Published in final edited form as:

J Acquir Immune Defic Syndr. 2010 February ; 53(Suppl 1): S54–S60. doi:10.1097/QAI.0b013e3181c7d8d2.

HIV-1 and STIs Prevalence and Risk Factors of Miners in Mining Districts of Yunnan, China

Guolei Zhang, MD, MPH^{*,†}, Ning Wang, MD, PhD^{*}, Michelle Wong, MPH^{*}, Pu Yi, MPH[†], Junjie Xu, MD^{*}, Baoshan Li, MPH[‡], Guowei Ding, MPH^{*}, Yanling Ma, MD, MPH[§], Haibo Wang, MPH^{*}, Xiwen Zheng, MD, MS^{*}, and Zhenglai Wu, MD, MS^{||}

^{*} Chinese Center for Disease Control and Prevention, Beijing, China

[†] Shijingshan District Center for Disease Control and Prevention, Beijing, China

[‡] Gejiu Center for Disease Control and Prevention, Yunnan Province, China

[§] Yunnan Province Center for Disease Control and Prevention, China

^{||} Peking Union Medical College

Abstract

Objective—To assess HIV/STI prevalence and associated risk factors among miners in Yunnan, China.

Methods—A cross-sectional study was conducted among 1,798 miners in 2 townships of Gejiu City, Yunnan, from March to May, 2006. Standardized interviewer-administered questionnaires were completed and specimens collected for HIV/STI testing.

Results—The prevalence of HIV, *Chlamydia trachomatis*, *Neisseria gonorrhoeae*, syphilis, HSV-2, and any STIs among all miners was 0.7%, 4.8%, 0.8%, 1.8%, 9.6%, and 14.9%, respectively. One-fifth of miners reported patronizing female sex workers (FSWs) at least once, and of these 72% never used a condom with a FSW. Miners who visited FSWs had a higher prevalence of HIV (1.8% vs. 0.5%) and any STI (23.2% vs. 4.3%), including *C. trachomatis* (6.9% vs. 4.3%), *N. gonorrhoeae* (2.1% vs. 0.5%), and HSV-2 (14.9% vs. 8.4%), and higher rates of illegal drug use, compared to miners who visited no FSWs.

Conclusions—High prevalence of HIV/STIs among miners in Gejiu warrants special attention to this population, and vigorous interventions should address both sexual and drug use related risk.

Keywords

Human immunodeficiency virus (HIV); Sexually transmitted infections (STIs); Miner; China

INTRODUCTION

Heterosexual transmission has become the leading route of transmission of new HIV cases in China, surpassing intravenous drug use (IDU) for the first time since China's HIV epidemic began in the late 1980s¹. Due to high rates of unprotected sex and drug use behaviors, China's "floating population" of migrant workers (*liudong renkou*) is at risk for HIV/STIs and may play a critical role in the spread of HIV in China^{2–5} as has been observed in other contexts⁶.

Correspondence to Wang Ning, MD, PhD, Professor, Chinese Center for Disease Control and Prevention, National Center for AIDS/STD Control and Prevention, 27 Nanwei Road, Xuanwu District, Beijing 100050, China. Phone: +86-10- 63039093; Fax: +86-10-63039093; and wangnbj@163.com.

Largely because of China's gender imbalance and economic reforms over the last twenty years, an estimated 100 to 150 million migrants from the countryside who are mostly male, young, poor and uneducated, have migrated to urban centers in search of work⁷. As mobility has increased and the economy has grown, the commercial sex industry has boomed and STI rates have risen^{8, 9}. Separated from home and working long hours in difficult conditions, male migrants may patronize female sex workers (FSWs), increasing their risk of HIV and helping to fuel epidemics of HIV and STIs⁴. Though China's HIV epidemic is still concentrated in high-risk groups, some regions of Yunnan province already have generalized epidemics with over 1% of pregnant women in antenatal clinics testing HIV positive^{10, 11}. Clients, especially in provinces such as Yunnan, may subsequently "bridge" these infections through unprotected intercourse with both sex workers and regular partners.

To our knowledge, this is the first study to examine HIV/STI prevalence and the associated risk behaviors among a large sample of miners in China. Only one other study has examined HIV risk among male migrant clients in China¹². Attention, however, has been given to HIV/STIs in migrant workers in China, with variable results. For instance, STIs were detected in 18% of market vendors of Eastern China¹³, and 20% of a community-sample of migrant workers in Beijing, Shanghai, and Nanjing reported a history of STIs¹². Studies in Zhejiang¹⁴ and Shanghai¹⁵, however, found minimal cases of STIs and no HIV. Still, behavioral studies in China have found migrant populations have high-risk sexual behaviors, including multiple sex partners, engagement in commercial sex, and scarce condom use^{3, 16}.

