

## 2001 CAMBODIA STI PREVALENCE SURVEY

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## Abbreviations

AIDS	Acquired Immunodeficiency Syndrome
ANC	Antenatal Clinic
BSS	Behavioral Surveillance Survey
BV	Bacterial vaginosis
CT	Chlamydia trachomatis
DSW	Direct Sex Worker
ELISA	Enzyme Linked Immunosorbant Assay
EU	European Union
FHI	Family Health International
FP	Family Planning
FSW	Female Sex Worker
GPA	Global Programme on AIDS
GUD	Genital Ulcer Disease
HCP	Health Care Provider
HD	Haemophilus ducreyi
HIV	Human Immunodeficiency Virus
HSS	HIV Sentinel Surveillance
HSV-2	Herpes Simplex Virus type 2
IMPACT	Implementing HIV/AIDS Prevention and Care
IPC	Institut Pasteur de Cambodge
ITM	Institute of Tropical Medicine
MOH	Ministry of Health
MSF	Medecins Sans Frontieres
MSM	Men who have Sex with Men
N	Number
NCHADS	National Center for HIV/AIDS, Dermatology and STD
NG	Neisseria gonorrhoeae
NGO	Non-Governmental Organization
OR	Odds Ratio
PCR	Polymerase Chain Reaction
PSF	Pharmaciens Sans Frontieres
PSI	Population Services International
RACHA	Reproductive and Child Health Alliance
RHC	Reproductive Health Clinics
RPR	Rapid Plasma Reagin
RTI	Reproductive Tract Infection
STD	Sexually Transmitted Diseases
STI	Sexually Transmitted Infection
TB	Tuberculosis
TPHA	Treponema pallidum Hemagglutination Assay
TV	Trichomonas vaginalis
TWG	Technical Working Group
USAID	United States Agency for International Development
VCT	Voluntary Counseling and Testing
WHO	World Health Organization

## Executive Summary

Cambodia has the highest Human Immunodeficiency Virus (HIV-1) prevalence in Asia [1,2]. The predominant mode of transmission is heterosexual, and active commercial sex and bridging networks are believed to have played an important role in rapid epidemic spread. Several sexually transmitted infections (STIs) - including syphilis, gonorrhea and chancroid - were also widely prevalent in Cambodia during the rapid growth phase of its HIV epidemic [3]. Estimates of the cofactor effect of such curable infections on HIV transmission range from at least two to five times for non-ulcerative STIs [4]; genital ulcers may increase the probability of infection per exposure by as much as 10-300 times [5]. STIs are also directly responsible for a large proportion of preventable morbidity and mortality including pelvic inflammatory disease, ectopic pregnancy, infertility and congenital infections.

Cambodia's response to its HIV/STI epidemic has included multisectoral awareness campaigns as well as more targeted interventions to improve STI management and reduce exposure in commercial sex settings [6]. The Cambodian National Center for HIV/AIDS, Dermatology and STD (NCHADS) conducts surveillance at regular intervals to monitor biological [2] and behavioral [7] indicators of HIV. In 2001, NCHADS organized an STI prevalence survey with the following objectives:

- To determine the prevalence of *Neisseria gonorrhoeae*, *Chlamydia trachomatis*, and syphilis seropositivity among brothel-based sex workers, police and women attending reproductive health clinics, and of *Trichomonas vaginalis* and bacterial vaginosis among the female groups;
- To determine the antimicrobial resistance patterns of *N. gonorrhoeae*;
- To measure the frequency of and the associations between risk behaviors and exposures to STIs among the groups tested; and
- To determine the prevalence and etiology of genital ulcers.

A cross-sectional cluster sampling design was used to determine the prevalence of the most common STIs in priority populations including brothel-based sex workers, police, and women attending reproductive health clinics (RHC). A seven-province representative sample of brothel-based sex workers and police was selected, and RHC women were chosen in consecutive sampling from sentinel sites. Among all populations, participants were interviewed to assess sexual risk behavior and examined for signs of STI. Highly sensitive tests were used to detect both symptomatic and asymptomatic STIs.

## Sample sizes, STI Prevalence Survey 2001, Cambodia

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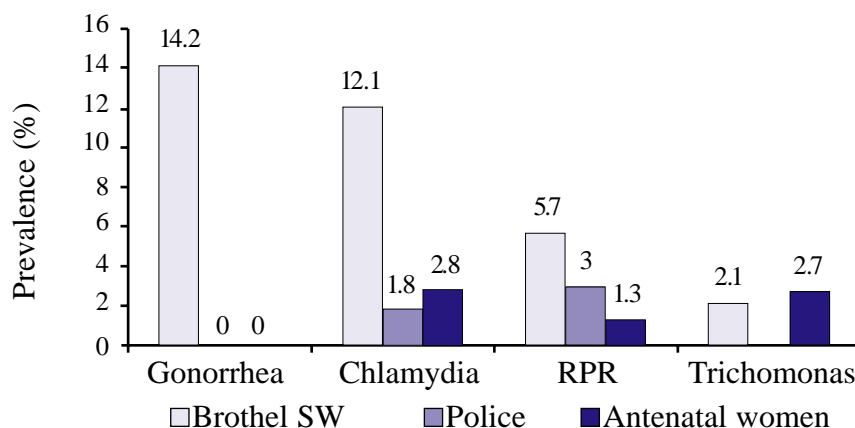
Brothel-based sex workers	141
Police	165
Women at reproductive health clinics	451
Total	757

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Results document very low STI prevalence rates for RHC women and police. No gonorrhea was detected in either group, and the prevalence of chlamydial infection was between two and three percent. Ulcerative STIs were rare - no cases were seen among police and less than one percent of RHC women had ulcers due to either herpes (HSV-2) or chancroid. No cases of primary syphilis were seen in either group.

As expected, rates for direct (brothel-based) sex workers were higher than for the other groups (Figure 1). Although prevalence of 14 percent for gonorrhea and 12 percent for chlamydial infection among direct sex workers greatly exceeded the prevalence among other groups, these rates were less than those reported previously for direct sex workers [3] in Cambodia, and are low for the region. [8-11] Very low rates of genital ulcer disease were detected in sex workers and no cases of primary syphilis were seen. Moreover, no evidence of asymptomatic chancroid or syphilis was detected using highly sensitive mPCR assay on vaginal swabs from brothel-based sex workers. Low rates of genital ulcers are especially significant because of the strong association between these STIs and HIV transmission. Low rates of serologic syphilis in all groups and the absence of syphilitic chancres are also encouraging findings because of the severe complications, including congenital infection, that accompany syphilis.

**Figure 1. STI Prevalence, STI Prevalence Survey 2001, Cambodia (n=141 SW, 165 police, 451 RHC)**



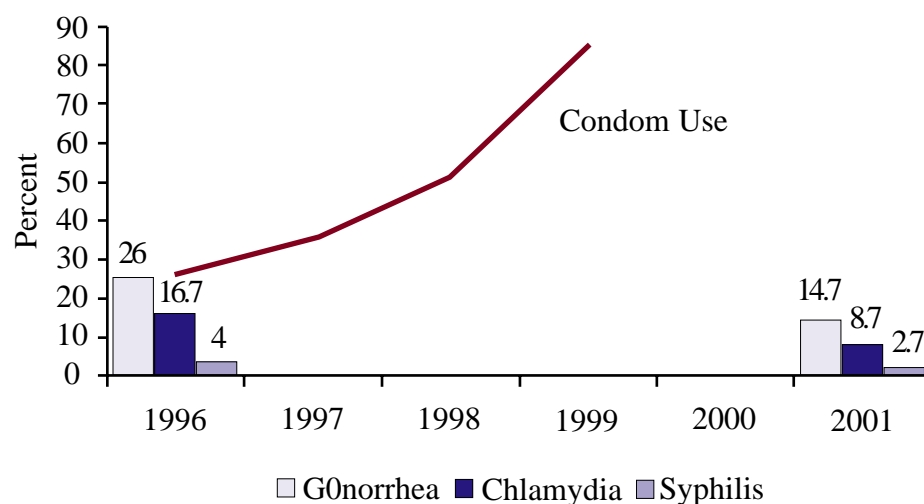
Because of the low number of infections detected, analysis of associations between STIs and demographic, behavioral and clinical factors was only possible in the sex worker sample. Significant association with cervical infection was seen for clinical signs of cervical erosion, cervical friability and purulent cervical discharge. Symptoms of dysuria and fever showed borderline significant associations. Notably, no significant association was measured between signs or symptoms of vaginal discharge and cervical infection. On multivariate analysis, only the cervical signs remained significant as predictors of cervicitis.

An algorithm for detecting cervical infection by screening sex workers with speculum exam was constructed using the results of the multivariate analysis. Such an algorithm would have detected only 41% of cervical infections in the sex workers with a positive predictive value of 31%. These findings suggest that speculum examination could be a useful component of sex worker STI screening but would be insufficient by itself - most cervical infections would remain undetected if a screening strategy were based exclusively on speculum exam findings.

The susceptibility of *Neisseria gonorrhoeae* to a range of antibiotics was also evaluated. Continued resistance to the quinolone antibiotics was seen but all strains were sensitive to third generation cephalosporins (including cefixime) and spectinomycin.

In summary, the 2001 Cambodia STI Prevalence Survey supports recent behavioral surveillance trends (Figure 2 for direct sex workers in Phnom Penh). Consistent with the trends found in recent behavioral surveillance surveys (BSS) [7], direct sex workers and police reported high levels of condom use. Low STI prevalence rates add biological evidence that strengthens the credibility of reported behavior change and helps explain recent declining HIV trends [2].

**Figure 2. Consistent condom use\* and STI prevalence among brothel-based sex workers in Phnom Penh, Behavioral Surveillance Survey 1997-1999, STI Prevalence Survey 1996, 2001, Cambodia**



\* Consistent condom use defined as using a condom every time with all clients in the past week

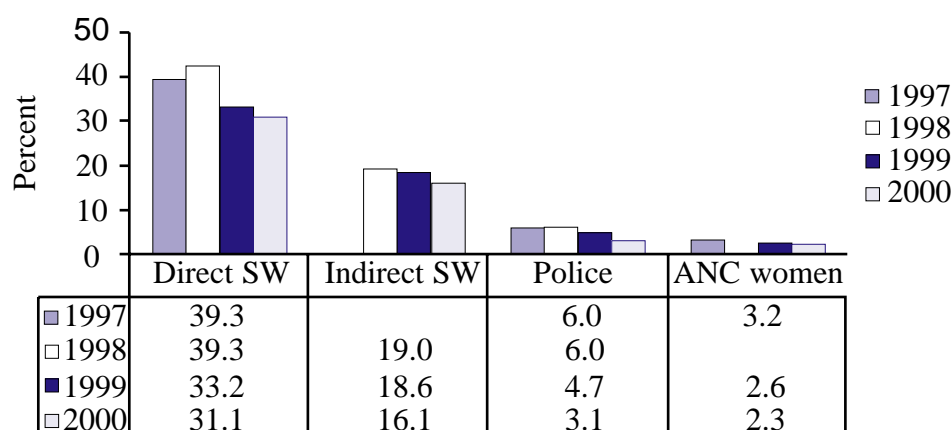
Taken together, these data point in the same direction and strongly suggest that efforts to encourage safer sexual behavior and improve the control of STIs are having an impact on the sexual transmission of a range of STIs in seven of 24 provinces among selected populations in Cambodia.

