Published in final edited form as:

Sex Transm Dis. 2010 November ; 37(11): 700–705. doi:10.1097/OLQ.0b013e3181e1a2b2.

A Multilevel Analysis of Gatekeeper Characteristics and Consistent Condom Use Among Establishment-Based Female Sex Workers in Guangxi, China

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Abstract

Background—Multilevel analytical techniques are being applied in condom use research to ensure the validity of investigation on environmental/structural influences and clustered data from venue-based sampling. The literature contains reports of consistent associations between perceived gatekeeper support and condom use among entertainments establishment-based female sex workers (FSWs) in Guangxi, China. However, the clustering inherent in the data (FSWs being clustered within establishment) has not been accounted in most of the analyses. We used multilevel analyses to examine perceived features of gatekeepers and individual correlates of consistent condom use among FSWs and to validate the findings in the existing literature.

Methods—We analyzed cross-sectional data from 318 FSWs from 29 entertainment establishments in Guangxi, China in 2004, with a minimum of 5 FSWs per establishment. The Hierarchical Linear Models program with Laplace estimation was used to estimate the parameters in models containing random effects and binary outcomes.

Results—About 11.6% of women reported consistent condom use with clients. The intraclass correlation coefficient indicated 18.5% of the variance in condom use could be attributed to their similarity between FSWs within the same establishments. Women's perceived gatekeeper support and education remained positively associated with condom use ($P < 0.05$), after controlling for other individual characteristics and clustering.

Conclusions—After adjusting for data clustering, perceived gatekeeper support remains associated with consistent condom use with clients among FSWs in China. The results imply that combined interventions to intervene both gatekeepers and individual FSW may effectively promote consistent condom use.

Multilevel analytical techniques are being applied to condom use research in venue-based (e.g., society,¹ neighborhood,² or dyad³) sampling to assess environmental/structural influences and clustered data. The use of multilevel analytical techniques is important to ensure of the validity of investigation because analyses ignoring the clustering inherent in the clustered data violate the assumption of independence among the data, and possibly lead to smaller standard errors and the overestimation of significance.^{4,5}

In the context of commercial sex, the HIV/sexually transmitted infection (STI) risk and environmental influences and structural interventions vary by workplaces and countries.^{6–8} For example, street-based sex workers generally are high risk. A study among street-based female sex workers (FSWs) in Canada reported that working areas away from main streets and serving clients in cars or public spaces were structural barriers of unprotected sexual intercourse.⁹ Legal brothels have comparably lower risk. Successful structural interventions in multidimensional programs among legal brothels included the 100% condom program in Thailand (e.g., sanctions and reinforcement at brothels, media campaign)^{10–12} and Sonagachi project in India (e.g., community mobilization and empowerment).^{13–15} Being higher risk than legal brothels, commercial sex in entertainment establishments (e.g., clubs and bars) is illegal in many countries, and under-researched in terms of structural barriers and interventions.¹⁶ Studies have investigated environmental clues, community solidarity, government policy and enforcement in the Dominican Republic^{17,18} and manager influence and reinforcement, peer influence in the Philippines.^{16,19–21} Although venue-based sampling and clustered data could be used in conducting studies on legal brothels and establishments, to date, multilevel analytical techniques have generally been employed in the Philippines.^{19–21}

The contemporary social context of commercial sex in China requires advanced understanding of environmental or structural barriers of condom use. Despite governmental attempts to eliminate brothels and successfully eradicate STIs by 1964 in China,²² commercial sex has been thriving in the form of entertainment establishments since the early 1980s.²³ Previous studies in Asia and Africa and our own data from FSWs in China suggest that social norms and policy within establishments as well as managers and gatekeepers overseeing the FSWs are significant environmental influences.^{17,20,23–25} Unlike the Philippines or the Dominican Republic, China has no mandatory condom use policy or HIV/STI testing programs by the government.²³ At these establishments in China, the constant interactions among condom use behavior, personal cognitive factors, and environmental factors, defined as the actual and perceived physical and social environment, provide structural mechanisms to identify related barriers and facilitators.^{26,27} Among personal cognitive factors, condom use self-efficacy was reported as a significant determinant of condom use in path analysis.²⁸ In the sex trade, condom use is a highly motivated behavior of the worker-client dyad through negotiation with influences of gatekeepers and establishments. A qualitative study among FSWs in Shanghai revealed that FSWs were under varied (e.g., limited, considerable, or complete) control by gatekeepers and lack of gatekeeper support and abusive FSW-gatekeeper relationships were barriers to condom use.²⁹ In contrast, gatekeepers who enforced educational policies, mandated and supported condom use, and provided condoms in the workplace contributed to increased condom use.²⁰ Despite the reports of consistent associations of perceived gatekeeper support and environmental support with condom use among establishment-based FSWs in Guangxi,^{23,24,28} the clustering inherent in the data (i.e., FSWs clustering within establishment) has not been accounted in most analyses.

