



# Estimation of Prevalence of Sexually Transmitted Infection Syndromes and Evaluation of the Surveillance Systems for Sexually Transmitted Infection in Marvdasht

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## Abstract

**Background:** Correctly estimating the prevalence of sexually transmitted infections (STIs) is crucial for monitoring and managing these diseases effectively.

**Objectives:** This study aimed to estimate the prevalence of STI syndromes and evaluate the surveillance systems for STIs in Marvdasht.

**Methods:** We conducted a cross-sectional study in 2018 involving a population-based random sample of 3 879 participants aged 18-50 in Marvdasht city. Genital ulcers and secretions in both genders were used as the primary outcomes to assess the completeness of the system and calculate the correction factor. A mathematical model was developed to estimate the correction factor for the prevalence of selected syndromes in each gender. The correction factor was determined by dividing the cases estimated through the mathematical model by the cases reported by the surveillance systems.

**Results:** The estimated prevalence (with 95% confidence intervals [CI]) of urethral discharge in men and women, based on the model, was 25.32% (23.08 - 27.56) and 47.03% (39.93 - 54.13), respectively, and for genital ulcers, it was 5.16% (4.06 - 6.86) for men and 15.50% (9.5 - 21.5) for women. In both genders and for both syndromes, the reported prevalence by the care system (men: Discharge 0.09% [0.07 - 0.11], ulcer 0.04% [0.03 - 0.06]; women: Discharge 0.12% [0.1 - 0.15], ulcer 0.19% [0.16 - 0.22]) was severely underestimated. The highest and lowest underreporting correction ratios in the national STI monitoring system were observed for urethral discharge in men (124.5) and genital ulcers in women (7.26), respectively.

**Conclusions:** The study revealed that the reported prevalence of STI syndromes in Iran is significantly underestimated compared to the actual prevalence in the population. Fundamental revisions are necessary to enhance the system's validity and completeness in detecting and reporting STIs.

**Keywords:** Sexually Transmitted Diseases, Communicable Diseases, Sentinel Surveillance, Iran

## 1. Background

Sexually transmitted infections (STIs) represent an escalating public health issue. Despite their largely preventable nature, they pose a significant challenge (1), leading to a spectrum of negative outcomes on both individual and public health, ranging from mild and acute conditions to severe and chronic complications (2). In addition to substantial morbidity and mortality, STIs inflict considerable socio-economic burdens (3).

Accurately quantifying the prevalence and incidence of STIs is essential for understanding the epidemiology of these diseases, which includes surveillance, prevention, and treatment efforts. Many countries rely on routine case reporting systems, while others utilize sentinel sites to estimate these indices (4).

The establishment of an STI surveillance system aims to provide reliable estimates of crucial epidemiological indices and monitor their trends over time (5). Although

routine registration and reporting systems can act as effective early warning mechanisms in areas lacking information on waterborne infections (6, 7), the accuracy of the estimated indices remains a significant concern, even for diseases with more robust reporting systems (8).

The cornerstone of any surveillance system involves its registration and reporting procedures (9). In the context of STIs, comprehending the diseases' epidemiology extends well beyond merely diagnosing and treating them (10). It necessitates a deeper understanding of the dynamics of infections and the social interactions of patients within core groups in the community (7).

The participation of numerous service providers in both urban and rural populations, including public and private clinics, hospitals, and pharmacies, in diagnosing and treating STI patients poses a significant challenge to the validity and reliability of surveillance systems that operate based on routine registry databases (11).

In the study by Ahmadnia et al. (12), the prevalence of urinary infections among married women in Zanjan was estimated to be 4.7%. Most studies conducted in Iran to explore the prevalence of infections have typically focused on at-risk groups (13, 14). These studies were not carried out on the general population, nor were they conducted randomly.

## 2. Objectives

The aim of this study was to assess the completeness and representativeness of the current Iranian STI surveillance system and to propose correction coefficients to enhance the validity of the existing metrics.