It should be kept in mind, however, that surveillance may miss important regional differences and pockets of continued high transmission. Moreover, behavioral surveys show that consistent condom use in commercial sex is not universal, and may actually be low with sex workers' regular partners. The prevalence of several STIs is still high enough among sex workers to facilitate HIV transmission when condoms are not used, and low rates of genital ulcers can rebound quickly if prevention efforts abate or commercial sex is forced underground. Despite encouraging trends, continued vigilance and close surveillance will be needed to sustain and extend recent successes.

## I Background

Cambodia has the highest HIV prevalence in South-east Asia [1]. The 2000 national HIV sentinel surveillance estimates that 169,000 Cambodians aged 15-49 years from an overall population of approximately 11.3 million are infected with HIV [2]. The predominant mode of transmission is heterosexual intercourse, and active commercial sex and bridging client networks are believed to have played an important role in rapid epidemic spread.

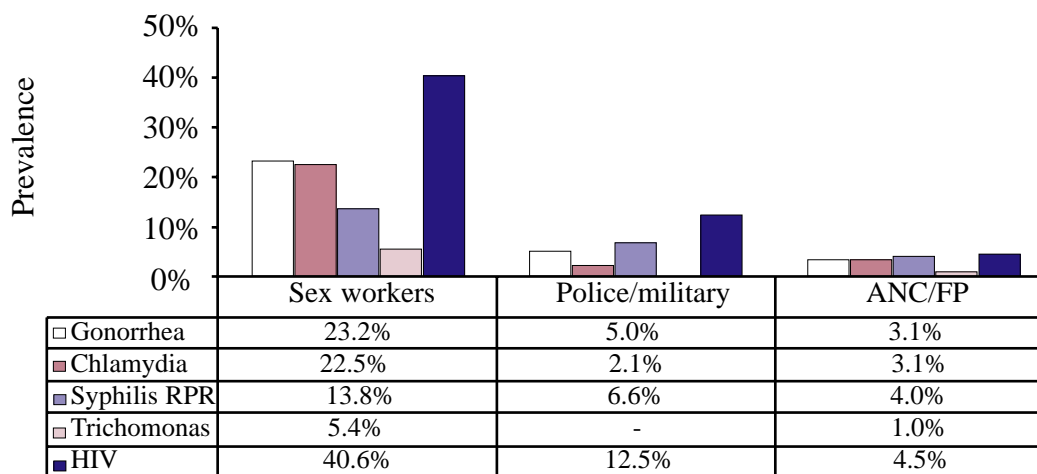
**Figure I-1 HIV prevalence in sentinel groups in Cambodia, HIV Sentinel Surveillance 1997-2000, Cambodia**



There are fewer data on STIs in Cambodia than on the better-documented HIV epidemic. A study conducted in 1996 by NCHADS with the University of Washington in Seattle [3] documented prevalence rates in selected populations, determined gonococcal antibiotic susceptibility, assessed the validity of the proposed World Health Organization (WHO) treatment algorithms for Cambodia and documented high risk sexual behaviors among brothel-based sex workers (n=364), police and military (n=288) and women attending antenatal and family planning clinics (n=260) in three cities (Phnom Penh, Battambang and Sihanoukville). The police and military were randomly sampled from a list of units while a convenience sample was taken among the female populations. The STI prevalence rates found in this cross sectional study are presented in Figure I-2.



**Figure I-2 STI prevalence among 3 population groups - STI Prevalence Survey 1996, Cambodia**



In addition to these alarming levels of HIV and STIs, this study documented high rates of unprotected commercial sex and a high level of resistance to commonly used antibiotics (e.g. quinolones, penicillin, tetracycline, and trimethoprim sulfamethoxazole). Gonococcal strains were only susceptible to third generation cephalosporins and spectinomycin. The data were also used to develop recommendations specific to Cambodia for the modification of the WHO STI syndrome guidelines for vaginal discharge.

Globally, sexually transmitted infections (STIs) are responsible for a large proportion of preventable morbidity and mortality including pelvic inflammatory disease, ectopic pregnancy, infertility and congenital infections.[12] STIs are also potent cofactors that increase the efficiency of both HIV transmission and acquisition. [13,14] Estimates of this cofactor effect range from at least two to five times for non-ulcerative STIs [4], to as much as 10-300 times for genital ulcers [5]. Control of STIs is thus a priority public health objective, and measuring the population prevalence of these infections is important for evaluating the effectiveness of STI interventions. Moreover, since both STIs and HIV transmission depend on similar behavior, STI prevalence trends are important indicators of HIV prevention program effectiveness.

Based on the results of earlier HIV, STI and behavioral surveys Cambodia launched a wide range of behavioral interventions among high-risk and bridging populations [6]. These interventions target female sex workers (FSW) and their clients, in particular high-risk men in the uniformed services, in a concerted effort to increase overall condom use and especially condom use in commercial sex.

The following behavioral interventions are part of the NCHADS national prevention strategy:

- 100 percent condom use policy in brothels adopted nationally in 1999;
- Aggressive condom social marketing campaign by Population Services International (PSI) (Number One condom);
- Widespread free condom availability in the public sector;
- Peer outreach, STI care, condom promotion and social mobilization of direct and indirect female sex workers;
- Sensitization of military and police commanders to the problem; training of peer-educators in the military and police in prevention interventions; and training of military and police health care providers in STI management;
- Workplace programs including policy and advocacy with company managers and reproductive health programs in the garment industry; and
- Outreach and education to street children.

The MOH approved STI syndrome management guidelines based on WHO recommendations in 1998. WHO is supporting the training of health care providers in nearly all the provinces in STI management based on these guidelines, but inadequate supplies of effective antibiotics limit widespread implementation. A more sensitive, non-laboratory based algorithm (except for syphilis serology when available) is being implemented for female sex workers and regular meetings are held with the non-governmental organizations (NGO) working with high-risk populations in order to coordinate efforts. The supply of antibiotics is prioritized for FSW interventions. The Ministry of Health clinics provide STI services in outpatient departments and several NGOs have been involved in the provision of STI prevention and care services for both general and high-risk populations (Table I-1).

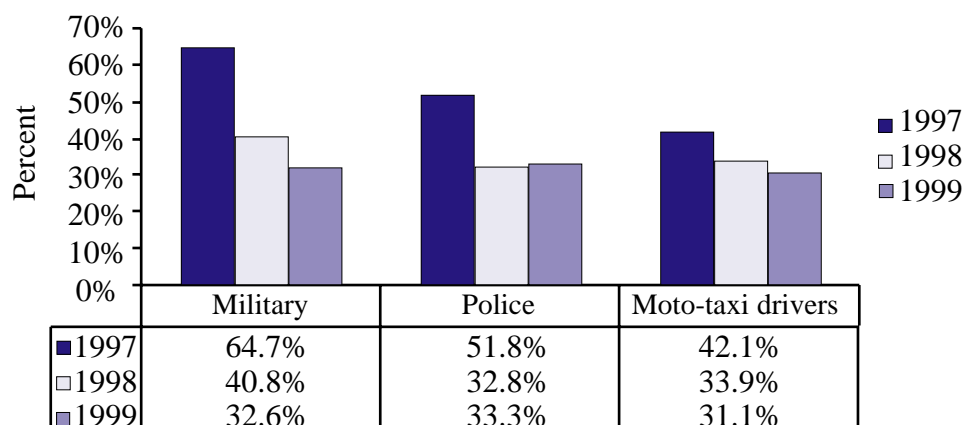
**Table I-1 NGO involvement in provision of STI services, Cambodia**

NGOs	Target populations
Reproductive Health Association of Cambodia	General population
Medecins San Frontieres (MSF)	Mixed: general and high risk populations
Reproductive and Child Health Alliance (RACHA)	General population
Pharmaciens Sans Frontieres (PSF)	Mixed: general and high risk populations
IMPACT/FHI	High risk groups
Medecins du Monde	Mixed: general and high risk populations
EU/ITM Project	Mixed: general and high risk populations

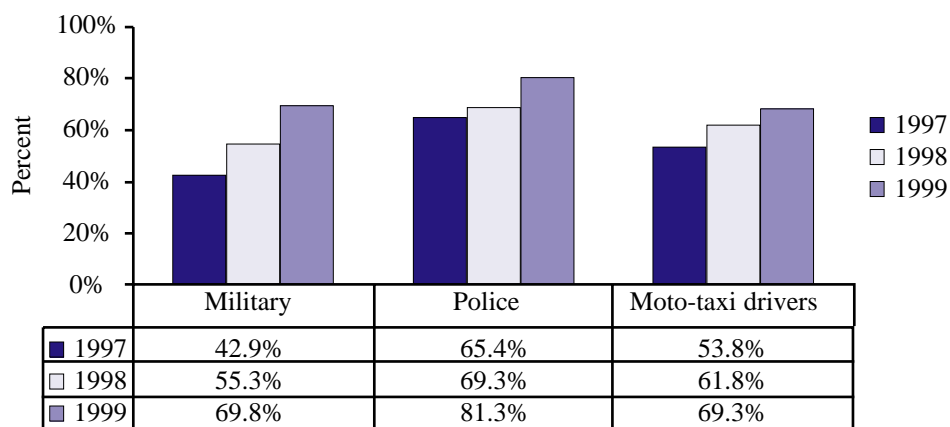
These efforts are complimented by behavioral change interventions and a large number of HIV/AIDS care and mitigation activities including home care, interventions to prevent mother-to-child-transmission, TB/HIV activities and responding to the issue of orphans.

Since the baseline study was done in 1996, there have been three subsequent behavioral surveillance surveys done yearly between 1997 and 1999 in Cambodia [7]. These behavioral surveys show a declining trend in the percentage of men in key target groups who visited sex workers in the previous month (Figure I-2) and an increasing percentage of men who reported always using condoms with sex workers (Figure I-3).

**Figure I-2** Percent of men by target groups reporting sex with commercial partner in previous month, Behavioral Surveillance Survey 1997-1999, Cambodia



**Figure I-3** Percent of men by target groups reporting condom use always with SW in the past 3 months, Behavioral Surveillance Survey 1997-1999, Cambodia



These behavioral data provide encouragement that Cambodia's strengthened STI prevention efforts are having an effect. The 2001 STI Prevalence Survey was organized to broaden the existing evidence base to include the common curable STIs that act as important cofactors of HIV transmission.

## II Objectives

Cambodia has a strong, institutionalized HIV surveillance system, with HIV Sentinel Surveillance (HSS) beginning in 1994 and Behavioral Surveillance Surveys (BSS) in 1997. However, only one previous study of STI prevalence had been conducted in the country [3]. The 2001 STI Prevalence Survey was implemented to obtain estimates of the prevalence of STIs among key populations in seven provinces. Periodic (every three years) STI prevalence surveys will be conducted to monitor trends in key populations. The surveys are not intended to evaluate the impact of specific programs, but rather to provide evidence of the effectiveness of the overall national response on the prevalence of STIs among targeted populations.

