Published in final edited form as:

Public Health. 2011 May ; 125(5): 283–292. doi:10.1016/j.puhe.2011.01.011.

Inclusion of the female condom in a male condom-only intervention in the sex industry in China: a cross-sectional analysis of pre- and post-intervention surveys in three study sites

S. Liao^{a,*}, M.R. Weeks^b, Y. Wang^a, N. Li^a, F. Li^a, Y. Zhou^c, X. Zeng^d, J. Jiang^a, B. He^d, J. Li^b, J. Dunn^b, and Q. Zhang^a

^a Department of Epidemiology and Biostatistics, Institute of Basic Medical Sciences, Peking Union Medical College/China Academy of Medical Sciences, 5 Dong Dan San Tiao, Beijing, China

^b Institute for Community Research, Hartford, CT, USA

^c Guangxi Centre for Disease Prevention and Control, HIV/AIDS Division, Nanning, Guangxi, China

^d Hainan Centre for Disease Prevention and Control, HIV/AIDS Division, Haikou, Hainan, China

SUMMARY

Objectives—To describe female condom (FC) use, male condom (MC) use and overall levels of protected sex before, during and after FC education and promotion (using the original prototype FC) combined with MC promotion among female sex workers in three rural or small urban settings in southern China.

Study design—The 1-year FC intervention was conducted by local health workers through outreach to establishments where sex work is conducted. Three serial cross-sectional surveys were conducted in each study town before, during and after the intervention along with process documentation throughout the intervention period.

Methods—Cross-sectional data from pre-intervention (baseline) and 6-month and 12-month post-intervention surveys from three study sites are used in a descriptive comparison of the context of the sex industry, outreach in two phases of intervention, and FC adoption after the intensive intervention phase in each site.

Results—Approximately 75–80% of eligible women working in sex establishments, varying from 74 to 155 participants for each survey, were recruited from three study sites. After introduction and promotion of the FC along with the MC during the community public health

*Corresponding author. Tel.: +86 10 65296971; fax: +86 10 65225752. susuliao@mx.cei.gov.cn (S. Liao).

Ethical approval

Institutional Review Boards at the Institute for Community Research, Hartford, Connecticut, USA; the Peking Union Medical College/China Academy of Medical Sciences, Beijing, China; and the Guangxi Provincial Centres for Disease Prevention and Control in Nanning, Guangxi, China. All study participants provided informed consent.

Competing interests

None declared

Publisher's Disclaimer: This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting proof before it is published in its final citable form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.

intervention, between one-fifth and one-half of the study participants had tried the FC in the three study sites by the time of the 6-month and 12-month cross-sectional surveys. Among them, 10–30% had used the FC more than once. FC awareness increased following the intervention with much less variation across the three study sites. At baseline, 31–54% of participants across the three sites reported 100% protected sex in the last 30 days with all types of partners. At one of the sites with relatively low MC use before the intervention, the proportion of women reporting 100% protected sex in the last 30 days increased by 15%, and the proportion reporting nil protected sex in the last 30 days decreased by 13% between baseline and 12-month post-intervention surveys. More complex profiles of FC and MC use and protected sex were shown at the other two study sites, where a higher level of protection had been reached before the project started.

Conclusions—Different levels of FC adoption were identified after the 1-year FC promotion intervention through outreach to sex establishments. The input, output and outcomes of the intervention may be associated with women's demographic and risk characteristics, the local capacities of intervention staff, and other contextual factors. Further analysis of these factors will help establish the role of the FC in increasing protected sex, and provide insight into how to achieve greater FC use.

Keywords

Female condom; Sex workers; China; HIV/AIDS prevention; Establishment-based intervention

Introduction

As the human immunodeficiency virus/acquired immunodeficiency syndrome (HIV/AIDS) epidemic has entered its third decade in China, recent changes in sexual culture, including attitudes and practice, and a resurgence of the sex industry^{1–3} have spawned a rapid increase in sexually transmitted infections (STIs), including HIV/AIDS.^{4,5} The ever-expanding sex industry is deeply integrated into China's developing economy, fed by these changing sexual norms. This is combined with population migration and continuing economic need, particularly in rural areas and among mobile women and men. These forces exacerbate the potential for a major upsurge of HIV through heterosexual contact. It is estimated that 740,000 people are living with HIV/AIDS in China; 48,000 were newly infected in 2009, of whom 42.2% acquired the infection through heterosexual transmission (Press Office of the China Ministry of Health, 30/11/2009).

Public health efforts that involve significant collaboration with local health workers to reach populations at the greatest risk are increasingly called for to reduce the rising spread of HIV.⁶ In particular, the expansion of prevention options through public health education, outreach and promotion has great potential in the fight to prevent a growing epidemic by reducing STIs that facilitate HIV transmission and the rising epidemic in China and other countries.⁷

Although many recent efforts to curtail the HIV/AIDS epidemic have been made through the Chinese Government and other international organizations, promotion of male condom (MC) use is generally the only tool used for prevention of sexual HIV transmission. Current MC use has increased since the early years of the epidemic. However, different studies have reported huge variation in usage rates, which suggests that so-called '100% condom use' is still far away.^{8–12} Much less effort has been invested in prevention in the rapidly growing sex industry in rural and small urban areas of China,^{13–16} although this has significant potential to accelerate the national epidemics of STIs and HIV.^{1,17,18} Many migrant sex workers, especially from rural areas, have very low levels of education, are unskilled and have extremely limited knowledge of basic health. Furthermore, the new rural or small

urban contexts in which they often find themselves offer few local resources for health and life necessities. Thus, there is increasing need to understand the multiple, complex situations of rural sex workers in different circumstances, and to develop multilevel prevention programmes to target sex work in rural and small urban contexts.^{13,19}

In general, prevention of STIs and HIV embraces comprehensive strategies. However, only barrier methods (exclusively MCs in the past) are effective for the prevention of multiple diseases and pregnancy. To compensate for the disadvantages of MCs, the female condom (FC) which can be worn by women, has been developed and marketed since the late 1980s.²⁰ Use of the FC still requires negotiation with male sex partners, but gives women more autonomy in its application when MC use is less than 100%. Along with MC promotion, the FC has become increasingly popular and promoted in several countries with high HIV incidence, including in rural contexts, and has been shown to decrease STI incidence and increase protected sex.^{21–24}

Very limited research on acceptability of the FC has been conducted in China. An early study assessed short-term satisfaction of FC use among married couples in a clinical setting.²⁵ A more recent study tested improvement in FC knowledge and attitudes among female sex workers after introducing the FC for a period of 2 months; however, the study provided few details on how many of the FCs delivered were actually used or the context of FC adoption.²⁶ A very recent publication compared the clinical features of the original prototype FC produced by the Female Health Company and a similar FC produced in China.²⁷ None of these studies have assessed FC use in the context of MC use among sex workers in China.