## 3. Methods

### 3.1. Settings

The STI surveillance system in Iran was initiated in 1998 and underwent revision in 2006. Its primary functions include assessing the prevalence of STIs in various groups (such as pregnant women) and the routine reporting of cases. This population-based cross-sectional study was conducted in 2018 on a random sample of 3,879 participants aged 18 - 50 from both the rural and urban populations of Marvdasht, a large county in Iran. Marvdasht is the second largest and most populous county in Fars province, located 45 km north of Shiraz, the province's capital. The county has a population of approximately 221,163, with 148,858 residing in urban areas and 72,305 in rural areas. The socio-economic status of Marvdasht, being both an industrial and agricultural area, contributes to its multicultural and multi-ethnic

population, making it an excellent representation of Iranian cultural and social characteristics (9, 12).

### 3.2. Selection of Participants

For the selection of participants, the first 260 clusters—comprising 130 urban and 130 rural clusters—were randomly chosen. Each cluster consisted of 15 households, and individuals aged 18 - 50 years were surveyed in each household.

### 3.3. Definition of a Cluster

According to the health survey plan by the Ministry of Health and Medicine, a cluster in this study was defined by assigning a specific number to each household at the base level, utilizing household file information. Subsequently, the households were sequentially listed, and from this list, 130 households were selected as the "head of the cluster." Following this selection, 15 households to the right of each "head of the cluster" were surveyed. In the rural phase, all the villages covered by the study were listed within the city, with each village being assigned a unique number. From this list, 130 villages (numbers) were randomly chosen. In each of these 130 villages, all household file numbers were cataloged, and one family was randomly selected as the head of the cluster.

The phone interviews were conducted by trained interviewers of the same sex as the participant (male or female), beginning with a concise explanation of the study's objectives and providing participants with further assurances regarding the confidentiality of their information. After the brief introduction, participants were informed that the interview could be terminated at any moment upon their request. Additionally, verbal consent was obtained from the participants over the phone.

In this study, three checklists were utilized. The first checklist was general and was completed at home by questioning the mother or the head of the household. The second checklist focused on the person's behavior at the time of the syndromes and was filled out through telephone inquiries. The third checklist was completed in person by a urologist and gynecologist for individuals who had exhibited symptoms in the previous stage (Figure 1).

### 3.4. Statistical Analysis and Calculation of the Correction Factor

Among the several syndromes identified by the Iranian Ministry of Health, we utilized genital ulcers and secretions in both genders as the primary outcomes to assess the system's completeness and to calculate the correction factor. We developed a mathematical model to determine the correction factor for estimating the