### ***Primary objective of STI Prevalence Study:***

To determine the overall prevalence\* of the following five infections:

- *Neisseria gonorrhoeae*
- *Chlamydia trachomatis*
- *Treponema pallidum* (syphilis seroprevalence)
- *Trichomonas vaginalis* (women only)
- Bacterial vaginosis (women only)

*\*STI prevalence for the seven provinces considered as one sampling domain, with the sample allocated proportionally, based on the size of each population.*

### ***Secondary objectives of STI Prevalence Study:***

- To determine the antimicrobial resistance patterns of *N. gonorrhoeae* in the study provinces in Cambodia;
- To measure the frequency of and the associations between risk behaviors and exposures to STIs among the groups tested; and
- To determine the etiology of genital ulcers.

### III Methods

#### *STUDY DESIGN*

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A cross-sectional study design was employed in selected provinces where major HIV and STI interventions were currently in place or were planned for the near future. The seven provinces were Phnom Penh, Kandal, Kompong Cham, Battambang, Sihanoukville, Banteay Mean Chey and Pursat. The study populations for the cross-sectional survey were as follows:

- Brothel-based female sex workers
- Police
- General population women attending reproductive health clinics (RHC)

A sampling strategy was developed based on the following principles.

- Probability sampling as opposed to convenience sampling was used to provide less biased estimates of the true prevalence of STI in the target groups.
- The sampling approach was designed to be systematic and repeatable with the intention that it should be done the same way in subsequent rounds of STI surveillance.

Samples were selected using cluster sampling methods similar to those used for the HIV Sentinel Surveillance, and the sampling strategy was finalized with the Surveillance Unit of NCHADS. Existing surveillance and STI guidelines were used and adapted where possible. Cluster sampling is done in multiple stages, and it allows difficult to reach populations to be representatively sampled in the absence of inclusive lists of sub-population members.

In choosing the sample sizes for each population, consideration went into both the desired sample size for maximum power and precision, as well as affordability and feasibility of reaching the targeted number. The sample was large enough to achieve 90% confidence levels (or better) of the higher STI prevalence among sex workers (n=141) and the lower prevalence among RHC women (n=451). Though the STI prevalence among police was lower than anticipated (n=165) the estimate is still relatively precise, with confidence levels on the order of  $\pm 3-4\%$ .

Provincial AIDS/STI offices first mapped and developed detailed lists of brothels, police stations, and health facilities with reproductive health services in all seven provinces to serve as sampling frames. Representatives of the Ministry of Interior and Ministry of Defense were involved in this process. From these lists, a first level (cluster) randomization was performed using population proportional to size (PPS) methods for brothel-based sex workers and police. In the second stage, individual randomization was performed at each selected cluster site at the time of the survey to select a fixed number

of participants. RHC attendees were selected at clinics using consecutive sampling. Sampling and data collection details are summarized for each group in Table III-1.

**Table III-1 Sampling design and data collection, STI Prevalence Survey 2001, Cambodia**

Population	Sampling Design	Data collection
Brothel-based sex workers	Cluster randomized	Brothel based (On-site or transported to nearby health center)
Police	Cluster randomized	On-site at police stations
Reproductive health clinic (RHC) women	Consecutive sampling	On-site at RHC clinics

Participants were recruited at cluster sites. Study objectives and procedures were explained to all individuals present who were then invited to participate in randomized or consecutive selection. Refusal rates were low, and there was no indication that participants were self-selecting either due to their behavioral risk or to receive the free treatment provided. Verbal informed consent was obtained by the interviewer in a private setting and witnessed by the second study interviewer. No names were taken, but a identification number was provided so the participant could later receive their STI results. Participants were apprised that they could end the interview or the examination at any time.

For consenting participants, study procedures included:

- Standardized interview (questionnaire) in a private setting;
- Systematic physical examination in a private setting where biologic specimens were obtained and blood drawn;
- Treatment of symptomatic participants based on the Cambodian STI treatment guidelines for general populations and the ITM-developed treatment guidelines for FSWs in Cambodia;
- Counseling regarding their STIs;
- Condom use demonstration; and
- Small remuneration (toiletries) for time taken away from work.

The questionnaire was adapted from that used in the BSS and employed standardized, tested questions on demographic information, risk behavior, and history of and treatment-seeking behavior for STIs.

To implement the survey, two field teams were organized - a male team for high-risk men (police) and a female team for high-risk women (FSW) and low-risk women (RHC). Many of the members of the study teams had participated in BSS and HSS data collection and were very familiar with the process of data collection. A thorough training was held for all supervisors, interviewers and clinicians.

- A physician/ medical assistant or midwife performed the clinical examination, collected specimens, and gave treatment.
- For the female team only, a clinical examination assistant was available to hold light, pass swabs, and assist with the examination.
- Two interviewers per team obtained consent and administered questionnaires.
- A nurse was responsible for blood drawing, urine collection, appropriate handling of specimens on-site,
- Several drivers worked in rotation to ensure daily transport of all specimens to the referral laboratory in Phnom Penh.

In addition, an overall study coordinator finalized study design with the NCHADS co-investigators and coordinated the logistics and activities of the male and female teams on the field. This study coordinator assumed overall responsibility to ensure the quality of the study.

## Clinical examination and specimen collection

The procedures for physical examination and specimen collection are detailed in Table III.2.

**Table III-2 Clinical examination and specimen collection procedures, STI Prevalence Survey 2001, Cambodia**

		Men	Women
<b>C L I N I C A L</b>	External genitalia	<b>Systematically:</b> Inspect the genital area and local lymph nodes looking for local changes: erythema, warts, abrasions, ulcers, swelling, discharge.	
	Abdomen Exam		<b>Systematically:</b> <ul style="list-style-type: none"> <li>■ Careful evaluation for any abdominal tenderness</li> <li>■ A bimanual examination</li> </ul>
	Speculum exam		<b>Systematically:</b> Without lubrication <ul style="list-style-type: none"> <li>■ Inspect vaginal discharge for color, amount, odor and consistency.</li> <li>■ Examination of the vaginal walls and cervix for warts or ulcers</li> <li>■ Examination of the cervical os for discharge, erythema, erosion.</li> </ul>
<b>L A B O R A T O R Y</b>	Urethral Swab	<b>ONLY IF</b> urethral discharge is present, for application on a microscope slide and on Modified Thayer Martin Media	
	Ulcer swab	<b>ONLY IF</b> ulcer for PCR syphilis, herpes, H.ducreyi	<b>ONLY IF</b> ulcer for PCR syphilis, herpes, H.ducreyi
	Vaginal Swab		<b>Systematically:</b> vaginal fluid from the posterior fornix using two cotton swabs avoiding cervical secretions. <ul style="list-style-type: none"> <li>■ One swab: microscope slide / air dried for Gram stain and examination for bacterial vaginosis.</li> <li>■ A second swab inoculated into the culture medium for T. vaginalis.</li> </ul>
	Cervical swab		<b>Systematically:</b> two endocervical swabs rolled in the endocervix for 30 seconds after cervix is cleaned: <ul style="list-style-type: none"> <li>■ One for inoculation onto Modified Thayer Martin medium. Plate placed immediately in jars with CO<sub>2</sub>.</li> <li>■ The second swab placed in transport tube for PCR testing for N. gonorrhoeae and C. trachomatis.</li> </ul>
	URINES	<b>Systematically:</b> Collection of a first catch specimen of urine for PCR testing for C. trachomatis and N. gonorrhoeae.	
	BLOOD	<b>Systematically:</b> Collection of 10cc of venous blood	



## **Laboratory Methods**

The following laboratory testing and specimen collection procedures were performed.

- **Trichomonas vaginalis:** A cotton swab with vaginal fluid was inoculated into the upper chamber of the pouch of the InPouch TV Test [15]. The bags were sealed and transported to the laboratory at the end of each day. The pouches were examined in the lab in Phnom Penh on arrival, incubated at 37°C and examined by microscopy at 12, 24 and 48 hours post-incubation for appropriate morphology and motility of the protozoa.
- **Neisseria gonorrhoeae culture:** After the sample of cervical secretion was inoculated on modified Thayer-Martin medium, it was placed in a Genbox jar with CO<sub>2</sub> and transported to the central laboratory in Phnom Penh where the jars were placed in an incubator at 36°C. Culture plates were read at 48 and 72 hours. Identification of *N. gonorrhoeae* was based on colony characteristics, Gram stain morphology and oxidase reaction. Isolates were frozen and tested for antimicrobial susceptibility using E-test strips [16] in the central lab in Phnom Penh (Institut Pasteur) and with agar dilution in a reference laboratory (Institute of Tropical Medicine, Antwerp, Belgium).
- **Polymerase chain reaction (PCR) for *N. gonorrhoeae* and *Chlamydia trachomatis*:** Cervical swabs from women in dry transport tubes and urine specimens from men were stored in a cool box until transported to the laboratory in Phnom Penh. There the urine specimens were then aliquoted and the urine and cervical specimens were frozen at -20° C, batched, and transported to the Institute of Tropical Medicine, Antwerp, Belgium for processing for PCR testing [17, 18].
- **Multiplex PCR for herpes simplex virus (HSV-2), *Treponema pallidum* and *Haemophilus ducreyi*.** Swabs of any ulcerations found in the course of this study, and for vaginal swabs collected routinely from sex workers, were placed in PCR transport tubes and placed in a cool box until transport to the central laboratory in Phnom Penh where they were stored at -20° C until transported to the ITM for testing with Roche Multiplex PCR [19].
- **Serologic tests for syphilis** were performed on sera transported in a cool box to the central laboratory in Phnom Penh using quantitative rapid plasma reagin (RPR) screening test with *Treponema pallidum* hemagglutination assay (TPHA) confirmatory test.
- **Bacterial vaginosis** was determined based on a Gram-stain examination of vaginal fluid using a standardized 0 to 10-point scoring system based on three morphotypes [20].
- **Candida albicans** was diagnosed microscopically through demonstration of characteristic budding yeast cells and hyphae.

All positive cultures of *N. gonorrhoeae* were stored at -70° C and shipped to the Institute of Tropical Medicine in Antwerpe, Belgium where the sensitivity of strains to a range of antibiotics was evaluated by standard agar dilution methods.

## ***DATA ANALYSIS***

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Data were entered twice and verified to maximize accuracy. Data entry was done using Epi-Info 6 software. Data analysis was performed using Epi-Info 6 and Stata 7 in Phnom Penh by the Surveillance Unit with the support of an FHI consultant.

- Simple proportions were calculated to determine prevalence.
- Continuous variables were assessed using Student's t-test.
- Chi square analysis and the two-tailed Fisher exact test were used to assess the correlation between symptoms and STIs. Odds Ratios were calculated.
- Multivariate stepwise logistic regression analysis was used for algorithm validation.
- The sensitivity, specificity, and positive predictive values were calculated for each proposed algorithm.

## IV Results

The survey was conducted from December 2000 to March 2001 in 7 provinces (Phnom Penh, Kandal, Kampong Cham, Battambang, Sihanoukville, Banteay Mean Chey and Pursat).