The China/US Women's Health Project was designed to develop, implement and test a public health intervention programme to expand HIV prevention with commercial sex workers in four typical southern Chinese towns, including two rural towns and two small cities, by promoting the original prototype FC along with the MC. The study assessed acceptability and adoption of the FC in the context of different levels of MC use after exposure to a community-based educational, skills-enhancement and support intervention conducted in sex work establishments by local health educators and healthcare workers. The international research team worked in partnership with the provincial-level Centres for Disease Prevention and Control (CDCs) in Hainan and Guangxi Provinces, and with county-level and town-level public health educators and healthcare providers to develop and implement the programme and test the intervention model in the study communities.^{18,28}

This paper reports MC and FC use among sex workers who participated in three cross-sectional surveys: pre-intervention (baseline) and 6 months and 12 months post-intervention. The intervention process and outcomes in the first three study sites of the project in Hainan and Guangxi Provinces are compared.

METHODS

Settings of the three study sites

In this paper, the three study sites are referred to as FS, YF and PX to protect their identity and that of the study participants. The first two sites (FS, YF) are rural towns located in the same county in Hainan Province. The third site (PX) is a small city in Guangxi Province. At the time of writing, data collection had been initiated at the fourth study site, a larger urban centre in Hainan Province. Only the results from the first three study sites are included in this report.

These three towns varied in several significant ways, although some features of the sex industry were similar in all three sites. The two rural towns, FS and YF, were similar in size, with approximately 20,000–30,000 local residents and hundreds of migrant labourers from other parts of the province or other provinces. The small city (PX) was significantly larger, with approximately 100,000 residents in the urban centre and surrounding rural county. There have been no reported cases of HIV infection in FS and YF, although hundreds of cases have been reported in PX since 1996 (PX CDC annual HIV/AIDS surveillance reports). HIV infection was first seen in injection drug users, but sexually transmitted HIV transmission has increased in recent years.

The sex industry began in these three sites in the early 1990s. The amount and types of sex establishments have changed over the past two decades.^{1,10,19} During the period of the project, there were four major types of sex establishments in operation: roadside restaurants (which presently only provide sex services), hairdressers/massage parlours (some of which provide these services as well as sex services), boarding houses (single-room apartment buildings rented by independent sex workers), and hotel-based massage, beauty and sauna parlours. All but the boarding houses were generally run by a manager or the owner. The women in boarding houses tended to be older on average and were more likely to be married than those in the other types of establishments. Parlours and boarding houses were present in all three study sites. Roadside restaurants were only found in FS, and hotel-based parlours were primarily found in PX.

During the formative ethnography for this study, ethnographers and the local staff documented 13, 17 and 47 establishments in FS, YF and PX, respectively. However, a few establishments opened and closed in PX during the course of the study, so the total number of establishments contacted by outreach workers varied at different stages of the study. The estimated number of women at each establishment varied by town [FS: range 3–12, median=8, standard deviation (SD)=2.6; YF: range 1–14, median=6.2, SD=4.1; PX: range 1–30, median=4, SD=6.2]. PX had the greatest variation in the number of women per establishment. Local estimates indicated that FS and YF had almost 100 women working in these sex establishments, and PX had approximately 200 women working in the downtown area at the time of the study.

Since the late 1990s, HIV/STI prevention projects have been conducted among sex workers in these three towns. Through these intervention activities, reported MC use has increased significantly among sex workers over time.^{15,29,30} Additionally, local health workers who conducted outreach in these sex work venues have established positive rapport with sex workers in these study sites. However, since the 1990s, more research and intervention projects have been conducted in FS and PX than in YF. During the period of this study, several other HIV and STI prevention projects were ongoing in PX, but no other projects were being conducted in FS and YF.

The structure of the authors' collaboration with the local staff and the history of their work on public health projects also varied between study towns. In the two rural towns, the research team worked with the local township hospitals, which provided outreach staff to the project under the direction of the CDC HIV/AIDS prevention unit co-ordinator at county level. In the small city, the municipal CDC worked directly with the research team, and staffed the project for outreach and FC promotion. Staff in all three study towns included one full-time outreach worker plus three part-time healthcare providers or public health personnel.

Research design

This study was designed to work in each town sequentially for approximately 18 months. The same approach was followed in all three sites, which began with 4–6 months of formative community ethnography to describe and map the locations of sex work establishments, gain access to these locations, and build rapport with the women and the establishment owners. This was followed with a cross-sectional baseline survey of sex workers in each town. Over the next year following baseline, the community intervention was implemented in two 6-month stages (months 1–6 were the intensive stage; months 7–12 were the maintenance stage), a process evaluation was conducted, and the cross-sectional surveys were repeated a 6 months and 12 months after baseline. Work in the two rural towns was conducted concurrently (2008–2009); initiation of efforts in the third study site began after completion of the 6-month surveys in the rural towns (2009–2010).

Participant eligibility included women who were aged ≥ 16 years, who worked in one of the establishments in which sex work takes place, and who had been sexually active with at least one male partner in the previous 30 days (regardless of whether the partner was paying or intimate). The cross-sectional survey sample size for the baseline, 6-month and 12-month surveys was calculated to achieve approximately 75–80% of the total sex work population in each town in order to seek sufficient coverage to represent the full target population at that time point. This included a goal of 75 women in each of the two rural towns (FS and YF) and 150 women in the small city (PX) recruited from the array of sex work establishments in each town (see Table 1). A period of 1–2 months was needed to collect the survey data in the two rural towns, and less than 1 month was needed in the small city, in part because of the local staff's greater experience in working closely with the sex worker population in PX.