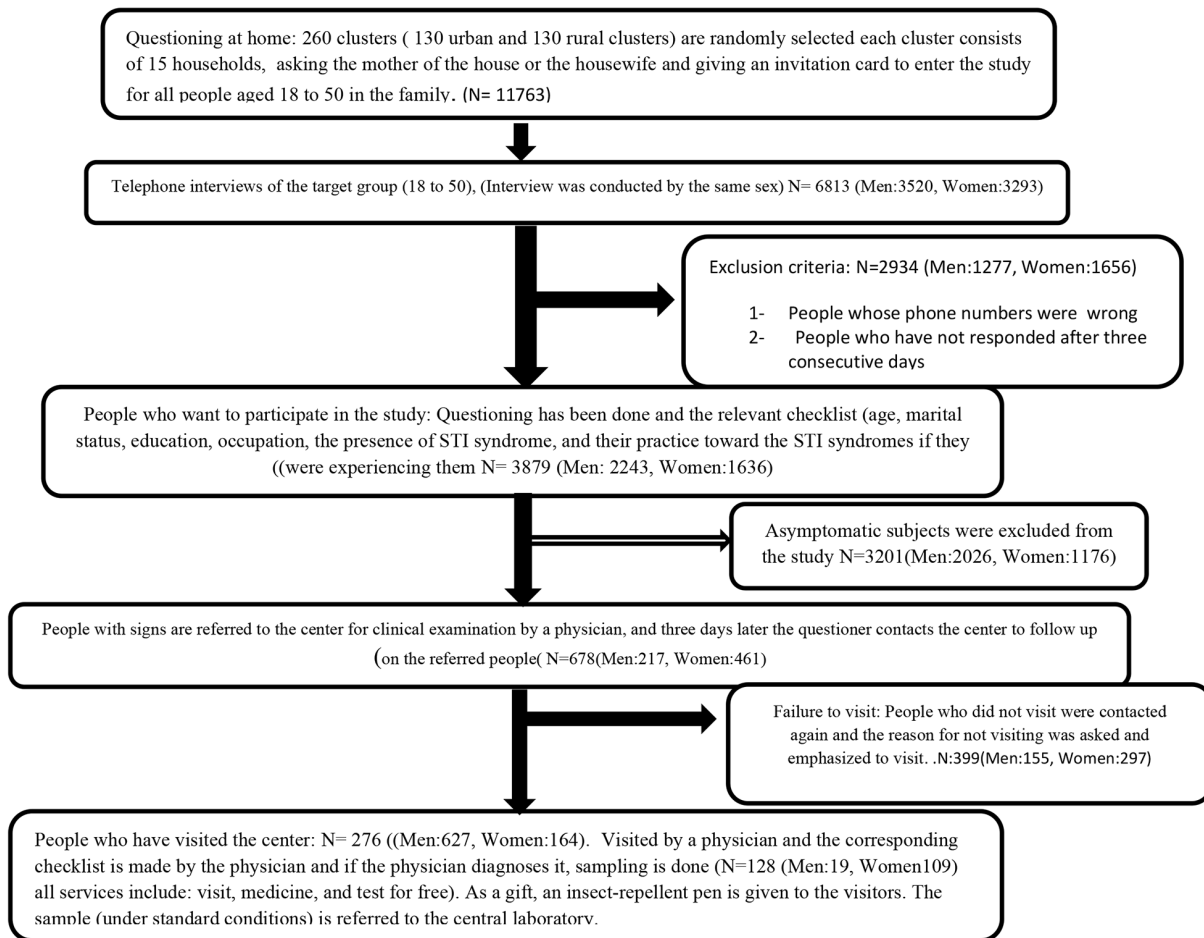


Figure 1. Step-by-step process of studying

prevalence of the selected syndromes in each gender. This model takes into account all factors that influence the registration and reporting of cases, as well as the latent period for the cases. Employing the "backward calculation method," we utilized both the registered cases and the cases detected in the survey for the calculations (Table 1 and Equation 1). The correction factor was estimated by dividing the cases projected from the mathematical model by the cases reported by the surveillance systems.

$$p = \frac{\left( \frac{P_s + SP_{ed} - 1}{SE_{cd} + SP_{cd}} \right) \times \left( \frac{1}{P_c} \right) \times \left( \frac{1}{(P_{c1} \times P_{p1}) + (P_{c2} \times P_{p2})} \right) \times \left( \frac{1}{1 - P_u} \right)}{Me}$$

### 3.5. Statistical Analysis

STATA 13.1 was used for data analysis.

### 3.6. Ethical Approval

The protocol for this study received approval from the ethical committee of Shiraz University of Medical Sciences

(reference code: IR.SUMS.REC.131096).

## 4. Results

A total of 3 879 individuals aged 18 - 50 participated in this study. The majority of the participants were male (57.89%), lived in urban areas (53.62%), and were married (69.63%). The age group under 30 years exhibited the highest frequency (39.95%) among the groups (Table 2).

The observed prevalence of urethral discharge in men and women is 25.32% (23.08 - 27.56) and 47.03% (39.93 - 54.13), respectively. Regarding genital ulcers, the observed prevalence in men and women is 5.16% (4.06 - 6.86) and 15.50% (9.5 - 21.5), respectively (Table 3).

Table 4 shows the surveillance system's completeness for the selected symptoms by gender. The correction factor for urethral discharge is 124.7 for men and 7.26 for women. The prevalence of urethral discharge and genital ulcers in

**Table 1.** Final Model Parameters and Used Sources of Data

Notation of Parameters	Model	Description	Source of Data	Urethral Discharge Men/Women	Genital Ulcer Men/Women
Ps	1	Reported prevalence based on registered data	Routine STI case reporting	0.09/0.12	0.04/0.19
pc	1	The possibility of seeking treatment in people with sexual infections in Iran	Present study	62.3/92.5	62.3/92.5
pC1	1	The possibility of the patient going to the public sector	Present study	38.3/38.3	38.3/38.3
PC2	1	The possibility of the patient going to the private sector	Present study	58.7/60.6	58.7/60.6
Pp1	1	The possibility of the participation of the public sector in the reporting of sexually transmitted infections	Present study	53.4/53.4	53.4/53.4
PP2	1	The possibility of private sector participation in reporting sexually transmitted infections	Present study	9.8/9.8	9.8/9.8
Pu	1	A share of visited patients who are not reported	Literature review	75.7/56.8	75.7/56.8
SEcd	1	Sensitivity of clinical diagnosis of each infection	Literature Review	97.5/98	97.5/98
SPcd	1	Specificity of Clinical diagnosis feature of each infection	Literature review	98/75	98/75
Me	1	The average number of occurrences of infection or syndrome	Literature review/WHO guideline	2.5/2.5	3.5/3.5