The survey results are presented below in the following sections:

1. *Sample description / demographic profile*
2. *Prevalence of STIs*
3. *Behavioral and clinical findings*
4. *Associations with STIs*
5. *Antibiotic susceptibility*

### IV-1 SAMPLE DESCRIPTION/DEMOGRAPHIC PROFILE

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The populations were chosen because of their perceived importance in development of the HIV/STI epidemics in Cambodia. The national response to the epidemics has emphasized the importance of commercial sex in transmission, and sex workers and their clients have been the focus of prevention interventions. Women who use reproductive health services are believed to be a lower risk group that more closely resembles the general population.

Brothel-based sex workers were selected from a sampling frame of enumerated brothels. These brothels are generally small operations with less than ten women each, and are commonly found in both small towns and in urban areas. Sex workers are highly mobile and there is frequent turnover at the brothels. Police work and/or reside in camps and bases of various size throughout the country. The uniformed services were identified as an important risk group early in the epidemic because of frequent unprotected commercial sex and rising HIV rates. Reproductive health clinics serve sexually active women in both rural and urban areas. Table IV-1.1 describes the sample obtained for each population.

**Table IV-1.1 Sample sizes, STI Prevalence Survey 2001, Cambodia**

Brothel-based sex workers	141
Police	165
Women at reproductive health clinics	451
Total	757

The three populations were very different in terms of demographic characteristics such as age, language, marital status, duration living at present location and age at first sex. These data are summarized in Table IV-1.2. Sex workers were younger, less likely to have ever been married and younger at first sex than the other groups. Women seen at reproductive health clinics and police were predominantly Khmer speaking while almost one-third of direct sex workers spoke Vietnamese as a first language. A majority of the police were over the age of 30. Because there is no longer recruitment of new police in the country, the age of this population is rising.

The social stability of RHC women and police stands in stark contrast to the high mobility of sex workers when responses on marital status and duration of residence are compared.

**Table IV-1.2 Demographic profile of study participants, STI Prevalence Survey 2001, Cambodia**

	Brothel-based Sex Workers	Police	RHC Women
<b>Sample (n)</b>	141	165	451
<b>Age (years)</b>			
mean	21.6	35.0	26.5
range	15-34	20-60	17-47
<b>Age group</b>			
<15	-	-	-
15-19	31.9	-	9.1
20-24	48.9	1.8	38.6
25-29	12.8	13.9	23.3
>=30	6.4	84.2	29.1
<b>Language</b>			
Khmer	68.8%	100%	98.9%
Vietnamese	31.2%	-	0.4%
Other	-	-	0.7%

**Table IV-1.3 Demographic profile of study participants, STI Prevalence Survey 2001, Cambodia**

	Brothel-based Sex Workers (n=141)	Police (n=165)	RHC Women (n=451)
<b>Marital status</b>			
Currently married	0.7%	91.5%	98.6%
Never married	56.7%	6.4%	0.7%
Divorced	38.3%	1.4%	0.7%
Separated	2.8%	-	0.7%
Widowed	1.4%	-	-
<b>Age at first sex</b>			
mean	17.7	22.5	20.9
range	14-26	17-36	15-34
<b>Age group (first sex)</b>			
<15	3.6%	-	-
15-19	81.5%	20.6%	42.8%
20-24	13.5%	41.2%	43.0%
25-29	1.4%	19.4%	11.1%
>=30	-	18.8	3.1%
<b>Length of time living here</b>			
median	8 months	120 months	-
range	0-252	18-384	-

## IV-2 PREVALENCE OF SEXUALLY TRANSMITTED INFECTIONS

STI prevalence rates for the sample are presented with 95% confidence intervals in Table IV-2.1. Low rates of non-ulcerative STIs were measured among police and RHC women - no gonorrhea was detected in either sample, and the prevalence of chlamydial infection and trichomonas was 3 percent or less. Clinical ulcers were rare in these two groups, syphilis seropositivity (any RPR titer confirmed by TPHA) was between 1 and 3 percent, and no primary syphilis was detected.

Gonorrhea and chlamydial infection were higher among direct sex workers than for the other groups with almost one in four having one or both infections. Genital ulcers on clinical examination were uncommon among sex workers, and again, no cases of primary syphilis were detected. To confirm these findings, vaginal swabs from sex workers were sent for multiplex PCR testing to detect carriage of genital ulcer disease (GUD) pathogens. No asymptomatic syphilis or chancroid was detected and only 2.4 percent of sex workers had evidence of herpes (HSV-2) infection.

**Table IV-2.1 STI prevalence , STI Prevalence Survey 2001, Cambodia**

	<b>Brothel-based Sex Workers n=141</b>		<b>Police n=165</b>		<b>RHC Women n=451</b>	
	Percent	(95%CI)*	Percent	(95%CI)*	Percent	(95%CI)*
<b>Gonorrhea (Ng)</b>						
PCR	14.2	8.7-19.6	0.0	0.0-2.2	0.0	0.0-0.8
<b>Chlamydia (Ct)</b>						
PCR	12.1	5.1-19.0	1.8	0-4.6	2.8	0.7-4.7
<b>Ng &amp;/or Ct</b>						
PCR	22.7	15.2-30.2	1.8	0-4.6	2.8	0.7-4.7
<b>Syphilis</b>						
RPR/TPHA seropos.	5.7	1.4-9.9	3.0	0.6-5.5	1.3	0.0-2.6
RPR titre >=1:8	2.8	0.0-6.2	0.0		0.7	0.0-1.4
<b>Syphilis</b>						
mPCR positive ulcer	0.0	0.0-2.6	0.0	0.0-2.2	0.0	0.0-2.8
mPCR (vaginal swab)	0.0	0.0-2.6	-	-	-	-
<b>Chancroid</b>						
mPCR positive ulcer	1.4	0.0-3.4	0.0	0.0-2.2	0.4	0.2-1.0
mPCR (vaginal swab)	0.0	0.0-2.6	-	-	-	-
<b>Herpes (HSV-2)</b>						
mPCR positive ulcer	0.7	0.0-2.1	0.0	0.0-2.2	0.4	0.2-1.0
mPCR (vaginal swab)	2.4	0.0-5.0	-	-	-	-
<b>Trichomonas</b>						
In-Pouch	2.1	0.0-4.5	-	-	2.7	1.2-4.2
<b>Any STI</b>						
Positive on any above	32.6	23.9-41.4	4.9	0.8-9.0	6.1	3.4-8.8

PCR - Polymerase Chain Reaction, mPCR - Multiplex Polymerase Chain Reaction,  
RPR - Rapid Plasma Reagin, TPHA - Treponema pallidum Hemagglutination Assay.

\*confidence intervals adjusted for cluster sample design effect.

Data were also collected on the prevalence of two reproductive tract infections (RTIs) that are not STIs but may be associated with sexual activity. Both bacterial vaginosis and vaginal candidiasis due to *Candida albicans* are conditions caused by disruptions of the vaginal flora, where organisms normally present in the vagina in low numbers become predominant. Practices and conditions such as vaginal douching, pregnancy and hormonal contraception can influence the prevalence of these conditions. Table IV-2.2 shows very different patterns of these endogenous reproductive tract infections (RTI) among sex workers and women attending RHC services.

**Table IV-2.2 Other reproductive tract infections detected in women, STI Prevalence Survey 2001, Cambodia**

	<b>Brothel-based Sex Workers</b> n=141		<b>RHC Women</b> n=451	
	Percent	(95%CI)	Percent	(95%CI)
<b>Bacterial vaginosis (score)</b>				
Positive (7-10)	56.7	48.1-65.3	11.6	6.6-16.6
Intermediate (4-6)	12.1	6.4-17.7	4.5	1.8-7.1
Negative (1-3)	24.8	17.4-32.3	82.9	77.7-88.0
No flora	6.4	2.1-10.6	0.9	0.0-2.0
<b>Vaginal candidiasis</b>				
Gram stain criteria only	12.7	6.7-18.7	38.9	30.1-47.5
Gram stain + vaginal DC**	6.0	1.5-10.5	25.7	20.8-31.0

*\*confidence intervals adjusted for cluster sample design effect.*

*\*\*reported symptom of vaginal discharge or clinical evidence on examination.*

### **IV-3 BEHAVIORAL AND CLINICAL FINDINGS**

The remaining sections explore many social and behavioral factors that may influence transmission and susceptibility to STI/HIV infection. In addition, data on STI symptoms noticed by patients and clinical signs detected by clinicians during examination are presented. Where possible, associations between these social, behavioral and clinical variables and laboratory STI results are investigated (section IV-4).

### ***Definition of partner types:***

- Client - A partner of a sex worker who paid money in exchange for sex with her less than five times
- Regular client - A partner of a sex worker who paid money in exchange for sex with her five or more times
- Sweetheart - A partner who is not a spouse and whom did not pay money in exchange for sex
- Commercial sex partner - A partner whom was paid money in exchange for sex

### ***Behavioral results - Brothel-based sex workers***

Social factors such as mobility and economic conditions influence a person's risk of STI and ability to adopt preventive behavior. This is particularly true for sex workers who often have little control over their work and living conditions. This section presents summaries of social and behavioral data as well as details of the clinical examinations that were performed.

A typical brothel-based sex worker surveyed in this study had worked as a sex worker before working at the present brothel. She had been living on average for about a year at her current location and had been working for about nine months at the present brothel. An average brothel in this survey employs seven sex workers (Table IV.3.1).

**Table IV.3.1 Brothel-based sex workers: Characteristics of sex work, STI Prevalence Survey 2001, Cambodia**

Duration in this city (n=141) - mean	12.6 months
range	0-108
Duration in this brothel (n=141) - mean	9.5 months
range	0-60
Age at first sex for money (n=139) - mean	20.0 years
range	14-31
Number of sex workers in this brothel (n= 133)	
mean	7.1
range	1-16
Worked other locations last 2 years (n=141)	71.6%
Ever looked for clients in hotel (n=141)	39.0%
Ever looked for clients in street (n=141)	7.8%
Ever looked for clients in restaurant (n=141)	3.6%

Women reported an average of 4 clients per day and the median payment received per client was 5000 riels (US\$1.25). This was equivalent to about 24 clients per week and a median weekly income of 126,000 riels (US\$31.50) as shown in table IV.3.2.

**Table IV-3.2 Brothel-based sex workers: Number of clients and earnings, STI Prevalence Survey 2001, Cambodia**

Number of clients last work day (n=141)	
mean	3.8
range	0-12
Earned last client (n=72)	Riels (US\$)
median	5,000 (1.25)
range	0 - 800,000 (0-200)
Earned last client (categories) (n=72)	
1000-5000 (\$0.25-1.25)	61.3%
5001-10000 (\$1.25-2.50)	12.9%
10001-20000 (\$2.50-5.00)	16.1%
>20000 (>\$5.00)	9.7%
Number of clients last week (n=141)	
mean	23.9
range	0-60
Weekly income (n=140)	Riels (US\$)
median	126,000 (31.5)
range	10,000 - 700,000 (2.50-175)
Weekly Income Groups (n=140)	
10,000-100,000 (\$2.50-25.00)	43.9%
100,001-200,000 (\$25.00-50.00)	30.9%
200,001-300,000 (\$50.00-75.00)	22.3%
>300,000 (>\$75.00)	3.9%

Condom use varied by type of client or partner as shown in the following tables. Self-reported condom use with clients was consistently high when probed in several ways (Table IV-3.3).

