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Unsafe Sex and STI Prevalence Among HIV-Infected Adults in Guangzhou, China: Opportunities to Deamplify Sexual HIV Transmission

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Abstract

This project examined sexual behavior and STI prevalence among HIV-infected individuals in South China. Adult HIV-infected outpatients in Guangzhou, Guangdong Province, China completed a self-administered survey about behaviors and antiretroviral treatment. Participants were screened for syphilis, gonorrhea, and chlamydia. Univariate and multivariate relationships with any STI were calculated using logistic regression. 810 HIV-infected individuals participated and 3 refused. 52.5 % (n = 415) of individuals reported having sex in the past 3 months, among whom 26.4 % (n = 111) reported inconsistent condom use. 10.4 % (n = 84) of all individuals had at least one sexually transmitted infection (STI). HIV-infected individuals not on antiretroviral treatment had an increased STI risk (aOR 2.5, 95 % CI: 1.4–4.5, P = 0.002). Unsafe sex was markedly reduced among HIV-infected individuals on treatment, possibly a reflection of

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integrated ART initiation counseling. Improved STI services among HIVinfected individuals are urgently needed to deamplify sexual HIV transmission.

Keywords

China; HIV/AIDS; ART; Sexually transmitted infections; MSM; IDU

Introduction

STI-HIV co-infections are common and have great clinical and public health significance [1]. Sexually transmitted co-infections amplify the risk of HIV transmission by drawing more susceptible immune cells to the genital area and increasing HIV viral shedding [2–4]. A meta-analysis found a mean STI prevalence of 16.3 % among HIV-infected individuals [5]. Antiretroviral treatment (ART) reduces HIV transmission [6], but the extent to which this offsets the amplification of STIs is unknown [7]. Initiation of ART may have various effects on sexual behaviors, contingent on counseling and culture. No change [5], increased unsafe sex [8, 9], and decreased unsafe sex [10–13] have all been reported immediately following ART initiation. To our knowledge this key point has not been explored in China which has a predominately sexually transmitted HIV epidemic [14] and an expanding syphilis epidemic [15].

By the end of 2009, an estimated 740,000 individuals were living with HIV in China, with 48,000 new annual cases [16]. Since 2005 sexual transmission has increased significantly, accounting for 74.9 % of new HIV cases in 2009 [16]. Responding to the HIV epidemic, China launched the National Free ART Program in 2003 [17]. This program provides free ART to all Chinese HIV-infected individuals who had a CD4 cell count of <350 cells per μl. Since then 82,540 individuals have received free ART through the program [18]. The purpose of our study was to investigate the sexual behaviors and syphilis, gonorrhea, and chlamydia prevalence among HIV-infected individuals in Guangzhou, China.

Methods

Study Population

Guangzhou is the capitol of Guangdong Province in southern China. The Guangzhou Number Eight People's Hospital HIV clinic evaluates more than 4,000 HIV-infected individuals every month. Individuals who are 18 years or older and HIV-infected were eligible to join the study. Institutional review boards from the University of North Carolina at Chapel Hill, Guangdong Provincial STI Control Center, and Guangzhou Number Eight Hospital approved the study protocol. Informed consent was obtained from all individuals prior to entering the study.

Study Design and Procedure

Between April and June 2011, 810 individuals with HIV infection who came to the Guangzhou Number Eight HIV clinic for care were enrolled. All participants consented to blood draw of 2 ml and gave 5 ml of urine. Participants were recruited by physicians, nurses, and dedicated research staff. Participants completed a self-administered paper questionnaire that collected information on gender, age, area of residence, income, education level, condom use, sexual behavior following HIV diagnosis, ART medication status, previous behavior interventions received, and history of STI. Nurses were available to assist participants who had questions. The questionnaire items regarding condom use, sexual behavior, ART medication status, and history of STI were based on previous published research [11, 19, 20] and translated into simplified Chinese. The questionnaire was field-

tested among clinic patients to check for question clarity and completion rate. Six clinic physicians and three nurses gave feedback on the questionnaire 2 weeks prior to study launch. Field-testing determined that elderly and low education HIV-infected individuals sometimes had problems understanding the questions and nurses were prompted to help. All participants received a small gift that cost approximately four US dollars. Patients received routine risk reduction counseling. There is no specific hospital counseling guideline and much of the counseling is ad hoc. Typically counseling focuses on patient questions and lasts from 5 to 20 min.