Mining townships around Gejiu City in Yunnan, like other mining communities studied in Africa^{17–19}, have great potential for HIV/STI spread. Gejiu City, known as the "tin capital" of China, has a population of 453,300, not including an estimated 67,900 migrant workers from rural areas, most of whom are miners. Development of the local mining industry and the influx of single, migrant miners have contributed to the expansion of the local commercial sex industry. The first HIV infection in Gejiu was reported in an injecting drug user in 1996, but by December 2004, a total of 1,774 HIV cases were confirmed in Gejiu²⁰. Though intravenous drug use still accounts for the majority of HIV infections in Yunnan²⁰, the percentage of cases associated with sexual transmission has risen steadily from 5.3% in 1996 to 11.8% in 2004^{11, 21}. There are indications that Gejiu City is moving toward a generalized HIV epidemic; in 2003, HIV prevalence among women receiving antenatal care was 0.8%¹⁰. A pilot study conducted in 2005 among 232 miners in Laochang and Kafeng mining townships outside of Gejiu indicated that almost all (94.8%) were not local residents; 9.4% reported sex with FSWs; and the prevalence of HIV, gonorrhea and chlamydia was 0.5%, 0.5% and 9.3%, respectively²². Our study assessed HIV and STI prevalence and risk factors among a large sample of miners in Gejiu City.

METHODS

Study Population

Laochang and Kafang are 2 mining townships located approximately 20 and 25 kilometers from Gejiu, respectively. They have a combined population of 13,000. Five mines were selected as study sites based on the following criteria: (1) short distance from the entertainment facilities in town with transportation readily available; (2) private ownership; and (3) employment of ethnic minority miners. There were approximately 2,000 miners working in the 5 selected mines.

All miners enrolled in the study were: (1) employed in 1 of the 5 selected mines; (2) aged 16 or above; and (3) willing and able to provide informed consent.

Data Collection

A cross-sectional study was conducted in the 5 selected mines of Laochang and Kafang townships from March to May, 2006. Every effort was made to include all potential subjects. Subjects who met the above selection criteria and signed the informed consent forms were assigned a personal identification number (PID). Study staff explained to every eligible participant the purpose of the study, the procedures, and the risks and benefits study participation. The informed consent process, interviews, and specimen collection were all conducted in private rooms at the hospital or clinic in each of the 5 mining districts. Each participant was interviewed face-to-face by an interviewer of the same gender to collect information on socio-demographics, sexual behaviors, drug use, HIV/AIDS related knowledge, and STI symptoms.

Individual pre-test counseling sessions were provided to each participant prior to specimen collection. A 5 ml void urine sample and 7 ml venous blood specimen was collected from each participant, and labeled only with a PID. All participants were requested to return in 4 weeks to receive testing results and post-test counseling by trained study staff.

Laboratory Procedures

All specimens were collected and processed according to the manual of procedures approved by the National Institutes of Allergy and Infectious Diseases (NIAID) and the Chinese Center for Disease Control and Prevention (CDC). Blood specimens were sent to the Gejiu CDC laboratory, where the plasma was separated for HIV testing by enzyme-linked immunosorbent assay (ELISA). Specimens found positive for HIV antibody by ELISA were confirmed by 2 additional ELISA tests and 1 Western Blot test at the Yunnan Provincial CDC reference laboratory.

The Gejiu CDC laboratory performed HSV-2 antibody testing as well as *Treponema pallidum* antibody testing by Rapid Plasma Reagin (RPR). Positive RPR specimens were confirmed by *Treponema pallidum* particle assay (TPPA) at the Yunnan Provincial CDC laboratory. Syphilis cases were identified by positive TPPA and RPR. Urine specimens were tested with morphine gold conjugate test strip (ACON MOP) for morphine in the Gejiu CDC laboratory.

Data Management and Statistical Analysis

All data collected were transmitted via the DataFax system to the data management team in Beijing. The final data received via DataFax were manually entered into the SAS database for analysis. Socio-demographics, HIV/STI prevalence, knowledge, and attitudes were analyzed for all miners and compared between miner clients and miner non-clients.

Statistical analysis of data was performed with SAS version 9.1 (SAS Institute Inc, Cary, NC, USA). The proportions between groups were compared by using χ^2 -test or Fisher's exact probability. The means between groups were compared by using Student's t-test. Univariate and multivariate logistic regression were used to estimate adjusted odds ratios (OR) and 95% confidence intervals (CI) for associations between HIV and STIs and variables of interest. Risk factors associated with HIV infection were adjusted for confounding variables and were fitted to a logistic regression model using a forward stepwise regression method. For multivariate analysis, variables were only retained if they were statistically significant at the level of $P < 0.05$ or if the coefficients of regression of the other variables in the same computation were substantially changed by their inclusion in the model.

Ethical Considerations

The study protocol was approved by the institutional review boards of the National Center for AIDS/STD Control and Prevention (NCAIDS), Yunnan Provincial CDC, and the Division of AIDS (DAIDS) Prevention Science Review Committee (PSRC) at the U.S. National Institutes of Health (NIH).

RESULTS

Participant Recruitment

A total of 1,804 miners were identified and screened, and 1,798 enrolled. Reasons for not participating included age less than 16 ($n=1$); refused to participate ($n=3$); and withdrawal from the study after giving informed consent ($n=2$). Of all the enrolled miners, 1,796 completed the questionnaire, 1,760 provided a blood specimen, and 1,773 provided a urine specimen.