**Table IV-3.3 Brothel-based sex workers: Condom use with all clients, STI Prevalence Survey 2001, Cambodia**

Proportion of clients with whom condoms used last working day (n=117)	98.4%
Frequency of condom use with clients last working day (n=113)	
Every time	82.3%
Almost every time	17.7%
Sometimes	-
Never	-
Frequency of condom use with clients in last 30 days (n=141)	
Every time	70.9%
Almost every time	29.1%
Sometimes	-
Never	-
Condom use last time with clients (n=141)	95.7%

Among these clients, sex workers had some clients who were 'regulars' in this study defined as clients who had returned 5 or more times. Reported condom use was not significantly different with these regular clients compared to all clients.



**Table IV.3.4 Brothel-based sex workers: Condom use with regular clients, STI Prevalence Survey 2001, Cambodia**

Proportion of SWs with regular clients (n=140)	75.0%
Number of current regular clients - median	3
Range	0-30
Condom use last sex with regular client (n=111)	90.1%
Frequency of condom use with regular clients last 30 days (n=108)	
Every time	70.3%
Almost every time	25.9%
Sometimes	1.9%
Never	1.9%

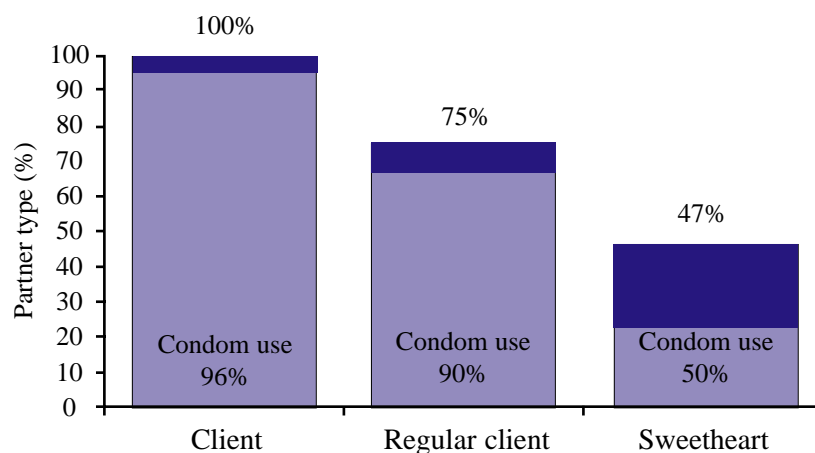
About half the sex workers reported having a sweetheart or boyfriend and only half of them used condoms with these partners.

**Table IV-3.5 Brothel-based sex workers: Condom use with sweethearts, STI Prevalence Survey 2001, Cambodia**

Proportion of SWs with boyfriend/sweetheart in past year (n=141)	46.8%
Condom use last sex with sweetheart (n=66)	50.0%
Frequency of condom use with sweetheart last 30 days (n=56)	
Every time	37.5%
Almost every time	12.5%
Sometimes	10.7%
Never	39.3%

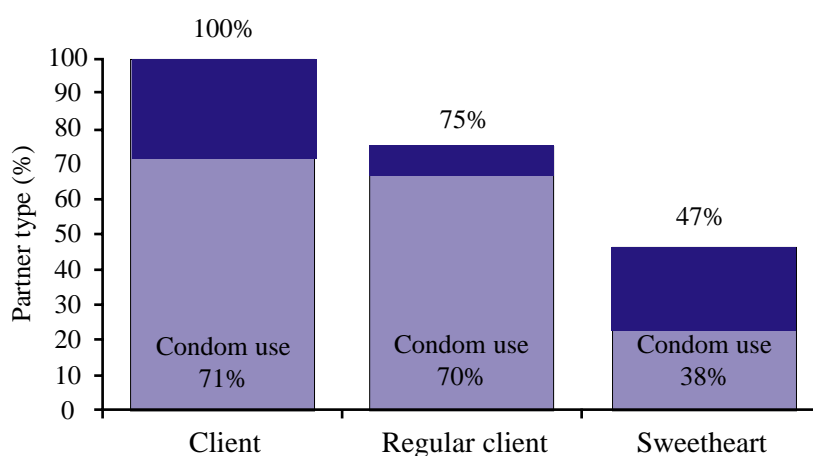
Figure IV-3.1 summarizes sex workers' responses on condom use at last sex by type of partner. All sex workers reported having clients and high levels of condom use with all clients, and with regular clients, were reported.

**Figure IV-3.1 Brothel-based sex workers: Reported sexual contacts and condom use last sex by type of partner, STI Prevalence Survey 2001, Cambodia**



Consistent condom use (every time during the past month) by type of partner is shown in Figure IV-3.2. These lower levels of condom use show that there is still opportunity for HIV/STI transmission to occur, particularly with potential bridging groups such as sweethearts.

**Figure IV-3.2 Brothel-based sex workers: Condom use always last month by type of partner, STI Prevalence Survey 2001, Cambodia**

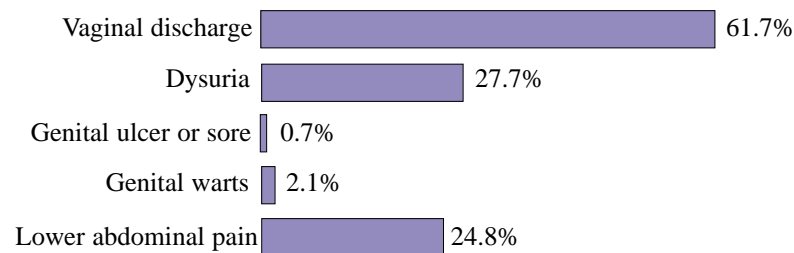


### *STI symptoms and clinical findings*

STI symptoms, clinical signs and risk assessment are sometimes used to assist in identifying persons who would benefit from STI treatment. The prevalence of these criteria is presented below and their association with actual STI is described in section IV.4.

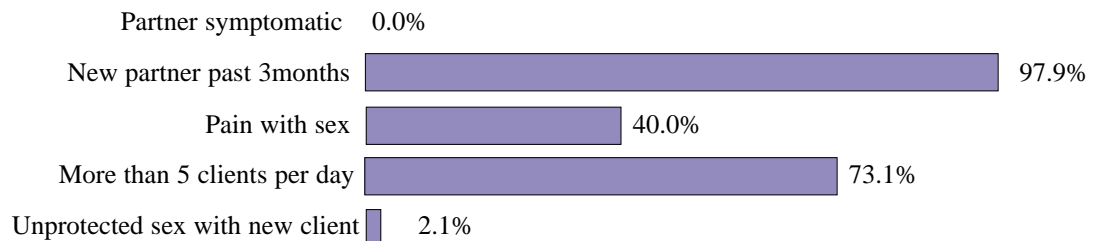
Sex workers reported a high prevalence of current STI symptoms (Table IV-3.6). When asked, almost two-thirds admitted to having vaginal discharge. Dysuria (painful urination) and lower abdominal pain were also common symptoms.

**Table IV-3.6 Brothel-based sex workers: Current genitourinary symptoms (n=141), STI Prevalence Survey 2001, Cambodia**



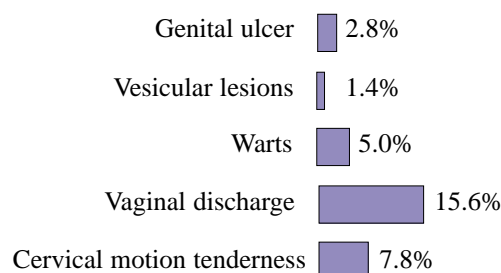
Use of risk assessment is problematic with sex workers since most score positive on commonly used risk criteria such as multiple or new sexual partners. In addition to these standard risk assessment questions, several others (pain with sex, more than 5 clients per day, unprotected sex with new client) were investigated to assess their validity in predicting STI. Table IV-3.7 shows nearly all sex workers had a new partner in the last three months, but that none of them was aware of STI symptoms in any partner. Other potential risk factors were commonly reported.

**Table IV-3.7 Brothel-based sex workers: Risk assessment (n=141), STI Prevalence Survey 2001, Cambodia**



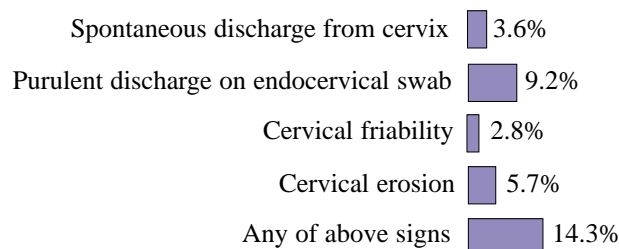
Clinical signs verified by the examining clinician were much less common than symptoms reported by participants (table IV-3.8). Only one in six was found to have abnormal vaginal discharge and other clinical signs were much less common.

**Table IV-3.8 Brothel-based sex workers: Clinical signs (n=141), STI Prevalence Survey 2001, Cambodia**



Signs of cervical infection on speculum examination were also relatively common (Table IV-3.9). Fourteen percent of sex workers (with a background prevalence of 23 percent cervical infection) had some evidence of cervical inflammation. Associations of signs and symptoms with STI are explored in section IV-4.

**Table IV-3.9 Brothel-based sex Workers: Signs of cervical infection (n=141), STI Prevalence Survey 2001, Cambodia**



### ***Behavioral results and clinical findings - Police***

Police and other uniformed services have been a focus of HIV prevention efforts in Cambodia. Mobility, income and influence with entertainment establishments make them a potentially important bridging group and previous surveys have documented both high-risk behavior and high STI/HIV prevalence.

Some of these factors are apparent in the results obtained from the police sample. Although over ninety percent of police had been living in the same place for more than five years and nearly all are currently living with a wife, the majority spends a week or more away from home each month. Reported condom use with wives is low.

**Table IV-3.10**  
**2001, Cambodia**

**Police: mobility and travel away from family, STI Prevalence Survey**

Duration in this city (n=165) - mean years	10.8
Duration of stay (grouped)	
0-2 years	3.0
2-5 years	6.1
5-10 years	46.1
>10 years	44.8
Marital Status (n=141)	
Currently married	91.5%
Divorced	6.4%
Separated	1.4%
Widowed	0.7%
Presently living with wife (n=141)	90.8%
Days per month away from family (n=129) - mean	8.5
Days per month away from family (grouped)	
0 days	30.2
1-7 days	19.4
8-15 days	41.9
16-30 days	8.5
Sex with wife last 3 months - all men (n=165)	72.1%
Sex with wife last 3 months - married men (n=128)	93.0%
Condom use last sex with wife (n=120)	13.3%
Condom use every time (n=120)	6.7%
Sex with wife last 12 months (n=129)	96.9%
Condom use every time (n=125)	5.6%

Four out of five police interviewed had had sex with a sex worker at some time, and over half had done so in the last year, usually at a brothel (Table IV-3.11). Condom use during last sex with a sex worker was nearly universal, however. The average price paid to the sex worker was 8000 riels (US\$2).