Seeking the near full population for participation in the surveys helped to address the problem of sample migration, expected with this highly mobile population, in order to assess evidence of intervention exposure and influence over time. Population mobility precluded conducting a full longitudinal cohort study to evaluate the intervention outcomes on a repeated sample of female sex workers in each town. Ethnographic reports documented a very limited degree of crossover between the two rural towns in the period when the intervention and surveys were being conducted. There was no crossover between the samples in Hainan and Guangxi Provinces.

Measures

This survey included: demographic measures (age, educational attainment, ethnicity, marital status, birth place, migration history, sex work establishment where recruited); health history and status (STI, HIV, pregnancy, birth control, douching, drug or alcohol use); STI and HIV knowledge and prevention beliefs and practices; sexual debut; history of and prior 6-month and 30-day MC and FC use during sexual activity with different types of sex partners (primary and paying); MC attitudes; FC knowledge (seven questions about preventive functions of FC and characteristics of FC);³¹ FC beliefs and attitudes [26-item scale, range 1–4; higher score is more positive (negative items reverse coded)];³² STI locus of control (eight-item scale, range 1–4; higher score is more internal locus of control (negative items reverse coded)); FC efficacy with primary and paying partners; peer influence on FC use; and exposure to the project's FC and MC interventions (measured at 6-month and 12-month surveys only)

The proportion of protected sex in the last 30 days is the reported number of a woman's sex acts using an MC or an FC divided by the total reported number of sex acts in that same period, which ranged from '100% protected' to 'nil protected'.

'Having participated in the previous survey' is indicated when a participant reported that she had previously been invited into a similar survey in the same town. Exposure to the intervention included 'knowing about the Women's Health project' (i.e. by name), and 'knowing about the flip chart' (one of the intervention tools used by project outreach staff) before the interviewer showed it to her.

'Times participated in FC education' was obtained through asking respondents how many times they had attended activities delivered by the outreach staff at their establishments. The number is a cumulative count of the two phases of the intervention, so if a woman stayed in the town longer, she may have had more opportunities to participate than a woman who stayed a shorter time. 'Learning FC insertion with the vaginal model' indicates that a respondent practised this after the staff's demonstration during the educational session. 'Practising FC insertion' means a woman had followed the intervention instructions to practice insertion on her own before use with a partner.

FC knowledge includes three questions regarding whether the FC can protect one from HIV/AIDS, STIs and pregnancy, and four questions to compare the FC and the MC in terms of their protectiveness and use. The FC knowledge score is the sum of all correct answers, with one point for each correct answer.

Results

Characteristics of the study participants

Table 2 indicates the key characteristics of the cross-sectional survey samples in each of the three comparison towns at the baseline, 6-month and 12-month surveys. Some distinctions are evident in the demographic profile and reproductive history of these women. Generally, women in rural FS and YF were more likely to be younger, single, originating from the same province and ethnic minority, while the women in PX were older, more likely to be married and have children, had a longer sexual history and were more experienced with other birth control methods such as the intra-uterine device. This pattern was evident at all survey time points. The majority of women working in the sex industry are migrants from outside the town in which they worked, but many in FS and YF were ethnic minorities who originated from Hainan Province (not shown in Table 2).

Profile of sexual activities and relationships

Table 3 shows the women's sexual activities and features of their sexual relationships in the last 30 days. A small proportion of women reported having neither a primary partner nor any paying partners ('guests') in the last 30 days, although all had at least one sex partner during that period to be eligible for the survey. The women often considered these other sexual partners to be 'other friends'. The proportion of reported other partners varied from 0% to 7.3% across the three surveys in all three study sites (not shown in Table 3). In comparison with women in FS and PX, women in YF were relatively less sexually active in terms of the mean number of sex acts in the last 30 days with either a primary partner or guests across the three survey time points.

At baseline, 31–54% of participants across the three sites reported 100% protected sex in the prior 30 days with all types of partners. In general, the average degree of protected sex with a primary partner was approximately 30–47%, much lower than that with guests (range 79–97%) (see Table 3). Before the project intervention, the average proportion of protected sex was much lower among women in YF (mean proportion=53%, median proportion=55%) than in the other two sites (FS: mean=77%, median=100%; PX: mean=68%, median=93%). However, after the intervention, the proportion of protected sex increased in YF, particularly among those with a primary partner. In addition, the number of YF women reporting 100%

protected sex with all partner types in the last 30 days increased by 15% (from 30.9% to 46.1%) and the number of women reporting nil protected sex in the last 30 days decreased by 13% (from 30.9% to 18.4%) between baseline and 12-month post-intervention surveys.

Intervention process and reported exposure to the intervention

The summary of outreach activities from the project in the three study sites is shown in Table 4. The total number of FCs delivered during the 1-year period of intervention activity in each study site was 485 in FS, 333 in YF and 1389 in PX. The total number of MCs distributed in these towns was approximately eight to 11 times greater than the number of FCs delivered. Patterns of outreach activity and FC and MC delivery during Stage I (months 1–6) and Stage II (months 7–12) interventions varied across the three study towns, with greater intervention delivered in FS in Stage I than Stage II, but with equal or greater intervention delivered in YF and PX in Stage II than Stage I.

Self-reported participation in the project activities is shown in Table 5. The proportion of women who reported that they had participated in the previous surveys (one of the measures to assess stability of the sex worker population between cross-sectional survey points) was higher in PX than in FS and YF. Although outreach was conducted a similar number of times in each establishment in the three towns, except for a lower mean number of outreach visits in the first stage of intervention in YF (months 1–6 of intervention, see Table 4), more women reported that they had participated in outreach in PX than in FS and YF (Table 5). The mean number of times that women reported participating in FC education was also higher among women in PX than FS and YF.

Male and female condom use

The baseline surveys showed that MC use was already relatively high in FS, and no change in MC use was observed over the period of the study. MC use in the last 30 days was much lower in YF, but increased over the study period (see Tables 2 and 3).

