given 70,000 Rials (equal to ~2.5 USD) as an incentive for participating in the study and 30,000 Rials (equal to ~1 USD) if they returned to receive their test results. The study protocol was reviewed and approved by the Ethics Committee of Kerman University of Medical Sciences (Ethical Code: K/93/209).

## References

1. Newman L, Rowley J, Vander Hoorn S, Wijesooriya NS, Unemo M, Low N, et al. Global estimates of the prevalence and incidence of four curable sexually transmitted infections in 2012 based on systematic review and global reporting. *PLoS ONE*. 2015;10(12):e0143304.
2. World Health Organization. Report on global sexually transmitted infection surveillance 2015. Geneva; 2016.
3. Gottlieb SL, Low N, Newman LM, Bolan G, Kamb M, Broutet N. Toward global prevention of sexually transmitted infections (STIs): the need for STI vaccines. *Vaccine*. 2014;32(14):1527–35.
4. Ortayli N, Ringheim K, Collins L, Sladden T. Sexually transmitted infections: progress and challenges since the 1994 International Conference on Population and Development (ICPD). *Contraception*. 2014;90(6):22–31.
5. Tucker JD, Bien CH, Peeling RW. Point-of-care testing for sexually transmitted infections: recent advances and implications for disease control. *Curr Opin Infect Dis*. 2013;26(1):73–9.
6. Aledort JE, Ronald A, Rafael ME, Girosi F, Vickerman P, Le Blancq SM, et al. Reducing the burden of sexually transmitted infections in resource-limited settings: the role of improved diagnostics. *Nature*. 2006;444:59–72.
7. Cwikel JG, Lazer T, Press F, Lazer S. Sexually transmissible infections among female sex workers: an international review with an emphasis on hard-to-access populations. *Sex Health*. 2008;5(1):9–16.
8. Mc Grath-Lone L, Marsh K, Hughes G, Ward H. The sexual health of female sex workers compared with other women in England: analysis of cross-sectional data from genitourinary medicine clinics. *Sex Trans Infect*. 2014;90:344–50.
9. World Health Organization. Report on global sexually transmitted infection surveillance 2013. Geneva; 2014.