**Table IV-3.11 Police: Commercial partners: sex, condom use, venue and cost, STI Prevalence Survey 2001, Cambodia**

Ever had sex with sex worker (n=165)	79.4%
Sex with sex worker last 3 months (n=165)	23.6%
If yes, mean number	2.2
Range	1-7
Condom use last sex with sex worker (n=39)	97.4%
Condom use every time last 3 months (n=39)	87.2%
Sex with sex worker last 12 months (n=165)	43.6%
If yes, mean number	4
Range	1-20
Condom use every time last 12 months (n=72)	81.9%
Place usually meet sex worker (n=129)	
Brothel	69.0%
Massage Place	4.7%
Karaoke	8.5%
Hotel or guesthouse	17.1%
Street, park or garden	-
Place met sex worker last time (n=129)	
Brothel	68.2%
Massage Place	3.9%
Karaoke	10.1%
Hotel or guesthouse	17.1%
Street, park or garden	-
Price paid with last sex worker (n=113) - median	8,000 riels
Range	2500-400,000

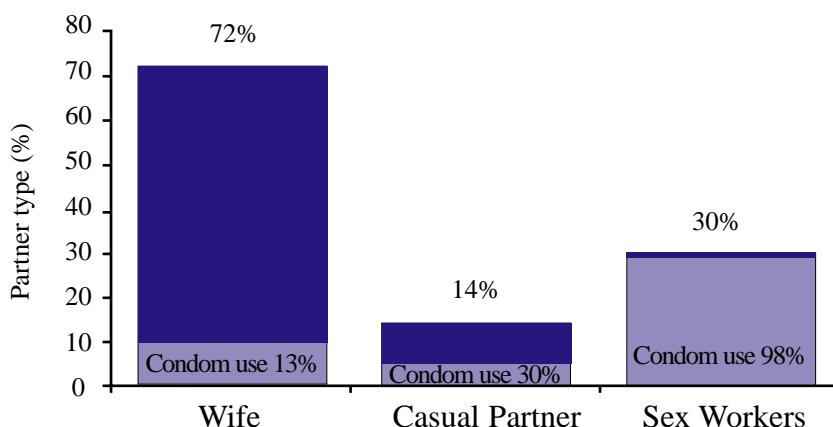
Almost half the police reported having sex with another partner who was not a wife or sex worker during the last year (Table IV-3.12). Condom use with these non-regular partners was much lower than with sex workers.

**Table IV-3.12 Police: Other partners: sex and condom use, STI Prevalence Survey 2001, Cambodia**

Ever had sex with partner other than wife or SW (n=165)	36.4%
Sex with another partner last 3 months (n=165)	13.9%
If yes, mean number	1.3
Range	1-3
Condom use last sex with another partner (n=23)	30.4%
Condom use every time last 3 months (n=23)	21.7%
Sex with another partner last 12 months (n=165)	17.0%
If yes, mean number	1.8
Range	1-10
Condom use every time last 12 months (n=28)	32.1%

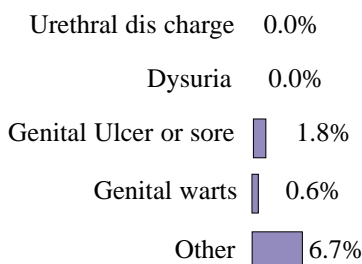
Figure IV-3.2 summarizes sexual contact and condom use at last sex (last 3 months) by type of partner reported by police.

**Figure IV-3.2 Police: reported sexual contacts last 3 months and condom use last sex by type of partner, STI Prevalence Survey 2001, Cambodia**



Despite reporting sex with non-regular partners and variable condom use, few police reported having genitourinary symptoms (Table IV-3.13). Clinical signs of STI were rare with no men having signs of urethral discharge, vesicles, warts or inguinal lymphadenopathy.

**Table IV-3.13 Police: Reported current genitourinary symptoms, STI Prevalence Survey 2001, Cambodia (n=165)**



### ***Behavioral results and clinical findings - Reproductive Health Clinic Attendees***

Women surveyed at antenatal and family planning clinics were found to have low prevalence rates of STI (Table IV-2.1). In contrast, non-sexually transmitted reproductive tract infections, particularly vaginal candidiasis, were common. Risk of STI for these women, as small as it is, appears to be related more to their husbands' behavior than to their own. The following responses to behavioral questions depict monogamous, married women with little personal risk behavior.

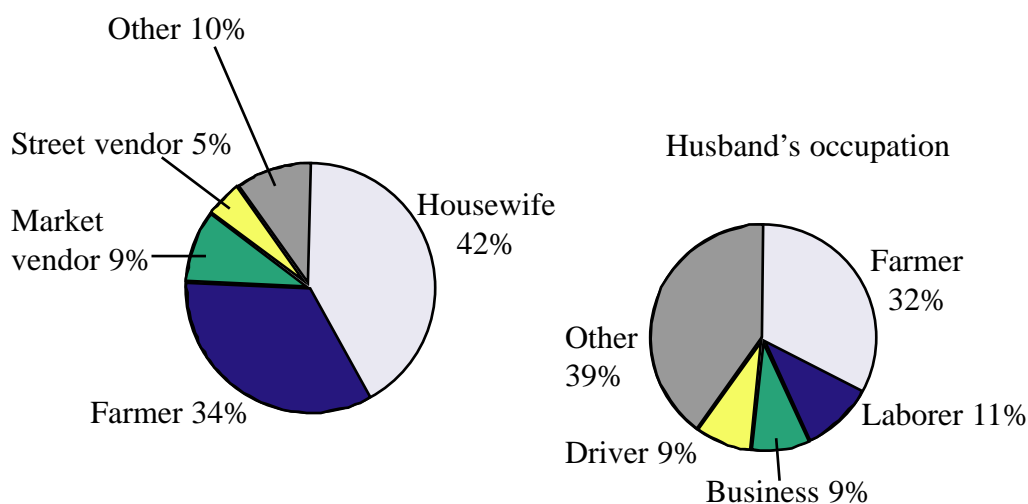
Nearly all were married and their husbands lived at home (Table IV-3.15). Less than a quarter reported that her husband goes out drinking and dancing or has sex with other women.

**Table IV-3.15 RHC attendees: Work and family life, STI Prevalence Survey 2001, Cambodia**

Presently married (n=450)	98.6%
Husband lives at home (n=445)	98.4%
Number of days in a month husband away (n=444)	
0 days	75.2%
1-7 days	16.0%
8-15 days	4.7%
16-30 days	4.0%
Thinks husband goes drinking and dancing (n=439)	
No	80.9%
Once a week	9.6%
Twice a week	4.8%
More than twice a week	4.8%
Thinks husband has sex with other women (n=438)	
Yes	18.7%
No	66.9%
Doesn't know	14.4%

Figure IV-3.3 shows the women's primary occupation and that of their husbands. Three- quarters of the women reported working at home or in the fields.

**Figure IV-3.3 RHC attendees: Main work (n=451)and husband's work (n=/445), STI Prevalence Survey 2001, Cambodia**



These women report sexual activity with their husbands but very low levels of condom use as shown in Table IV-3.16.



**Table IV-3.16 RHC attendees: Sex and condom use with husband, STI Prevalence Survey 2001, Cambodia**

Sex with husband last 3 months (n=444)	90.5%
Condom use last sex with husband (n=403)	2.2%
Sex with husband last 12 months (n=444)	98.4%
Condom use (n=437)	
Every time	0.2%
Almost every time	0.2%
Sometimes	8.0%
Never	91.5%

Ten percent reported ever having a sweetheart but few of these women admitted to having sex with one (table IV-3.18). None reported sex with a sweetheart in the past year.

**Table IV-3.17 RHC attendees: Sex with sweetheart, STI Prevalence Survey 2001, Cambodia**

Ever had sweetheart (n=451)	10.6%
Ever had sex with sweetheart (n=451)	1.6%
Sex with sweetheart last 12 mos (n=7)	0.0%
Condom use last sex with sweetheart	N/A

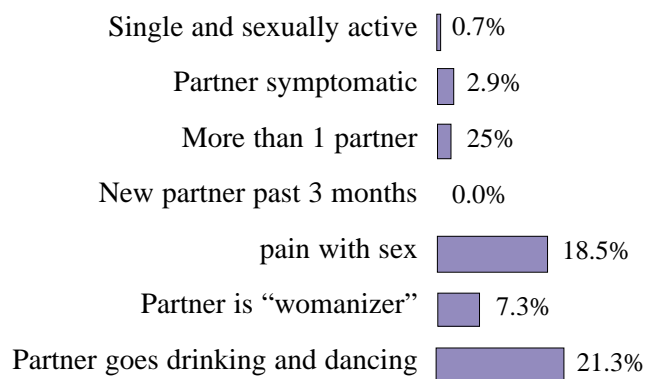
Despite low prevalence of STIs and low-risk behavior, the majority of women complained of RTI symptoms (Table IV-3.18). Half were symptomatic with vaginal discharge and a third complained of vaginal itching. These results are in line with the high prevalence of candidiasis that was detected by gram stain.

**Table IV-3.18 RHC clinic attendees: Reported current genitourinary symptoms, STI Prevalence Survey 2001, Cambodia (n=451)**

Vaginal discharge	52.8%
Dysuria	19.3%
Genital Ulcer or sore	0.2%
Genital warts	0.4%
Lower abdominal pain	13.6%
Vaginal Itchiness	35.7%

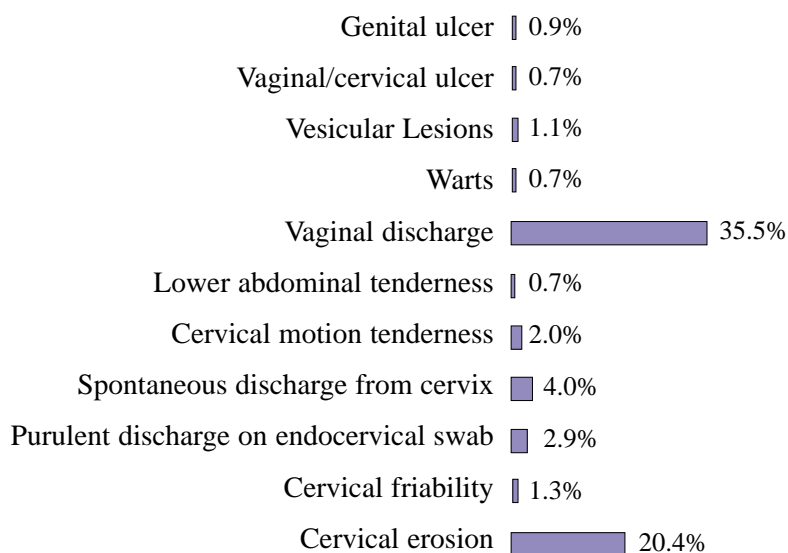
Risk assessment questions were asked of the women but the low number of STIs does not permit analysis of association between these criteria and infection. Only two factors ('partner goes drinking and dancing' and 'pain with sex') were acknowledged by more than ten percent of women (Table IV-3.19).

**Table IV-3.19 RHC clinic attendees: Risk assessment, STI Prevalence Survey 2001, Cambodia (n=449)**



Over one-third of women were found to have vaginal discharge and one-fifth cervical erosion on examination (Table IV-3.20). Other signs of RTI were uncommon. Presence of any vaginal discharge was associated with bacterial vaginosis (OR=1.7 p=0.04), and green (OR=5.1, p=0.01) or white discharge (OR=2.2, p=0.04) was associated with candidiasis. Three quarters of women said that they used vaginal douches and ten percent used vaginal antiseptic tablets (Salnophomine).

