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Sexual behavior with non-commercial partners: a concurrent partnership study among middle-aged female sex workers in China

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Abstract

Female sex workers (FSWs) often engage in concurrent partnerships, meaning they have multiple sexual relationships at the same time. The objective of this study was to investigate sexual concurrency and its associations with condom use and syphilitic infections among FSWs over 35 years old. Respondent-driven sampling was used to recruit 1,245 FSWs in Nanning, Hefei, and Qingdao in China. FSWs were asked to report whether they had concurrent partners in the past six months. Concurrency was defined as engagement in sex with commercial clients and: 1) husbands and boyfriends ($n = 167$); 2) husbands only ($n = 301$); or 3) boyfriends only ($n = 469$). FSWs with only commercial clients were used as the comparison group ($n = 308$). Across all groups, the percentage of FSWs with prevalent and active syphilis ranged from 19.6%–25.6% and 9.1%–11.5%, respectively. Condom use was low with non-commercial sexual partners and was more likely to be used when FSW's boyfriends had other partners. Three components of the Theory of Planned Behavior were significantly associated with consistent condom use. Concurrent relationships may lead to increased transmission of syphilis at the workplace and family levels. Effective interventions should target concurrency with both commercial and non-commercial partners.

Keywords

AIDS/HIV; Sex work; Sociological Theories; STDs

Introduction

The epidemics of sexually transmitted infections (STIs), including syphilis, have spread among older populations worldwide, including in China (Cai, Tan, Chen, Richardus, & de Vlas, 2013; X.-S. Chen et al., 2012; Mahy, Autenrieth, Stanecki, & Wynd, 2014; Zhou et al., 2014). In 2009, Chinese sentinel surveillance data indicated that the incidence of primary and secondary syphilitic infection was 11.7 cases per 100,000, and increased 2.5 times since 2005 (X.-S. Chen, Peeling, Yin, & Mabey, 2011). Adult FSWs who are 35 years old or older have a 2–7 fold higher risk of syphilis compared to younger FSWs (X.-S. Chen et al., 2012;

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Zhou et al., 2014) and often enter the sex industry as low-tier sex workers (Fang et al., 2007; Hao et al., 2014). Previous studies have documented that women turn to the sex industry after facing economic adversity in order to provide for their families, as many have pre-school or school-aged children (Y. Chen et al., 2016; Huang, Henderson, Pan, & Cohen, 2004). Their clients are primarily rural-to-urban migrants, low-paid labor workers, or retired older men, compared to younger FSWs, who enter the sex service as high- or middle-tier workers and serve businessmen (Gu et al., 2009a; Han et al., 2016). Given their low socioeconomic status, adult FSWs may seek out multiple partnerships to improve financial stability.

FSWs in China often have intimate relationships with spouses and/or boyfriends (e.g., non-commercial sex partners), in addition to commercial clients (Yang et al., 2005). A concurrent relationship is one where an individual has an overlapping sexual partnership with multiple people at the same time (Mah & Halperin, 2010). Concurrent relationships may lead to an increased transmission of STIs among multiple sex partners (Wong, Yim, Leung, Lynn, & Ling, 2012). In the 1990s, Hudson proposed that the variation in HIV prevalence within and between countries could be partially explained by levels of concurrent sexual partnerships. Specifically, the spread of HIV would more frequently occur in populations with higher levels of overlapping partnerships (C. P. Hudson, 1998; Christopher P. Hudson, 1993). More recently, mathematical models have demonstrated that concurrent partnerships can increase the number of partners exposed to HIV/STIs for a given number of lifetime partners compared to “serially monogamous” relationships (Epstein & Morris, 2011; Morris, 2001; Morris, Kurth, Hamilton, Moody, & Wakefield, 2009). One simulation study using data from Uganda projected that the HIV epidemic would become about ten times larger over a five-year period for individuals with concurrency in 50% of their relationships, compared to serially monogamous relationships (Morris & Kretzschmar, 2000). The majority of previous qualitative studies (Dandona et al., 2005; Ghimire, Smith, van Teijlingen, Dahal, & Luitel, 2011; Outwater et al., 2000) and observational studies were conducted among young FSWs (Van Den Hoek et al., 2001), men who have sex with men (MSM) (Choi, Hudes, & Steward, 2008; Choi, Ning, Gregorich, & Pan, 2007; Van Tieu et al., 2014), drug users (Li et al., 2011), or adolescents (Heeren et al., 2014). While these studies provide evidence that concurrent partnerships increase the likelihood of contracting and spreading HIV/STIs, findings centered on the syphilis epidemic in adult FSW populations are limited.

Few studies have been conducted to investigate the types of overlapping concurrent partnerships, the prevalence of concurrency, and its association with syphilitic infection among adult FSWs in China. For example, a qualitative study of 25 younger FSWs (aged 18–32) in Guangzhou, China documented more condom use with clients than non-commercial partners (Jie et al., 2012). A study by Chen et al. (2005), reported that 44% of FSWs of varying ages had concurrent partnerships with clients and boyfriends in Yunnan, China (X. Chen et al., 2005). Given that older FSWs are more likely to be infected with syphilis than younger FSWs (Han et al., 2016) underscores the need to understand the role of concurrency in the syphilis epidemic.