Abbreviation: STI, sexually transmitted infection.

men is 11.16% (10.95-11.38) and 3.11% (2.99-3.23), respectively, and in women are 10.63% (10.42-10.84) and 1.41% (1.33-1.49), respectively.

## 5. Discussion

The aim of this study was to evaluate the current syndromic surveillance system for STIs by assessing the completeness and representativeness of the system. Additionally, we provided a correction factor to adjust the reported prevalence of the selected syndromes.

The findings indicated that the prevalence reported by the health system is significantly underestimated in both genders. Generally, only 25 - 38% of medical practitioners who are required to report cases of STIs do so on a monthly basis (15). The lack of participation from physicians is even more pronounced in the private sector than in the public sector, leading to underreporting, particularly among men who prefer the private sector (16). This underestimation is attributed to factors such as lack of motivation, insufficient knowledge among physicians

about the importance of reporting STI cases, lack of feedback, conflicts of interest, and reluctance to report STIs, resulting in a considerable number of patients who seek care in the private sector not being registered and reported to the system (13).

In Iran, pharmacists, physicians, midwives, and laboratories are required to report STIs based on defined syndromes in both sexes. Various studies have indicated that the syndromic diagnosis of STIs, such as genital ulcers and urinary tract secretions, lacks satisfactory validity due to low sensitivity and specificity. Consequently, we incorporated a parameter in the model to account for the sensitivity of symptom-based diagnosis of STIs (16).

In men, the completeness of the national surveillance system for genital ulcers was found to be surprisingly low. As previously discussed, most individuals with STI syndromes tend to seek care in the private sector due to the importance of confidentiality and the stigma associated with STIs (17). Considering that sex outside of marriage is prohibited in Iran, individuals with STIs face significant stigma, which may deter them from seeking

**Table 2.** Demographic Characteristics of the Participants

Variables	Values <sup>a</sup>
<b>Sex</b>	
Male	2243 (57.89)
Female	1636 (42.17)
<b>Residency</b>	
Urban	2080 (53.62)
Rural	1799 (46.37)
<b>Marital status</b>	
Single	1144 (29.49)
Married	2701 (69.63)
<b>Job</b>	
Worker/free	1308 (35.25)
Employee	251 (6.76)
Farmer	298 (8.03)
Housewife/unemployed	1578 (42.53)
Soldier/student/retired	275 (7.41)
<b>Education</b>	
Literate/primary	951 (24.515)
Secondary/high school	2104 (54.24)
Academic	819 (21.11)
<b>Age</b>	
< 30	1550 (39.95)
31 - 40	1377 (35.49)
41 - 50	952 (24.54)
<b>Having any kind of sexual contact</b>	
Yes	2714 (69.96)
No	1165 (30.03)
<b>Age</b>	34.28 ± 8.85

<sup>a</sup> Values are expressed as No. (%) or mean ± SD.

treatment. This contributes to a severe underestimation of the prevalence of STI symptoms in the population, especially among men, as the prevalence of risky behaviors is higher in Iranian men than in women (18).

The prevalence of genital discharge in women is relatively high and significantly differs from the data recorded in the surveillance system. This discrepancy can be attributed to factors such as social stigma, family conflicts, lack of trust, dissatisfaction with the services, and the embarrassment of being examined by a doctor. Consequently, women may delay seeking treatment, hoping for symptoms to improve on their own, or resort to self-medication as they can purchase medicines from a pharmacy without a prescription (19, 20). This issue

may also be related to the low sensitivity and specificity of certain symptoms associated with STIs, particularly in women. Some symptoms may overlap with those of other diseases, meaning the presence of a specific symptom does not necessarily indicate an STI (21, 22).