Laboratory Procedures

All specimens were collected and processed according to hospital guidelines. Blood samples were tested for syphilis with rapid plasma regain for initial screening and a rapid treponemal antibody test (colloidal gold device) (WanTai Rapid Syphilis; Beijing WanTai Biological Pharmacy Enterprise Co. Ltd, Beijng, China) for confirmation. Urine samples were evaluated for *Neisseria gonorrheae* and *Chlamydia trachomatis* by PCR (CT/NG PCR Diagnositic Kit; DA An Gene Co., Ltd. of Sun Yat-sen University, Guangzhou, China) at the laboratory of Guangdong Provincial Skin Diseases and STI Control Center. All participants with STIs were treated according to national guidelines.

Data Management and Statistical Analysis

Questionnaire data were double entered into EpiData Entry 2.0 (“The EpiData Association”, Odense, Denmark) and <2 % of items were discordant. Group means were compared using Student’s *t* tests. Group proportions were compared using Chi-square tests or Fisher tests. The main outcome of interest was any STI, defined as syphilis, gonorrhea, or chlamydia. Univariate regression analysis examined the association between covariates and presence of any STI. Covariates with a *P* value of <0.10 were included in the multivariate regression model. SPSS 17.0 (Chicago, IL) was used to perform all data analysis.

Results

Sample Characteristics

813 eligible individuals were approached and three refused to participate. 725 (89.5 %) of individuals had already started ART based on national guidelines (Table 1). The mean ART duration was 825 days (SD = 716 days) with 10.1 % (n = 73) of the participants having started ART <2 months prior to the study. 61.4 % (n = 497) of the participants were male. The age of the participants ranged from 19 to 79 years old (mean ± SD: 40.3 ± 11). 19.5 % (n = 157) of the participants lived in the city of Guangzhou and 67.5 % (n = 547) of the participants had an education level of middle school or less. 31.4 % (n = 253) of participants were fully employed and 37.7 % (n = 304) of the participants were unemployed. ART usage was significantly greater in HIV-infected individuals from Guangdong Province residents (including those from Guangzhou city) compared to those from other provinces (90.9 vs 80.9 %, P = 0.008, Table 1).

Sexual Behaviors of HIV-Infected Individuals

52.5 % (n = 415) of individuals reported having sex in the past 3 months (Table 2). 26.4 % (n = 111) of individuals reported not using a condom during each episode of sex. 27.7 % (n = 201) of all HIV-infected individuals stopped having sex after initiating ART. 76.7 % (n = 386) of individuals reported they were more likely to use a condom after starting ART. Among men who have sex with men, 73.7 % reported they were more likely to use a condom after starting ART, higher than intravenous drug users (63.2 %) or sex workers (66.7 %). 27.5 % of HIV-infected MSM subgroups in our study had unprotected sex in the

past 3 months. ART users were more likely to report always using a condom in the past 3 months (75.9 vs 50.0 %, $P = 0.001$).

Counseling services were well integrated into the ART initiation process at our site. 74.1 % ($n = 529$) of participants reported receiving education about safe sex focused on condom use at ART initiation. Among those who reported receiving counseling, 97.0 % ($n = 513$) received physician counseling, 79.6 % ($n = 421$) received NGO counseling, and 53.7 % ($n = 284$) received nurse counseling. Individuals who reported receiving counseling from nurses reported less unprotected sex compared to those who did not report receiving counseling from nurses ($P = 0.001$).

STI Prevalence and Correlates

STI prevalence among all HIV-infected individuals was 10.4 % (95 % CI: 8.2–12.5 %). Syphilis, gonorrhea and chlamydia prevalence were 4.6 % (95 % CI: 1.4–6.0 %), 0.7 % (95 % CI: 0.6–1.3 %), 5.2 % (95 % CI: 1.5–6.7 %), respectively. There was a significant reduction in the prevalence of chlamydia ($P = 0.004$) and any STI ($P = 0.004$) comparing individuals on ART and untreated individuals. Among those taking ART, the first 2 months of ART were associated with a trend toward higher risk of any STI (15.1 vs 9.4 %, $P = 0.086$) compared to subsequent months.