The Theory of Planned Behavior (TPB) has been used to explain individuals' intention to engage in health-related behaviors (Ajzen, 2005). The TPB suggests that the intention to

perform (or not to perform) a behavior is the immediate determinant of the behavior. The TPB has three major components: attitudes toward the behavior, subjective norms with respect to the behavior, and perceived control over the behavior (Ajzen, 2011). Attitudes toward condom use measures the degree of positive appraisal of condom use. Subjective norms are the perceived beliefs of other FSWs related to condom use. Perceived behavioral control refers to the ability to use condoms when obstacles arise. Together, these three components have been shown to predict condom use intention with a high degree of accuracy (Carmack & Lewis-Moss, 2009; Gu et al., 2009b; Molla, Nordrehaug Aastrøm, & Brehane, 2007). Understanding the relationships of the TPB components and condom use in the context of sexual concurrency may provide useful information to develop effective interventions for this vulnerable population. However, few studies have used the TPB to explain engagement in condom-protected sex among FSWs.

The current study addresses the limitations of the literature by using a large sample of FSWs over the age of 35 with multiple types of concurrent partnerships from three cities to contextualize the syphilis epidemic in China. The objectives of this study were to: 1) describe different concurrent sexual partnerships, 2) investigate patterns of concurrent partnerships and their associations with syphilis and risky sex practices, and 3) explain consistent condom use with the TPB in the context of sexual concurrent partnerships among FSWs in China.

Method

Study sites and study population

Detailed information regarding sampling has been previously reported elsewhere (Liu et al., 2016). Briefly, this cross-sectional study was conducted in Qingdao, Hefei, and Nanning, China in 2014. The three cities covered different prevalence levels of the HIV/STI epidemics and different geographic regions from northeast to southwest China. According to local surveillance data and the China National HIV/STD Surveillance (Ministry of Health of the People's Republic of China, 2012), Nanning is located in the area with the highest HIV/STI prevalence (8,618 HIV cases and 36,404 notifiable STI cases reported from 2010–2013), Hefei with mid-level prevalence (1,105 HIV cases and 21,344 STI cases), and Qingdao with the lowest prevalence (733 HIV cases and 8,748 STI cases).

FSWs were invited to participate in the study based on the following inclusion criteria: 1) were 35 years old or older at the time of the interview; 2) lived in Nanning, Hefei, Qingdao for at least 3 months; and 3) had commercial sex at least once a week in the month prior to the interview. The selection of 35 years of age to define adult FSWs was based on findings from our qualitative study conducted at the three sites (Hao et al., 2014).

Respondent-driven sampling (RDS) was used to recruit FSWs (Heckathorn, 1997, 2002). Detailed evaluation of the RDS sample has been previously reported (Liu et al., 2016). Briefly, we chose RDS over a venue-based sampling approach because our previous study suggested that FSWs worked in other locations and RDS allows for non-venue based sampling (Hao et al., 2014). Four or five seeds were selected from each study location and were diverse in terms of their duration of sex work and preferred client solicitation site. The

seeds received an explanation of the study purpose and three coupons to recruit up to three eligible subjects. All new recruits in the subsequent recruitment waves participated in an anonymous interview using a computer-assisted personal interviewing (CAPI) device in a private room. New recruits were also offered three coupons, similar to the seeds. RDS samples include a comprehensive cross-section of the hidden population after five to six recruitment waves (Heckathorn, 2007). We estimated that a sample size of 400 participants would be needed at each study site to reach a sufficient number of recruitment waves. In total, we recruited 418 FSWs from Nanning, 407 from Hefei, and 420 from Qingdao and successfully reached eight waves of recruitment in Qingdao, nine in Hefei, and eleven in Nanning. Inference from RDS involves assumptions about the network structure, sampling procedures, and participant behavior (Gile & Handcock, 2010). As outlined by Gile, Johnston & Salganik (2015), seed dependence was evaluated with convergence plots and bottleneck plots to determine if the RDS estimates were biased by the initial sample of seeds (Gile, Johnston, & Salganik, 2015). Age, education, marital status, migration status, and location of client solicitation were included in the convergence analysis. Results indicated that after 100–300 participants were recruited at each study site, the proportions of the five variables reached equilibrium and included a broad cross-section of the hidden population.

