

## WHO ARE THE PREFERENTIAL TARGETS FOR INTERVENTION PROGRAMS RELATED TO THE FEMALE CONDOM AMONG SEX WORKERS IN SOUTHERN CHINA?

Yanhong Wang, Susu Liao, Jingmei Jiang, Margaret R. Weeks, Li Nie, Jianghong Li, Bin He, Yuejiao Zhou, Fei Li, Jennifer Dunn, and Qingning Zhang

The authors used a cluster analysis approach to investigate which female sex workers (FSW) are preferential targets for female condom (FC) intervention programs in southern China. Cross-sectional 6-month ( $N = 316$ ) and 12-month ( $N = 217$ ) postintervention surveys of FSW were analyzed. Based on FC attitudes and beliefs, initially suggesting FC use to a partner, practicing insertion, total times ever used, and willingness to use in the future, cluster analysis apportioned women into two clusters, with 50.6% and 58.1% of participants in the likely future FC users group at 6 months and 12 months, respectively. Likely future FC users tended to be from boarding houses, older, currently or previously married, experienced with childbirth, with current multiple sex partners, longer history of sex work, and more unprotected sexual encounters. Focusing FC programs on sectors of the community with more FSW who are likely to use FC may be more cost-effective for enhancing FC acceptability and usage.

Since the first Chinese AIDS case was diagnosed in 1985, mainland China had a reported cumulative total of 780,000 people living with HIV by the end of 2011; of those, 46.5% were infected through heterosexual transmission and 17.4% through homosexual transmission (Ministry of Health of the People's Republic of China,

---

Yanhong Wang, PhD, Susu Liao, MD, PhD, Jingmei Jiang, PhD, Li Nie, BA, and Qingning Zhang, PhD, are affiliated with the Department of Epidemiology and Bio-statistics, and Fei Li, PhD, is affiliated with the Department of Social Sciences, Institute of Basic Medical Sciences, Peking Union Medical College/China Academy of Medical Sciences, Beijing, China. Margaret R. Weeks, PhD, is Executive Director and Jianghong Li, MD, MS, and Jennifer Dunn, MA, are affiliated with the Institute for Community Research, Hartford, Connecticut. Bin He, MPH, is affiliated with the HIV/AIDS Division, Hainan Center for Disease Prevention and Control, Haikou, Hainan, China. Yuejiao Zhou is affiliated with the HIV/AIDS Division, Guangxi Center for Disease Prevention and Control, Nanning, Guangxi, China.

This project was supported by Award Number R01MH077541 from the United States National Institute of Mental Health. The content of this article is solely the responsibility of the authors and does not necessarily represent the official views of the National Institute of Mental Health or the U.S. National Institutes of Health. No conflicts of interests are involved in this study.

Address correspondence to Susu Liao, MD, PhD, Department of Epidemiology and Bio-statistics, Institute of Basic Medical Sciences, Peking Union Medical College/China Academy of Medical Sciences, 5 Dong Dan San Tiao, Beijing, China. E-mail: susuliao@mx.cei.gov.cn

2012). The HIV/AIDS epidemic in China has already started to spread from high-risk populations to the general population, and sexual transmission continues to be the primary mode of transmission (Ministry of Health of the People's Republic of China, 2012). Female sex workers (FSW) are considered a high-risk population for HIV infection and a bridge for HIV sexual transmission to the general population (The UN Theme Group on HIV/AIDS in China, 2002). There have been many efforts in China to improve male condom (MC) use rates among FSW in order to decrease the risk of sexually transmitted infections (STIs) and prevent unwanted pregnancy (Rojanapithayakorn, 2006). Nevertheless, consistent condom use among Chinese FSW with their paying partners remains inadequate and is even lower with their nonpaying partners (Li et al., 2010). The lack of power of FSW to make the decision to use MC might be one important factor contributing to this problem (Li et al., 2010).

The development of the female condom (FC) ushered in a new era of female-initiated condom use and offered women an important alternative option for STI prevention and contraception (Hoffman, Mantell, Exner, & Stein, 2004). Since the FC was first introduced, studies of acceptability and usage have been widely conducted among sex workers (Cheng et al., 2002; Hoke et al., 2007; Jivasak-Apimas et al., 2001; Lara et al., 2009; Liao et al., 2011a, 2011b; Mack, Grey, Amsterdam, Matta, & Williamson, 2010; Thomsen et al., 2006; Witte, El-Bassel, Wada, Gray, & Wallace, 1999; Zachariah et al., 2003), couples (Lameiras Fernandez et al., 2008; Lawson et al., 2003; Musaba, Morrison, Sunkutu, & Wong, 1998; Smita et al., 2005), patients from clinics (Artz et al., 2000; Hoffman, Exner, Leu, Ehrhardt, & Stein, 2003; Kulczycki, Kim, Duerr, Jamieson, & Macaluso, 2004), and volunteers (Barbosa, Kalckmann, Berquo, & Stein, 2007). Despite numerous studies demonstrating high acceptability of FC among various populations, its use remains low and a large proportion of women who initially tried it did not sustain its use (Gallo, Kilbourne-Brook, & Coffey, 2012; Hoffman et al., 2004). It might seem that the high risks of STIs and unintended pregnancy would motivate FSW to try or continue to use FC (Vijayakumar, Mabude, Smit, Beksinska, & Lurie, 2006). Only a few studies focusing on FSW tracked them for over 6 months or more, but these studies revealed that not all women accepted the FC, and acceptability and patterns of use varied with settings, populations, and study designs (Artz et al., 2000; Choi & Gregorich, 2009; Hoffman et al., 2003; Hoke et al., 2007; Macaluso et al., 2000; Musaba et al., 1998; Thomsen et al., 2006). Demographic factors (e.g., age, ethnicity, education, and so on) and sex partner type might be correlated with acceptability and use of FC, but study results differ widely (Vijayakumar et al., 2006). For example, the FC was more popular among older women in Uganda (Pool 1999), but among younger women in Zimbabwe (Francis-Chizororo & Natshalaga, 2003). In the United States, women have been found to use the FC more often with regular partners than with casual or newer partners (Macaluso, Demand, Artz, & Hook, 2000), but the reverse was found among FSW in Zimbabwe (Ray, Wiggert, Mason, Ndowa, & Maposhere, 2001). Unlike the general population, FSW might pay more attention to the lubrication, ease of use, and low cost of preventive or contraceptive products, which might affect FC acceptability among them. Furthermore, women's attitudes toward risk, experience with MC and other barrier methods, and initial reactions to the FC were also found to influence FC use in many studies (Vijayakumar et al., 2006).