Not starting ART (OR 2.5, 95 % CI: 1.4–4.5, $P = 0.002$) was correlated with an increased risk of having an STI in a multivariate regression model (Table 3), while being unmarried (aOR 1.5, 95 % CI: 0.9–2.5, $P = 0.057$) was associated with a trend toward higher risk of any STI. HIV-infected individuals receiving counseling from nurses was also less likely to have any STI (OR 0.4, 95 % CI: 0.17–0.93, $P = 0.034$). Receiving physician ($P = 0.30$) or NGO ($P = 0.18$) counseling was not associated with a decreased risk of STI. CD4 <200 cells/μl, ART duration <2 months, consistent condom use in the past 3 months and missing 1 day of ART in past were not statistically significantly associated with having an STI.

Discussion

STI amplification of HIV transmission is a persistent threat to the effectiveness of HIV treatment as prevention strategies. Although HPTN 052 demonstrated that ART decreases the risk of HIV transmission [6], the low burden of incident STIs precluded a thorough investigation of the degree to which STIs amplify HIV. Persistent HIV viral shedding on treatment [21] raises the possibility of HIV transmission despite treatment. Our findings showed a higher risk of any STI among HIV-infected individuals prior to initiating ART, followed by a precipitous reduction in sexual risk following ART initiation. To our knowledge this is first study to systematically explore sexual risk among different HIV risk groups in mainland China. A previous systematic review noted a dearth of STI prevalence studies among HIV-infected individuals in Asia [5]. Our study extends previous global research in this field [10, 11, 13, 19] by analyzing biomarkers and routine clinical practice.

Our sample came from Guangzhou, China's third largest city, and is likely similar to other megacities (cities >10 million individuals) along China's eastern coast [22]. The HIV-infected population in our study (Table 1) is comparable to other nationwide studies of HIV-infected individuals in China [23, 24] in terms of HIV transmission route, sex, marital status, and age. Over half of all HIV-infected individuals in Guangdong Province are rural-to-urban migrants [25], consistent with our sample and other studies in Chinese megacities [26]. The median CD4 count among HIV-infected on ART (282 cells/μl) was higher compared to a national study of all HIV-infected adults on ART at baseline in China (118 cells/μl) [27]. The frequency of unprotected sex among HIV-infected MSM subgroups in our study (27.5 %) was substantially lower compared to a recent meta-analysis of HIV-infected MSM (75.4

%) [28]. This suggests that the sexual risk of HIV-infected individuals in our study may underestimate the actual risk.

The overall prevalence of any STI in our HIV-infected sample was 10.4 %. This burden of STI is greater than Taiwan (8.9 %) [29] and slightly lower than a global meta-analysis (median 12.4 %) that included the same three diseases we examined plus trichomonas [5]. The syphilis and gonorrhea rate were comparable to those reported in HPTN 052 (4.6 vs 5.0 and 0.7 vs 1.5 %, respectively) [6]. Our sample of HIV-infected individuals had a lower syphilis [30, 31] and gonorrhea [32, 33] prevalence compared to other smaller studies of subsets of HIV-infected individuals in China. Our sample was probably less risky compared to the broader HIV-infected population in China because all the individuals in our sample were connected to the outpatient HIV system.

Not starting ART ($P = 0.002$) was significantly associated with an increased risk of any STI in multivariate analysis. The finding of less STI risk after ART initiation contrasts research from high-income nations [5, 8, 9] and is similar to behavioral research from Africa [10–13]. Among regions where homosexual HIV transmission is predominant [5, 34, 35], risk compensation likely drives persistent HIV transmission despite ART. Our MSM subgroup did not demonstrate risk compensation following ART initiation. The relationship between ART initiation and sexual risk was independent of marital status.

Our research suggested the relationship between sexual risk and ART initiation was correlated with integrated counseling, especially counseling provided by nurses. Counseling at this site typically consisted of 30 min one-on-one guidance driven by patient responses and questions. HIV-infected individuals receiving nurse counseling at the time of ART initiation was associated with improved condom use at last sex (OR 4.1, 95 % CI: 1.7–9.7, $P = 0.001$) and a decreased risk of STI (OR 0.4, 95 % CI: 0.17–0.93, $P = 0.034$).

The trend toward unmarried status being associated with STI risk among HIV-infected individuals is similar to Western data [36, 37]. This trend could be problematic in the context of skewed sex ratios. Demographers estimate that China conservatively has tens of millions more boys than girls born since the 1980s [38]. “Surplus men” are men unable to find brides who may have increased sexual risk compared to their married counterparts [39]. Further research on the sexual risk of unmarried groups in China is warranted.

