

# Self-Reported Sexually Transmitted Disease Symptoms and Treatment-Seeking Behaviors in China

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## Abstract

In recent decades, sexually transmitted diseases (STDs) have reemerged and spread as a major public health problem in China. However, little effort has been made on promoting appropriate health-seeking behaviors among people living with STDs. A randomly selected sample of market vendors in Fuzhou ( $N = 4510$ ) was recruited and assessed from 2003 to 2004 to examine their choice of pharmacy versus hospital, and folk remedy versus Western medicine when having STD symptoms. Approximately 11.3% of the sample (4.0% of men and 17.8% of women) reported having had abnormal genital discharge or genital ulcer during the past 6 months. More (over 60%) people chose Chinese folk remedy to treat symptoms or prevent transmission when they had genital discharge and/or genital ulcer. Approximately 30% of study participants with reported STD symptoms visited pharmacies only to seek treatment, and 17% visited neither hospital nor pharmacies. Visiting a pharmacy only for STD treatment was marginally significantly associated with being female (prevalence ratio [PR] = 1.665, confidence interval [CI] = 0.980, 2.831) and never married (PR = 1.984, CI = 1.098, 3.594) after controlling for other potential confounders. Education about appropriate health-seeking behaviors to obtain effective treatment of STD must be a top priority to control the rapid spread of STDs in China.

## Introduction

**I**N THE PAST THREE DECADES, sexually transmitted diseases (STDs) have reemerged as a major public health threat in China. Perhaps due to the rapid economic development and change in the social environment that has altered sexual beliefs and behaviors in the younger generation,<sup>1</sup> the overall trend of STDs is rising among different study populations.<sup>2-4</sup> In addition to change in sexual behaviors, the Chinese health care system has also undergone major reforms.<sup>5,6</sup> Both studies have found that the poor still have access to basic health care despite income inequality but made no mention of access to treatment of STDs. In urban centers, one convenient way to access health care, including treatment for STDs, is through community health centers established under China's Urban Health Care Reform System. However, in a more recent study, Pan et al.<sup>7</sup> found that these community health centers were underutilized and needed major adjustment to increase accessibility. Zhao et al.<sup>8</sup> found that only 39% of patients in

Beijing sought STD diagnosis and treatment in the authorized STD treatment facilities.

To control the spread of STDs in China, it is necessary to treat those who are infected. However, little effort has been focused on promoting appropriate health-seeking behaviors or assessing the availability and use of existing STD services.<sup>9</sup> Misconceptions regarding appropriate STD treatments are common.<sup>10</sup> The stigma of being identified as an STD patient and the prejudicial attitude among health providers inhibits use of public clinics.<sup>11</sup> Unlicensed physicians are also ubiquitously setting up illegal private practices everywhere as considerable profit can be made by dispensing medicines.<sup>12</sup> Therefore, it is important for health officials to understand treatment seeking behaviors in order to tackle the problem of STDs.

Information on treatment seeking behaviors among STD patients in China is scant.<sup>8,9</sup> According to Choi et al.,<sup>9</sup> the main sources of STD treatments among their study participants were private physicians followed by public clinics and

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drugstores and factors associated with treatment-seeking behaviors differed by gender. Zhao et al.<sup>8</sup> identified pharmacies as the most common source of treatment. A study among female street sex workers in Hong Kong found that they experienced difficulty in utilizing health services and self-medicating was common.<sup>13</sup> Our study on assessing STD treatment-seeking behaviors was conducted among market vendors in Fuzhou, China. This population was not traditionally considered a high-risk population, such as commercial sex workers, men who have sex with men, drug users, or truck drivers, and therefore may provide information on the specific cultural factors unique to Chinese society.

## Materials and Methods

### *Study background and population selection*

This study was part of a National Institute of Mental Health (NIMH) Collaborative HIV/STD Prevention Trial conducted in five populations at risk for HIV and STDs in China, India, Peru, Russia, and Zimbabwe. The trial used the Community Popular Opinion Leader (C-POL) model and community-level HIV prevention intervention strategy, which has been shown to be successful in risk reduction among populations vulnerable to HIV risk in the United States and has the potential to be applied in a variety of international settings.<sup>14</sup> The study phases consist of an ethnographic study, pilot studies, and a randomized controlled trial. This article focuses on results from the baseline assessment documenting treatment-seeking behaviors among market vendors.