In China, Cheng et al. (2002, 2003) published the results of an experimental study designed to find new ways to introduce FC among sex workers. In this study,

about 94% of women in the intervention reported liking FC, and 97% expressed that they would use it in the future. Liao et al. (2011b) reported findings from cross-sectional surveys in three study sites in southern China conducted by our project team, in which about 25%–50% of the study participants reported using FC; of these, only 10%–30% used it more than once after FC intervention, but this varied by study site. All of these studies indicated that, although FC provides dual protection from STI and unwanted pregnancy, it might not be considered an alternative option for all FSW in China. If this is so, the role of FC to improve the proportion of protected sex as expected is uncertain for public health programs combining FC and MC promotion among FSW. Moreover, the cost of FC is more expensive than MC. So if the women more likely to use FC can be identified, intervention aimed at these potential FC users might be more cost-effective, which is significant in public health programming.

However, the identification of the best candidates for FC intervention, especially conducted in a context of scarce resources, is still a challenge and rarely has been published. To identify candidates who are the best potential future FC users in the long run, actual FC use during an intervention delivery trial, which may be affected by many occasional and contextual factors (e.g., sex partners disliking or refusing to use FC, having no FC at hand, and so on), might not be the optimal indicator. In this context, multiple measures, including FC attitudes, motivation, past use, practice, and willingness to use FC, might be a better way to outline and predict the women's potential for FC use in the future. A cluster analysis approach focuses on the inherent differences between individuals and reveals unknown heterogeneity. Grouping cases together on the basis of patterns of similarity can be used to uncover naturally occurring groupings, social structures, or social types (Luke, 2005).

In this article, we will use a cluster analysis approach to investigate which FSW are more likely to be future FC users, and therefore preferred intervention targets, among women in the sex industry in southern China.

## METHODS

### SETTING OF THE STUDY

We conducted the China/U.S. Women's Health Project FC intervention trial from 2007 to 2012 in two rural towns (abbreviated as FS and YF) and two small urban communities (abbreviated as PX and QH) in southern China. The rural towns and QH are located in Hainan Province, and PX is a small city in Guangxi Province. FSW in these study towns generally worked in several types of establishments in which sex work was one or the only business activity. These included roadside restaurants or brothels (which presently provide only sex services); massage and beauty parlors (some of which provide these services as well as sex services); boardinghouses (single rooms rented by freelance sex workers); hotel-based massage, beauty, and sauna parlors (only in PX and QH); and nightclubs (only in QH, which serve alcoholic drinks as well as sex services). All but the boardinghouses are generally managed by a boss or owner. Extremely few or no women in these study towns worked as street walkers; nearly all were connected to one such establishment, and a few women worked in more than one. Only women working in association with sex work establishments were recruited into our study.

### DESIGN OF THE RESEARCH

We implemented a multilevel community intervention, conducted primarily in sex work establishments, to introduce and promote FC in combination with MC for HIV/STI prevention. The goal of the intervention was to change the environment of risk and prevention within the sex work establishments to achieve community-wide increase in overall protected sex among women in the local sex industry. We used the original prototype FC1 in FS, YF, and PX, and FC2 (the second generation of FC by the Female Health Company) in QH. The intervention was accomplished mainly through outreach to the establishments, with a project hotline and local community women's center as backup for individual women if they wanted one-on-one project support. The intervention teams in each town consisted of three part-time female health practitioners from the township hospitals (FS, YF), municipal CDC (PX) or municipal STI and skin disease clinic (QH), and one full-time health educator hired by the project. The intervention design is described in detail elsewhere (Liao et al. 2011a, 2011b; Weeks et al., 2010).

Our study began with 4–6 months of formative community ethnography in each study site to describe and map the locations of sex work establishments, gain access to these locations, and build rapport with the women and establishment owners in them. Then, a cross-sectional baseline survey covering approximately 80% of the sex workers was carried out in the study sites of YF, FS, and PX. After the baseline, we implemented the community intervention in two 6-month stages (months 1–6 were the intensive stage; months 7–12 were the maintenance stage), conducted process evaluation, and then repeated the cross-sectional surveys at 6 months and 12 months after the baseline.

