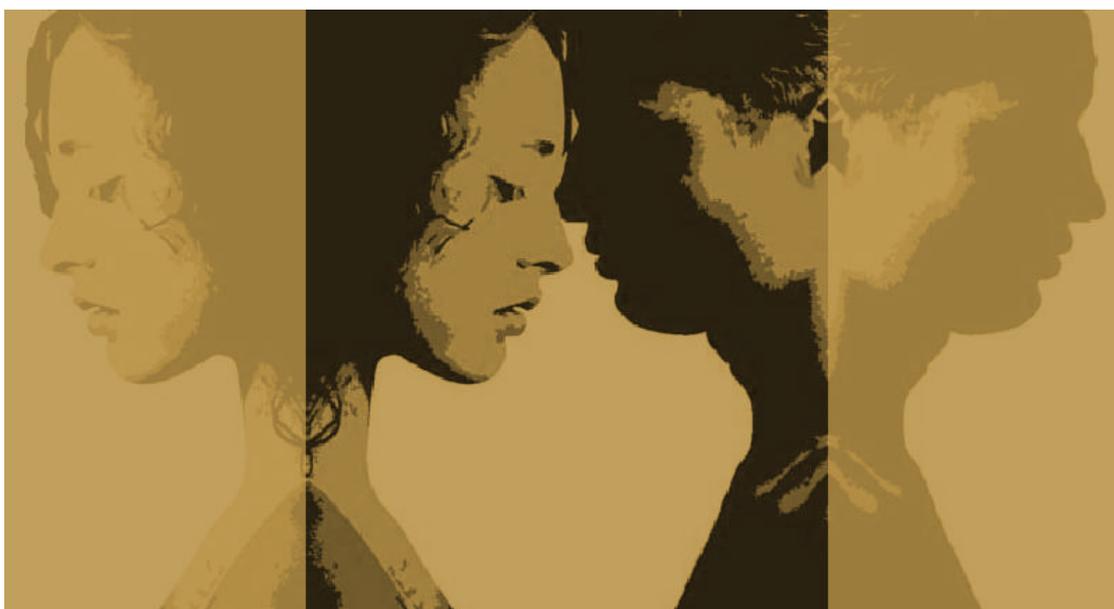




**World Health Organization  
Regional Office for the Western Pacific**

**National Center for STD and Leprosy Control  
Ministry of Health  
of the People's Republic of China**

# STI/HIV



**PREVALENCE SURVEY OF SEXUALLY TRANSMITTED  
INFECTIONS AMONG FEMALE SEX WORKERS AND  
TRUCK DRIVERS IN CHINA  
1999-2000**

**September 2001**

## **ABBREVIATIONS AND ACRONYMS**

ELISA	enzyme-linked immuno-sorbent assay
IDU	injecting drug users
PCR	polymerase chain reaction
PID	pelvic inflammatory disease
RPR	rapid plasma reagin
STI	sexually transmitted infection
TPHA	treponema pallidum haemagglutination assay



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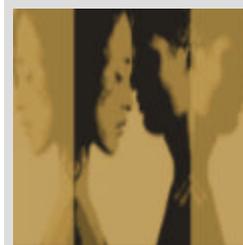


## EXECUTIVE SUMMARY

A cross-sectional sexually transmitted infection (STI) prevalence survey was conducted by the National Center for STD and Leprosy Control, China, in conjunction with the Kunming Institute of Dermatology, Yunnan Province, and the Tongling Institute of Dermatology, Anhui Province, China. A total of 505 female sex workers, recruited in Kunming from November 1999 to May 2000, and 550 male truck drivers, recruited in Tongling from February to May 2000, participated in the survey. All eligible participants gave written informed consent.

Demographic, behavioural and clinical information of the participants was gathered by direct interviews. Tampon swabs and blood samples were collected from the women. Urine and blood samples were collected from the men. Tampon swabs were tested using the polymerase chain reaction (PCR) technique for *Chlamydia trachomatis*, *Nesseria gonorrhoeae* and *Trichomonas vaginalis*. Urine was tested with PCR for *C. trachomatis* and *N. gonorrhoeae*. Blood was tested for syphilis using rapid plasma reagin (RPR) serology as the screening test, and *Treponema pallidum* haemagglutination assay (TPHA) as a confirmatory test. HIV testing was carried out using enzyme-linked immuno-sorbent assay (ELISA) and, if positive, Western blot for confirmation. Free treatment was provided to study participants diagnosed with an STI.