This study was conducted from 2003 to 2004 in markets in Fuzhou City, the capital of Fujian Province, eastern China. Usually a market has 50 to 150 stalls, with a total of 150 to 300 stall owners and employees. Social activities for market vendors usually center within a few blocks of each market, as they usually live close to work, work long hours, and socialize within that area. Participants for this study were recruited from 40 local food markets. The market selection was based on the size and geographic location of the markets. Only the markets with more than 100 workers were selected, and we selected markets with sufficient distance separation between each other to minimize contamination. All vendors aged 18 to 49 years in the selected market were approached for participation in the study. Participants agreed to be in the study were scheduled to be picked up by a van and taken to a health assessment at a local health facility. The refusal rate was less than 8%.

### *Data collection*

Data collection began after meeting with and obtaining agreements from gatekeepers, primarily government officials and market managers. The purpose of the study and the type of recruitment activities were announced in the market the day before data collection began. After the administration of informed consent, participants were transported by van to the Institute of Health Education of the Provincial Center for Disease Control and Prevention (CDC) for behavioral risk assessment. All participants were paid 20 Yuan (U.S. \$2.50) in cash for their participation. The study only used materials and procedures that had been approved by Institutional Review Boards (IRBs) at both the UCLA and China Center for Disease Control and Prevention (China CDC).

The survey questionnaire was administered in a private office face-to-face with interviewers recording responses on laptop computers. A computer-assisted personal interview (CAPI) was developed to automatically incorporate skip patterns and logistic checks to reduce human errors.<sup>15</sup> Background factors such as age, gender, marital status, education, discretionary income per month, and self-rated health were collected. Health service utilization information was collected by asking whether the participant had seen a doctor or other health care provider for any health-related problems or if they had gone to a pharmacy to obtain medicines or other treatment for themselves in the last 6 months. Self-reported STD symptoms included abnormal genital discharge and genital ulcer. The interviewer explained what "genital discharge" and "genital ulcer" were to the participants. For example, genital discharge meant pus or a thick and/or sticky liquid from the genital area (penis or vagina) and genital ulcers meant a sore or blister on the penis or scrotum for men or in the vaginal area for women. Participants were then asked the total number of episodes of genital discharge and genital ulcer they had experienced during the last 6 months. For those people reporting genital discharge or genital ulcer in the past 6 months, we asked if they had done anything to prevent giving the infection to their spouses or other sexual partners and if they have done anything to get rid of the symptom(s). For those who took action to prevent transmission or seek treatment, we further queried the actions that they had taken. The choices included condoms, folk remedy, Western medicine, and others. Participants could choose all that applied.

### *Data analysis*

All analyses were performed using SAS statistical software version 9.1.3 (SAS Inc., Cary, NC). First, descriptive analyses were performed to determine the prevalence of self-reported STD symptoms, and frequency distributions of STDs were tabulated by background factors. Second, we descriptively analyzed the prevalence of genital discharge and genital ulcer, percentage of participants who took actions to treat or prevent transmission among those reported to have symptoms, and percentage of each measure used. Third, proportion on visiting a doctor or pharmacy during the last 6 months was calculated for participants with genital discharge, genital ulcer, and both. Finally, Log-binomial regression<sup>16</sup> was performed among those who reported STD symptoms to examine independent associations between seeking health care in pharmacy only and participants' age, gender, education, marital status, self-report discretionary income per month, and self-rated health. The respective prevalence ratios (PRs) and 95% confidence intervals (CI) were also reported.