**Table IV-3.20 RHC clinic attendees: Clinical signs, STI Prevalence Survey 2001, Cambodia (n=451)**



#### IV-4 ASSOCIATIONS WITH SEXUALLY TRANSMITTED INFECTION

The low prevalence of STIs among police and RHC women makes determination of associations with infection difficult. Only in the sex worker group were there enough infections to make this possible. To increase the power of detecting significant association in the following tables, the sample of brothel-based (direct) sex workers was enlarged (using an oversample from 3 provinces) to give a total sample of 408 women among whom there were 97 cervical infections and 134 total STIs. As such, these results are not representative of the seven province sample but may be useful in improving STI care for sex workers in general. Significant and borderline significant results are in bold.

No significant associations were found between demographic variables and either cervicitis or any STI (Table IV-4.1)

**Table IV-4.1 Brothel-based sex workers: Association between demographic factors and STI, STI Prevalence Survey 2001, Cambodia**

	Cervical infection		Any STI	
	OR	95% CI	OR	95% CI
Age<21	0.82	0.52-1.3	1.2	0.77-1.8
Worked in other location last 2 years	1.1	0.64-1.8	0.79	0.50-1.3
Seeks clients in hotel	0.98	0.62-1.6	0.81	0.53-1.2
Seeks clients on street	2.1	0.82-5.5	2.1	0.85-5.3
Seeks clients in restaurant	2.1	0.69-6.1	1.8	0.62-5.2

*Cervical infection: gonorrhea and/or chlamydia*

*Any STI: any of gonorrhea, chlamydia, syphilis, chancroid, HSV-2, trichomonas*

There were no associations found between reported behavior and either cervical infection or any STI (Table IV-4.2).

**Tabel IV-4.2 -Brothel-based sex workers: Association between reported behavior and STI, STI Prevalence Survey 2001, Cambodia**

	Cervical infection		Any STI	
	OR	95% CI	OR	95% CI
Condom use last client	1.6	0.58-4.3	0.60	0.24-1.5
Condom use every time with client last 30 days	0.77	0.47-1.3	0.69	0.44-1.1
Has regular clients	1.5	0.90-2.5	0.91	0.59-1.4
Condom with last regular	0.75	0.30-1.9	0.54	0.23-1.3
Has sweetheart	1.2	0.76-1.9	0.93	0.61-1.4
Condom with sweetheart	1.0	0.56-1.8	0.88	0.50-1.5

Fever was the only reported symptom associated with cervical infection. Both fever and itching were associated with presence of any STI.

**Table IV-4.3 Brothel-based sex workers: Association between genitourinary symptoms and STI, STI Prevalence Survey 2001, Cambodia**

	Cervical infection		Any STI	
	OR	95% CI	OR	95% CI
Vaginal discharge	1.1	0.68-1.8	0.94	0.61-1.4
Dysuria	1.5	0.93-2.5	1.2	0.77-1.9
Lower abdominal pain	1.0	0.61-1.6	0.99	0.63-1.6
<b>Fever</b>	<b>3.5</b>	<b>1.4-8.4</b>	<b>4.1</b>	<b>1.6-10.2</b>
Itching	1.5	0.92-2.3	<b>1.5</b>	<b>1.0-2.3</b>

None of the hypothesized risk factors was associated with either cervical infection or any STI.

**Table IV-4.4 Brothel-based sex workers: Association between risk factors and STI, STI Prevalence Survey 2001, Cambodia**

	Cervical infection		Any STI	
	OR	95% CI	OR	95% CI
Partner symptomatic	1.7	0.0-13.0	4.4	0.40-49
Pain with sex	1.2	0.77-1.9	1.1	0.72-1.7
More than 5 clients per day	1.3	0.84-2.2	1.1	0.73-1.7
Unprotected sex with new client	1.2	0.74-1.8	1.2	0.78-1.8

Clinical signs on examination that were associated with cervical infection included cervical discharge, friability and erosion.

**Table IV-4.5 Brothel-based sex workers: Association between clinical signs and STI, STI Prevalence Survey 2001, Cambodia**

	Cervical infection		Any STI	
	OR	95% CI	OR	95% CI
Vaginal discharge	1.4	0.82-2.5	1.4	0.82-2.3
<b>Purulent cervical discharge</b>	<b>17.0</b>	<b>2.4-148</b>	<b>10.7</b>	<b>1.2-92</b>
Purulent discharge on endocervical swab	1.4	0.64-3.1	1.0	0.47-2.2
<b>Cervical friability</b>	<b>1.6</b>	<b>0.99-2.6</b>	1.4	0.92-2.3
<b>Cervical erosion</b>	<b>2.7</b>	<b>1.3-5.4</b>	1.8	0.91-3.6
Cervical motion tenderness	1.2	0.55-2.5	1.1	0.54-2.1

In logistic regression analysis only clinical signs of purulent cervical discharge, cervical erosion and symptom of fever were significantly associated with cervical infection. An algorithm with these diagnostic criteria had a sensitivity of 30% (29/97) and positive predictive value

(PPV) of 48% (29/60). In addition, the validity of two other illustrative screening algorithms are compared in Table IV-4.6.

**Table IV-4.6 Brothel-based sex workers: Validity of 3 illustrative screening algorithms, STI Prevalence Survey 2001, Cambodia**

Algorithm	Criteria	Sensitivity	Specificity	PPV	NPV
1	Purulent cervical discharge Cervical erosion Fever as a symptom	29.9	90.0	48.3	80.5
2	Purulent cervical discharge Cervical erosion	20.6	93.2	48.8	83.3
3	Purulent cervical discharge Cervical erosion Cervical friability	47.4	80.5	32.4	80.1

#### **IV-5 ANTIMICROBIAL SUSCEPTIBILITY**

The antimicrobial susceptibility of *N. gonorrhoeae* was evaluated on 41 strains collected from the combined samples of all groups. Results show reduced sensitivity to ciprofloxacin but continued high sensitivity to currently recommended drugs (cefixime/ceftriaxone and spectinomycin).

**Table IV-5.1 Antimicrobial Resistance Pattern of *N. gonorrhoeae* (MIC), STI Prevalence Survey 2001, Cambodia**

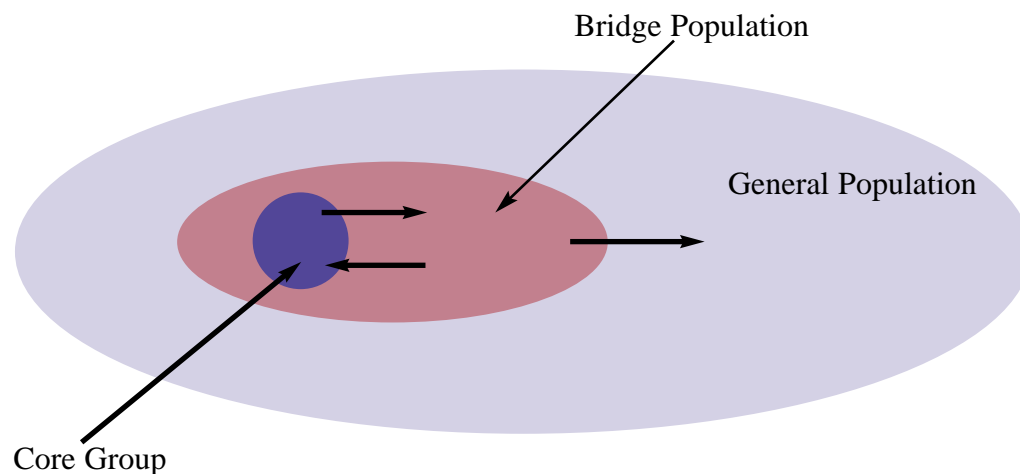
	Sensitive n(%)	Reduced sensitivity n(%)	Resistant n(%)
Ciprofloxacin	2 (4.9)	19 (46.3)	20 (48.8)
Norfloxacin	2 (4.9)		39 (95.1)
Ceftriaxone	41 (100)		
Penicillin	9 (22.0)		32 (78.0)
Tetracycline			41 (100)
Spectinomycin	41 (100)		
Kanamycin	37 (90.2)	4 (9.8)	
Gentamycin	41 (100)		

## V Discussion

Cambodia is making serious efforts to confront the challenge of an HIV epidemic that has evolved rapidly to attain the highest seroprevalence in Asia. Many of the common, curable STIs facilitate HIV spread by increasing both efficiency of transmission and vulnerability to infection. Control of these infections has thus been accorded high priority as an HIV prevention strategy in Cambodia and a comprehensive yet focused strategy to reduce transmission opportunities is being implemented.

Since early in the Cambodian epidemic, behavioral and HIV prevalence surveys have documented high levels of commercial sex activity as well as high HIV prevalence among sex workers and male occupational groups that report frequent commercial sex contact. These findings suggested that clients of sex workers were acting as an important bridging group between high transmission networks and the general population [21] (Figure V.1).

**Figure V-1 Sexual networks and STI/HIV transmission**



To the extent that HIV and STI transmission is concentrated in commercial sex networks, interventions that effectively reach those networks would be most effective in reducing that transmission, as well as slowing onward transmission to the general population [22]. This situation analysis was used to advocate for a targeted STI control and HIV prevention strategy as the most appropriate response for a country with an HIV epidemic in a rapid growth phase. Cambodia's strategy was thus designed to focus prevention resources on core and bridging groups (or 'spread networks') while appropriate services for 'maintenance networks' in the general population are also developed. This phase specific approach is outlined below [6].

**Table V-1. Phase-specific strategies for the prevention, control and elimination of sexually transmitted infection - Cambodia's response**

	<b>Strategies for "Spread Networks"</b>	<b>Strategies for "Maintenance Networks"</b>
<b>Cambodia's response to an STI epidemic in Phase II (hyper endemic) and an HIV epidemic in Phase I (growth)</b>	<ul style="list-style-type: none"> <li>• Outreach to brothel-based sex workers and indirect sex workers with condom promotion</li> <li>• STI treatment provision and training of health care providers to SWs.</li> <li>• Condom social marketing with explicit outlets in brothels and bars.</li> <li>• FSW, MSM, military, police and select work-place peer-education.</li> <li>• Community mobilization of FSW</li> <li>• STI management training of military physicians.</li> <li>• 100% condom brothel policy</li> <li>• Free HIV VCT services in 5 major cities available</li> </ul>	<ul style="list-style-type: none"> <li>• HIV mass media campaigns</li> <li>• Condom social marketing</li> <li>• General population STI treatment guide lines developed and training of HCP. (Implementation limited by lack of antibiotics)</li> <li>• Free HIV VCT services available in 5 major cities</li> <li>• Integration of HIV/STI education into reproductive health programs</li> </ul>

In order to monitor the impact of its HIV prevention interventions, NCHADS developed surveillance systems that follow rates of HIV prevalence as well as associated behaviors among key sectors of the population. The 2001 STI Prevalence Survey provides information on a third epidemiologic dimension - that of sexually transmitted infections - that is important in HIV prevention. STIs act as cofactors that facilitate HIV transmission, and monitoring of STI prevalence provides a direct indicator of the success of these control efforts. In addition, STIs respond to the same behavioral interventions as HIV - often much more rapidly - and their surveillance can provide important and timely information for measuring the success of prevention programs. For these reasons, WHO recommends second generation surveillance systems that monitor trends of STI and related behaviors in addition to HIV seroprevalence, especially in subgroups of the population at greatest risk of infection.