Among female sex workers, the most prevalent STI was *Chlamydia trachomatis* (58.6%), followed by *Trichomonas vaginalis* (43.2%) and *Neisseria gonorrhoeae* (37.8%). Twenty-five per cent had co-infection with both gonorrhoea and chlamydiosis; 10% were positive for HIV infection, all injecting drug users (IDUs); and 9.5% had treponemal seropositivity. The highest prevalence of chlamydial infection or gonorrhoea was observed among the 15-19 and the 19-24 age groups.



Among truck drivers, no positive HIV infection was found. The most prevalent STI was chlamydia (10.2%), followed by gonorrhoea (7.8%). Treponemal seropositivity was low (0.7%). Two per cent had co-infection with both gonorrhoea and chlamydia.

A high prevalence of STI was observed among sex workers and men at higher risk of infection. Sentinel surveillance and passive case-reporting need to be complemented by further STI surveys among specific populations. Policies and prevention strategies for STI/HIV need to focus on high-risk sub-populations, such as IDUs, sex workers (particularly sex workers who inject drugs) and clients.

## **ACKNOWLEDGEMENTS**

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## INTRODUCTION

Sexually transmitted infections (STIs) are a major public health concern in the developing world. It has been estimated that more than 35 million new STI cases occurred in the Western Pacific Region in the 1990s. STIs have consistently ranked among the five most important causes of adults seeking health care and of healthy productive lives lost<sup>1</sup>. In recent years, epidemiological studies have shown that persons with ulcerative and non-ulcerative STIs are more susceptible to HIV. People with HIV and non-ulcerative STIs have increased shedding of HIV-infected cells and greater efficiency in transmitting the virus<sup>2</sup>. The association between STIs and HIV is strongest for those infections that cause genital ulceration,<sup>3-5</sup> but has also been demonstrated for infections such as gonorrhoea, chlamydiosis and trichomoniasis. Prevention and treatment of STIs are efficient and cost-effective ways to contain the HIV epidemic. In order to formulate STI and HIV control strategies and programmes, it is useful to understand the epidemiology of STIs and to estimate the prevalence of the various etiological agents responsible for STIs in the local community, particularly among high-risk populations.

China covers an area of 9.6 million square kilometres and extends about 4000 kilometres from north to south and 4800 from east to west. Land frontiers extend for 20 000 km and are shared with Afghanistan, Bhutan, the Democratic People's Republic of Korea, India, Kazakhstan, Kyrgyzstan, the Lao People's Democratic Republic, Mongolia, Nepal, Pakistan, the Russian Federation, Tajikistan and Vietnam. The country had an estimated population of 1.22 billion in 1996, of which about 70% lived in rural areas. In 1996, the crude birth rate was 17 per 1000 population, the death rate was 6.6 and the growth rate was 10.4.

The epidemiology of STIs in China is not well defined, with only a few prevalence surveys,<sup>6-8</sup> in which small size samples were investigated with non-standardized protocols, having been conducted. Based on the National STI Surveillance System, more than 600 000 to 800 000 new infections have been reported annually in recent years and there was an almost fourfold increase in reported STIs from 1990 to 1998 (from 14 to 51 cases per 100 000 persons).<sup>9</sup> The most commonly reported STI is gonorrhoea (40.7 % of the 837 357 reported STIs in 1999).<sup>10</sup>



It is estimated that about 600 000 people in China were living with HIV infection in 2000. Surveillance of STI and HIV infections concentrates on passive case-reporting and sentinel site surveillance. It is acknowledged that reported STI and HIV infections make up only a small portion of the real number and that there is a need to strengthen STI and HIV surveillance and information systems. One strategy to improve surveillance is to conduct periodic baseline prevalence studies of selected STIs.

This report details the findings of the STI prevalence survey conducted during 1999–2000 among female sex workers in Kunming City, Yunnan Province, and long-distance truck drivers in Tongling City, Anhui Province. The majority of the female sex workers were recruited from among those arrested because of their illegal commercial sex activities. All truck drivers in the Tongling local transportation company were recruited. Although caution should be used in extrapolation of these results to similar population groups in China, the findings of the survey can be used in refining STI prevention and control measures and revising disease prevalence estimates among high-risk populations.