## Results

Table 1 summarizes the characteristics of the study population. Among the 4510 participants, 52.7% were women, 82.4% were currently married or lived with a partner, and 45.4% had education level of primary school or less. About 58.0% rated their health as good or excellent. The study population was at a lower socioeconomic status in the province. Approximately 73.4% of the sample reported having discretionary money of 500 Yuan (\$74) per month or less. As a comparison, the local average monthly discretionary income in was 1292 Yuan (\$185) in 2007.<sup>17</sup>

TABLE 1. HAVING SEXUALLY TRANSMITTED DISEASE SYMPTOM(S) DURING THE PAST SIX MONTHS BY DEMOGRAPHIC CHARACTERISTICS

	#	%	Reporting STD symptoms		p
			#	%	
Age					
25 or younger	862	19.10	95	11.03	
26-30	718	15.93	113	15.74	
31-35	907	20.12	112	12.35	
36 or older	2023	44.84	188	9.29	<0.0001
Gender					
Male	2132	47.27	86	4.04	
Female	2378	52.73	422	17.75	<0.0001
Marital status					
Married/live with partner	3717	82.43	439	11.81	
Never married/single	740	16.40	65	8.80	
Widowed/separated/divorced	53	1.18	4	7.55	0.0419
Education					
No schooling	379	8.39	66	17.41	
Primary school	1667	36.99	200	12.00	
Junior high	1882	41.74	194	10.31	
Senior high	557	12.34	46	8.26	
College and higher	25	0.55	2	8.00	0.0002
Discretionary money (Yuan) per month					
≤200	1596	35.40	180	11.28	
201-500	1714	38.01	196	11.44	
501-1000	907	20.12	104	11.47	
>1000	292	6.48	28	9.59	0.8237
Self-rated health					
Excellent	547	12.13	37	6.76	
Good	1977	43.84	168	8.50	
Fair	1776	39.38	252	14.19	
Poor	210	4.66	51	24.29	<0.0001

STD, sexually transmitted disease.

Frequency distribution of reporting at least one episode of genital ulcer or genital discharge and its relationship with background factors of study participants are also presented (Table 1). The highest prevalence of self-reported STD symptom(s) was found in the 20- to 30-year-old age group,

those married or living with a partner, and those with the least education. Females reported more STD symptoms than male. Those who rated their health as poor were more likely to report STD symptoms.

TABLE 2. MEASURES TAKEN FOR PREVENTION AND TREATMENT WHEN HAVING SEXUALLY TRANSMITTED DISEASE SYMPTOMS

	Genital discharge (n = 466)		Genital ulcer (n = 76)	
	#	%	#	%
For prevention purpose	141	30.3	24	31.6
Different prevention measures				
Condom	13	9.2	3	12.5
Folk remedy	92	65.2	15	62.5
Western medicine	63	44.7	16	66.7
Others	6	4.3	1	4.2
For treatment purpose	268	57.5	53	69.7
Different treatment measures				
Folk remedy	186	69.4	34	64.2
Western medicine	134	50.0	38	71.7
Others	19	7.5	2	3.8

The specific STD symptoms and measures taken for prevention and treatment purpose are presented in Table 2. Four hundred sixty-six (10.3%) participants reported genital discharge during the last 6 months. Among them, 141 (30.3%) took measures to prevent transmitting infection to their spouse or sexual partners and 268 (57.5%) took measures to get rid of the symptoms. More participants used folk remedies than Western medicine when they had genital discharge (65.2% versus 44.7% for prevention purpose; 69.4% versus 50.0% for treatment purpose). Among the 76 participants who reported having genital ulcer during the past 6 months, 31.6% had done something to prevent transmission and 69.7% had tried using treatment, more often Western medicine than folk remedies.

Care-seeking behaviors when having any health-related problems during the past 6 months among those who reported STD symptoms are presented with gender specific data in Table 3. Among those who reported genital discharge, 17.6% did not seek help from health care providers or pharmacies, and 30.9% visited pharmacies only. Among people with genital ulcer, 51.3% visited both health care providers and pharmacies to seek health care, and among people with genital discharge, only 39.1% did so.