Therefore, the objective of our study was to use multilevel analyses to investigate the associations of environmental and individual-level correlates of consistent condom use among entertainment establishment-based FSWs in China. We hypothesized that perceived gatekeeper support will be associated with increased condom use among FSWs in China, after controlling the clustering in the data and other individual characteristics and cognitive constructs (e.g., alcohol use, condom use self-efficacy, perceived barriers, perceived benefits, HIV/STD knowledge, susceptibility, and severity).

MATERIALS AND METHODS

Study Site

Data were obtained from the baseline assessment of a community-based voluntary counseling and testing intervention study in 2004 in a rural county (H County) in Guangxi Zhuang Autonomous Region (“Guangxi”).³⁰ Being 1 of 5 autonomous and multiethnic regions and located in southern China, Guangxi has experienced a significant rise in HIV prevalence in the past decade. A total of 48,703 HIV/AIDS cases at June of 2009 were reported, which placed Guangxi second among Chinese provinces in terms of cumulative reported HIV seropositive cases.³¹ A prosperous economy, increased international contact, and general tourism in Guangxi have created a market for commercial sex. According to the statistics from the public security agency, there are at least 50,000 FSWs in Guangxi. H country had an estimated 200 entertainment establishments, with more than 2000 women engaging in commercial sex service at the time of the study.

Participants and Survey

Detailed venue-based sampling, recruitment, and survey procedures have been described elsewhere.^{24,28,30} Briefly, the research team and local health workers conducted an ethnographic mapping³² of entertainment establishments providing sexual services and identified 85 such establishments (i.e., restaurants, barbershops, and hair-washing rooms) in the survey areas. The research team received permission from owners/managers of 57 (67%) establishments. Trained outreach health workers from the county antiepidemic station and local hospitals contacted 582 women in these establishments, of whom 454 (78%) agreed to participate, provided written informed consent, and completed a self-administered questionnaire. The survey was confidential and conducted in separate rooms or private spaces. No one was allowed to stay with participant during the survey except the interviewer who provided the participant with necessary assistance. The questionnaire took about 1 hour to complete. The study protocol was approved by the Institutional Review Boards at Wayne State University, Beijing Normal University, and Guangxi Central for Diseases Control and Prevention in China.

The venue-based sampling results in a hierarchical structure with individuals clustered within the venue. In this study, FSWs were clustered within establishment and influenced by the gatekeepers. Following Furstenberg and colleague’s recommendation³³ that a minimum of 5 cases per cluster provided the most stable data, we excluded establishments with less than 5 participants. This resulted in a final sample of 318 women from 29 establishments, averaging about 11 (range, 5–31) women per establishment.

Measures

Consistent Condom Use With Clients—Following the practices in other studies,^{17,28} we dichotomized Consistent Condom Use With Clients (CCUC) whether a participant always use a condom with clients during their sexual life and during the 3 most recent sexual encounters.

Demographic and Working Characteristics—Demographic information included their age, ethnicity including Han or non-Han (e.g., Zhuang, Jingpo, Tong, and other ethnical minorities), years of formal schooling, marital status (i.e., currently married, unmarried or divorced), hometown type (i.e., rural, county seat, and medium/large city), living arrangements (i.e., alone, with family, or with other FSWs), and having children. Working characteristics included how long they had been working in commercial sex, monthly income, and average clients per week.

Gatekeeper Support for Condom Use—FSWs' perception of gatekeeper attitude and support for condom use in the workplace was assessed with 5 items. A composite score was created by indexing positive condom use attitudes and practices of gatekeepers (i.e., requiring FSWs to use condoms, allowing FSWs' refusal of sex if a client does not use a condom, discussing condom use with FSWs, providing FSWs with free condoms, and being supportive to FSWs in dealing with abusive clients). The Cronbach α was 0.56. A higher score indicates a higher level of gatekeeper support for condom use.