Measures

Biospecimens.—Trained lab technicians collected and tested the following specimens from each consenting participant: 1) a venipuncture blood specimen for syphilitic infection, and 2) vaginal swabs to test for prostate-specific antigen (PSA). Syphilitic infection was first screened using a qualitative immunoassay to detect antibodies to *Treponema pallidum* (Alere Determine™ TP test; Alere Medical Co., Ltd, Chiba Prefecture, Japan) and was confirmed by a *Treponema pallidum* particle agglutination test for detection of antibodies to *Treponema pallidum* (TPPA; Fujirebio Inc., Tokyo, Japan or ABON Biopharm Co., Ltd., Hangzhou, China). Confirmed positive TPPA samples were tested for *non-treponemal antilipoidal* antibodies, using Tolidine Red Unheated Serum Test (TRUST; Wantai Biological Pharmacy Enterprise Co., Ltd., Beijing, China). FSWs who sero-tested positive for TPPA were classified as *prevalent cases* of syphilitic infection (including both previous and active syphilitic infection) since a positive test result indicates evidence of antibody to syphilis and is interpreted as a lifetime marker of infection (Seña, White, & Sparling, 2010). Those who sero-tested positive for both TPPA and TRUST were classified as *active cases* (or current cases) of syphilitic infection, including active or latent treponemal infection.

Condomless sex was biologically measured by prostate specific antigen (PSA) with vaginal swabs. Fresh vaginal swabs were placed in the extraction buffer provided with the testing kit and were soaked for at least five minutes. Presence of PSA was detected with the ABACard p30 test (Abacus Diagnostics, West Hill, CA) using 200 mL of swab extraction and was loaded directly into the well of the immunochromatographic test strip according to the manufacturer's instructions. PSA positivity indicates condomless sex within the past 48 hours (Gallo et al., 2013).

Concurrent Partnerships.—Concurrent partnerships were defined as engagement in commercial sex with clients and non-commercial partners, such as husbands and/or

boyfriends in the past six months. Sexual behavior with boyfriends was purposefully articulated in the questionnaire to be specific to non-commercial clients. Regular clients were defined as commercial sex partners with whom FSWs knew well and had sex for a while. FSWs were asked in the questionnaire “*did you have sex with your husband in the past six months?*” followed by “*did you have sex with your boyfriend in the past six months?*” Based on the responses to the two questions, FSWs were grouped into four distinct groups: 1) had sex with husbands, boyfriends, and commercial clients (both regular and irregular), 2) had sex with husbands and commercial clients, 3) had sex with boyfriends and commercial clients, and 4) had sex with commercial clients only (Figure 1). Sexual activity in the past six months was used rather than marital status because approximately 70% of the FSWs were migrants and did not live with their husbands and, therefore, did not have sex with them.

Constructs of the Theory of Planned Behavior (TPB).—Measures of the TPB constructs were adopted from scales reported by Reinecke and colleagues (Reinecke, Schmidt, & Ajzen, 1996) and Boileau and colleagues (Boileau, Rashed, Sylla, & Zunzunegui, 2008). Composite scores were calculated for all three scales by summing the items. All scale items are presented in Appendix A. *Attitudes towards condom use* were measured by a 9-item scale (sample item: “*You do not need to use condoms with intimate sex partners*”) and response categories ranged from (0) ‘strongly agree’ to (3) ‘strongly disagree’. Two items measured *subjective norms related to condom use* (sample item: “*How many FSWs encourage you to consistently use condoms?*”). Response options included: none of them, only a few of them, less than half of them, half of them, most of them, and all of them. Six items measured *perceived behavioral control* with a 3-point response scale ranging from (0) ‘very unlikely’ to (3) ‘very likely’ (sample item: “*If a client gives you more money for unprotected sex, how likely is it that you could you persuade him to use condoms?*”). The Cronbach’s alpha for attitudes towards condom use, subjective norms, and perceived behavioral control was 0.71, 0.72, and 0.82, respectively.

Frequency of condom use.—Frequency of condom use in the past 30 days was measured for casual and regular clients, boyfriends, and husbands. Responses consisted of: (1) used condoms every time, (2) used condoms most of the time, and (3) used condoms half or less than half of the time. Frequent condom use was defined as “used condoms every time or most of the time”.

Perception of husband’s or boyfriend’s risk for HIV or STIs.—FSWs were asked to report whether they believed their husbands or boyfriends were at risk for HIV and STIs (definitely not at risk, possible risk, very likely at risk, and definitely at risk) and engaged in sex with other partners (yes/no). They were also asked if their husbands or boyfriends were aware of their sex work (yes/no).

Covariates.—Covariates were selected from the literature and included: age (35–39, 40–44, 45–49, and 50 or older), education (high school or above, middle school, elementary school, and no school), migrant status (non-migrant/migrant), the number of clients in the past week, and monthly income from sex work (<3000 RMB, 3001–6000 RMB, and >6000

RMB). One US dollar is equivalent to 6.3 RMB. The location where FSW solicited clients for sex work included streets/parks, roadside hotels, barber shops, massage/sauna houses, dance hall/music bar, rental homes or other) (Hao et al., 2014).