## **STUDY INVESTIGATORS**

The study was supported by the World Health Organization Regional Office for the Western Pacific, coordinated by the Ministry of Health and implemented by the National Center for STD and Leprosy Control with the assistance of the Kunming Institute of Dermatology and Tongling Institute of Dermatology. The principal investigators were Drs Zhang Guocheng, Liang Guojun and Yin Yueping. The study team comprised staff members from the National Center for STD and Leprosy Control, Nanjing, Jiangsu Province, the Kunming Institute of Dermatology, Yunnan Province, and Tongling Institute of Dermatology, Anhui Province (see Table 1).





**Table 1: Study Team and Technical Support Group for STI Prevalence Survey**

Name	Affiliation	Role
Dr Zhang, Guo-cheng	National Center for STD and Leprosy Control	Principal Investigator / Executive Director-General
Dr Liang Guo-jun	National Center for STD and Leprosy Control	Co-Principal Investigator / Head of Surveillance Unit
Dr Yin Yue-ping	National Center for STD and Leprosy Control	Co-Principal Investigator / Head of Referral Laboratory
Dr Chen Xiang-sheng	National Center for STD and Leprosy Control	Study coordinator / epidemiologist
Dr Gong Xiang-dong	National Center for STD and Leprosy Control	Clinician
Dr Li Hua-sheng	Kunming Institute of Dermatology, Kunming, Yunnan Province	Director of the Institute Organization on Kunming site
Dr Zhang We-ying	Tongling Institute of Dermatology, Tongling, Anhui Province	Director of the Institute Organization on Tongling site
Mrs Shi Mei-qin	National Center for STD and Leprosy Control	Referral Laboratory
Mrs Yu Yan-hua	National Center for STD and Leprosy Control	Referral Laboratory
Mr Wei Cong	Kunming Institute of Dermatology, Kunming, Yunnan Province	Chief Technician
Mr Wu Shouqiang	Tongling Institute of Dermatology, Tongling, Anhui Province	Chief Technician

## OBJECTIVES

- (1) to provide baseline data to monitor trends and impacts of STI prevention and control programmes:
  - to determine the baseline prevalence rates of gonorrhoea, chlamydiosis, treponemal seropositivity and HIV infection among a group of female sex workers and male truck drivers in China; and
  - to determine the prevalence rate of trichomoniasis among female sex workers;
- (2) to analyse demographic and behavioural factors related to the STI infections in specific populations;
- (3) to strengthen the capacity for epidemiological assessment and surveillance for STIs in China; and
- (4) to strengthen the technical capacity of epidemiological, laboratory, and clinical based study investigators.

Sexually transmitted infections included:

- *Neisseria gonorrhoeae* (gonorrhoea), *Chlamydia trachomatis* (chlamydiosis) *Trichomonas vaginalis* (trichomoniasis);
- Syphilis: as reflected by prevalence of treponemal seropositivity; and
- Human immunodeficiency virus (HIV).

The STIs were included in the prevalence survey because they are curable, and are primarily sexually transmitted. In addition, chlamydiosis and trichomoniasis are often asymptomatic in men and women.



## METHODS

### STUDY POPULATION AND STUDY PROCEDURE

A cross-sectional study was undertaken to determine by laboratory confirmation the prevalence of the selected STIs. A total of 505 female sex workers, arrested by public security forces in Kunming, Yunnan Province, were recruited from November 1999 to May 2000. A sample of 550 male truck drivers attending their annual routine physical examination in Tongling, Anhui Province, participated in the surveys from February to May 2000.

The protocol of the study was reviewed and approval granted by the ethics committee for each participating institution, i.e. the National Center for STD and Leprosy Control, the Kunming Institute of Dermatology and the Tongling Institute of Dermatology. Participation in the study was voluntary and informed consent was obtained from all eligible participants prior to data and sample collection. Participants completed a confidential interview administered by trained interviewers to obtain demographic, behavioural and other information. Vaginal swabs and blood specimens were also taken.

The STI prevalence surveys in the field were organized by the study team in cooperation with the local government.