Socio-demographic Characteristics

Miners ranged in age from 16 to 58, with an average age of $28.5 (\pm 7.4)$ years. There was no significant difference in the mean ages of the miners enrolled from the 2 townships ($P=0.17$). Among the 1,796 miners who completed questionnaires, 81.6% were <35 years, 65.1% attended school for ≤ 6 years, 14.3% never attended school, 60.9% were married, and of those married, 36.4% lived apart from their spouses. Forty-two (42.6%) percent were Han (the major ethnic group in China accounting for 90% of the total Chinese population), 44.8% were Hani, and 12.6% were from other ethnic groups. Most miners (92.8%) had a *hukou* (residence permit) from outside Gejiu, only 7.2% had a Gejiu *hukou*. Most (84.7%) with a *hukou* from outside Gejiu were from elsewhere in Yunnan, with only 8.1% from other provinces. A significant proportion (41.3%) had stayed at the study site for <1 year. Prior to mining in Gejiu, many miners were farmers (64.8%), and others were miners (11.0%), students (8.4%), factory workers (2.1%), construction workers (7.1%), or other (6.6%).

Three-hundred thirty-nine miners (339/1,796; 18.9%) reported a history of patronizing FSWs. Comparison of socio-demographic characteristics between client and non-client miners are presented in Table 1.

HIV and STI Prevalence

Thirteen miners (0.7%) [95% C.I. 0.3%~1.1%] were HIV positive. The relative prevalence's of syphilis, HSV-2, *Neisseria gonorrhea* and *Chlamydia trachomatis* were 1.8% (95% C.I. 1.2%~2.4%), 9.6% (95% C.I. 8.2%~10.9%), 0.8% (95% C.I. 0.4%~1.2%) and 4.8% (95% C.I. 3.8%~5.8%). Prevalence of any STI was 14.9% (95% C.I. 13.2%~16.5%). There was a statistically significant difference in prevalence of syphilis ($P=0.02$), *C. trachomatis* ($P=0.01$) and HSV-2 ($P=0.01$) between Kafang and Laochang townships.

Miner clients had a significantly higher prevalence of HIV (1.8% v 0.5%, $P < 0.05$), HSV-2 (14.9% vs. 8.4%, $P < 0.001$), *N. gonorrhea* (2.1% vs. 0.5%, $P < 0.01$), *C. trachomatis* (6.9% vs. 4.3%, $P < 0.05$), compared to non-clients (Table 1). There was no difference in syphilis ($P = 0.05$) based on client status. Prevalence of any STI was also significantly higher in clients (23.2% vs. 4.3%, $P < 0.0001$).

Awareness Of HIV and other STIs Knowledge

Misconceptions about HIV transmission were high. Only 66.9% had heard of HIV/AIDS; 84.5% believed that mosquitoes can transmit HIV; and 73.0% believed that sharing bathroom facilities with others could transmit HIV. Only 4.1% knew the correct routes of HIV

transmission. In addition, only 43.9% of miners knew that people living with HIV/AIDS may appear healthy.

Miner clients in general had higher knowledge and awareness of HIV/STIs compared to non-clients (Table 2). Significantly more clients had heard of HIV/AIDS (82.3% vs. 63.3%, $P < 0.0001$), had heard of condoms (75.8% vs. 54.6%, $P < 0.0001$) and knew HIV can be sexually transmitted (76.4% vs. 59.4%, $P < 0.0001$). In general, more clients than non-clients knew the correct routes of HIV transmission; more clients believed there is a risk of HIV transmission from sexual intercourse (67.6% vs. 48.5%, $P < 0.0001$), a risk from sharing injection needles (65.5% vs. 47.4%, $P < 0.0001$), and a risk from blood transfusion (68.7% vs. 49.1%, $P < 0.0001$). However, only 9.1% of clients and 3.8% of non-clients believed they were at risk for HIV.

Sexual Behavior and Drug Use

High-risk sexual behaviors were frequent among miners. Eighty-seven (87.3%) percent of all miners reported having sexual intercourse, and 34.0% reported having 2 or more sex partners in the past 12 months. One-fifth of miners (18.9%) reported having purchased sex, and of these, 45.1% had visited FSWs twice or more in the past 12 months (range: X to 70 visits). Reported condom use with FSWs was very low, 72.0% reported never using condoms with FSWs. Levels of drug use among miners were low, with 19 (1.1%) miners reporting previous illegal drug use and 4 of these 19 (21.1%) reporting injecting drug use (IDU). Sixteen miners tested positive for morphine in their urine (0.09%).

In general, miner clients had more risk behaviors but higher knowledge and perceived risk of HIV/STIs (Table 2). Significantly more miner clients than non-clients reported illegal drug use (3.5% vs. 1.3%, $P < 0.01$). They also reported more STI symptoms in the last 12 months (1.2% vs. 0.3%, $P < 0.001$), multiple sexual partners (>3 partners in the last 12 months 65.8% vs. 14.5%, $P < 0.0001$), early age of sexual debut (<16 years old 21.8% vs. 15.9%, $P < 0.05$), and frequenting karaoke halls in leisure time (36.9% vs. 11.1%), a common work venue for FSWs. There was no significant difference in condom use with regular partners or FSWs, and tattoo or surgical operation history.