FCs had never been available in any of the study towns prior to this study, as indicated by the baseline reports (Tables 3 and 6). Approximately 20–50% of participants reported that they had used an FC at least once in the follow-up surveys. The proportion of women who had used an FC more than once was much lower in YF than in FS. In the two follow-up surveys, women in PX were most likely to report that they had ever used an FC and that they had used an FC more than once.

Knowledge of FCs

The proportion of women who were aware of the FC and who had increased FC knowledge scores increased significantly after the intervention in the follow-up surveys (Table 6). However, the proportion of correct answers to the two specific questions about FC use (i.e. ‘Does lubricant use help to reduce problems of FC use?’ and ‘Should female condoms be used by a woman and male condoms by the man at the same time to achieve maximum protection?’) were not as high as those of other knowledge items, and did not improve between baseline and follow-up surveys.

Discussion

This paper describes the findings from cross-sectional surveys and process documentation to evaluate the efficacy of an intervention to promote FC use, supplemented with MC use, among Chinese sex workers in rural and small urban towns. The major outcomes in the study are increased FC and MC use and protected sex. Despite no prior knowledge of or experience with FCs before the intervention, approximately one-fifth to one-half of the

women in the three study sites had tried the FC by the time of the 6-month and 12-month cross-sectional surveys; among them, 10–30% had used an FC more than once. Likewise, the sex worker population in these three towns, represented by the sample of 75–80% of the women present in the towns at each survey time point, increased their general knowledge about the FC. However, their responses to specific FC characteristics associated with direct experience of using FCs showed somewhat less improvement. Nevertheless, this initial introduction of the FC into the sex industry through a community-based public health effort suggests the promise of the FC as a viable, acceptable and efficacious alternative to the MC for prevention of HIV, STIs and unwanted pregnancy.

At baseline, the proportion of women reporting 100% protected sex in the previous 30 days with all types of partners varied from 31% to 54% across three sites. The most notable increase in women reporting 100% protected sex and the largest decrease in women reporting nil protected sex in the previous 30 days between the baseline and 12-month surveys was found in YF, a town where relatively low MC use was observed before the intervention. However, in the other two sites with a higher level of protected sex at baseline, there was less room for improvement; instead, more complex profiles of FC and MC use and protected sex were found. In particular, with average proportions of protection during sex with paying partners (guests) ranging from 79% to 97% across all surveys, no obvious change was seen in FS and only a slight increase in condom use was observed in PX. The protected sex levels with a primary partner were much lower than those with paying partners in these two sites; this element may be the most difficult to change despite the overall higher condom use by these women.

This descriptive comparison of the three study sites at multiple time points over a 1-year period suggests several key factors as potential influences on successful FC promotion in sex work establishments, and potential for increased FC uptake among subsectors of the sex worker population. The three towns show different profiles in terms of major input, output and outcomes in MC use, FC use and protected sex. These towns started the intervention in different contexts, such as the demographic and sexual features of the women, the capacities of the local staff and local collaborative institutes, previous and concurrent experience with other intervention programmes, as well as other characteristics of the communities. For example, YF started the intervention with a lower level of protected sexual activity among women in sex work establishments in the town, but demonstrated notable improvement in overall protected sex by the 12-month survey point. PX started with greater experience, resulting in more public health outreach activity, combined with stronger rapport with the women and managers/owners of the establishments, which meant greater exposure of PX women to the intervention. Further exploration of their multifaceted influences is beyond the scope of this paper, but warrants examination and multilevel testing.

The cross-sectional data from these three study locations indicate several trends that suggest potential explanations for differences in FC use among these women. For example, in PX, where women were more likely to be older, married, have children and use intra-uterine devices for contraception, their evident willingness to use the FC may relate to their greater comfort using a vaginally inserted product. They may also have greater concern for protection from disease than younger women because they engage in more frequent sex and have greater economic need. Likewise, YF women, a significant proportion of whom had little education and were ethnic minorities, may have had greater challenges using this product successfully. FS women, in contrast, may have perceived little need to adopt the more complex FC when they were already having such success negotiating and using MCs. Understanding the complex and intersecting personal and social factors among these women can illuminate the full potential for the FC to become a viable option for women who might need it and use it most.

This study has some limitations. Expected and documented sex worker population migration precluded the authors from conducting a longitudinal cohort study to test intervention outcomes, and the community-based nature of the intervention design did not support a randomized controlled trial to test factors that affect FC use and long-term adoption. However, no other activities besides this community intervention included FC delivery or promotion during the study period in all locations, and no FCs were available locally except through this project, which suggests the efficacy of the intervention as the impetus for women's FC use.

Despite these limitations, the multiple time point surveys and the protracted effort to document the context of sex work, changing prevention efforts of sex workers, and details of the intervention implementation make possible the exploration of factors that explain the impact of this public health intervention on the women, the establishments and the community. Questions worth further exploration about the role of the FC to promote protection include whether women considered the FC to offer sufficient barrier protection in itself or whether they saw it as a tool to facilitate MC negotiation. Also important is whether the promotion and delivery of both MC and FC options may ease the introduction of the somewhat challenging new FC product. These and other challenging questions about the contexts and impacts of community and multilevel interventions in real-world settings merit greater understanding and focus.

Acknowledgments

The authors wish to thank staff of the Hainan and Guangxi Province Centres for Disease Control and Prevention, and staff of the local county and townships who contributed significantly to this study and made it possible.

Funding

United States National Institute of Mental Health, Grant # R01 MH077541.