Ethical Considerations

Since sex work in China is illegal and stigmatized, we used three approaches to ensure participant confidentiality. First, interviewers received training on confidentiality. Second, interview sites were chosen for their ability to maintain confidentiality and included clinics, hotels, and the local Centers for Disease Control and Prevention. Third, FSWs were recruited using RDS, a peer referral method that serves to build rapport between researchers and potential participants and address fears related to study participation. Trained research team members explained the study protocol and procedures and answered questions prior to obtaining informed consent. FSWs were told their HIV and syphilis status and those who tested positive were referred for treatment. Participants received compensation for transportation and \$10 for their participation in the interview and \$3 for each eligible subject they recruited. This study was approved by the Institutional Review Boards of the University of Maryland, Shandong University School of Public Health, and the Centers for Disease Control and Prevention in Hefei and Guangxi.

Statistical analysis

Univariate analyses were conducted to calculate the mean, median, and standard deviations (SD) of key study variables. Chi-square tests and one-way ANOVA tests were used to examine differences among the four groups. Two separate multiple logistic regression models were used to assess factors of non-commercial partnerships with (1) frequent condom use with husbands and (2) frequent condom use with boyfriends. Confounders were selected a priori from the literature and were evaluated using the 10 percent change in estimate strategy (Mickey & Greenland, 1989). Age, education, client solicitation site, income from sex work, and the study locations were adjusted in each of the models. The study sites were controlled for to adjust for potential clustering at each site. SAS Version 9.4 (SAS Inc., Cary, NC) was used to perform all analyses.

Results

Concurrent sexual partnerships and socio-demographic characteristics of the FSWs

A total of 1,245 FSWs aged 35 and older were recruited from three cities in China (407 in Nanning, 418 in Hefei, and 420 in Qingdao). Three quarters of the sample reported having concurrent sexual partners with both commercial and non-commercial partners (husbands or boyfriends) in the past 6 months (75.3%; 937/1245). The majority of FSWs engaged in concurrent sexual relations with their boyfriends and clients (Group 3: $n = 469$, 37.7%), followed by 24.2% ($n = 301$) who had sex with their husbands and clients (Group 2), and 13.4% ($n = 167$) engaged in sex with all three types of partners (Group 1: husbands, boyfriends, and commercial clients) (Figure 1). About one fourth (24.7%; $n = 308$) reported having sex with only clients (Group 4).

There were significant differences by age, marital status, educational level, migrant status, location for soliciting clients, and income from sex work across the four groups of FSWs (Table 1). FSWs who had no concurrent partnerships with non-commercial partners (Group 4) were different in terms of their socio-demographics compared with other groups. Specifically, they were more likely to be older, less educated, migrants, and serve more clients, compared to FSWs who had concurrent partnerships with non-commercial partners (Groups 1–3). FSWs who engaged in concurrent partnerships with their husbands, boyfriends, and commercial clients (Group 1) had the lowest income from sex work and were less likely to be migrants. The majority of them (56.3%) earned less than 3,000 RMB per month from sex work. The most common sites for FSWs to solicit clients were barbershops, massage parlors, sauna houses, streets, parks, and roadside hotels. Only a small proportion (8%–12.7%) solicited clients in relatively high-class venues, such as dancing halls or music bars.

The percentage of FSWs with prevalent syphilis ranged from 19.6% to 25.6% and the percentage of active syphilis cases was between 9.1% and 11.5% across the four different groups (Table 2). Although there were no statistically significant differences among the four groups, FSWs who had concurrency with both clients and boyfriends (group 3) had the highest prevalence of both active and prevalent syphilis, and those who had concurrency with their husbands and clients (group 2) had the lowest percentages of prevalent syphilis. FSWs who did not have concurrent partnerships with non-commercial partners had the lowest prevalence of active syphilis infection (group 4).

Condom use was low among all FSWs. The proportion of condomless sex within the past 48 hours prior to interview was between 37.4% and 48%. In Group 1, 7.6% of FSWs used condoms every sexual act with husbands, 25.8% with boyfriends, 50.9% with regular clients, and 58.1% with all clients. In Group 2, FSWs reported using condoms during every sex act 9.7%, 67.4%, and 60.5% of the time with their husbands, regular clients, and all clients, respectively. In Group 3, 17.7% of FSWs used condoms every time with their boyfriends, 57.8% with regular clients, and 53.9% with all clients. In Group 4, about half of the FSWs used condoms during every sexual act with regular clients (47.7%) and all clients (50.7%).

The three TPB constructs differed significantly across the four groups of FSWs (Table 2). FSWs in Group 2 and Group 4 had more favorable attitudes towards condom use, compared with those in Group 1 and Group 3. FSWs in Group 2 had a higher perceived behavioral control score. The subjective norms score was highest among FSWs in Group 4.

Frequent condom use and concurrent sexual partnerships

Table 3 presents the associations between frequent condom use and factors related to concurrent sex with non-commercial partners, including husbands' or boyfriends' own concurrent partnerships, knowledge of their wife's sex work, and the TPB constructs. FSWs' condom use with their husband was not statistically associated with their husband's risky sex behaviors (husband's concurrent partnership, perception of husband's risk for HIV or STIs, or husband's awareness of wife's sex work). Condom use was low even when FSWs knew their husbands had other sexual partners (21.6%), perceived their husbands were at risk for HIV or STIs (20% and 8.3%, respectively), and disclosed their sex work (14.1%).