HIV/STI Risk Factors

Risk factors for HIV and STIs by client status significant in univariate and multivariate analyses are presented in Table 3. HIV infection in miner clients was independently associated with illegal drug use (adjusted OR 266.9, 95% C.I. 13.3 – 999.9, $P < 0.01$), tattoo history (adjusted OR 42.3, CI 3.6 – 502.1, $P < 0.01$), and 3 or more FSW partners in the past 12 months (adjusted OR 24.0, CI 2.1–276.9, $P < 0.01$). HIV infection in non-clients was independently associated with illegal drug use (adjusted OR 11.5, CI 1.3 – 105.3, $P < 0.05$), and 3 or more sexual partners in the last 12 months (adjusted OR 5.9, CI 1.2 – 31.7, $P < 0.05$).

STI infection in miner clients was independently associated with illegal drug use (adjusted OR 3.5, CI 1.1–11.3, $P < 0.05$) and reported STI symptoms in the last 12 months (adjusted OR 2.5, CI 1.4–4.5, $P < 0.01$). STI infection in non-clients was independently associated with being an ethnic minority (adjusted OR 2.6, CI 1.8 – 3.6, $P < 0.01$), and living with a spouse (adjusted OR 1.6, CI 1.2 – 2.2, $P < 0.01$). Going to a karaoke hall frequently in leisure time, however, was independently protective of STIs in miner non-clients (adjusted OR 0.5, CI 0.3 – 0.9, $P < 0.05$).

DISCUSSION

Mining communities are high-risk areas for HIV and STI transmission, largely due to the temporary nature of the work and the associated disruption of social ties^{17–19}. Mining areas often do not provide accommodation for spouses or families, and most miners migrate alone (only 36% of married miners lived with spouses). Mining districts, perceived to be thriving economically, also attract female migrants who engage in sex work¹⁸.

The miners in our study were primarily young, ethnic minority migrants with low educational attainment and except for their ethnic minority status match the demographic characteristics of China's so-called "surplus males"⁷. These migrant surplus men may be helping to fuel the HIV epidemic in China through unprotected sex with multiple partners or through IDU behaviors⁵. HIV-related risks among FSWs (often also migrants), have been more widely studied in China^{23–30}, than those of migrant surplus men.

HIV among the participating miners (0.7%) was 10 times higher than China's last national HIV estimate among the general population (0.05%, end of 2007)¹. Comparisons with other migrant population studies should be made with caution given their diversity across China, however HIV prevalence among miners in this study was much higher than recent studies of migrants in eastern China^{13–15}, and slightly higher than a smaller convenience sample of miners in the same area (0.5%)²². *N. gonorrhea* and *C. trachomatis* rates in our miners were also greater than in a population-based study of 20–64 year-old Chinese male adults (0.02% and 2.1%)³² and among migrant workers in Shanghai (0.5% and 3.5%)¹⁵.

HIV/STI rates may be higher in our study because of increased heterosexual risks. Over two-times more males (18.9%) reported ever patronizing FSWs compared to a study of male adults aged 20–64 years old in China (9.4%)³² and migrants in Shanghai (3.2%)¹⁵. Other sexual risks (multiple sexual partners, young age at sexual debut, STI symptoms) were higher among clients compared to non-clients. This is consistent with a recent study of male migrant clients in China, in which multiple sex partners and history of STIs were associated with client status¹².

Clients also had higher HIV rates (1.7% vs. 0.5%) and overall STI rates (23.3% vs. 4.3%). Yunnan CDC data shows a relatively high HIV prevalence among FSW clients (0.3%–1.8%, 2003)³³, and a study in southwest China of FSW male clients reported an STI prevalence of 37.8%³⁴. Multiple encounters with FSWs (≥ 3) conferred an independent HIV risk for clients in our study, and even for non-clients, multiple sex partners was associated with HIV. Though never using a condom with FSWs was not associated with HIV/STIs, condom use among clients was very low (only 13.3% reported always using condoms with FSWs) placing them at high risk of acquiring HIV/STIs. One interesting finding was that many clients were of an ethnic minority. It is possible that certain ethnic minority cultures facilitate liberal sexual norms, such as 2 Hani holidays when it is customary for men to have extramarital sexual contacts. Ethnic minorities in our study were twice more likely to be STI-infected (OR 2.1).

Drug use was an important factor in HIV/STI risk among miners and was strongly associated with HIV and STIs among clients (OR 266.9 and 3.5, respectively) with half (3/6) of the HIV positive clients being drug users (2/3 IDUs). Clients were also more likely to be drug users than non-clients (3.5% Vs. 1.3%, $P < 0.05$), a finding consistent with those of another study of male migrant clients in China¹². While multiple sex contacts with FSWs may increase HIV/STI risk among miner clients, those clients infected with HIV by IDU and with inconsistent condom use may simultaneously put FSWs at risk. Some international studies have proposed that HIV/STI transmission occurs from the "core" group of sex workers to "bridging" groups of clients who may transmit to the general population^{35, 36}. Similar to Africa^{17, 37} our findings suggest in mining communities both FSWs and miner clients may be both "core" and "bridging" groups for HIV/STI transmission to the general population. Mining districts as a

whole may be considered high-risk places, and interventions targeting the entire mining community should be considered, such as those proposed in a study of a Tanzanian mining community¹⁷.