TABLE 3. CARE-SEEKING BEHAVIOR AND ITS ASSOCIATION WITH SEXUALLY TRANSMITTED DISEASE SYMPTOMS

	<i>Neither HCP nor pharmacy</i>		<i>Pharmacy only</i>		<i>HCP only</i>		<i>Both HCP and pharmacy Total</i>	
	#	%	#	%	#	%	#	%
Genital discharge								
Female	65	16.1	129	32.0	48	11.9	161	40.0
Male	17	27.0	15	23.8	10	15.9	21	33.3
Total	82	17.7	144	30.9	58	12.5	182	39.1
Genital ulcer								
Female	2	4.8	11	26.2	6	14.3	23	54.8
Male	5	14.0	9	26.5	4	11.8	16	47.1
Total	7	9.2	20	26.3	10	13.2	39	51.3
STD symptoms								
Female	67	15.9	134	31.8	51	12.1	170	40.3
Male	20	23.3	21	24.4	13	15.1	32	37.2
Total	87	17.1	155	30.5	64	12.6	202	39.8

HCP, health care provider; STD, sexually transmitted disease.

Table 4 summarizes the results of log-binomial regression analyses of visiting pharmacist only when having any health-related problems among those who reported STD symptoms. When all other selected variables were held constant, being never married becomes an important factor in predicting visiting pharmacist only (PR = 1.984, CI = 1.098, 3.594). Female gender (PR = 1.665, CI = 0.980, 2.831) was marginally significant associated with visiting pharmacies only when have any health-related problems.

## Discussion

A large percentage of participants in this study used folk remedies to relieve symptoms or prevent transmission to sexual partners, especially those who had genital discharge. This kind of "alternative treatment" is not generally used in hospitals, however, it was found to be widespread in many populations for many diseases. Eisenberg<sup>18</sup> found an increase of using of relaxation, herbal medicine, and massage for back problems, anxiety, depression and headaches in the United States. In New York, Gulla<sup>19</sup> also found that more than half of emergency department patients had used some form of alternative medicines before going to the hospital and approximately 87% of them believed in the effectiveness of the treatment. However, these unconventional therapies were

found to cause, complicate, or exacerbate the problem.<sup>20</sup> Blanc et al.<sup>21</sup> found that patients with asthma frequently self-medicated with herbs, coffee, or black tea, which was associated with an increased hospitalization rate. Gruenwald et al.<sup>22</sup> noted that some home remedies can interfere with the planned treatment for patients attending emergency departments. Similarly, improper use of folk remedies can potentially result in complications or worsen the disease situation in people with STDs. It is important to better understand the role of folk remedies in care of people with STD symptoms and reasons for using folk remedies rather than seeking appropriate care at authorized facilities.

Difficulties in access to STD treatment in hospitals exist for the never married people, whose STD care-seeking process is especially complicated by the stigma and social proscription around premarital sexual activities. Many never-married participants in our study chose to seek STD treatment from pharmacies, instead of hospitals where people have to fill in many forms and go through layers of screening questions by different people (nurses, laboratory technicians, and sometimes the cashier) before finally reaching the doctor or taking a laboratory test. Comparatively, local pharmacies are easier to access than hospitals<sup>12</sup> and seeking medical consultations provided by pharmacists is a far less intimidating process. For this reason, more single people decide to seek medical treatment in pharmacies, and purchase over-the-counter medications, which is convenient, private, and has much less risk of stigma, especially for highly socially stigmatized conditions like STD.

Among those who reported STD symptoms, women were more likely to seek treatment from pharmacies. Gender differences in care-seeking behavior were also reported in other studies<sup>23–25</sup> where women were shown to have a lower case detection rate than men. In China, to a large extent, women's economic dependency constrained their decision power on making health expenditure. Compared to their male counterpart, women with symptoms tend to spend less money on health care. In addition, in traditional Chinese culture, men were considered to be the main supporters of the family and women were expected to be totally subservient to men.<sup>23</sup> Women often have less access to information and are restrained in discussions of sexuality with others.<sup>23,26</sup> Moreover,

TABLE 4. LOG-BINOMIAL REGRESSION COEFFICIENTS AND PREVALENCE RATIOS OF SEEKING CARE IN PHARMACY ONLY WITH DEMOGRAPHIC CHARACTERISTICS AMONG THOSE WHO REPORTED SEXUALLY TRANSMITTED DISEASE SYMPTOMS