## **SPECIMEN COLLECTION, TRANSPORTATION AND PREPARATION**

After a routine clinical examination for STI signs and symptoms, a 5ml blood sample was obtained from each participant. Sera were separated by centrifugation at 3000 rpm for 10 minutes.

A vaginal swab was taken from each female sex worker, with a tampon inserted and immediately withdrawn and placed in 15ml of transport medium (0.14 M NaCl, 3 mM KCl, 10 mM Na<sub>2</sub>HPO<sub>4</sub>, 2 mM KH<sub>2</sub>PO<sub>4</sub>).<sup>11</sup>

All samples were coded with a number corresponding to the number in the questionnaire, and then stored at 4°C in the local laboratory until transportation to the Reference

Laboratory of the National Center for STD and Leprosy Control, Nanjing. Specimen collection, preparation, storage and shipping were supervised by the chief technician at the local laboratory. Shipments were completed within one day.

## **POLYMERASE CHAIN REACTION (PCR)**

Upon arrival at the National Center for STD and Leprosy Control, Nanjing, cells were dislodged from tampons by manual ringing and squeezing, and were pelleted by centrifugation. DNA was extracted from 20µl aliquots of tampon cell pellet using a QIAamp DNA Purification Kit (Qiagen Inc., Valencia, CA, USA) as per the manufacturer's instructions

Overall, three amplification reactions were performed on DNA extracted from each tampon specimen: (1) combined amplification of *C. trachomatis* and *N. gonorrhoeae* sequences using PE 9600 (Perkin Elmer Geneamp PCR 9600 Thermalcycler, PE Corporation, USA); (2) amplification of *T. vaginalis* sequences and; (3) amplification of β-globin gene sequences as positive internal control



PCR reaction for detection of *C. trachomatis* and *N. gonorrhoeae* by PE 9600 thermalcycler mixing of 25µl of extracted tampon DNA and 25µl of Specimen Diluent (Roche Diagnostics), followed by a 10-minute room temperature incubation prior to amplification and detection of *C. trachomatis* and *N. gonorrhoeae*.

PCR detection of *T. vaginalis* and  $\beta$ -globin gene sequences were performed using PCR ELISA DNA detection assay (Roche Biochemicals). Amplification was performed in capillaries with a volume of 50µl, consisting of a 20µl aliquot of extracted DNA and 30µl of mastermix reactions (obtaining from Royal Women's Hospital, Melbourne). The samples were heated at 95°C for nine minutes and cycled 35 times using parameters of 94°C for one minute, 47°C for one minute and 67°C for one minute.

### **ANTIBODY TESTING OF SERA**

The survey provided the prevalence rates of treponemal seropositivity, not the prevalence of syphilis (active infection). Accurate diagnosis of infectious syphilis and latent syphilis require the recording of serial rapid plasma reagin (RPR) titres and treatment details. A significant proportion of high-level titres would support a high background prevalence of active infection. Each serum sample was tested by RPR (Shanghai, China) according to manufacturer's instructions. All positive RPR sera were re-tested using *Treponema pallidum* haemagglutination assay (TPHA, Fuji Corporation, Japan) for confirmation of positives.

HIV tests were done on an unlinked aliquot of serum using the enzyme-linked immuno-sorbent assay (ELISA) technique (Vironostika® HIV Uni-Form II Plus O; Organon Teknika). Positive serum samples were then confirmed by a reference laboratory using Western blot (Genelabs Diagnostics®, HIV Blot 2.2, Singapore).



## **STI SYNDROMIC CASE MANAGEMENT**

During the survey, participants received counselling on STI and HIV prevention. STI Syndromic case management was provided at the time of examination, based on clinical findings, according to the standard syndromic approach protocol.

## **NOTIFICATION OF RESULTS**

The results were notified to the Principal Investigator and kept with the maximum level of confidentiality. The HIV results were unlinked and were reported on a population basis.

## **DATA ANALYSIS**

Data were entered using Epi-Info software (version 6.0; Centers for Disease Control and Prevention, Atlanta, GA, USA) and analysed using SPSS (version 8.0 for Windows; SPSS Inc., Chicago, IL), in the National Center for STD and Leprosy Control. Outcome variables include prevalence rates of study STIs, of any STI (at least one infection), and their 95% confidence intervals.