References

1. Liao, SS.; Li, F. Changes of sex-industry in a rural town of South China: a follow-up observation in the past 10 years. In: Huang, Y.; Pan, S., editors. Series of sexuality research in China (No 30). Taiwan: Wan You Publishing House; 2009. p. 196-207.
2. Pan, S.; Huang, Q.; Shi, M.; Wang, X.; Mao, L.; Zhang, N.; Wang, D.; Du, J.; Wang, G.; Hou, R.; Huang, Y.; Jin, Y. The accomplishment of sexuality revolution in China—preliminary report of a comparison study between 2000 and 2006. Taiwan: Wan You Publishing House; 2008.
3. Wang, Y. HIV/AIDS related knowledge, attitudes and sexual behaviors among Li and Han youth in Hainan Province: the influence of mobility, gender and sex-related community context. Beijing: Department of Epidemiology and Biostatistics, Institute of Basic Medical Sciences, Peking Union Medical College/Chinese Academy of Medical Sciences; 2008. [unpublished dissertation]
4. Chen ZQ, Zhang GC, Gong XD, Lin C, Gao X, Liang GJ, Yue XL, Chen XS, Cohen MS. Syphilis in China: results of a national surveillance programme. *Lancet*. 2007; 369:132–8. [PubMed: 17223476]
5. Parish WL, Laumann EO, Cohen MS, Pan S, Zheng H, Hoffman I, Wang T, Ng KH. Population-based study of chlamydial infection in China: a hidden epidemic. *JAMA*. 2003; 289:1265–73. [PubMed: 12633188]
6. Limbu B. The role of community-based nurses in harm reduction for HIV prevention: a South East and South Asia case study. *Int J Drug Policy*. 2008; 19:211–3. [PubMed: 18440796]
7. Hammett TM, Wu Z, Duc TT, Stephens D, Sullivan S, Liu W, Chen Y, Ngu D, Des Jarlais DC. 'Social evils' and harm reduction: the evolving policy environment for human immunodeficiency virus prevention among injection drug users in China and Vietnam. *Addiction*. 2008; 103:137–45. [PubMed: 18028519]

8. Lau JTF, Zhang J, Zhang L, Wang N, Cheng F, Zhang Y, Gu J, Tsui HY, Lan Y. Comparing prevalence of condom use among 15,379 female sex workers injecting or not injecting drugs in China. *Sex Transm Dis.* 2007; 34:908–16. [PubMed: 18049424]
9. Wang L, Ding Z, Ding G, Guo W, Wang L, Qin Q, Li D, Wang L, Yan R, Hei F. Data analysis of national HIV comprehensive surveillance among female sex workers from 2004 to 2008. *Chin J Prev Med.* 2009; 43:1009–15.
10. Wang Y, Liao SS, Weeks MR, Jiang JM, Abbott M, Zhou YJ, He B, Liu W, Mosack KE. Acceptability of hypothetical microbicides among women in sex establishments in rural areas in Southern China. *Sex Transm Dis.* 2008; 35:102–10. [PubMed: 17767093]
11. State Council. A joint assessment of HIV/AIDS prevention, treatment and care in China. Beijing. AIDS Working Committee Office and UN Theme Group on AIDS in China; 2007.
12. Wang B, Li X, Stanton B, Yang H, Fang X, Zhao R, Dong B, Zhou Y, Liu W, Liang S. Vaginal douching, condom use, and sexually transmitted infections among Chinese female sex workers. *Sex Transm Dis.* 2005; 32:696–702. [PubMed: 16254545]
13. Fang X, Li X, Yang H, Hong Y, Stanton B, Zhao R, Dong B, Liu W, Zhou Y, Liang S. Can variation in HIV/STD-related risk be explained by individual SES? Findings from female sex workers in a rural Chinese county. *Health Care Women Int.* 2008; 29:316–35. [PubMed: 18350430]
14. Hong Y, Li X. Behavioral studies of female sex workers in China: a literature review and recommendation for future research. *AIDS Behav.* 2008; 12:623–36. [PubMed: 17694431]
15. Liao SS, He QY, Choi KH, Hudes ES, Liao JF, Wang XC, Liu M, Pan WL, Mandel J. Working to prevent HIV/STIs among women in the sex industry in a rural town of Hainan, China. *AIDS Behav.* 2006; 10:S35–45. [PubMed: 16823627]
16. Wong WC, Wang YL. A qualitative study on HIV risk behaviors and medical needs of sex workers in a China/Myanmar border town. *AIDS Patient Care STDs.* 2003; 17:417–22. [PubMed: 13678543]
17. Chen X, Stanton B, Li X, Fang X, Lin D, Xiong Q. A comparison of health-risk behaviors of rural migrants with rural residents and urban residents in China. *Am J Health Behav.* 2009; 33:15–25. [PubMed: 18844517]
18. Liao SS, Weeks MR, Wang YH, Li F, Jiang JM, Li JH, Zeng XM, He B, Dunn J. Female condom use in the rural sex industry in China: analysis of users and non-users at post-intervention surveys. *AIDS Care.* 2010 in review.
19. Liao SS, Schensul JJ, Wolffers I. Sex-related health risks and implications for interventions with hospitality women in Hainan, China. *AIDS Educ Prev.* 2003; 15:109–21. [PubMed: 12739788]
20. Female Health Company. Working with the female condom. 2008. Available at: <http://www.femalehealth.com/images/miniguide.pdf>
21. Choi KH, Gregorich SE, Anderson K, Grinstead O, Gomez CA. Patterns and predictors of female condom use among ethnically diverse women attending family planning clinics. *Sex Transm Dis.* 2003; 30:91–8. [PubMed: 12514450]
22. Mantell JE, Hoffman JA, Weiss E, Adeokun L, Delano G, Jagha T, Exner TM, Stein ZA, Karim QA, Scheepers E, Atkins K, Weiss E. The acceptability of the female condom: perspectives of family planning providers in New York City, South Africa, and Nigeria. *J Urban Health.* 2001; 78:658–68. [PubMed: 11796812]
23. Thomsen S, Ombidi W, Toroitich-Ruto C, Wong EL, Tucker HO, Homan R, Kingola N, Luchters S. A prospective study assessing the effects of introducing the female condom in a sex worker population in Mombasa, Kenya. *Sex Transm Infect.* 2006; 82:397–402. [PubMed: 16854997]
24. Telles Dias PR, Souto K, Page-Shafer K. Long-term female condom use among vulnerable populations in Brazil. *AIDS Behav.* 2006; 10(Suppl):S67–75. [PubMed: 16799843]
25. Xu JX, Leeper MA, Wu Y, Zhou XB, Xu SY, Chen T, Yang XL, Zhuang LQ. User acceptability of a female condom (Reality) in Shanghai. *Adv Contracept.* 1998; 14:193–9. [PubMed: 10075288]
26. Cheng YM, Li ZH, Wang XM, Wang SY, Hu LZ, Xie YY, Huang XL, Xu LF, Wu YZ, Zheng SL, Liu YL. Introductory study on female condom use among sex workers in China. *Contraception.* 2002; 66:179–85. [PubMed: 12384207]