Attitudes towards condom use (*Odds ratio (OR)* = 1.35, *95% Confidence Interval (95% CI)* = 1.22–1.50) and perceived behavioral control (*OR* = 1.13, *95% CI* = 1.01–1.27) were positively associated with frequent condom use with husbands.

FSWs were more likely to use condoms with their boyfriends when they knew their boyfriends had other concurrent sexual partners and perceived they were at risk for HIV (*OR* = 1.94, *95% CI* = 1.46–3.68). However, condom use with their boyfriends was low. For example, only one-third of FSWs used condoms frequently even when they knew their boyfriends had other concurrent sexual partners and sex work was disclosed. All three TPB constructs were positively associated with condom use with boyfriends.

Discussion

This study documents that a substantial proportion of FSWs over age 35 engaged in risky sexual behaviors including non-commercial partnerships (i.e., husband or boyfriends) and condomless sex with concurrent partners. Contrary to our expectation, engagement in concurrency did not increase the risk of syphilitic infection. However, all four groups experienced high levels of prevalent syphilis and these levels were higher than those reported by other East Asian countries (Nguyen et al., 2005; Van Den Hoek et al., 2001). This study also found that condom use was not only low between FSWs and their clients at the workplace level, but was also low between FSWs and their husbands or boyfriends at the family level, suggesting that syphilis could be transmitted and spread at both levels. Effective behavioral and biomedical interventions are needed to prevent syphilis from spreading among this population and their family members in China.

Previous studies suggest that concurrent relationships among FSWs are common (Baral et al., 2012). In our study, more than two thirds (75.3%) of FSWs reported a non-commercial concurrent partnership. This estimate is higher than the percentage of concurrent relationships reported in other countries. For example, 51.8% of younger FSWs in south India (Deering et al., 2011), 43% of FSWs from Senegal (mean age: 35 years, range: not reported) (Wang et al., 2007), and 16% of FSWs from Mexico reported concurrent partnerships (median age = 35 years, range 29–42) (Robertson et al., 2013). The differences between the studies may be, in part, due to the age distribution of the FSWs.

In other East Asian countries, the estimated prevalence of syphilis among FSWs ranged from 1–14% (Nguyen et al., 2005; Van Den Hoek et al., 2001), which is similar to the 10.3% of active syphilis cases and lower than the 23% of prevalent syphilis cases in our study. The percentage of FSWs with prevalent and active syphilis were similar across the four groups, which is contrary to our hypothesis that FSWs with concurrent partners would be more likely to have syphilis. There are two possible explanations for these findings. First, FSWs without concurrent relationships (Group 4) were older, poorly educated, and served more clients, which places them at a higher risk for syphilis. Second, the lowest levels of frequent condom use as measured by both self-report and the PSA test were found among those without concurrent relationships (Table 2). Together, the impact of concurrency on syphilitic infection may be counterbalanced by the risky behavior of those without concurrent partners. Although there were no statistical differences, the levels of syphilitic infection

were consistently high across the four groups compared to other neighboring countries and therefore, biobehavioral interventions should consider multiple approaches, including addressing concurrency and education to reduce syphilitic transmission.

Frequent condom use with husbands and boyfriends was low, which is consistent with a study in China (Yi et al., 2010) and other countries (Kayembe et al., 2008; Outwater et al., 2000; Ulibarri et al., 2012; van Veen, Götz, van Leeuwen, Prins, & van de Laar, 2010; Voeten, Egesah, Varkevisser, & Habbema, 2007). For example, Voeten et al.'s (2007) study showed that the majority of young FSWs in Kenya engaged in sex with both regular partners (e.g., former regular clients or men married) and clients within the past two weeks. They also reported that condom use with clients was common, but infrequent among long-term partners (Scorgie et al., 2012; Voeten et al., 2007). The low levels of condom use may be due to the psychological distinction that FSWs make between their work and private lives (Murray et al., 2007; Outwater et al., 2000), economic stability received from their non-commercial partner(s) (Outwater et al., 2000), and/or the level of trust between FSWs and their steady partners (Burton, Darbes, & Operario, 2010; Jie et al., 2012). Low condom use with husbands and boyfriends suggests a high possibility that concurrent relationships lead to syphilis transmission between high-risk groups.