## **RESULTS**

### **CHARACTERISTICS OF THE STUDY POPULATIONS (TABLE 2)**

Of the 505 eligible female sex workers, more than half (54.3%) were aged under 25 years; their mean age was 24.7 years (SD:  $\pm 5.0$ , range: 15-39). The majority had an educational level of secondary school or lower; 75% were unmarried, divorced or cohabiting. One third came from outside the local area, but from within the study province, and one third came from other provinces.





**Table 2 - Demographic characteristics of 505 female sex workers in Kunming, and 550 truck drivers in Tongling, China, 2000**

Demographic characteristics	Female sex workers		Truck drivers	
	Number	%	Number	%
Age group (years)				
15-19	70	13.9	0	0.0
20-24	204	40.4	55	10.0
25-29	144	28.5	143	26.0
30-34	60	11.9	158	28.7
35-39	27	5.3	111	20.2
≥40	0	0.0	83	15.1
Education				
Illiteracy	34	6.7	3	0.5
Primary school	142	28.1	18	3.3
Secondary school	234	46.3	277	50.4
High school or higher	95	18.8	252	45.8
Marital status				
Married	126	25.0	395	71.8
Unmarried	282	55.8	145	26.4
Divorced	54	10.7	3	0.9
Cohabiting	43	8.5	4	0.7
Residence				
Local area	162	32.1	498	90.5
Other area in province	152	30.1	46	8.4
Other province	191	37.8	6	1.1

## **PREVALENCE OF SEXUALLY TRANSMITTED INFECTIONS**

### **(TABLES 3 AND 4)**

Among the female sex workers, the prevalence rate for *Chlamydia trachomatis* was 58.6%, for *Trichomonas vaginalis* 43.2% and for *Neisseria gonorrhoeae* 37.8%. One quarter had co-infection with both gonorrhoea and chlamydiosis. The prevalence of HIV infection was 10.3% and all HIV-positive cases were injecting drug users (IDUs). Treponemal seropositivity was about 10 %. Of the 505 female sex workers, 433 (85.7%) had at least one infection, 179 (35.4%) had two concurrent infections, 80 (15.8%) had three concurrent infections and 11 (2.2%) had four infections. The highest prevalences of chlamydial infection and of gonorrhoea were observed among the 15-19 and 19-24 year-old age groups (Chi square test for trend,  $P < 0.05$  and  $< 0.01$ , respectively; data not shown).

Among the truck drivers, treponemal seropositivity was 0.7%, gonorrhoea 7.8%, chlamydial infection 10.2%, and co-infection with gonorrhoea and chlamydiosis 2.0%. Of the 550 truck drivers, 92 (16.7%) had at least one infection and 11 (2.0%) had two concurrent infections. No HIV infection was diagnosed.





**Table 3: Prevalence of sexually transmitted infections, seroprevalence of treponemal antibodies, and HIV infection among 505 female sex workers in Kunming, and 550 truck drivers in Tongling, China, 2000**

Sexually transmitted infection	Female sex workers		Truck drivers	
	Prevalence %	95% confidence interval	Prevalence %	95% confidence interval
Trichomonas vaginalis	43.2	38.9–47.5	—	—
Neisseria gonorrhoeae	37.8	33.6–42.0	7.8	5.6–10.0
Chlamydia trachomatis	58.6	54.3–62.9	10.2	7.7–12.7
Chlamydia trachomatis and Neisseria gonorrhoeae	24.6	20.8–28.4	2.0	0.8–3.2
Chlamydia trachomatis or Neisseria gonorrhoeae	71.9	68.0–75.8	16.0	12.9–19.1
Treponemal antibody seroreactivity	9.5	6.9–12.1	0.7	0.0–1.4
HIV	10.3	7.6–13.0	0.0	—

**Table 4: HIV and any STI infection by demographic and behavioural factors among 505 female sex workers in Kunming, and 550 truck drivers in Tongling, China, 2000**