HIV/STD Knowledge—Total 22 items were employed to assess knowledge of STD symptoms (10 items), HIV transmission modes (6 items), and misconception of HIV transmission through routine daily contact (6 items). The total number of correct answers to the 22 knowledge questions was retained as a single score, with higher scores reflecting increased HIV/STD knowledge. The internal consistency estimate (Cronbach α) for the 22 items was 0.88.

Susceptibility and Severity—Two scales assessed perceived personal susceptibility to and perception of negative consequences resulting from sex risk behavior. Participants were asked to rate their perceptions regarding the likelihood of acquiring HIV and STD infection (e.g., "how likely do you think it is that you would get an STD/HIV in the future?"). This 2-item scale had a Cronbach α of 0.71. Participants were also asked to assess their perceptions regarding negative consequences of being infected with HIV (i.e., "One will lose his/her friends if he/she becomes infected with HIV"; "One will suffer the whole life if he/she becomes infected with HIV"; and "One's family will suffer if he/she becomes infected with HIV.") The Cronbach α for this 3-item scale was 0.71. Because 2 scales were highly correlated (correlation coefficient 0.89), a composite score was created by summing the numbers of positive responses (i.e., likely or agree) across the 5 items. A higher score indicated a higher level of perceived susceptibility/severity.

Condom Use Self-Efficacy—Personal belief about one's own ability to use a condom was assessed using 4 items: "I know where to get condoms"; "I can persuade my client to use a condom if he is unwilling to use it"; "I will refuse to have sex if my client does not want to use a condom"; and "I know how to use condoms properly." The Cronbach α for this scale was 0.56. A composite score was created by summing the numbers of positive responses to the 4 items. A higher score indicated a higher level of self-efficacy.

Perceived Barriers to Condom Use—The barriers or negative consequences of condom use were assessed by asking participants whether they agreed or disagreed with the following 6 statements: "if the police found you carrying a condom, you might be in trouble"; "few men like to use condoms"; "if you insisted on using a condom, your partner might be suspicious that you had an STD"; "if you insisted on using a condom, your clients might get angry at you"; "if you insisted on using a condom, your clients might not come to you any more"; and "if you insisted on using a condom, you might make less money." The Cronbach α for this scale was 0.54. A composite score was created by summing "agree" responses.

Perceived Benefits—Five items were employed to measure perceived benefits of unprotected sex (i.e., "if I do not use condoms, my clients will pay me more"; "if I do not use condoms, then the sex with clients finish faster"; "if I do not use condoms, then clients will be happier"; "if I do not use condoms, my clients will come back in the future"; "if I do not use condoms, then save my money and time"). The Cronbach α was 0.75. A composite score was created by summing the number of positive responses of the 5 items. A higher score reflected a higher level of perceived benefits of unprotected sex.

Alcohol Intoxication—It was measured by asking participants whether they have been intoxicated with alcohol at least monthly in the past 6 months (yes/no).

Using Alcohol Before Having Sex With Clients—Was measured by asking participants whether they had consumed alcohol before having sex with clients (yes/no).

Potential multicollinearity was assessed by examining Pearson correlation coefficients between each pair of independent variables. Three variables (age, marital status, and having a child) had interpair correlations exceeding $|0.5|^{34}$: age and marital status ($r = -0.692$), having a child and marital status ($r = -0.816$), and having a child and age ($r = 0.774$). None of them was significant in multilevel analysis therefore was dropped from the final model.

Analyses

We formulated a multilevel logistic regression model that represents the odds of a given woman from a given establishment reporting CCUC. We employed this strategy to account for the hierarchical structure of the 2-level data with 318 FSWs (level 1) nested within 29 establishments (level 2).^{35,36} Then, we compared the results of the multilevel logistic regression with those of the ordinary logistic regression.

Define $y_{ij} = 1$ if participant i from establishment j reported CCUC, whereas define $y_{ij} = 0$ if participant did not. We are interested in the probability of CCUC, $\text{Prob}(y_{ij} = 1) = p_{ij}$. Rather than directly modeling the probability, we model $\log[p_{ij}/(1-p_{ij})]$, the natural logarithm of the odds ratio with the form $\log[p_{ij}/(1-p_{ij})] = \beta x_{ij} + \gamma w_j + r_{ij}$, where x_{ij} is a vector of individual and establishment characteristics of participant i from establishment j and w_j is a vector of establishment characteristics. The components of β characterize partial associations between individual/dyad characteristics and the CCUC, whereas the components of γ characterize partial associations between establishment characteristics and the CCUC, and r_{ij} is a model intercept.