There were some differences in procedure in the QH study site. First, more than 800 FSW were estimated to be distributed in widely scattered establishments across the city. Considering the limitations of the study period, funds, and staffing, we could not cover all these establishments; therefore, we chose the establishments located in several designated districts to be the target study sites in QH, which covered all the boardinghouses, one third of the massage parlors and nightclubs, and some of the roadside establishments in two relatively adjacent areas of the city. About 80% of FSW in these establishments were recruited in the baseline and postintervention surveys. Besides the size and complexity of the city to complicate this study site, public security in QH took strict measures against the sex industry, so that FSW in the city were more vigilant and difficult to access throughout our work there. Compared with YF, FS, and PX, it took significantly more time to complete the formative ethnography and baseline survey in QH. Therefore, we implemented only one 6-month period of intervention and then conducted one follow-up cross-sectional survey (6-month).

Participants eligible for the surveys in all study sites included women who were 16 years or older, worked in one of the establishments where sex work took place, and had been sexually active in the prior 30 days at the baseline survey. In the cross-sectional surveys at 6 months and 12 months, if the woman showed a project card with her unique ID given to her at a previous survey, she was taken directly as eligible. Other participants were recruited and screened for eligibility in the same manner as at baseline.

If a woman was eligible and agreed to participate in the survey, the recruitment staff brought her to a private survey location. An interviewer formally obtained her informed consent and conducted a face-to-face interview using a structured ques-

tionnaire. All protocols for participant recruitment, informed consent, interviewing, and intervention were reviewed and approved by Institutional Review Boards in the United States, Beijing, Hainan, and Guangxi by research partner organizations. A total of 467 women participated in the baseline survey, 468 women in the 6-month surveys, and 303 women in the 12-month surveys.

In this article, participants in the two postintervention surveys who self-reported that they had heard of and seen the FC used in our project and who reported being sexually active in the prior 30 days were included in our analyses. Altogether 316 women in the 6-month survey and 217 women in the 12-month survey were included in analyses for this article. Among those participants excluded from our analysis (152 in the 6-month survey and 86 in the 12-month survey), women who self-reported that they had never heard of or seen the FC used in our project accounted for 80%–85%, and women who self-reported that they had not engaged in any sexual activity in the past 30 days accounted for 15%–20%. A comparison of the women included in the study with those excluded revealed no significant differences in demographic characteristics (such as education, ethnicity) or behaviors (such as the proportion of protected sex in the past 30 days, abortion). However, compared with ineligible women, more eligible women were older, from boarding-houses, had given birth, had a longer history of sex work, had multiple sex partners, and had more sex activities, but a lower proportion were unmarried, especially in the 6-month survey (see Table 1).

### MEASURES

The survey contained the following measures: demographics; health history and status; STI and HIV knowledge and prevention beliefs and practices; sexual debut; history of condom use during sexual activity with different types of sex partners (primary and paying); MC attitudes; FC knowledge; FC beliefs and attitudes (17-item scale, range 1–4; higher score is more positive [negative items reverse coded]); and exposure to our project's FC and MC interventions.

We hypothesized that the women likely to use FC in the future might show one or more of the following features: (a) have more positive attitudes and beliefs about FC; (b) has asked her partner to use FC during sexual activities; (c) has practiced FC insertion by herself without a sexual partner; (d) has used FC during sex during the period of our study; and (e) is willing to use FC in the future. The 17-item FC beliefs and attitudes scale had four possible responses, from *completely disagree* to *completely agree*, in which *completely disagree* meant negative attitudes and beliefs and *completely agree* meant positive attitudes (negative items reverse coded). A few items were missing in scale values because women refused to answer or were unsure (a total of eight missing values distributed among five items), which were recoded as a neutral attitude. According to the principle of one point for *completely disagree*, two points for *disagree*, three points for *missing value*, four points for *agree*, and five points for *completely agree*, we calculated the scores of FC beliefs and attitudes for each participant. For this scale, Cronbach's alpha was 0.77 for internal consistency. Whether or not the woman asked her partner to use FC during sex in the past 30 days was measured by a variable with four categories: (a) never asked; (b) asked only primary partners; (c) asked only paying partners; and (d) asked both primary and paying partners. A dichotomous variable was used to measure if the woman practiced FC insertion on her own in preparing to use it with a partner (values: *No*, *Yes*). Actual use of FC during the study period was measured by one variable with