Variable	Female Sex Workers		Truck Drivers
	HIV infection rate (%)	Any STI rate (%)	Any STI rate (%)
Age group (years)			
▪ < 25 yrs.		87.6	16.4
▪ ≥25 yrs.		70.4	16.8
15-19	4.3		
20-24	9.8		
25-29	13.2		
30-34	10.0		
35-39	14.8		
≥40 *			
Education			
≤ Primary	5.1	86.4	4.8
≥ Secondary	13.2	85.4	17.2
Marital status			
Married	11.1	84.9	16.2
Other	10.0	86.0	18.1
Residence			
Local area	19.1	87.7	17.1
Other	6.1	84.8	13.5
Condom use			
< 50% of sex	11.7	85.6	
≥ 50% of sex	7.1	85.7	
Sex partners			
Regular	9.4	84.5	
Irregular	11.0	87.2	
Drug use			
Yes	17.8	87.3	
No	0	83.4	

Rate: % of HIV/ any STI among the number of study subjects in each row.

\* No study participants in this group



## HIGH -RISK BEHAVIOUR

A high frequency of risky behaviours was noted among the female sex workers in the study. Only 30% (n=154) reported using condoms for  $\geq$  50% of sexual acts. About 44 % (n=219 out of 496 responses) reported having irregular sex partners, including irregular clients and casual boyfriends, and 58.1% (n=292 out of 503 responses) reported using drugs.

## DISCUSSION

Very high prevalence rates of bacterial STIs were found among the female sex workers studied in Kunming (58.6% chlamydiosis, 37.8% gonorrhoea and 43.2% trichomoniasis). About 35 % were diagnosed with two concurrent infections and 16% with three concurrent infections.

The prevalence of gonorrhoea approximates to results of other studies among similar populations in China, ranging from 29% to 35%<sup>12-15</sup>. However, the prevalence of chlamydial infection is much higher than previously reported for female sex workers in China<sup>16</sup>, probably because a more sensitive diagnostic technique (PCR-based test) was used in the study. Chlamydial infection has been associated with pelvic inflammatory disease (PID) and infertility, while trichomoniasis has been implicated in atypical PID in infertile women. A hyperendemic level of *T. vaginalis* was detected among the female sex workers in the study. *T. vaginalis* is associated with premature rupture of membranes and premature labour<sup>17</sup> and may increase the transmission of HIV<sup>18</sup>. Prevalence of HIV infection (10.3%) was much higher than that had been reported in previous studies in some areas in the country<sup>19-21</sup>. Two factors that could explain the high HIV infection rate in the study group are the high STI prevalence rates (which can facilitate HIV infection) and the high proportion (58.1%) of drug users in among the participants. Because most female sex workers were from the re-education centres and had recently been arrested by the police, and more than 50% were drug users, caution should be used in extrapolation of the HIV prevalence to the general sex worker population of China. The high rates of STIs among the female sex workers in the study would justify STI screening and treatment in that population. In a previous survey of the high-risk population in Yunnan

Province, the HIV prevalence rate among underground prostitutes not using drugs was found to be 2.2%. It was projected that the rate would increase to over 5% by 2003<sup>22</sup>. The low prevalence of HIV among prostitutes not using drugs of this survey perhaps is due to the small number.

The prevalence rates of chlamydial infection and gonorrhoea in the truck drivers participating in the study were 10.2% and 7.8%, substantially higher than observed in the general population sample (5.6% and 1.9%, respectively)<sup>23, 16</sup> and also higher than those of previous studies reported among similar populations<sup>24-26</sup> in China.

The study suggests that underreporting of STI cases is common in China. The main reason is that many people with a mild or subclinical STI are not identified, particularly in areas with limited diagnostic capacity. In addition, a significant proportion of STI patients seek care from other sources than public health settings, and many health care providers do not report cases because of their heavy workload<sup>27</sup>.

Current surveillance of STIs in China could be improved to facilitate better policy development, measurement of the disease burden and potential risks, and evaluation of STI programmes. Sentinel surveillance and passive case-reporting could be complemented by similar well-targeted STI surveys among specific population groups. STI/HIV and prevention programmes (i.e. health promotion and risk reduction programmes that promote safer sex, including condom use, health information programmes to raise community awareness of STI/HIV and implementation of syndrome management programmes) should focus on high-risk sub-populations, such as IDUs, sex workers (particularly sex workers who inject drugs) and clients. However, surveillance of female sex workers who are not drug users is also important.



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