Our study also suggests that only 20% of FSWs' husbands and 44% of their boyfriends were aware of their sex work, which is consistent with another study where 30.8% of FSWs disclosed their occupation to their husbands/cohabitating partners (Deering et al., 2011). It is possible that FSWs did not use condoms with non-commercial partners to protect their identity since sex work is both illegal and stigmatized in China (Rosenthal & Oanh, 2006). However, our findings suggest that non-commercial partners' awareness of sex work did not contribute to condom use. This result contradicts another study that showed that disclosure of sex work was associated with increased condom use with non-commercial partners (Deering et al., 2011). It is possible that both partners mutually accepted sex work as a job and did not believe using condoms was necessary or, perhaps husbands believed their wives used condoms with clients. Given that FSWs knew their boyfriends had other sex partners and that this was significantly associated with frequent condom use (and a similar, but not statistically significant relationship was observed between frequent condom use and awareness of husband's sex partners), it is possible that disclosure was not associated with condom use because the non-commercial partner revealed their risky behavior (e.g., having other partners) and advocated for condom use. This explanation is fitting with one qualitative study in Nepal, which suggested that FSWs who disclosed their identity have lower self-efficacy and reduced power to negotiate condom use with their non-commercial partners (Ghimire et al., 2011). Therefore, the decision to use condoms may arise from the non-commercial sex partner and their high-risk behavior (Scorgie et al., 2012). Interventions focusing on couple based approaches with FSWs and their non-commercial partners may help to promote consistent condom use.

The TPB constructs were significantly associated with frequent condom use. FSWs were more likely to use condoms if they had better attitudes toward condom use, stronger perceived behavioral control, and higher levels of subjective norms. Effective intervention

programs should focus on increasing the levels of the TPB constructs and educate FSWs on the risks of concurrency.

The strengths of this study include respondent-driven sampling to recruit older FSWs in three cities that covered different levels of the HIV/STI epidemics. Additionally, our study was grounded in the TPB to investigate the possible reasons behind condom use behavior. However, several limitations exist. First, the duration of overlapping partnerships and coital sex frequency were unknown in this study. Longer concurrent partnerships with husbands or boyfriends may lead to a higher risk of STIs. Similarly, due to low condom use with non-commercial partners, a higher frequency of sexual activity may also raise the possibility of transmitting syphilis. Second, all FSWs were recruited from three cities in China and the study population may not be representative of all the FSWs in China. The findings from this study may have limited generalizability to other settings. Third, although PSA was used to assess condom use within the past 48 hours, the frequency of condom use in the past 30 days was self-reported and may be overestimated due to social desirability bias. Fourth, RDS-specific analytic techniques were not used in this analysis because 1) the data were combined from three separate RDS samples (that is, subjects were referred from three different network sampling frames since sampling seeds were selected from three study sites) and 2) modeling techniques for analyzing RDS data are still under development.

Despite these limitations, this study provides insight into the concurrent partnerships of the FSWs. The findings of this study document that having concurrent sexual partners of both commercial clients and non-commercial partners may facilitate forward transmission from high-risk population to the general population, which may explain the elevated syphilis epidemic among older adults in China. Given the engagement in high-risk behaviors among this population (e.g., high numbers of sexual partners, sexual concurrency, and prevalence of syphilitic infection), combined intervention programs that integrate both behavioral (promotion of condom use) and biomedical (treatment of STIs) components for FSWs and their concurrent partners are warranted. Because the TPB constructs were significantly associated with condom use, the TPB can be used to guide the development of effective intervention programs for syphilitic prevention and control among FSWs and their partners.

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Appendix A. Measurement Items

Attitudes towards condom use scale (Cronbach's $\alpha = 0.71$; score range: 0–27)

Please indicate whether you strongly disagree (0), disagree (1), agree (2), strongly agree (3) with the following statements:

- 1) It is not necessary to use condoms if you trust your partner.

- 2) You do not need to use condoms with intimate sex partners.
- 3) There is no need to use condoms with stable sex partners (e.g., husbands or boyfriends).
- 4) There is no need to use condoms with regular clients.
- 5) Requesting to use condoms will make sex partners think you don't trust them.
- 6) It is very difficult to request to use condoms with sex partners.
- 7) If you insist on using condoms, it is possible to lose sex partners.
- 8) Using condoms reduces satisfaction during sex.
- 9) Using condoms is the most effective way to prevent STDs and HIV.

Subjective Norms (Cronbach's alpha = 0.72; score range: 2–12)

Please indicate the number of middle-aged FSWs who do or would do the following:

- 1) How many of the middle-aged FSWs you know use condoms regularly?
 - 2) How many of the middle-aged FSWs you know encourage you to consistently use condoms?
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Perceived behavioral control (Cronbach's alpha = 0.82; score range: 0–18)

Please indicate whether it is not likely (0), somewhat likely (1), likely (2), or very likely (3) that you will do the following statements:

- 1) How likely is it that you will use a condom with every infrequent client?
 - 2) How likely is it for you to use a condom with every regular client?
 - 3) How likely is it for you to still have sex with a client if he doesn't want to use condoms?
 - 4) How likely is it for you to have sex with a client if he pays you more to not to use condoms during sex?
 - 5) How likely is it for you to have sex with a client if he could not get an erection with a condom on?
 - 6) How likely is it for you to convince a client to use condoms if he doesn't want to use?
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Figure 1.
Four sexual partnerships among middle-aged female sex workers