Several limitations to this study should be noted. First, as this was a cross-sectional study, causality cannot be confirmed. For instance, as both drug use and multiple encounters with FSWs were independent risk factors for HIV in miner clients, it is not known how infection occurred. It is also unclear whether risky behaviors preceded migration or were encouraged by it. Second, as sexual behavior is a sensitive topic and data was collected by a face-to-face interview, participants likely under-reported commercial sex and other risk behaviors. Even with under-reporting, however, rates of patronizing FSWs, HIV, and STIs were higher in this population compared to the previously mentioned studies. Third, although this was a large sample of miners, results should not be extrapolated to all miners in China due to important regional differences in terms of demographics, economic conditions and illicit drug availability and use.

Despite these limitations, this study demonstrates that miners who patronize FSWs are at substantial risk of contracting HIV/STIs and potentially escalating these epidemics in China. While targeting mobile populations can be a major challenge³⁸, some mining communities have reported declining STIs following prevention, education and systematic treatment of miners and FSWs³⁹. Workplace-based peer education, improvement of STI services, condom promotion and community-based voluntary testing and counseling has also proven effective in other migrant communities⁴⁰. HIV/STI treatment options should not be reliant on a local residence permit, therefore other methods of healthcare delivery should be made available.

In conclusion, miners in Gejiu constitute a high-risk population that may bridge HIV/STIs to both FSWs and regular partners, and subsequently to the general population. Future studies should explore the availability and effectiveness of HIV/STI prevention and treatment programs in this high-risk community.

Acknowledgments

Authors thank Gejiu CDC, Yunnan Provincial CDC and the National Center for STD Control in Nanjing for their aid in laboratory testing and their enthusiastic help and support throughout the project. Authors also thank all the study participants and Naomi Juniper for editing drafts of this manuscript.

Supported by the Comprehensive Integrated Programs for the Research on AIDS (CIPRA) funded by the National Institute of Allergy and Infectious Diseases (NIAID), the United States National Institutes of Health with grant number U19AI51915 and by the International Clinical Operational and Health Services Research and Training Award (ICOHRTA) AIDS/TB, Grant #U2R TW 006918, funded by the National Institutes of Health, the Fogarty International Center, the National Institute of Drug Abuse and the National Institute of Mental Health.

References

1. State Council AIDS Working Committee Office UN Theme Group on AIDS in China. A Joint Assessment of HIV/AIDS Prevention, Treatment and Care in China, 2007. Dec. 2007
2. Lu F, Wang N, Wu Z, et al. Estimating the number of people at risk for and living with HIV in China in 2005: methods and results. *Sex Transm Infect* 2006;82 (Suppl 3):87–91.
3. Li X, Fang X, Lin D, et al. HIV/STD risk behaviors and perceptions among rural-to-urban migrants in China. *AIDS Educ Prev* 2004;16 (6):538–556. [PubMed: 15585430]
4. Anderson AF, Qingsi Z, Hua X, Jianfeng B. China's floating population and the potential for HIV transmission: a social-behavioural perspective. *AIDS Care* 2003;15(2):177–185. [PubMed: 12856339]
5. Hertog, S.; Merli, GM. Demographic Shifts and the Spread of HIV in China. Paper presented at: Population Association of America annual meetings; March, 2007; New York City, NY.
6. Quinn TC. Global burden of the HIV pandemic. *Lancet* 1996;348(9020):99–106. [PubMed: 8676726]