	<i>Prevalence ratio</i>	<i>95% CI</i>	<i>p</i>
Age	1.010	(0.984–1.037)	0.4370
Female	1.665	(0.980–2.831)	0.0596
Never married	1.984	(1.098–3.584)	0.0233
Years completed in school	1.007	(0.960–1.058)	0.7684
Discretionary money (every 500 Yuan/month)	0.970	(0.820–1.149)	0.7271
Excellent or good health	0.871	(0.625–1.212)	0.4166

CI, confidence interval.

STDs in women are associated with a higher level of stigmatization and discrimination than in men.<sup>27</sup> This further compromises women's ability to seek STD treatment. The result suggested that targeting women and single people for health seeking behavior intervention is a priority in STD control programs.

To obtain medication for STD symptoms from pharmacy sometimes could be helpful in relieving symptom and preventing transmission, particularly as compared with no treatment at all. However, a study by Zhao et al.<sup>8</sup> in Beijing found that pharmacies did not provide appropriate treatment. Pharmacists in China typically sell medicines to people based on their verbal descriptions of the symptoms. However, symptoms alone are not a good indicator of STDs, especially among women. Even if it is not harmful, the symptom-based treatment could rarely guarantee a complete cure for a STD. With inadequate treatment, lack of counseling, reinfection and sequela could be highly likely. More importantly, treatment of sexual partners and risk-reduction counseling are rarely available in pharmacies, resulting in limited prevention in further transmission and high risk for repeat infection.

Several limitations of the study must be noted. First, information about health seeking behavior was collected for any health-related problem, not STD symptom. It might be possible that health-seeking behavior of STD was different from that of other diseases. Second, data on STD symptoms are from self-reports and subject to social desirability biases. Thus, data on genital ulcer and genital discharge were likely to be underreported. Third, since the data were collected in only one geographic region of China and within specific subgroup, generalization of findings to other populations is limited. Nonetheless, the study has important implications for prevention and intervention.

Sexually transmitted diseases are spreading rapidly throughout China, and have been proven to facilitate HIV transmissions.<sup>28,29</sup> However, there is informal treatments of symptomatic patients continue to dominate STD management. Promotion of appropriate health seeking behavior is vital to control and prevent further spread of STDs in China. Special attention must be paid to educate women and single people about STD-related symptoms as well as the importance to seek treatment in competent health care settings. Hospital services need to be improved and made more accessible to everyone. Educating the public on STDs and reduce stigma associated with seeking treatment is also an important step in encouraging STD treatment-seeking behaviors.