The number of cases of syndromes and STIs estimated in the model for the population was significantly higher than those recorded in the care system for STIs. This discrepancy varied according to the type of syndrome, with the greatest difference observed in discharge cases in men and the smallest difference in ulcer cases in women. The disparity between the estimated cases at the disease center and elsewhere highlights a deficiency in the current registration and reporting system for STIs and indicates a significant underestimation of these infections.

Consequently, by comparing the number of syndrome cases identified in the study with those reported in the system, we calculated a coefficient to adjust the cases recorded in the registration system. This correction factor can be utilized to more accurately estimate the actual number of disease cases in the population.

### 5.1. Limitations

(1) The estimated median for the number of events per syndrome or infection is assumed to be uniform across all age groups. However, it is likely that this number varies with age.

(2) The incidence of STIs among groups with high-risk sexual behaviors, such as sex workers, is probably underestimated. In this study, we assumed that all information for these groups was completely and accurately recorded in the current registration and reporting system. Consequently, we did not apply the correction factor in the model to account for the impact of cases in these groups on the estimated prevalence and incidence of STIs in the country.

(3) The model was treated as static, disregarding the dynamics of the variables over time. It was assumed that all model variables remained constant throughout the year and did not change. The assumption extended to demographic shifts, suggesting individuals do not transition between age groups. Additionally, model calculations were performed for a single point in time (2019) to estimate incidence based on point prevalence without removing individuals previously infected from the denominator.

(4) This issue may stem from the low sensitivity and specificity of certain symptoms associated with STIs, particularly in women. Some symptoms may overlap with those of other diseases, meaning the presence of a specific symptom does not conclusively indicate an STI (21, 22).

**Table 3.** Prevalence of the Selected Syndromes Based on Population and Surveillance System

Syndrome/Agent	Population-Based, %	Surveillance System, %	Completeness, %
<b>Men</b>			
Urethral discharge	4.84 (1.01 - 13.50)	0.09 (0.07 - 0.011)	25.33 (23.08 - 27.56)
Genital ulcer	0	0.04 (0.03 - 0.06)	5.16 (4.06 - 6.86)
<b>Women</b>			
Urethral discharge	60.98 (53.06 - 68.49)	0.12 (0.1 - 0.15)	47.03 (39.93 - 54.13)
Genital ulcer	11.59 (7.12 - 17.50)	0.19 (0.16 - 0.22)	15.50 (9.5 - 21.5)

**Table 4.** Prevalence of Syndromes in the Population Based on Polyclinic Cases and Correction Factor

Syndrome/Agent	Routine STI Case Reporting	Correction Ratio	Population Corrected Cases	Prevalence, %
<b>Men</b>				
Urethral discharge	74	124.7	9230	11.16 (10.95 - 11.38)
Genital Ulcer	35	73.37	2568	3.11 (2.99 - 3.23)
<b>Women</b>				
Urethral discharge	95	89.41	8494	10.63 (10.42 - 10.84)
Genital Ulcer	155	7.26	1126	1.41 (1.33 - 1.49)

Abbreviation: STI: sexually transmitted infection.

## 5.2. Conclusions

The estimated prevalence of syndromes related to STIs, as determined in this study (using both the population and the model), is significant. Furthermore, the findings reveal an underestimation of the reporting system's data. By tracing the journey from the onset of an individual's infection to its registration in the reporting system, a correction factor can be applied to the data reported in each department to achieve a more accurate estimate. Additionally, establishing an observation base in each city could enable the estimation of the incidence and prevalence of these infections in the same population while considering cultural and social factors.

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## Footnotes

**Authors' Contribution:** Study concept and design: MSM and MF; Acquisition of data: MSM, MF, and ZD; Analysis and interpretation of data: MSM and SP; Drafting of the

manuscript: ZD and SP; Critical revision of the manuscript for important intellectual content: MSM and MF; Statistical analysis: MSM; Administrative, technical, and material support: MSM and MF; Study supervision: MSM.

**Conflict of Interests:** The authors confirm that this study has no relevant financial or non-financial competing interests.

**Data Availability:** Data will be provided by the corresponding author upon request of the journal editor.

**Ethical Approval:** The protocol of the present study was approved by the ethical committee of Shiraz University of Medical Sciences (IR.SUMS.REC.131096).

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**Informed Consent:** Verbal consent was obtained from the participants over the phone.

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