27. Hou L, Qiu H, Zhao Y, Zeng X, Cheng Y. A crossover comparison of two types of female condom. *Int J Gynecol Obstetr.* 2010; 108:214–8.
28. Weeks MR, Liao SS, Li F, Li J, Dunn J, He B, He Q, Feng W, Wang Y. Challenges, strategies and lessons learned from a participatory community intervention study to promote female condoms among rural sex workers in southern China. *AIDS Educ Prev.* 2010; 22:253–72.
29. Liao SS, He QY, Liu W, Liao JF, Zhou YJ, Pan XH, Liang SL, Pan WL, Wang XC, Wu QH, Gu YC, He B. Working with women in the sex industry in rural China to prevent HIV/STDs: three years later, what did we learn? (Part I). *Chin J Prev Contr STD AIDS.* 2001; 7:218–22.
30. Liao SS, He QY, Liu W, Liao JF, Zhou YJ, Pan XH, Liang SL, Pan WL, Wang XC, Wu QH, Gu YC, He B. Working with women in the sex industry in rural China to prevent HIV/STDs: three years later, what did we learn? (Part II). *Chin J Prev Contr STD AIDS.* 2001; 7:266–9.
31. Raphan G, Cohen S, Boyer AM. The female condom, a tool for empowering sexually active urban adolescent women. *J Urban Health Bull NY Acad Med.* 2001; 78:605–13.
32. Neilands TB, Choi KH. A validation and reduced form of the Female Condom Attitudes Scale. *AIDS Educ Prev.* 2002; 14:158–71. [PubMed: 12000233]

Sample recruitment from types of sex work establishments in three study towns at baseline, 6-month and 12-month follow-up.

Table 1

Types of establishments (%)	Baseline				6-month follow-up				12-month follow-up			
	FS	YF	PX	FS	FS	YF	PX	FS	FS	YF	PX	FS
	n=76	n=81	n=155	n=78	n=73	n=151	n=74	n=76	n=151	n=76	n=151	n=76
Roadside restaurant	13 (17.1)	0 (0.0)	0 (0.0)	24 (30.8)	0 (0.0)	0 (0.0)	10 (13.5)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Massage/beauty parlour	37 (48.7)	44 (54.3)	33 (21.3)	34 (43.6)	36 (49.3)	51 (33.8)	36 (48.7)	33 (43.4)	53 (35.1)	33 (43.4)	53 (35.1)	53 (35.1)
Boarding house	25 (32.9)	37 (45.7)	56 (36.1)	20 (25.6)	36 (49.3)	53 (35.1)	28 (37.8)	40 (52.6)	59 (39.1)	40 (52.6)	59 (39.1)	59 (39.1)
Hotel-based	0 (0.0)	0 (0.0)	66 (42.6)	0 (0.0)	0 (0.0)	47 (31.1)	0 (0.0)	0 (0.0)	39 (25.8)	0 (0.0)	39 (25.8)	39 (25.8)
Other	1 (1.3)	0 (0.0)	0 (0.0)	0 (0.0)	1 (1.4)	0 (0.0)	0 (0.0)	3 (3.9)	0 (0.0)	3 (3.9)	0 (0.0)	0 (0.0)

Table 2

Characteristics of women in three study sites in cross-sectional surveys at baseline, 6-month and 12-month follow-up.

Characteristics	Baseline				6-month follow-up				12-month follow-up			
	FS n=76	YF n=81	PX n=155	FS n=78	YF n=73	PX n=151	FS n=74	YF n=76	PX n=151	FS n=76	YF n=76	PX n=151
Demographic												
Mean age (range)	26.2 (16–50)	27.3 (18–42)	32.8 (17–55)	25.6 (16–43)	28.4 (17–48)	32.4 (18–53)	28.7 (17–44)	29.1 (18–48)	33.6 (17–54)			
Never married (%)	44 (57.9)	51 (63.0)	28 (18.1)	53 (67.9)	40 (54.8)	33 (21.9)	32 (43.2)	35 (46.1)	36 (23.8)			
Non-Han ethnicity (%)	35 (46.1)	49 (60.5)	18 (11.6)	39 (50.0)	37 (50.7)	23 (15.2)	25 (33.8)	38 (50.0)	37 (24.5)			
Education above primary school (%)	48 (63.2)	38 (46.9)	111 (71.6)	52 (66.7)	40 (54.8)	100 (66.2)	50 (67.6)	54 (71.1)	108 (71.5)			
From the same province as the study site (%)	47 (61.8)	63 (77.8)	17 (11.0)	51 (65.4)	50 (68.5)	19 (12.6)	39 (52.7)	50 (65.8)	35 (23.2)			
Sexual and reproductive history												
Median age at sexual debut (range)	18.0 (13–24)	19.0 (15–25)	20.0 (14–29)	18.0 13–23	19.0 (14–23)	19.0 (15–28)	18.5 (12–30)	19.0 (15–24)	19.0 (15–28)			
Median years of being sexually active (range)	6.0 (<1–27)	6.0 (1–23)	13.0 (<1–31)	4.0 (<1–24)	7.0 (<1–30)	13.0 (<1–31)	7.5 (<1–26)	8.0 (1–25)	14.0 (1–30)			
Median age of first-time sex work (range) ^a	22.0 (14–38)	23.0 (16–40)	28.0 (16–45)	20.0 (15–38)	26.0 (17–40)	28.0 (15–45)	25.0 (16–44)	26.0 (17–45)	28.0 (16–45)			
Median years of sex work (range) ^a	2.0 (<1–14)	1.0 (<1–11)	3.0 (<1–26)	2.0 (<1–15)	1.0 (<1–14)	3.0 (<1–19)	2.0 (<1–16)	3.0 (<1–14)	3.0 (<1–19)			
Never pregnant (%)	27 (35.5)	28 (34.6)	9 (5.8)	39 (50.0)	18 (24.7)	11 (7.3)	19 (25.7)	12 (15.8)	11 (7.3)			
Experienced an abortion (%)	35 (46.1)	35 (43.2)	98 (63.2)	23 (29.5)	40 (54.8)	102 (67.6)	36 (48.7)	41 (54.0)	100 (66.2)			
Had more than one abortion (%)	11 (14.5)	20 (24.7)	49 (31.6)	9 (11.5)	15 (20.5)	54 (35.8)	12 (16.2)	20 (26.3)	61 (40.4)			
Has no children (%)	48 (63.2)	54 (66.7)	35 (22.6)	53 (67.9)	40 (54.8)	42 (27.8)	35 (47.3)	35 (46.1)	45 (29.8)			
Ever used an IUD (%)	24 (31.6)	22 (27.2)	96 (61.9)	20 (25.6)	26 (35.6)	93 (61.6)	30 (40.5)	32 (42.1)	87 (57.6)			
Used an IUD in last 30 days (%)	8 (10.5)	9 (11.1)	56 (36.1)	8 (10.3)	12 (16.4)	54 (35.8)	13 (17.6)	15 (19.7)	55 (36.4)			
Has been sterilized (%)	14 (18.4)	15 (18.5)	30 (19.4)	14 (17.9)	13 (17.8)	27 (17.9)	15 (20.3)	12 (15.8)	24 (15.9)			
Ever used male condoms (%)	73 (96.1)	67 (82.7)	148 (95.5)	76 (97.4)	64 (87.7)	147 (97.4)	70 (94.6)	72 (94.7)	149 (98.7)			