The 2001 STI Prevalence Survey was conducted using rigorous methods to achieve reliable measurements that reflect actual prevalence rates and are representative of the populations surveyed. The sample was drawn from seven provinces with proportional representation. Highly sensitive tests were used to detect both symptomatic and asymptomatic infection among the populations surveyed. All aspects of field and laboratory work were closely monitored to ensure high quality.

There are a few limitations to consider when evaluating trends. An effort was made to adapt the survey protocol to maximize comparability with other sources of STI and behavioral data. Many of the behavioral indicators were taken from BSS questionnaires and the STI testing methods were the same as used in the 1996 STI prevalence survey. It was not possible, however, to conduct population-based sampling in 1996 because of security reasons. Although study participants were selected from similar sites

(brothels, police stations, antenatal and family planning clinics) in both rounds, the 1996 results reflect a convenience sample that is less representative of the underlying populations and not directly comparable to 2001 results. There were also some geographic differences between the two STI prevalence surveys. Interpretation of trends during this period must take these methodological differences into account.

Despite differences in sampling, the survey results support three important assertions about STI prevalence in Cambodia:

- That STI rates are low, both in absolute terms and in comparison to previous data. This is encouraging evidence that control programs are having an impact on disease transmission.
- That reported behavior is consistent with the declining trends of risk behavior that have been documented by serial rounds of BSS and helps explain the observed low rates of STI and declining HIV seroprevalence trends.
- That the majority of the STIs that were detected were asymptomatic, lacked obvious clinical signs and were not associated with behavioral risk factors other than sex work. This has important implications for STI control programs.

The prevalence of sexually transmitted infections should be interpreted in light of their underlying transmission dynamics. STIs are not equal in terms of infectiousness or susceptibility to control, nor in their potential to facilitate HIV infection. STI transmission is a function of the infectiousness of the organism, the duration of infection and the rate of partner change in susceptible populations as described in the reproductive rate formula  $R_0 = \beta c D$  [21]. These parameters can be modified by interventions to reduce the overall reproductive rate of the STI pathogen - when the reproductive rate is reduced to below one, the prevalence of the disease declines in the population. Importantly, these dynamics vary significantly from one STI to another.

The lowest prevalence rates seen in this survey, both in absolute terms and in comparison to 1996 rates, were for clinical genital ulcers and for gonorrhea. No case of primary syphilis was detected among the entire sample of men and women and reactive syphilis serology (reactive RPR at any titer confirmed by TPHA) ranged from 1.3% in RH women to 5.7% among sex workers. These rates are low by regional standards, and less than half the 1996 prevalence for each of the groups surveyed.

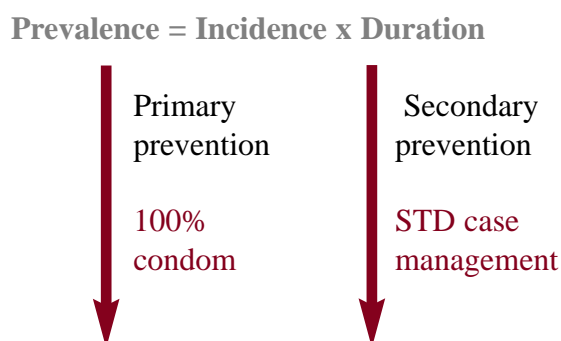
No ulcerative STIs were seen among police (n=165) examined in the sample. Two cases each of chancroid and HSV-2 were seen in the entire sample of RHC women (n=451) and only 2 chancroid and 1 HSV-2 among sex workers (n=141). Such low rates of clinically apparent genital ulcer disease (GUD) among sex workers are surprising, especially in a population with low rates of male circumcision. In contrast, 59 clinically apparent genital ulcers were detected in 1996 (n=1083).



Since genital ulcer rates, especially chancroid, are often highest in sex worker populations, an additional screening test was performed to look for evidence of genital ulcer disease pathogens in vaginal swab specimens from the brothel-based sex worker sample. An additional 2 tested positive for HSV-2 but no new chancroid or syphilis infections were identified. Such low prevalence of GUD in brothel settings - especially in populations where GUD was recently common - is an encouraging indicator that effective STI prevention and control are being applied. These findings are especially important for HIV prevention since, as HIV cofactors, genital ulcers have been more strongly associated with HIV transmission than non-ulcerative STIs.

The prevalence of any STI (including HIV) varies according to incidence of new infections and the average duration of infection (Figure V-2).

**Figure V-2 Factors influencing STI prevalence**



Effective STI treatment reduces transmission by decreasing the duration of infection during which new partners can be infected. Access to effective STI treatment has been improved since 1997 when NCHADS strengthened STI case management protocols. In addition to algorithm standardization and training, an effective third generation cephalosporin (cefixime) was made available since the 1996 survey showed high levels of gonococcal resistance to widely used quinolone antibiotics. As with other interventions, strengthening of STI case management was prioritized to areas of high commercial sex activity.

In the 2001 survey, gonorrhea prevalence was also low, both by culture and by the more sensitive PCR assay. No cases of gonorrhea were detected by either method among police and RHC women. Prevalence among brothel-based sex workers was 14.2%, a little more than half the rate measured previously. Continued high rates of quinolone resistance but no resistance to cephalosporins was found in this survey.

Other interventions that reduce STI transmission include condom use (by decreasing infectiousness), and reducing rates of partner change. NCHADS activities target all three areas and behavioral surveillance surveys have shown a positive change in relevant indicators. Condom use in commercial sex has increased dramatically since 1996 and men report fewer commercial sex contacts [7]. These behavioral trends were confirmed in the 2001 STI prevalence survey.

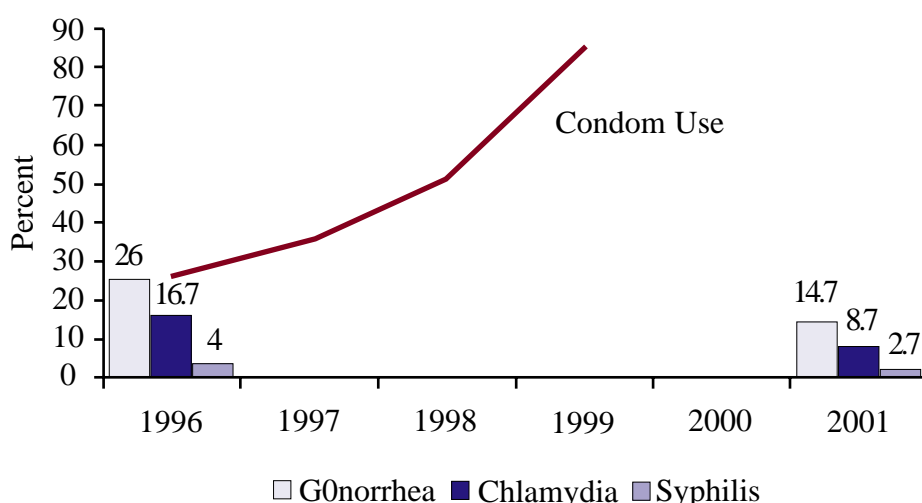
The prevalence of chlamydial infection, while low, was closer than other STIs to rates measured in 1996. Possible explanations include a high proportion of asymptomatic infection, and other epidemiologic characteristics of the organism. For example, chlamydia has a long duration of infection and requires lower rates of partner change to maintain itself in a population. It is thus less influenced by interventions within commercial sex networks. Chlamydia is also the only common curable STI not currently treated with single dose therapy and poor compliance may result in incomplete cure.

The STI prevalence rates reported here are low in absolute terms as well as in comparison to 1996. Could these low rates be due to laboratory error or to transport problems that reduced the sensitivity of the tests? To answer this question, all results were analyzed to check for consistency with clinical findings and with other laboratory data. Detailed physical examination findings revealed very low rates of clinically apparent STI. For STI where data were available from more than one test, the results were compared. For gonorrhea, for example, culture was found to be 99% specific compared to PCR but only 56% sensitive - PCR detected an additional 29 positive GCs that were negative by culture. Also, low rates of RPR/TPHA positive syphilis serology are compatible with findings of low genital ulcer prevalence among which no cases of primary syphilis were detected.

These findings of low STI prevalence are consistent with recent behavioral [7] and HIV seroprevalence [2] trends. Consistent condom use in commercial sex increased from less than 50 percent in 1996/7 to 78 percent (reported by sex workers) and 81 percent (reported by high risk men) in 1999. During this period, commercial sex contact in the past month decreased by 26-50 percent for moto-taxi drivers, police and military. Such behavior change, along with improvements in STI case management, would certainly limit opportunities for STI transmission.

Between 1997 and 2000, HIV seroprevalence decreased 28 percent (from 3.2 to 2.3 percent) among antenatal women, 48 percent (from 6 to 3.1 percent) for police, and 21 percent (from 39.3 to 31.1 percent) among direct sex workers. [2] During the same time period consistent condom use in commercial sex transactions increased among all populations. Figure V-4 shows consistent condom use and the prevalence of three common STIs for direct sex workers in Phnom Penh during this period.

**Figure V-4 Brothel-based sex workers, Phnom Penh: STI prevalence and reported consistent condom use\*: STI Prevalence Survey 1996, 2001, Behavioral Surveillance Survey 1997-1999, Cambodia**



\* Consistent condom use defined as using a condom every time with all clients in the past week

The trends from these both these sources of surveillance data are consistent. Such triangulation of data from different sources supports a plausible epidemiologic picture. Safer behavior in commercial sex would reduce both STI and HIV risk for sex workers. Lower STI prevalence would reduce the efficiency of HIV transmission and further slow transmission.

In order to examine potential bias due to geographic differences between 1996 and 2001, we looked at regional differences. Sex workers are highly mobile in Cambodia as indicated by the average time at their present brothel (9 months). There is also evidence that women are regularly moved between brothels for purely business reasons (in an effort to maintain novelty for the clientele). Whatever the reasons, mobility would tend to homogenize regional differences, and it was found that STI prevalence among sex workers in the survey did not, in fact, differ significantly between regions.

The relative contribution of behavior change and STI control to this decline is more difficult to estimate. High rates of condom use reported in commercial sex would greatly limit HIV transmission opportunities. Reported condom use may be overestimated, however, and lower rates of condom use are reported with sweethearts and among indirect sex workers. Low prevalence of ulcerative and non-ulcerative STIs is important in these situations. Where condoms are not used, absence of cofactors that facilitate HIV transmission and acquisition may reduce the efficiency of heterosexual HIV transmission to rates comparable to those seen in other regions with low background STI prevalence.

In summary, three sources of data - HSS, BSS and the STI Prevalence Survey - point in the same direction and strongly suggest that efforts to encourage safer sexual behavior and improve the control of STIs are having an impact on the sexual transmission of a range of STIs - including HIV infection - in Cambodia.

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