Table 1.
Socio-demographics of middle-aged FSWs in four groups of concurrent sexual partnerships

	Total	Group 1 (husband, boyfriend, and clients) n (%)	Group 2 (husband and clients) n (%)	Group 3 (boyfriend and clients) n (%)	Group 4 (client partners only) n (%)	p - value
Age Group (Years)						<0.01
35 – 39	753	107 (64.1)	199 (66.1)	282 (60.1)	165 (53.6)	
40 – 44	249	30 (18.0)	74 (24.6)	85 (18.1)	60 (19.5)	
45 – 49	160	23 (13.8)	22 (7.3)	63 (14.4)	52 (16.9)	
50 or older	83	7 (4.2)	6 (2.0)	39 (8.3)	31 (10.1)	
Marital Status						<0.01
Single	116	0 (0)	0 (0)	90 (19.2)	26 (8.4)	
Married	610	167 (100)	301 (100)	50 (10.7)	92 (29.9)	
Divorced/widowed	519	0 (0)	0 (0)	329 (70.2)	190 (61.7)	
Education						<0.01
No school	82	14 (8.4)	14 (4.7)	23 (4.9)	31 (10.1)	
Elementary school or less	464	58 (34.7)	102 (33.9)	174 (37.1)	130 (42.2)	
Middle school	577	84 (50.3)	154 (51.2)	218 (46.5)	121 (39.3)	
High school or above	122	11 (6.6)	31 (10.3)	54 (11.5)	26 (8.4)	
Migrant						<0.01
Non-migrant	380	68 (40.7)	107 (35.6)	132 (28.1)	73 (23.7)	
Migrant	865	99 (59.3)	194 (64.5)	337 (71.9)	235 (76.3)	
Client solicitation location						<0.01
Barber shop/massage/sauna	686	99 (59.3)	202 (67.1)	250 (53.3)	135 (43.8)	
Dance hall/music bar	126	15 (9.0)	24 (8.0)	48 (10.2)	39 (12.7)	
Internet/phone/other	80	15 (9.0)	10 (3.3)	33 (7.0)	22 (7.1)	
Rental home	129	5 (3.0)	21 (7.0)	56 (11.9)	47 (15.3)	
Street/park/roadside hotel	224	33 (19.8)	44 (14.6)	82 (17.5)	65 (21.1)	
Number of clients in last week (median)		7	10	10	15	<0.01
Monthly income from sex work (Yuan, RMB)*						<0.01
< 3000	506	94 (56.3)	141 (46.8)	178 (38.0)	93 (30.2)	
3001–6000	469	51 (30.5)	15 (38.2)	185 (39.5)	118 (38.3)	

	Total	Group 1 (husband, boyfriend, and clients) <i>n</i> (%)	Group 2 (husband and clients) <i>n</i> (%)	Group 3 (boyfriend and clients) <i>n</i> (%)	Group 4 (client partners only) <i>n</i> (%)	<i>p</i> - value
>6000	270	22 (13.2)	45 (15.0)	106 (22.6)	97 (31.5)	

* \$1 equals to 6.3 Yuan in RMB.

Note: Frequencies may not add to 100% due to rounding.

Table 2.
Syphilis, condom use, and TPB constructs for the four groups of concurrent sexual partnerships

	Group 1 (husband, boyfriend, and clients) <i>N</i> = 301	Group 2 (husband and clients) <i>N</i> = 469	Group 3 (boyfriend and clients) <i>N</i> = 308	Group 4 (client partners only) <i>N</i> = 308	<i>p</i> -value
Prevalent syphilis					0.28
No	130 (77.8)	242 (80.4)	349 (74.4)	235 (76.3)	
Yes	37 (22.2)	59 (19.6)	120 (25.6)	73 (23.7)	
Active syphilis					0.71
No	150 (89.8)	272 (90.4)	415 (88.5)	280 (90.9)	
Yes	17 (10.2)	29 (9.6)	54 (11.5)	28 (9.1)	
Unprotected sex within 48 hours of the interview					0.08
No	104 (62.7)	181 (60.5)	268 (57.8)	159 (52.0)	
Yes	62 (37.4)	118 (39.5)	196 (42.2)	147 (48.0)	
Frequency of condom use with husband in the past month					<0.01
Every time	12 (7.6)	28 (9.7)	NA [†]	NA	
Most of the time	22 (14.0)	8 (2.8)	NA	NA	
Half of the time or less	123 (78.3)	254 (87.6)	NA	NA	
Frequency of condom use with boyfriend in the past month					0.08
Every time	41 (25.8)	NA	82 (17.7)	NA	
Most of the time	17 (10.7)	NA	48 (10.3)	NA	
Half of the time or less	101 (63.5)	NA	334 (72.0)	NA	
Frequency of condom use with all clients in the past month					0.04
Every time	97 (58.1)	182 (60.5)	253 (53.9)	156 (50.7)	
Most of the time	45 (27.0)	60 (19.9)	138 (29.4)	95 (30.8)	
Half of the time or less	25 (15.0)	59 (19.6)	78 (16.6)	57 (18.5)	
Frequency of condom use with regular clients in the past month					<0.01
Every time	85 (50.9)	203 (67.4)	271 (57.8)	147 (47.7)	
Most of the time	38 (22.8)	73 (24.3)	129 (27.5)	115 (37.3)	
Half of the time or less	44 (26.4)	25 (8.3)	69 (14.7)	46 (14.9)	