IUD, intra-uterine device.

^aThose with missing values were deleted from the denominators.

Table 3

Sexual activities and relationships in last 30 days reported in three study sites at baseline, 6-month and 12-month follow-up.

Characteristics	Baseline			6-month follow-up			12-month follow-up		
	FS n=76	YF n=81	PX n=155	FS n=78	YF n=73	PX n=151	FS n=74	YF n=76	PX n=151
Sex with all types of partners:									
Mean # of sex partners in last 30 days (median)	13.0 (6.0)	5.6 (2.0)	13.3 (8.0)	12.2 (6.0)	8.7 (2.0)	12.7 (7.0)	14.4 (7.0)	7.4 (3.0)	15.7 (6.0)
Use of MC in last 30 days (%)	69 (90.8)	51 (63.0)	127 (81.9)	72 (92.3)	52 (71.2)	124 (82.1)	68 (91.9)	61 (80.3)	121 (80.1)
Use of FC in last 30 days (%)	0 (0.0)	0 (0.0)	0 (0.0)	12 (15.4)	7 (9.6)	13 (8.6)	7 (9.5)	3 (3.9)	18 (11.9)
100% protected sex in last 30 days (%)	41 (53.9)	25 (30.9)	66 (42.6)	44 (56.4)	28 (38.4)	74 (49.0)	37 (50.0)	35 (46.1)	68 (45.0)
Nil protection in last 30 days (%)	6 (7.9)	25 (30.9)	30 (19.4)	6 (7.7)	19 (26.0)	24 (15.9)	5 (6.8)	14 (18.4)	28 (18.5)
Sex with primary partners*									
Had a primary partner in last 30 days (%)	37 (48.7)	53 (65.4)	99 (63.9)	35 (44.3)	45 (60.0)	80 (52.3)	39 (52.7)	58 (76.3)	79 (52.3)
Mean # of sex acts with primary partner (median)	4.54 (3.0)	4.04 (3.0)	5.64 (4.0)	4.43 (3.0)	4.53 (3.0)	6.44 (5.0)	5.5 (3)	4.9 (4)	5.6 (4.0)
Mean proportion of protected sex with primary partner (median)	0.47 (0.4)	0.30 (0)	0.42 (0)	0.41 (0)	0.43 (0.25)	0.42 (0.21)	0.39 (0)	0.46 (0.26)	0.32 (0.0)
100% protected sex with primary partner (%)	15 (40.5)	13 (24.5)	34 (34.3)	13 (37.1)	16 (35.6)	27 (33.8)	12 (30.8)	21 (36.2)	20 (25.3)
Nil protected sex with primary partner (%)	16 (43.2)	30 (56.6)	50 (50.5)	19 (54.3)	21 (46.7)	38 (47.5)	21 (53.8)	28 (48.3)	47 (59.5)
Sex with paying partners (guests)^a									
Had guest(s) in last 30 days (%)	64 (84.2)	47 (58.0)	109 (70.3)	66 (83.5)	43 (58.1)	104 (68.0)	64 (86.5)	51 (67.1)	103 (68.2)
Mean # of guests in last 30 days (median)	14.7 (7.5)	8.0 (6.0)	17.5 (14.0)	13.8 (8.0)	13.5 (6.0)	17.4 (10.0)	15.8 (7)	9.8 (4.0)	21.9 (15.0)
Mean # of sex acts with guests in last 30 days (median)	19.6 (8.0)	10.2 (8.0)	21.3 (15.0)	16.6 (10.0)	18.0 (9.0)	19.9 (14.0)	20.9 (10.5)	12.7 (5.0)	25.2 (20.0)
Mean proportion of protected sex with guests (median)	0.90 (1.0)	0.86 (1.0)	0.88 (1.0)	0.89 (1.0)	0.79 (1.0)	0.97 (1.0)	0.92 (1.0)	0.87 (1.0)	0.95 (1.0)
100% protected sex with guests (%)	47 (73.4)	32 (68.1)	84 (77.1)	50 (75.8)	26 (60.5)	91 (87.5)	51 (79.7)	39 (76.5)	86 (83.5)
Nil protected sex with guests (%)	1 (1.6)	1 (2.2)	4 (3.7)	0 (0.0)	4 (9.3)	0 (0.0)	1 (1.6)	2 (3.9)	0 (0.0)

MC, male condom; FC, female condom.