7. Tucker JD, Henderson GE, Wang TF, et al. Surplus men, sex work, and the spread of HIV in China. *AIDS* 2005;19 (6):539–547. [PubMed: 15802971]
8. Gil VE, Wang MS, Anderson AF, Lin GM, Wu ZO. Prostitutes, prostitution and STD/HIV transmission in mainland China. *Soc Sci Med* 1996;42 (1):141–152. [PubMed: 8745115]
9. Cohen MS, Henderson GE, Aiello P, Zheng H. Successful eradication of sexually transmitted diseases in the People's Republic of China: implications for the 21st century. *J Infect Dis* 1996;174 (Suppl 2):S223–229. [PubMed: 8843252]
10. Ministry of Health U. WHO A Joint assessment of HIV/AIDS prevention, treatment and care in China. Beijing: China Ministry of Health and UN Theme Group on HIV/AIDS in China; 2003.
11. Xiao Y, Kristensen S, Sun J, Lu L, Vermund SH. Expansion of HIV/AIDS in China: lessons from Yunnan Province. *Soc Sci Med* 2007;64(3):665–675. [PubMed: 17107739]
12. Wang B, Li X, Stanton B, Fang X, Lin D, Mao R. HIV-related risk behaviors and history of sexually transmitted diseases among male migrants who patronize commercial sex in China. *Sex Transm Dis* 2007;34(1):1–8. [PubMed: 16755272]
13. Detels R, Wu Z, Rotheram MJ, et al. Sexually transmitted disease prevalence and characteristics of market vendors in eastern China. *Sex Transm Dis* 2003;30(11):803–808. [PubMed: 14603085]
14. Hesketh T, Li L, Ye X, Wang H, Jiang M, Tomkins A. HIV and syphilis in migrant workers in eastern China. *Sex Transm Infect* 2006;82(1):11–14. [PubMed: 16461594]
15. 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(5):286–292. [PubMed: 15849529]
16. He N, Detels R, Chen Z, et al. Sexual behavior among employed male rural migrants in Shanghai, China. *AIDS Educ Prev* 2006;18(2):176–186. [PubMed: 16649962]
17. Desmond N, Allen CF, Clift S, et al. A typology of groups at risk of HIV/STI in a gold mining town in north-western Tanzania. *Soc Sci Med* 2005;60(8):1739–1749. [PubMed: 15686806]
18. Campbell C. Migrancy, masculine identities and AIDS: the psychosocial context of HIV transmission on the South African gold mines. *Soc Sci Med* 1997;45(2):273–281. [PubMed: 9225414]
19. Clift S, Anemona A, Watson-Jones D, et al. Variations of HIV and STI prevalences within communities neighbouring new goldmines in Tanzania: importance for intervention design. *Sex Transm Infect* 2003;79(4):307–312. [PubMed: 12902582]
20. Zhang, CA.; Duan, Y.; Tong, JY. Breakthroughs and Discoveries of AIDS: Best practice of AIDS integrated control and prevention of China-UK programme in Yunnan Province. Kunming: Yunnan Provincial Bureau of Health; 2006.
21. Cheng H, Zhang J, Jia M, Kuo J, Zhang Y, Bi X. The study on HIV epidemic and trend in Yunnan Province. *Journal of Chinese AIDS/STD Prevention and Control* 1995;1(2):8–11.
22. Zhao R, Gao H, Shi X, et al. Sexually transmitted disease/HIV and heterosexual risk among miners in townships of Yunnan Province, China. *AIDS Patient Care STDS* 2005;19(12):848–852. [PubMed: 16375617]
23. Chen XS, Yin YP, Liang GJ, et al. Sexually transmitted infections among female sex workers in Yunnan, China. *AIDS Patient Care STDS* 2005;19(12):853–860. [PubMed: 16375618]
24. Liao SS, Schensul J, Wolffers I. Sex-related health risks and implications for interventions with hospitality women in Hainan, China. *AIDS Educ Prev* 2003;15(2):109–121. [PubMed: 12739788]
25. Qian HZ, Vermund SH, Wang N. Risk of HIV/AIDS in China: subpopulations of special importance. *Sex Transm Infect* 2005;81(6):442–447. [PubMed: 16326842]
26. Lau JT, Tsui HY, Siah PC, Zhang KL. A study on female sex workers in southern China (Shenzhen): HIV-related knowledge, condom use and STD history. *AIDS Care* 2002;14(2):219–233. [PubMed: 11940280]
27. Ding Y, Detels R, Zhao Z, et al. HIV infection and sexually transmitted diseases in female commercial sex workers in China. *J Acquir Immune Defic Syndr* 2005;38(3):314–319. [PubMed: 15735451]
28. Rogers SJ, Ying L, Xin YT, Fung K, Kaufman J. Reaching and identifying the STD/HIV risk of sex workers in Beijing. *AIDS Educ Prev* 2002;14(3):217–227. [PubMed: 12092924]
29. Wei SB, Chen ZD, Zhou W, Wu FB, Li SP, Shan JG. A study of commercial sex and HIV/STI-related risk factors among hospitality girls in entertainment establishments in Wuhan, China. *Sex Health* 2004;1(3):141–144. [PubMed: 16335301]

30. Hesketh T, Zhang J, Qiang DJ. HIV knowledge and risk behaviour of female sex workers in Yunnan Province, China: potential as bridging groups to the general population. *AIDS Care* 2005;17(8):958–966. [PubMed: 16176892]
31. Parish WL, Laumann EO, Cohen MS, et al. Population-based study of chlamydia infection in China: a hidden epidemic. *Jama* 2003;289(10):1265–1273. [PubMed: 12633188]
32. Lu L, Jia MH, Zhang XB. Analysis for epidemic trend of acquired immunodeficiency syndrome in Yunnan province of China. *Chin J Prev Med* 2004;12(4):104–107.
33. Zeng YL, Luan RS, Huang Y. Qualitative study of behavior associated HIV in male clients. *Modern Prev Med* 2004;31(6):829–831.
34. Cowan FM, Langhaug LF, Hargrove JW, et al. Is sexual contact with sex workers important in driving the HIV epidemic among men in rural Zimbabwe? *J Acquir Immune Defic Syndr* 2005;40(3):371–376. [PubMed: 16249714]
35. Gomes do Espirito Santo ME, Etheredge GD. Male clients of brothel prostitutes as a bridge for HIV infection between high risk and low risk groups of women in Senegal. *Sex Transm Infect* 2005;81(4):342–344. [PubMed: 16061544]
36. Lowndes CM, Alary M, Gnintoungbe CA, et al. Management of sexually transmitted diseases and HIV prevention in men at high risk: targeting clients and non-paying sexual partners of female sex workers in Benin. *Aids* 2000;14(16):2523–2534. [PubMed: 11101064]
37. Williams BG, Taljaard D, Campbell CM, et al. Changing patterns of knowledge, reported behaviour and sexually transmitted infections in a South African gold mining community. *Aids* 2003;17(14):2099–2107. [PubMed: 14502013]
38. Steen R, Vuylsteke B, DeCoito T, et al. Evidence of declining STD prevalence in a South African mining community following a core-group intervention. *Sex Transm Dis* 2000;27(1):1–8. [PubMed: 10654860]
39. Bao, V. Expanding Workplace HIV Prevention Programs for a Highly Mobile Population in Ho Chi Minh City. Washington, D.C: Population Council; 2003.