	Group 1 (husband, boyfriend, and clients) <i>N</i> = 167	Group 2 (husband and clients) <i>N</i> = 301	Group 3 (boyfriend and clients) <i>N</i> = 469	Group 4 (client partners only) <i>N</i> = 308	<i>p</i> -value
	<i>n</i> (%)	<i>n</i> (%)	<i>n</i> (%)	<i>n</i> (%)	
<i>Mean (SD)</i> ²					
Attitudes towards condom use	14.3 (3.2)	15.3 (2.8)	14.8 (2.9)	15.2 (3.0)	<0.01
Perceived behavioral control	13.7 (3.8)	15 (2.5)	14.2 (3.3)	13.8 (3.3)	<0.01
Subjective norms	6.8 (2.5)	7.4 (2.3)	7.4 (2.2)	7.6 (2.1)	<0.01

Note: Frequencies may not add to 100% due to rounding.

¹ Not applicable and indicates that the groups are not included in the categories for husband or boyfriend's condom use.

² Standard Deviation

Table 3.

Associations between frequent condom use and factors related to non-commercial sexual partnership

a. Frequent condom use with husbands				
	Frequent condom use <i>n</i> (%)	Infrequent condom use <i>n</i> (%)	<i>OR</i> ^{<i>I</i>}	<i>95% CI</i> ^{<i>2</i>}
Husband had other sexual partners				
No	35 (14.1)	214 (85.9)	1	
Yes	16 (21.6)	58 (78.4)	1.68	0.83–3.38
Do not know	19 (15.3)	105 (84.7)	0.94	0.50–1.79
Perception of husband's risk for HIV infection				
Definitely no risk	50 (15.0)	284 (85.0)	1	
Possible	19 (17.6)	89 (82.4)	1.11	0.57–2.17
Very likely or definite risk	1 (20.0)	4 (80.0)	1.19	0.12–12.2
Perception of husband's risk for STIs				
Definitely no risk	47 (15.3)	261 (84.7)	1	
Possible	22 (17.3)	105 (82.7)	1.27	0.67–2.39
Very likely or definite risk	1 (8.3)	11 (91.7)	0.70	0.08–6.07
Sex work disclosed to husband				
No	58 (16.0)	304 (84.0)	1	
Yes	12 (14.1)	73 (85.9)	0.97	0.47–1.99
	<i>Mean (SD)³</i>	<i>Mean (SD)</i>		
Attitudes towards condom use	16.9 (3.3)	14.6 (2.8)	1.35	1.22–1.50
Perceived behavioral control	15.4 (3.0)	14.4 (3.1)	1.13	1.01–1.27
Subjective norms	7.4 (2.4)	7.1 (2.4)	1.10	0.97–1.25
b. Frequent condom use with boyfriends				
	Frequent condom use <i>n</i> (%)	Infrequent condom use <i>n</i> (%)	<i>OR</i>	<i>95% CI</i>
Boyfriend had other sexual partners				
No	52 (22.0)	184 (78.0)	1	
Yes	65 (31.9)	139 (68.1)	1.94	1.23–3.08
Do not know	71 (38.8)	112 (61.2)	2.32	1.46–3.68
Perception of boyfriend's risk for HIV infection				
Definitely no risk	95 (24.7)	290 (75.3)	1	
Possible	82 (37.3)	138 (62.7)	1.58	1.05–2.38
Very likely or definite risk	11 (61.1)	7 (38.9)	3.22	1.13–9.19
Perception of boyfriend's risk for STIs				
Definitely no risk	82 (25.3)	242 (74.7)	1	
Possible	92 (35.7)	166 (64.3)	1.45	0.96–2.18
Very likely or definite risk	14 (34.1)	27 (65.9)	1.64	0.75–3.57
Sex work disclosed to boyfriend				

No	105 (30.0)	245 (70.0)	1	
Yes	83 (30.4)	190 (69.6)	1.24	0.84–1.82
<hr/>				
	<i>Mean (SD)</i>	<i>Mean (SD)</i>		
<hr/>				
Attitudes towards condom use	16.0 (2.6)	14.1 (3.0)	1.26	1.17–1.36
Perceived behavioral control	15.3 (2.4)	13.5 (3.7)	1.16	1.08–1.25
Subjective norms	7.6 (2.0)	7.0 (2.4)	1.10	1.00–1.20

Note: All models are adjusted for age, education, client solicitation site, income from sex work, and the study sites

¹. Odds Ratio

². 95% Confidence Interval

³. Standard Deviation