TABLE 1. Characteristics of Women in the Baseline, 6-Month and 12-Month Surveys

	6-Month Survey			12-Month Survey	
	All the Women in Baseline Survey (N = 467)	Women Excluded From the Analyses (N = 152)	Women Eligible for the Analyses (N = 316)	Women Excluded From the Analyses (N = 86)	Women Eligible for the Analyses (N = 217)
<b>Recruitment study site (%)</b>					
FS	16.3	18.4	16.1	24.4	24.4
YF	17.6	19.1	14.6	33.7	22.1
PX	33.6	30.9	33.5	41.9	53.5
QH	32.6	31.6	35.8	N.A.	N.A.
<b>Recruitment establishment type (%)</b>					
Roadside restaurant/brothel	5.8	9.2**	8.2**	5.8*	2.3*
Massage or beauty parlor	38.1	39.5**	34.2**	37.2*	41.5*
Boarding house	30.8	25.7**	41.5**	40.7*	39.2*
Hotel	17.1	14.5**	11.4**	12.8*	17.1*
Nightclub	8.1	11.2**	4.8**	3.5	N.A.
Mean age (SD)	29.1 (8.2)	28.4 (8.6)**	30.8 (8.7)**	30.3 (8.7)	31.8 (8.2)
Ethnic Han (%)	66.6	64.5	69.0	64.0	68.2
Education above primary school (%)	65.7	65.8	66.5	67.4	71.0
Never married (%)	44.3	50.7**	37.0**	37.2	32.7
Ever given birth (%)	51.2	47.4**	60.4**	58.1	63.6
Ever had an abortion (%)	56.8	48.7	57.3	60.5	58.5
Median years as a sex worker (range) <sup>a</sup>	2.0 (0–26.0)	1.0 (0–19.0)**	2.0 (0–16.0)**	2.0 (0–15.0)	2.0 (0–19.0)
Median number of sex partners in last 30 days (range) <sup>b</sup>	4.0 (1–376)	2 (0–75)**	7 (1–500)**	3 (0–61)**	6 (1–101)**
Median number of sexual encounters (range) <sup>b</sup>	8.0 (1–395)	8 (1–91)**	15 (1–500)**	9 (1–76)**	12 (1–122)**
Reported 100% protected sex in last 30 days (%)	35.6	38.2	41.5	41.9	47.9

<sup>a</sup>Among the women who had sex activities for money. <sup>b</sup>Among the women who had sex activities in the past 30 days. \*\*Eligible women vs. ineligible women,  $p < .01$ ; \*Eligible women vs. ineligible women,  $p < .05$ .

five categories: (a) never used FC; (b) used FC only once; (c) used it 2–4 times; (d) used it 5–10 times; and (e) used it more than 10 times. (Note that because FC was not available in these study sites before our project, number of times FC was used during the study period was also lifetime use.) Willingness to use FC in the future was measured by a categorical variable (values: *No*, *Unsure*, *Yes*).

Exposure to intervention was measured by three questions in the surveys: (a) whether or not the women participated in the intervention conducted by our project; (b) whether or not she recognized the intervention flip chart used by project staff; and (c) whether or not she practiced FC insertion in a vaginal model during the intervention. Based on responses to these questions, the total scores of intervention exposure were calculated ranging from zero (not receiving any intervention) to three (receiving all the interventions). In addition, in our analyses, “current multiple sexual partners” meant that the woman reported having had sexual relationships with two or more partners in the past 30 days.

### DATA PROCESSING AND STATISTICAL ANALYSIS

Considering that the five measures we have described to distinguish the women likely to use FC from those unlikely to use FC included categorical and continuous variables, we used the two-step cluster method to divide the women into groups. This method was recently developed to reveal inherent and unknown heterogeneity between individuals (Bacher, Wenzig, & Vogler, 2004; Luke, 2005; Rezanková, 2009).

The SPSS two-step cluster algorithm was used in our analysis. Two procedures are included in this method (SPSS Inc., 2001). The first step is to precluster the records into many small subclusters, in which Schwarz's Bayesian Criterion (BIC) is calculated and used to determine the optimal number of clusters. The second step is to cluster the subclusters resulting from the precluster step into the desired number of clusters. In our analysis, the largest ratio of distances was found in two clusters in each cross-sectional survey, which indicated the optimal number of clusters was two, that is, the likely and unlikely FC users.

After identifying the clusters, statistical analyses were conducted to compare demographics and behaviors (sexual history, reproductive history, contraception choices, perceived and actual risks) between the two groups. Considering that exposure to the intervention and recruitment study site might be two confounding factors, in our analysis we used the variables intervention score and study site as the control variables in logistic analysis. Moreover, age was not only an important demographic characteristic, but also a confounding factor associated with most demographics and behaviors. Therefore, during our analysis, age was also considered a control variable.

Statistical significance was accepted at  $p < .05$ , and all analyses (except two-step cluster analysis) were conducted using SAS 9.2 software (SAS Institute, Cary, NC, USA).

## RESULTS

### CHARACTERISTICS OF THE SAMPLE

A total of 316 women in the 6-month surveys and 217 women in the 12-month surveys were eligible in our analysis. The characteristics of these women are indicated in Table 1. The average age was about 31 years old and nearly two thirds were ethnic Han and received education above primary school. More than 60% of the women were currently or ever married; of those, 94% had ever given birth. The women self-reported a lifespan as FSW ranging from less than 1 year to 19 years (median 2 years), with a median of six sex partners in the past 30 days (range: 1–500), and a median of 13 sexual encounters (range: 1–500), more than 50% of which were unprotected sexual encounters in the past 30 days. There were no differences between women in the 6-month and 12-month surveys (see Table 1).