Several limitations of this study should be noted. First, all participants came from one outpatient setting and may not be representative of HIV-infected individuals in Guangdong Province. However, this site is the only HIV-focused outpatient clinic in Guangdong City and draws patients from across the province and region. Second, HIV-infected individuals may be managed locally by another clinic prior to initiating ART [40], limiting the extent to which our data on ART naïve patients can be generalized to all contexts. Third, the effects of counseling on sexual behavior may not be generalizable to others sites in China due to a lack of universal counseling guidelines. However, voluntary counseling by the nurses at this site reduced risky sexual behavior. Finally, this is a cross-sectional study and so inferences about the timing of STI acquisition should be cautious.

Conclusion

This research underlines the progress and challenges of preventing sexual HIV transmission. ART initiation is associated with a sharp reduction in sexual risk taking, potentially related to counseling services. However, persistent risky behaviors, especially among HIV-infected individuals not taking ART, complicate HIV prevention. More intensive STI screening, treatment, and partner services among all HIV-infected individuals are urgently needed to curb sexual HIV transmission.

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Table 1

Social and demographic data of HIV-infected individuals in Guangzhou, Guangdong Province, China

Variable	All participants (*n* = 810) *n* (%)	Started ART (*n* = 725) *n* (%)	Not started on ART (*n* = 85) *n* (%)	*P* value
Sex				
Male	497 (61.4)	445 (61.4)	52 (61.2)	1.000
Female	313 (38.6)	280 (38.6)	33 (38.8)	
Age				
<20 years old	3 (0.4)	2 (0.3)	1 (1.2)	0.538
20–40 years old	473 (58.4)	423 (58.3)	50 (58.8)	
years old	288 (35.5)	260 (35.9)	28 (32.9)	
>60 years old	46 (5.7)	40 (5.5)	6 (7.1)	
Residence *				
Within Guangzhou City	157/807 (19.5)	143/723 (19.8)	14/84 (16.7)	0.008
Within Guangdong Prov.	540/807 (66.9)	491/723 (67.9)	49/84 (58.3)	
Outside Guangdong Prov.	110/807 (13.6)	89/723 (12.3)	21/84 (25.0)	
Education				
Elementary or lower	176 (21.8)	154 (21.2)	22 (25.9)	0.093
Middle school	371 (45.8)	337 (46.5)	34 (40.0)	
High school	161 (19.8)	144 (19.9)	17 (20.0)	
College or higher	102 (12.6)	90 (12.4)	12 (14.1)	
Employment status				
Full time	253/806 (31.4)	223/721 (31.0)	30 (35.3)	0.916
Part time or temporary	201/806 (24.9)	182/721 (25.2)	19 (22.3)	
Retired	48/806 (6.0)	43/721 (6.0)	5 (5.9)	
No employment	304/806 (37.7)	273/721 (37.8)	31 (36.5)	
Marital status				
Single	148/809 (18.3)	127/724 (17.5)	21 (24.7)	0.139
Married/cohabitating	509/809 (62.9)	454/724 (62.7)	55 (64.7)	
Separated/divorced	86/809 (10.6)	80/724 (11.1)	6 (7.1)	
Widowed	66/809 (8.2)	63/724 (8.7)	3 (3.5)	

* Defined as registered residence in the city of Guangzhou, outside of Guangzhou but within Guangdong Province, outside of Guangdong Province

Table 2

Sexual behavior data and sexually transmitted infection (STI) testing results of study participants