^a All denominators used for primary partner or guests (paying sex partners) are the subtotal numbers of women or sex acts with the same types of partners indicated.

Table 4

Outreach activities by stage of intervention^a in three study sites.

	FS			YF			PX		
	Stage I (%)	Stage II (%)	Subtotal (%)	Stage I (%)	Stage II (%)	Subtotal (%)	Stage I (%)	Stage II (%)	Subtotal (%)
No. of establishments where outreach conducted ^b	13	13	n.a.	15	17	n.a.	32	37	n.a.
Total no. of times outreach conducted	60 (51.7)	56 (48.3)	116 (100.0)	43 (36.4)	75 (63.6)	118 (100.0)	146 (47.1)	164 (52.9)	310 (100.0)
Mean times outreach conducted at each establishment (range)	4.6 (3–7)	4.3 (2–7)	n.a.	2.7 (2–5)	4.4 (1–6)	n.a.	4.6 (1–10)	4.4 (1–10)	n.a.
No. of FCs delivered	337 (69.5)	148 (30.5)	485 (100.0)	200 (60.1)	133 (39.9)	333 (100.0)	697 (50.2)	692 (49.8)	1389 (100.0)
Times outreach with FC delivery	30 (75.0)	10 (25.0)	40 (100.0)	29 (53.7)	25 (46.3)	54 (100.0)	94 (52.8)	84 (47.2)	178 (100.0)
No. of MCs delivered	1967 (36.1)	3480 (63.9)	5447 (100.0)	1560 (42.0)	2150 (58.0)	3710 (100.0)	4900 (45.2)	5942 (54.8)	10,842 (100.0)
Times outreach with MC delivery	55 (51.4)	52 (48.6)	107 (100.0)	39 (34.5)	74 (65.5)	113 (100.0)	126 (47.4)	140 (52.6)	266 (100.0) ^s
Copies of educational materials delivered	57 (50.9)	55 (49.1)	112 (100.0)	60 (30.3)	138 (69.7)	198 (100.0)	271 (36.0)	481 (64.0)	752 (100.0)

MC, male condom; FC, female condom.

^a Stage I included months 1–6, which was a period of intensive intervention; Stage II included months 7–12, which was a period of intervention maintenance through intermittent follow-up.

^b Number of sex work establishments where female sex workers were present when the outreach staff visited to conduct outreach.

Table 5

Self-reported participation in the project activities.

Characteristics	6-month follow-up				12-month follow-up			
	FS n=78	YF n=73	PX n=151	FS n=74	YF n=76	PX n=151	FS n=76	PX n=151
Participated in previous survey (%)	32 (41.0)	35 (48.0)	92 (60.9)	39 (52.7)	40 (52.6)	102 (67.6)	40 (52.6)	102 (67.6)
Awareness of the project (%)	42 (53.9)	29 (39.7)	78 (51.7)	41 (55.4)	33 (43.4)	90 (59.6)	33 (43.4)	90 (59.6)
Recognized intervention flip chart (%)	37 (47.4)	33 (45.2)	72 (47.7)	29 (39.2)	21 (27.6)	94 (62.3)	21 (27.6)	94 (62.3)
Participated in FC education by the outreach team (%)	45 (57.7)	40 (54.8)	105 (69.5)	38 (51.4)	38 (50.0)	108 (71.5)	38 (50.0)	108 (71.5)
Mean # times participated in FC education (median) ^a	2.47 (2.0)	2.29 (2.0)	3.17 (2.0)	2.33 (2.0)	2.23 (2.0)	3.20 (3.0)	2.23 (2.0)	3.20 (3.0)
Learned FC insertion in a vaginal model (%)	21 (26.9)	31 (42.5)	45 (29.8)	18 (24.3)	24 (31.6)	58 (38.4)	24 (31.6)	58 (38.4)
Practised FC insertion (%)	22 (28.21)	12 (16.4)	36 (23.8)	15 (20.3)	14 (18.4)	51 (33.8)	14 (18.4)	51 (33.8)

FC, female condom.

^aWomen who were sexually active and reported awareness of the outreach activities in 6-month or 12-month surveys were used as the denominators.

History of use of female condom (FC) and knowledge about FC in three study sites at baseline, 6-month and 12-month follow-up.

Table 6

Characteristics	Baseline			6-month follow-up			12-month follow-up		
	FS n=76	YF n=81	PX n=155	FS n=78	YF n=73	PX n=151	FS n=74	YF n=76	PX n=151
Is aware of FC (%)	20 (26.3)	8 (9.9)	46 (29.7)	62 (79.5)	56 (76.7)	130 (86.1)	60 (81.1)	51 (67.1)	136 (90.1)
Ever used FC (%)	2 (2.6)	0	0	20 (25.6)	15 (20.6)	55 (36.4)	19 (25.7)	15 (19.7)	76 (50.3)
Used FC more than once (%)	0 (0.0)	0 (0.0)	0 (0.0)	11 (14.1)	9 (12.3)	29 (19.2)	10 (13.5)	9 (11.8)	47 (31.1)
Median FC knowledge score 1 (range)	0.0 (0–7)	0.0 (0–7)	0.0 (0–7)	5.0 (0–7)	5.0 (0–7)	6.0 (0–7)	5.0 (0–7)	4.5 (0–7)	6.0 (0–7)
Median FC knowledge score 2 (range) ^a	6.0 (0–7)	3.0 (0–7)	5.0 (1–7)	6.0 (1–7)	5.0 (0–7)	6.0 (1–7)	5.5 (2–7)	5.0 (1–7)	6.0 (0–7)
Correct about lubricant item (%) ^a	13 (65.0)	2 (25.0)	29 (63.0)	40 (64.5)	31 (55.4)	79 (60.8)	30 (50.0)	21 (41.2)	104 (77.0)
Correct about dual condoms item (%) ^a	3 (15.0)	1 (12.5)	5 (10.9)	21 (33.9)	12 (21.4)	27 (20.8)	13 (21.7)	13 (25.5)	20 (14.8)

^aOnly women who had heard of FC were included.