A total of 126 women (39.9%) in the 6-month surveys and 106 women (48.9%) in the 12-month surveys reported to have ever used FC. Of those, about 33.3% in the 6-month surveys and 22.6% in the 12-month surveys reported having used FC during the past 30 days. Among the FC users in both 6-month and 12-month surveys, 66.7% used FC only with clients, 25.0%–26.2% only with primary partners, and 7.1% with both primary partners and clients (not shown in the tables). In addition, only 18.3% of FC users in the 6-month surveys and 23.6% in the 12-month surveys reported having used FC at least five times, in which 72%–82.6% had prac-

TABLE 2. Features of Likely and Unlikely Future FC Users in 6-Month and 12-Month Surveys (percent except where otherwise indicated)

	6-Month Survey		12-Month Survey	
	Likely Future FC User (N = 160)	Unlikely Future FC Users (N = 156)	Likely Future FC Users (N = 126)	Unlikely Future FC User (N = 91)
Mean scores of FC beliefs & attitudes ( <i>SD</i> )	57.5 (9.0)*	55.1 (8.2)*	56.0 (9.1)	54.6 (7.7)
Asked partners to use FC				
None	62.5**	100.0**	67.5**	100.0**
Only asked a commercial partner	21.9**	0.0**	20.6**	0.0**
Only asked a primary partner	10.0**	0.0**	6.4**	0.0**
Asked both commercial and primary partners	5.6**	0.0**	5.6**	0.0**
Practiced FC insertion without sex partners	56.9**	0.0**	61.9**	0.0**
Total times used FC during sex throughout our study period				
None	21.3**	100.0**	15.9**	100.0**
Once	36.9**	0.0**	34.9**	0.0**
2–4 times	27.5**	0.0**	29.4**	0.0**
5–10 times	7.5**	0.0**	7.9**	0.0**
More than 10 times	6.9**	0.0**	11.9**	0.0**
Willingness to use FC for STI and HIV/AIDS protection in the future				
No	22.5*	32.7*	30.2**	46.2**
Uncertain	9.4*	15.4*	4.0**	18.7**
Yes	68.1*	51.9*	65.9**	35.2**

\*\*Likely future users vs. unlikely future users,  $p < .01$ ; \*Likely future users vs. unlikely future users,  $p < .05$ . *SD*: standard deviation.

ticed FC insertion without sex partners and 92%–100% reported willingness to use FC in the future (not shown in the tables).

#### CLUSTER IDENTIFICATION: FC ATTITUDES, PRACTICES, PATTERNS, AND WILLINGNESS FOR FUTURE USE

The features for likely future FC users and unlikely users are shown in Table 2. Fifty-one percent (160/316) and 58.1% (126/217) of participants fell into the cluster identified as potential future FC users at 6-month and 12-month surveys, respectively. Table 2 also revealed the differences in FC attitudes and past behaviors between potential future FC users and unlikely future users in each survey. Among the potential future users, there were no differences in these characteristics between the 6-month surveys and 12-month surveys. This was also true of the clusters of unlikely future FC users (except for the variable willingness to use FC in the future).

#### COMPARISON OF DEMOGRAPHIC AND BEHAVIOR CHARACTERISTICS OF THE TWO CLUSTERS

*Demographic characteristics.* The demographic characteristics of the likely future FC users and unlikely future users were compared, respectively, at the 6-month and



TABLE 3. Demographic and Behavior Characteristics of Likely Future FC Users and Unlikely Future Users (percent except where otherwise indicated)

	6-Month Survey			12-Month Survey				
	Likely Future FC Users (N = 160)	Unlikely Future FC Users (N = 156)	P <sup>a</sup> value	P <sup>b</sup> value (N = 126)	Likely Future FC Users (N = 91)	Unlikely Future FC Users	P <sup>a</sup> value	P <sup>b</sup> value
Aged 35 years or older	46.9	27.6	< 0.01	N.A.	48.4	27.5	< 0.01	N.A.
Ethnic Han	71.3	66.7	0.32	0.68	70.6	64.8	0.38	0.59
Education above primary school	66.3	66.7	0.91	0.60	68.3	74.7	0.34	0.54
Never married	30.0	44.2	0.01	0.11	22.2	47.3	< 0.01	0.02
From boarding houses	52.5	30.1	< 0.01	< 0.01	49.2	25.3	< 0.01	< 0.01
Sexual history								
Median age at first sex (range)	19.0 (14.0–28.0)	19.0 (13.0–27.0)	0.41	0.89	19.0 (12.0–27.0)	19.0 (15.0–28.0)	0.50	0.60
Engaged in sex work for at least two years	59.4	41.7	< 0.01	0.03	60.3	42.9	0.06	0.20
Sexual history at least ten years	60.6	46.8	< 0.05	0.59	69.1	48.4	< 0.01	0.20
Perceived or actual risk								
Having had an HIV test	65.6	55.1	0.05	0.12	75.4	56.0	0.82	0.94
Worried about HIV infection	76.9	70.5	0.11	0.22	80.8	65.9	0.11	0.06
Having had an STI	26.3	22.4	0.29	0.32	35.7	30.8	0.61	0.83
Reported 100% protected sex in last 30 days	38.1	44.9	0.17	0.29	47.6	48.3	0.93	0.34
Used MC consistently with primary partners*	24.4	28.4	0.18	0.22	27.0	26.9	0.84	0.57
Used MC consistently with clients**	51.5	73.1	0.37	0.01	62.0	90.8	0.13	< 0.01
Reasons for not using MC were partners' dislike or refusal	40.0	23.7	< 0.01	< 0.01	31.0	23.1	0.33	0.57
Multiple sex partners in last 30 days	81.9	66.0	< 0.01	< 0.01	80.2	73.6	0.13	0.12
Reproductive history and contraception choices								
Ever been pregnant	83.8	80.8	0.73	0.48	91.3	79.1	0.03	0.22
Ever had an abortion	55.6	59.0	0.50	0.53	58.7	58.2	0.52	0.74
Ever gave birth	65.6	55.1	0.13	0.99	73.8	49.5	< 0.01	0.04
Contraception choices ever used								
Male condom	98.1	96.8	0.31	0.32	100	95.6	—	—
IUD	51.4	39.1	0.06	0.31	61.1	41.8	0.03	0.23
Oral contraceptive	51.9	53.2	0.63	0.31	46.8	49.5	0.66	0.92