10. Chen Y, Shen Z, Morano JP, Khoshnood K, Wu Z, Lan G, et al. Bridging the epidemic: a comprehensive analysis of prevalence and correlates of HIV, Hepatitis C, and syphilis, and infection among female sex workers in Guangxi Province, China. *PLoS ONE*. 2015;10(2):e0115311.
11. Kazerooni PA, Motazedian N, Motamedifar M, Sayadi M, Sabet M, Lari MA, et al. The prevalence of human immunodeficiency virus and sexually transmitted infections among female sex workers in Shiraz, South of Iran: by respondent-driven sampling. *Int J STD AIDS*. 2014;25(2):155–61.
12. Roksana J, Fatemeh A. An overview on sexually transmitted infections in Iran. *Int J Reprod Contracept Obstet Gynecol*. 2016;5(3):585–95.
13. Kassaian N, Ataei B, Yaran M, Babak A, Shoaie P. Hepatitis B and C among women with illegal social behavior in Isfahan, Iran: seroprevalence and associated factors. *Hepat Mon*. 2011;11(5):368–71.
14. Shah NS, Kim E, de Maria Hernández Ayala F, Guardado Escobar ME, Nieto AL, Kim AA, et al. Performance and comparison of self-reported STI symptoms among high-risk populations—MSM, sex workers, persons living with HIV/AIDS—in El Salvador. *Int J STD AIDS*. 2014;25(14):984–91.
15. Kosambiya JK, Baria H, Parmar R, Mhaskar R, Emmanuel P, Kumar A. Diagnostic accuracy of self-reported symptomatic assessment versus per speculum/per vaginal examination for the diagnosis of vaginal/cervical discharge and lower abdominal pain syndromes among female sex workers. *Indian J Sex Trans Dis*. 2016;37(1):12.
16. Mirzazadeh A, Haghdoost AA, Nedjat S, Navadeh S, McFarland W, Mohammad K. Accuracy of HIV-related risk behaviors reported by female sex workers, Iran: a method to quantify measurement bias in marginalized populations. *AIDS Behav*. 2013;17(2):623–31.
17. Mirzendehtdel S, Nadji SA, Tabarsi P, Baghaei P, Javanmard P, Sigarroodi A, et al. Prevalence of HPV and HIV among female drug addicts attending a drop-in center in Tehran, Iran. *Int J Gynecol Obstet*. 2010;108(3):254–55.
18. StataCorp. Stata statistical software: release 15 (Package DIAGT). College Station, TX: StataCorp LLC; 2017.
19. Shaukat S, Kazmi AH. Sexually transmitted infections and syndromic management. *J Pak Assoc Dermatol*. 2015;25:159–61.
20. Sloan NL, Winikoff B, Haberland N, Coggins C, Elias C. Screening and syndromic approaches to identify gonorrhea and chlamydial infection among women. *Stud Fam Plann*. 2000;31(1):55–68.
21. Otieno FO, Ndivo R, Oswago S, Ondiek J, Pals S, McLellan-Lemal E, et al. Evaluation of syndromic management of sexually transmitted infections within the Kisumu Incidence Cohort Study. *Int J STD AIDS*. 2014;25(12):851–9.
22. Clark JL, Lescano AG, Konda KA, Leon SR, Jones FR, Klausner JD, et al. Syndromic management and STI control in urban Peru. *PLoS ONE*. 2009;4(9):e7201.
23. Ghebremichael M. The syndromic versus laboratory diagnosis of sexually transmitted infections in resource-limited settings. *ISRN AIDS*. 2014;2014:103452. <https://doi.org/10.1155/2014/103452>.
24. Yin Y-p, WuZ, Lin C, Guan J, Wen Y, Li L, et al. Syndromic and laboratory diagnosis of sexually transmitted infection: a comparative study in China. *Int J STD AIDS*. 2008;19(6):381–4.
25. Mirzazadeh A, Shokoohi M, Khajehkazemi R, Hosseini Hooshyar S, Karamouzian M, Fahimfar N, et al. HIV and Sexually Transmitted Infections among Female Sex Workers in Iran: Findings from the 2010 and 2015 National Surveillance Surveys. In: Conference SIA, editor. 21st International AIDS Conference; Durban: 21st International AIDS Conference; 2016.
26. Sen S. Syndromic management in the control of sexually transmitted infections: time for a relook. *Indian J Dermatol Venereol Leprol*. 2013;79(6):816.
27. Farley TA, Cohen DA, Elkins W. Asymptomatic sexually transmitted diseases: the case for screening. *Prev Med*. 2003;36(4):502–9.
28. Patterson TL, Volkmann T, Gallardo M, Goldenberg S, Lozada R, Semple SJ, et al. Identifying the HIV transmission bridge: which men are having unsafe sex with female sex workers and with their own wives or steady partners? *J Acquir Immune Defic Syndr*. 2012;60(4):414.
29. Cárcamo CP, Campos PE, García PJ, Hughes JP, Garnett GP, Holmes KK, et al. Prevalences of sexually transmitted infections in young adults and female sex workers in Peru: a national population-based survey. *Lancet Infect Dis*. 2012;12(10):765–73.
30. World Health Organization. Guidelines for the management of sexually transmitted infections. Geneva: World Health Organization; 2004.
31. Lalkhen AG, McCluskey A. Clinical tests: sensitivity and specificity. *Contin Educ Anaesth Crit Care Pain*. 2008;8(6):221–3.
32. Wariki W, Ota E, Mori R, Koyanagi A, Hori N, Shibuya K. Behavioral interventions to reduce the transmission of HIV infection among sex workers and their clients in low and middle income countries. *Cochrane Database Syst Rev*. 2012(2):No:CD005272.
33. Sharifi H, Karamouzian M, Baneshi MR, Shokoohi M, Haghdoost A, McFarland W, et al. Population size estimation of female sex workers in Iran: synthesis of methods and results. *PLoS ONE*. 2017;12(8):e0182755.