Variable	All (*n* = 810) Frequency (%)	No STI (*n* = 726) Frequency (%)	Any STI (*n* = 84) Frequency (%)	*P* value
Sex in past 3 months				
Yes	415/791 (52.5)	375/710 (52.8)	40/81 (49.4)	0.560
No	376/791 (47.5)	335/710 (47.2)	41/81 (50.6)	
Number of sex partners				
One or none	453/468 (96.8)	410/421 (97.4)	43/47 (91.5)	0.053
More than one	15/468 (3.2)	11/421 (2.6)	4/47 (8.5)	
Last sex unprotected				
Yes	88/462 (19.0)	76/416 (18.3)	12/46 (26.1)	0.234
No	374/462 (81.0)	340/416 (81.7)	34/46 (73.9)	
100 % condom use in past 3 months				
Yes	309/420 (73.6)	283/379 (74.7)	26/41 (63.4)	0.136
No	111/420 (26.4)	96/379 (25.3)	15/41 (36.6)	
HIV transmission route				
Homosexual sex	86/806 (10.7)	74/723 (10.2)	12/83 (14.5)	0.718
Heterosexual sex	307/806 (38.1)	272/723 (37.6)	35/83 (42.2)	
Intravenous drug use	152/806 (18.9)	137/723 (18.9)	15/83 (18.1)	
Mother-to-child	1/806 (0.1)	1/723 (0.1)	0/83 (0)	
Transfusion	85/806 (10.5)	78/723 (10.8)	7/83 (8.4)	
Unclear	175/806 (21.7)	161/723 (22.2)	14/83 (16.9)	
Started ART				
Yes	725/810 (89.5)	658/726 (90.6)	67/84 (79.8)	0.004
No	85/810 (10.4)	68/726 (9.4)	17/84 (20.2)	
Received sexual health education prior to starting ART*				
Yes	529/714 (74.1)	482/648 (73.9)	47/66 (70.1)	0.558
No	185/714 (25.9)	166/648 (26.1)	19/66 (29.9)	
Sexual health topics discussed when starting ART*				
Reduce frequency	121/725 (16.6)	109/658 (16.6)	12/67 (17.9)	0.555
Reduce partners	103/725 (14.2)	97/658 (14.7)	6/67 (8.9)	0.090
Using condoms	553/725 (76.2)	498/658 (75.7)	55/67 (82.1)	0.281
Partner testing	261/725 (36)	237/658 (36)	24/67 (35.8)	0.243
No sex or decreased frequency since starting ART*				
Yes	560/709 (79.0)	511/645 (79.2)	49/64 (76.6)	0.630
No	149/709 (21.0)	134/645 (20.8)	15/64 (23.4)	
Increased condom use since starting ART*				
Yes	386/503 (76.7)	352/461 (76.4)	34/42 (80.9)	0.572
No	117/503 (23.3)	109/461 (23.6)	8/42 (19.1)	
Missed at least 1 day of ART in past month				
Yes	136/711 (19.1)	122/646 (18.9)	14/65 (21.6)	0.620

Variable	All (*n* = 810) Frequency (%)	No STI (*n* = 726) Frequency (%)	Any STI (*n* = 84) Frequency (%)	*P* value
No	575/711 (80.9)	524/646 (81.1)	51/65 (78.4)	
Missed more than 4 weeks of ART* in past year				
Yes	49/663 (7.4)	44/603 (7.3)	5/60 (8.3)	0.809
No	614/663 (92.6)	559/603 (92.7)	55/60 (91.7)	
Mean ART duration	825 days ± 716	814 days ± 699	931 days ± 856	0.201

*Anti-retroviral therapy

Table 3

Univariate and multivariate regression analysis of covariates associated with any STI

Variable	Frequency (%)	Univariate		Multivariate	
		Unadjusted odds ratio (95 % CI)	*P* value	Adjusted odds ratio (95 % CI)	*P* value
Male sex	497/810 (61)	1.3 (0.8–2.1)	0.292		
Age <40	476/810 (59)	0.7 (0.7–1.7)	0.702		
Registered residence outside of Guangdong	110/810 (37)	1.3 (0.7–2.4)	0.438		
Middle school or less education	547/810 (67)	0.8 (0.4–1.2)	0.240		
Not married or cohabitating	301/810 (37)	1.5 (0.9–2.4)	0.065	1.5 (0.9–2.5)	0.057
Sex in past 3 months	415/791 (52)	0.8 (0.6–1.4)	0.558		
Always used a condom in past 3 months	309/420 (73)	0.6 (0.3–1.2)	0.124		
Have not started ART	725/810 (90)	2.5 (1.3–4.4)	0.003	2.5 (1.4–4.5)	0.002
Missed at least 1 day of ART in past 4 weeks	136/711 (19)	1.2 (0.6–2.2)	0.605		
Sexual education received prior to ART	535/725 (74)	0.8 (0.5–1.4)	0.503		
ART duration <2 months	73/725 (10.1)	1.9 (0.9–3.8)	0.074		
CD4 <200 cells/μl	316/809 (39)	0.8 (0.5–1.3)	0.376		
IV drug use in past month	32/748 (4)	1.6 (0.6–4.4)	0.330		