Note. <sup>a</sup>Test of likely future FC users vs. unlikely future FC users. Control variables: score of intervention exposure and recruitment study site. <sup>b</sup>Test of likely future FC users vs. unlikely future FC users. Control variables: age, score of intervention exposure and recruitment study site.

\* Analysis only with women who had sex with primary partners during the past 30 days.

\*\* Analysis only with women who had sex with clients during the past 30 days.

12-month surveys (see Table 3). The women in the likely future users cluster were more likely to be older, married, to have children, and to work in the boardinghouses. These patterns were similar in the 6-month and 12-month surveys.

After controlling for age, the proportions of women from the boardinghouses in the likely future users cluster were still higher in both 6-month and 12-month surveys. Also, the women in the future users cluster were more likely to be currently or previously married, and a higher percentage who had experienced childbirth were also found in the 12-month survey.

*Sexual behavior characteristics.* As Table 3 indicates, there was no difference in the proportion of protected sex between likely and unlikely future FC users. However, the rate of consistent MC use during sexual activity with clients in the past 30 days was lower among likely future FC users than unlikely FC users, which was statistically significant when age was controlled for during the comparison between groups (see Table 3). This pattern was similar in both the 6-month and 12-month surveys.

In addition, the likely future user group in the 6-month survey tended to have a higher percentage of women who worked as FSW for at least 2 years and who had more sex partners than the unlikely future FC users (see Table 3). This was also found in the 12-month survey, but was not statistically significant.

## DISCUSSION

In our study, we found a similar pattern in differences between the likely and unlikely FC users in the 6-month and 12-month surveys. The likely future FC users among FSW in China tended to be from boardinghouses, older, currently or previously married, experienced with childbirth, had multiple sex partners, had a longer history of sex work, and had more unprotected sexual encounters. Three factors may explain why these women might be more likely to use FC than other FSW in our study. First, the women living with a higher risk of STIs might be more motivated to try or use an FC when it is available. Unlike women in other establishments, the women in boardinghouses in our study were freelance sex workers, and they charged less but bore greater obligation to their families. Nearly 70% of them self-reported that they had engaged in had unprotected sex in the past 30 days (vs. less than 50% in other establishments), in which 50% of these unprotected sexual encounters were due to the partner's dislike of or refusal to use MC (vs. nearly 15% in other establishments). All of these experiences with MC might make these women have more interest in FC. Second, older women, as well as the women with childbirth experience, might be more familiar with their own reproductive anatomy and less afraid about touching their genitals, which might help them to practice FC insertion more effectively. In our study, we found that the average age among the women from boardinghouses was 38.1 years old and over 90% of them were currently or previously married, of whom 99.5% had given birth, which may explain their greater likelihood of being current or likely future FC users.

The third explanation might be that the environment of a boardinghouse and freelance sex would facilitate FC intervention (Nie et al., 2013). Our outreach workers reported that FC education and delivery were conducted more effectively in

boardinghouses than in other types of establishments because women there could arrange their time more freely and liked to share their experience of FC use with each other during the intervention.

FC intervention projects among Chinese FSW are scarce. A study conducted by Cheng and his colleagues (2002) introduced FC to FSW through an education session (30 min), FC demonstration (20 min) and FC distribution, and assessed the improvements in FC knowledge and attitudes after 2 months, but no information about FC use was reported. The other publications about our project showed that context such as study sites and establishment type might affect FC use in addition to the intervention program itself (Nie et al., 2013). In addition, some factors identified in this analysis associated with higher potential to use FC (e.g., practicing FC insertion) are the same as those in our previous analysis comparing FC current or past users and nonusers (Liao et al., 2011a; Nie et al., 2013). Beksinska, Smit, Joanis, and Hart (2012) reported recently that practice led to reduction in FC failure, and after use of the first five FC, rates of failure decreased markedly. Therefore, targeted FC intervention programs should encourage and guide potential users to practice FC insertion more in order to reduce initial barriers to FC use. Furthermore, initiating FC use with a partner was found to be an important indicator related to motivation for FC usage. However, among the women initiating FC use in our study, 52.0%–66.7% were refused by primary partners and 65.9%–84.9% were refused by commercial partners. So sex partner refusal was the main barrier to FC use. The review by Hoffman et al. (2004) pointed out that negotiation was the challenge of FC acceptability, and partners' positive attitudes and willingness to use FC might improve FC acceptability and usage among women. Thus, FC programs might need not only more strategies to help women introduce and promote FC with their partners in order to successfully overcome partner resistance, but also more direct intervention with clients to support their willingness to try FC and overcome the initial challenges and unfamiliarity of the device.