Table 1

Socio-demographic characteristics and HIV and STI prevalence of miners by client status (numbers are percentages)

Variables	Miners		P-value
	Clients (n=339)	Not Clients (n=1457)	
Socio-demographic			
Mean age (SD) (yrs.) *	27.5(6.7)	28.7(7.6)	0.0023
Han Ethnic Group	36.0	44.1	0.0063
Married	56.6	64.5	0.0068
Schooling > 6 yrs.	38.1	34.1	0.1701
Living with regular partners	36.3	39.3	0.3001
Residing locally ≤ 2 yr.	52.1	64.0	<0.0001
Born locally	7.7	7.0	0.6663
Income >800 Yuan/month	50.2	45.4	0.1171
Travel time to the township center≤15 min.	71.4	64.5	0.0153
Resident Permit (<i>hukou</i>)			
Gejiu	8.0	7.1	0.5667
Yunnan but non Gejiu	88.5	83.8	0.0285
Other province	3.5	9.1	0.0007
Drinks alcohol	77.3	65.8	<0.0001
Smokes	91.2	87.0	0.0367
HIV and STI prevalence			
HIV infection ^{&}	1.8	0.5	0.0127
<i>Syphilis</i> ^{&}	2.4	1.6	0.3371
HSV-2 ^{&}	14.9	8.4	0.0003
<i>N. gonorthoea</i> [#]	2.1	0.5	0.0029
<i>C. trachomatis</i> [#]	6.9	4.3	0.0496
Total STIs infection	23.2	12.9	<0.0001

* mean age and (standard deviation of age) in years.

[&] Thirty six subjects did not provide blood specimen for HIV, Syphilis and HSV-2

[#] 23 subjects did not provide urine specimens for *N. gonorrhoea* and *C. trachomatis*

Table 2

HIV/STI risk behaviors, knowledge, and attitudes of miners by client status

Variables	Miners		P-value
	Clients (n=339)	Not Clients (n=1457)	
Risk behaviors			
Illegal drug use	3.5	1.3	0.0044
Tattoo	9.4	6.0	0.0240
Surgical operation history	8.9	6.5	0.1290
Frequents Karaoke halls in leisure time	36.9	11.1	<0.0001
Circumcised	1.2	0.3	0.0241
Reported STIs symptoms in the last 12 months	19.5	3.0	<0.0001
Age of first sexual experience<16 yr.	15.9	21.8	0.0158
>1 partner in past 12 months	65.8	14.5	<0.0001
>3 partner in past 12 months	33.6	6.0	<0.0001
Never used a condom with regular partner	56.3	61.5	0.0804
Never used a condom with female sex worker	72.3	NA	NA
Knowledge and Attitudes of HIV/STIs			
Ever heard of condoms	75.8	54.6	<0.0001
Ever heard of HIV/AIDS	82.3	63.3	<0.0001
Disease can be transmitted through sexual behavior	76.4	59.4	<0.0001
Someone with HIV can look normal and healthy	47.2	35.2	<0.0001
No HIV risk from dining with others commensally	30.4	19.9	<0.0001
No HIV risk from shaking hands with others	32.7	24.4	0.0017
No HIV risk from sharing tools with others	35.1	26.0	0.0008
No HIV risk from sharing bathroom facilities with others	23.3	16.8	0.0051
No HIV risk from mosquitoes bites	13.6	9.6	0.0311
Risk of HIV transmission from sexual intercourse	67.6	48.5	<0.0001
Risk of HIV transmission from sharing injection needles	65.5	47.4	<0.0001
Risk of HIV transmission from mother to child	55.2	42.3	<0.0001
Risk of HIV transmission from sharing shaving paraphernalia with others	49.6	32.3	<0.0001
Risk of HIV transmission from blood transfusion	68.7	49.1	<0.0001
Believes self to be at risk of HIV	9.1	3.8	<0.0001
Believes self to be at risk of STIs	15.6	3.4	<0.0001
AIDS can not be cured	34.2	23.5	<0.0001

Table 3
Univariate and multivariate analysis of HIV/STI infection and selected socio-demographic and risk behavior variables by client status