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### References

- Chen XS, Gong XD, Liang GJ, et al. Epidemiologic trends of sexually transmitted diseases in China. *Sex Transm Dis* 1999;27:138–142.
- Chen XS, Yin YP, Chen LP, et al. Sexually transmitted infections among pregnant women attending an antenatal clinic in Fuzhou, China. *Sex Transm Dis* 2006;33:296–301.
- Detels R, Wu Z, Rotheram-Borus MJ, et al. Sexually transmitted disease prevalence and characteristics of market vendors in eastern China. *Sex Transm Dis* 2003;30:803–808.
- He N, Detels R, Zhu J, et al. Characteristics and sexually transmitted diseases of male rural migrants in a metropolitan area of eastern China. *Sex Transm Dis* 2005;32:286–292.
- Henderson GE, Akin JS, Hutchinson PM, et al. Trends in health services utilization in eight provinces in China, 1989–1993. *Soc Sci Med* 1998;47:1057–1971.
- Liu GG, Zhao Z, Cai R, et al. Equity in health care access: Assessing the urban health insurance reform in China. *Soc Sci Med* 2002;55:1779–1794.
- Pan X, Dib HH, Wang X, et al. Service utilization in community health centers in China: A comparison analysis with local hospitals. *BMC Health Serv Res* 2006;6:93–101.
- Zhao GB, Detels R, Gu F, et al. The distribution of people seeking STD services in the various types of health care facilities in Chao Yang District, Beijing, China. *Sex Transm Dis* 2008;35:65–67.
- Choi K, Zheng X, Zhou H, et al. Treatment delay and reliance on private physicians among patients with sexually transmitted diseases in China. *Int J STD AIDS* 1999;10:309–315.
- Brackbill RM, Sternberg MR, Fishbein M. Where do people go for treatment of sexually transmitted diseases? *Fam Plann Perspect* 1999;31:10–15.
- Li L, Wu Z, Wu S, et al. HIV-related stigma in health care settings: A survey of service providers in China. *AIDS Patient Care STDs* 2007;21:753–762.
- Smith CJ. (Over) eating success: The health consequences of the restoration of capitalism in rural China. *Soc Sci Med* 1993;37:761–770.
- Wong WCW, Gray A, Ling DC, et al. Patterns of health care utilization and health behaviors among street sex workers in Hong Kong. *Health Policy* 2006;77:140–148.
- Kelly JA, Murphy DA, Sikkema KJ, et al. Randomised, controlled, community-level HIV-prevention intervention for sexual-risk behaviour among homosexual men in US cities. *Community HIV Prevention Research Collaborative. Lancet* 1997;350:1500–1505.
- Li L, Wu Z, Rotheram-Borus MJ, et al. Measuring sexual risk using audio-computer assisted self-interviewing (ACASI) vs. computer-assisted personal interview (CAPI) in China. *Int J Sex Health* 2007;19:25–30.
- Deddens JA, Petersen MR. Approaches for estimating prevalence ratios. *Occup Environ Med.* 2008; 65:501–506.
- Fujian Provincial Statistic Bureau, 2008. Income and Spending of Residents in City and Township. Available online: [www.stats-fj.gov.cn/tjsj/rmsh/czjmsz/0200801220104.htm](http://www.stats-fj.gov.cn/tjsj/rmsh/czjmsz/0200801220104.htm) (Last accessed August 26, 2008).
- Eisenberg DM, David RB, Ettner SL, et al. Trends in alternative medicine use in the United States. 1990–1997, results of a follow-up national survey. *JAMA* 1998;280:1568–1575.
- Gulla J, Singer AJ. Use of alternative therapies among emergency department patients. *Ann Emerg Med* 2000;18:51–54.
- Larkin M. Surgery patients at risk for herb-anesthesia interaction. *Lancet* 1999;354:1362.
- Blanc PD, Kuschner WG, Kats PP, et al. Use of herbal products, coffee or black tea, and over the counter medications as self-treatment among adults with asthma. *J Allergy Clin Immunol* 1997;100:789–791.

23. Gruenwald J, Brendler T, Jaenicke C. PDR for Herbal Medicines. Montvale, NJ: Medical Economics, 1998.
24. Xu B, Fochsen G, Xiu Y, et al. Perceptions and experiences of health care seeking and access to TB care—a qualitative study in rural Jiangsu Province, China. *Health Policy* 2004;69:139–149.
24. Thorson A, Dong H, Wang K, et al. Health seeking behavior of individuals with a cough for more than 3 weeks. *Lancet* 2000;25356:1823–1824.
15. Thorson A. Equity and Equality—case Detection of Tuberculosis among Women and Men in Vietnam [Dissertation]. Stockholm, Sweden: Karolinska Institute, 2003.
26. Wu ZY, Rotheram-Borus MJ, Li L, et al. Sexually transmitted diseases and risk behaviors among market vendors in China. *Sex Transm Dis* 2007;34:1030–1034.
27. Lieber E, Li L, Wu Z, et al. HIV/STD stigmatization fears as health seeking barriers in China. *AIDS Behav* 2006;10:463–471.
28. Cohen MS. Sexually transmitted diseases enhance HIV transmission: No longer a hypothesis. *Lancet* 1998;351 (suppl):5–7.
29. Laga M, Manoka A, Kivuv M, et al. Non-ulcerative sexually transmitted diseases as risk factors for HIV-1 transmission in women: Results from a cohort study. *AIDS* 1993;7: 95–102.

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