Our study had two primary limitations. First, it is a cross-sectional design rather than a longitudinal cohort, so it is difficult to track individuals' change in FC adoption over time and to establish temporal causal relationships. Second, it is not enough to understand FC acceptability and use among FSW as measured only by quantitative data. Although we have collected significant qualitative data on FC likes, dislikes, and failures among these women, we could not include those data in this quantitative analysis.

On one hand, broader awareness and availability of FC in contexts of sex work or other health or reproductive health venues will help establish a supportive context for the FC as an option for prevention. On the other, if FC intervention programs could make more efforts to identify and reach the preferred targets—that is, in China, the FSW from boardinghouses, those who are older, and those having more unprotected sexual encounters—they might be streamlined and achieve more cost-effective benefits. With both strategies, FC could potentially become a more significant factor in HIV and STI prevention and public health in China.

## REFERENCES

- Artz, L., Macaluso, M., Brill, I., Kelaghan, J., Austin, H., Fleenor, M., et al. (2000). Effectiveness of an intervention promoting the female condom to patients at sexually transmitted disease clinics. *American Journal of Public Health, 90*(2), 237–244.
- Bacher, J., Wenzig, K., & Vogler, M. (2004). *SPSS twostep cluster: A first evaluation*. Retrieved from <http://www.opus.ub.uni-erlangen.de/opus/volltexte/2004/81/>.
- Barbosa, R. M., Kalckmann, S., Berquo, E., & Stein, Z. (2007). Notes on the female condom: Experiences in Brazil. *International Journal of STD & AIDS, 18*(4), 261–266.
- Beksinska, M., Smit, J., Joanis, C., & Hart, C. (2012). Practice makes perfect: Reduction in female condom failures and user problems with short-term experience in a randomized trial. *Contraception, 86*(2), 127–131.
- Cheng, Y. M., Li, Z. H., Wang, X. M., Wang, S. Y., Hu, L. Z., Xie, Y. Y., et al. (2002). Introductory study on female condom use among sex workers in China. *Contraception, 66*(3), 179–185.
- Cheng, Y. M., Li, Z. H., Wang, X. M., Wang, S. Y., Hu, L. Z., Xie, Y. Y., et al. (2003). Use of the female condom among sex workers in China. *International Journal of Gynecology & Obstetrics, 81*(2), 233–239.
- Choi, K. H., & Gregorich, S. E. (2009). Social network influences on male and female condom use among women attending family planning clinics in the United States. *Sexually Transmitted Diseases, 36*(12), 757–762.
- Francis-Chizororo, M., & Natshalaga, N. R. (2003). The female condom: Acceptability and perception among rural women in Zimbabwe. *African Journal of Reproductive Health, 7*(3), 101–116.
- Gallo, M. F., Kilbourne-Brook, M., & Coffey, P. S. (2012). A review of the effectiveness and acceptability of the female condom for dual protection. *Sex Health, 9*(1), 18–26.
- Hoffman, S., Exner, T. M., Leu, C. S., Ehrhardt, A. A., & Stein, Z. (2003). Female-condom use in a gender-specific family planning clinic trial. *American Journal of Public Health, 93*(11), 1897–1903.
- Hoffman, S., Mantell, J., Exner, T., & Stein, Z. (2004). The future of the female condom. *International Family Planning Perspectives, 30*(3), 139–145.
- Hoke, T. H., Feldblum, P. J., Van Damme, K., Nasution, M. D., Grey, T.W., Wong, E. L., et al. (2007). Temporal trends in sexually transmitted infection prevalence and condom use following introduction of the female condom to Madagascar sex workers. *International Journal of STD & AIDS, 18*(7), 461–466.
- Jivasak-Apimas, S., Saba, J., Chandeying, V., Sakondhavit, C., Kiriwat, O., Ruggao, S., et al. (2001). Acceptability of the female condom among sex workers in Thailand: Results from a prospective study. *Sexually Transmitted Diseases, 28*(11), 648–654.
- Kulczycki, A., Kim, D. J., Duerr, A., Jamieson, D. J., & Macaluso, M. (2004). The acceptability of the female and male condom: A randomized crossover trial. *Perspectives on Sexual and Reproductive Health, 36*(3), 114–119.
- Lameiras Fernandez, M., Failde Garrido, J. M., Castro, Y. R., Nunez Mangana, A. M., Carrera Fernandez, M. V., & Foltz, M. L. (2008). Assessing female condom acceptability among heterosexual Spanish couples. *European Journal of Contraception and Reproductive Health Care, 13*(3), 255–263.
- Lara, D. K., Grossman, D. A., Munoz, J. E., Rosario, S. R., Gomez, B. J., & Garcia, S. G. (2009). Acceptability and use of the female condom and diaphragm among sex workers in Dominican Republic: Results from a prospective study. *AIDS Education and Prevention, 21*(6), 538–551.
- Lawson, M. L., Macaluso, M., Duerr, A., Hortin, G., Hammond, K. R., Blackwell, R., et al. (2003). Partner characteristics, intensity of the intercourse, and semen exposure during use of the female condom. *American Journal of Epidemiology, 157*(4), 282–288.
- Li, Y., Detels, R., Lin, P., Fu, X., Deng, Z., Liu, Y., et al. (2010). Prevalence of HIV and STIs and associated risk factors among female sex workers in Guangdong Province, China. *Journal of Acquired Immune Deficiency Syndromes, 53*(Suppl.), S48–S53.
- Liao, S. S., Weeks, M. R., Wang, Y. H., Li, F., Jiang, J. M., Li, J. H., et al. (2011a). Female condom use in the rural sex industry in China: Analysis of users and non-users at post-intervention surveys. *AIDS Care, 23*(Suppl. 1), 66–74.
- Liao, S. S., Weeks, M. R., Wang, Y. H., Nie, L., Li, F., Zhou, Y. J., et al. (2011b). 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. *Public Health, 125*(5), 283–292.
- Luke, D. A. (2005). Getting the big picture in community science: Methods that capture context. *American Journal of Community Psychology, 35*(3/4), 185–200.
- Macaluso, M., Demand, M., Artz, L., Fleenor, M., Robey, L., Kelaghan, J., et al. (2000).