Variables	Miner Clients (n=336)						Miner non –clients (n=1421)					
	HIV positive (n=6)			STI positive (n=78)			HIV positive (n=7)			STI Positive (n=185)		
	No. (%)	OR (95%CI)	Adjust OR (95%CI)	No. (%)	OR (95%CI)	Adjust OR (95%CI)	No. (%)	OR (95%CI)	Adjust OR (95%CI)	No. (%)	OR (95%CI)	Adjust OR (95%CI)
Age >27 yr.	5 (3.1)	5.5 (0.6~47.7)	--	44 (27.2)	1.5 (0.9~2.6)	--	4 (0.5)	1.1 (0.2~5.0)	--	110 (14.2)	1.3 (0.9~1.7)	--
Ethnic minority	2 (0.9)	0.3 (0.1~1.5)	--	50 (23.3)	1.0 (0.6~1.7)	--	6 (0.8)	4.7 (0.6~39.0)	--	138 (17.3)	2.5 (1.8~3.6)**	2.6 (1.8~3.6)**
Married	2 (1.1)	0.4 (0.1~2.1)	--	45 (23.6)	1.0 (0.6~1.7)	--	6 (0.7)	3.4 (0.4~28.0)	--	133 (14.6)	1.5 (1.1~2.1)*	--
Schooling >6 yr.	4 (3.1)	3.3 (0.6~18.2)	--	27 (20.9)	0.8 (0.5~1.4)	--	1 (0.2)	0.4 (0.1~2.7)	--	48 (9.9)	0.6 (0.5~0.9)	--
Illegal drug use&	3 (25.0)	35.7 (6.3~201.6)**	266.9 (13.3~999)**	6 (50.0)	3.5 (1.1~11.2)*	3.5 (1.1~11.3)*	1 (5.3)	12.9 (1.5~112.9)*	11.5 (1.3~105)*	3 (15.8)	1.3 (0.4~4.4)	--
Tattoo	3 (9.4)	10.4 (2.0~53.8)**	42.3 (3.6~502)**	5 (15.6)	0.6 (0.2~1.6)	--	1 (1.2)	2.6 (0.3~21.6)	--	10 (11.5)	0.9 (0.4~1.7)	--
Smoking	6 (2.0)	1.3 (0.1~23.1)	--	74 (24.1)	2.0 (0.7~5.9)	--	7 (0.6)	2.3 (0.1~40.0)	--	168 (13.6)	1.6 (0.9~2.6)	--
Drinks alcohol	5 (1.9)	1.4 (0.2~12.6)	--	62 (23.8)	1.1 (0.6~2.1)	--	6 (0.6)	3.1 (0.4~26.0)	--	136 (14.5)	1.5 (1.1~2.1)*	--
Frequents karaoke halls in leisure time	5 (4.1)	9.0 (1.0~77.8)*	--	29 (23.6)	1.0 (0.6~1.7)	--	1 (0.6)	1.3 (0.2~11.2)	--	11 (7.0)	0.5 (0.2~0.9)*	0.5 (0.3~0.9)*
Living with spouse	1 (0.8)	0.3 (0.1~3.0)	--	33 (26.8)	1.4 (0.8~2.3)	--	4 (0.7)	2.1 (0.5~9.2)	--	93 (16.6)	1.7 (1.2~2.3)**	1.6 (1.2~2.2)**
Time living in the local township>2 yr.	5 (3.1)	5.5 (0.6~47.7)	--	44 (27.2)	1.5 (0.9~2.6)	--	3 (0.6)	1.4 (0.3~6.1)	--	72 (14.2)	1.2 (0.9~1.6)	--
Age of first sexual experience<16 yr.	2 (3.8)	2.7 (0.5~15.3)	--	9 (17.0)	0.6 (0.3~1.4)	--	0 (0.0)	0.2 (0.0~4.1)	--	26 (8.3)	0.5 (0.3~0.8)**	--
Age of first sexual experience with FSW <16 yr.	1 (10.0)	7.1 (0.8~67.5)	--	1 (10.0)	0.4 (0.1~2.9)	--	NA	NA	--	NA	NA	--
Reported STIs symptoms in the past 12 months	4 (6.1)	8.6 (1.5~48.3)*	--	25 (37.9)	2.5 (1.4~4.5)**	2.5 (1.4~4.5)**	0 (0.0)	0.5 (0.0~8.5)	--	10 (23.3)	2.1 (1.0~4.3)*	--
Number of FSW partner in the past 12 months >3	3 (5.2)	5.0 (1.0~25.4)*	24.0 (2.1~277)*	14 (24.1)	1.1 (0.5~2.1)	--	NA	NA	--	NA	NA	--
Number of sexual partner in the past 12 months>3	3 (2.7)	2.0 (0.4~10.1)	--	28 (24.8)	1.1 (0.6~1.9)	--	2 (2.3)	6.3 (1.2~33.1)*	5.9 (1.1~31.7)*	16 18.6	1.6 (0.9~2.8)	--
Never used condom with FSW's	2 (1.3)	0.6 (0.1~3.4)	--	34 (22.7)	0.9 (0.6~1.6)	--	NA	NA	--	NA	NA	--

NA=not applicable.
& Illegal drug use indicates the status found via self-reporting or the positive status from urine morphine testing. HIV and STI association with IDU was not calculated because IDU sample was too small.
* p<0.05,
** p<0.0