- Female condom use among women at high risk of sexually transmitted disease. *Family Planning Perspectives*, 32(3), 138–144.
- Macaluso, M., Demand, M. J., Artz, L. M., & Hook III, E. W. (2000). Partner type and condom use. *AIDS*, 14(5), 537–546.
- Mack, N., Grey, T. G., Amsterdam, A., Matta, C. I., & Williamson N. (2010). Central American sex workers' introduction of the female condom to different types of sexual partners. *AIDS Education and Prevention*, 22(5), 466–481.
- Ministry of Health of the People's Republic of China. (2012). *2012 China AIDS response progress report*. Retrieved from <http://aid-datahub.org/en/reference-librarycols2/item/24194-ungass-country-progress-report-china-state-council-aids-working-committee-office-china-2012>
- Musaba, E., Morrison, C. S., Sunkutu, M. R., & Wong, E. L. (1998). Long-term use of the female condom among couples at high risk of human immunodeficiency virus infection in Zambia. *Sexually Transmitted Diseases*, 25(5), 260–264.
- Nie, L., Liao, S. S., Weeks, M. R., Wang, Y. H., Jiang, J. M., Zhang, Q. N., et al. (2013). Promoting female condoms in the sex industry in 4 towns of southern China: Context matters. *Sexually Transmitted Diseases*, 40(3), 264–270.
- Pool, R. (1999). Acceptability of the female condom and vaginal spermicidal products in Uganda. *Sexual Health Exchange*, (1), 5–7.
- Ray, S., Wijgert, J., Mason, P., Ndowa, F., & Maphoshere, C. (2001). Constraints faced by sex workers in use of female and male condoms for safer sex in urban Zimbabwe. *Journal of Urban Health: Bulletin of the New York Academy of Medicine*, 78(4), 581–592.
- Rezanková, H. (2009). Cluster analysis and categorical data. *Statistik*, (3), 216–232.
- Rojanapithayakorn, W. (2006). The 100% condom use programme in Asia. *Reproductive Health Matters*, 14(28), 41–52.
- Smita, J., Neelam, J., Rochelle, D. Y., Kumar, B. K., Callahan, M., Suniti, S., et al. (2005). Comparative acceptability study of the Reality female condom and the version 4 of modified Reddy female condom in India. *Contraception*, 72(5), 366–371.
- SPSS Inc. (2001). *The SPSS TwoStep Cluster Component: A scalable component enabling more efficient customer segmentation* (White paper—Technical report). Chicago: SPSS Inc. Retrieved from <ftp://ftp.spss.com/pub/web/wp/TSCWP-1100.pdf>
- Thomsen, S. C., Ombidi, W., Toroitich-Ruto, C., Wong, E. L., Tucker, H. O., Homan R., et al. (2006). A prospective study assessing the effects of introducing the female condom in a sex worker population in Mombasa, Kenya. *Sexually Transmitted Infections*, 82(5), 397–402.
- UN Theme Group on HIV/AIDS in China. (2002). *HIV/AIDS: China's titanic peril, 2001 update of the AIDS situation and needs assessment report*. Geneva, Switzerland: UNAIDS. Retrieved from <http://www.hivpolicy.org/Library/HPP000056.pdf>
- Vijayakumar, G., Mabude, Z., Smit, J., Bekinska, M., & Lurie, M. (2006). A review of female-condom effectiveness: Patterns of use and impact on protected sex acts and STI incidence. *International Journal of STD & AIDS*, 17(10), 652–659.
- Weeks, M. R., Liao, S. S., Li, F., Li, J. H., Dunn, J., He, B., et al. (2010). Challenges, strategies, and lessons learned from a participatory community intervention study to promote female condoms among rural sex workers in Southern China. *AIDS Education and Prevention*, 22(3), 252–271.
- Witte, S. S., El-Bassel, N., Wada, T., Gray, O., & Wallace, J. (1999). Acceptability of female condom use among women exchanging street sex in New York City. *International Journal of STD & AIDS*, 10(3), 162–168.
- Zachariah, R., Harries, A. D., Buhendwa, L., Spielman, M. P., Chantulo, A., & Bakali, E. (2003). Acceptability and technical problems of the female condom amongst commercial sex workers in a rural district of Malawi. *Tropical Doctor*, 33(4), 220–224.