The initial model included only the dependent variable and establishment identifiers in the unconditional model (not shown in tables) to generate between-cluster variance. The intraclass correlation coefficient (ICC) measures the proportion of the total variance of an outcome that is accounted for by the clustering. In other words, ICC measures similarity in condom use between FSWs within the same establishments. ICC is the ratio of between-cluster variance divided by the sum of within-and between-cluster variance of a given variable. The within-cluster variance for a Bernoulli distribution of the variable equals to $\pi^2/3$ (that is, 3.29).^{37,38} The ICC for CCUC indicated 18.5% [$0.747/(0.747 + 3.29)$] of the similarity in condom use between FSWs within the same establishments, which could not be ignored.

The model-building process then followed the steps outlined by other researchers.^{39–41} A level-1 equation for the final random-coefficient regression model predicting CCUC (yes vs. no) for FSW i from establishment j was specified as:

$$\begin{aligned} \log[p_{ij}/(1-p_{ij})] &= \beta_{0j} + \beta_{1j}(\text{perceived gatekeeper support}_{ij}) \\ &+ \beta_{2j}(\text{self-efficacy}_{ij}) \\ &+ \beta_{3j}(\text{knowledge}_{ij}) \\ &+ \beta_{4j}(\text{education}_{ij}) \\ &+ \beta_{5j}(\text{drinking before selling sex}_{ij}) \\ &+ \beta_{6j}(\text{susceptibility and severity}_{ij}) + r_{ij} \end{aligned}$$

with the continuous predictors centered on their grand means. β_{0j} is the individual-level intercept. r_{ij} is the error term, assumed to be normally distributed with mean zero and variance of σ_{ε}^2 . We included perceived gatekeeper support as an individual level variable in multilevel analysis.

The Hierarchical Linear Models version 6 program with Laplace estimation was used to estimate the parameters in models containing random effects and binary outcomes.⁴² The model selection process intended to find the balance between the theoretical informed model and the best approximating model, and then develop reliable inferences based on the entire set of models considered a priori.⁴³ To identify the most parsimonious (simple but effective) model, deviance statistic was used to compute a likelihood ratio test for hypothesis testing. A chi-square test determined whether the difference in deviances between 2 nested models is statistically significant.^{37,44} Through the interactive process, several variables in Table 1 were dropped till a few variables were retained in Table 2. Model 1 and Model 2 showed the differential impacts without and with the consideration of perceived gatekeeper support in multilevel logistic regressions. Model 3 presented the result of ordinary logistic regression, including perceived gatekeeper support. All tests of statistical significance were 2-tailed, with $\alpha = 0.05$ as the level for statistical significance.

RESULTS

In this sample of 318 FSWs, 11.6% reported consistent condom use with clients, and 61.0% knew how to correctly use condom (Table 1). Most participants were of Han ethnicity (54.4%), had a child (41.7%), unmarried or divorced (64.0%), young (23.4 ± 5.0 years old), and migrated from rural areas (80.5%). The mean years of education was $5.6 (\pm 3.2)$. They had worked as sex workers for an average of 13.2 months and median monthly income 400 Yuan, ranging from 100 to 3500 Yuan (8 Yuan $\approx$ 1 US \$ at the time of study). On average, each woman had about 1.8 clients per week. The average perceived gatekeeper support score was $1.6 (\pm 0.9)$. The average condom use self-efficacy score was $3.2 (\pm 1.4)$. About one-third (34.6%) had been intoxicated with alcohol at least monthly in the past 6 months; and 32.1% drank before having sex with clients.

Table 2 presents the results of the multilevel logistic regression analyses (Models 1 and 2), comparing with the ordinary logistic regression (Model 3). When Model 1 did not consider perceived gatekeeper support, condom use self-efficacy and higher education were positively associated with CCUC. After adding perceived gatekeeper support as an individual level variable (Model 2), the finding of education persisted; condom use self-efficacy was not associated with CCUC; and perceived gatekeeper support was positively associated with CCUC. Compared to the multilevel analysis, the ordinary logistic regression produced smaller odds ratio in perceived gatekeeper support and significant association between condom use self-efficacy and consistent condom use (Model 3).

DISCUSSION

When controlling for the clustering in the data and other personal characteristics, our findings indicate the importance of perceived gatekeeper support for consistent condom use among FSWs in Guangxi, China. We found that the impact of condom use self-efficacy became insignificant after the perceived gatekeeper support was taken into account. Women's perceived gatekeeper support and education were positively associated with condom use. Our findings suggest that interventions targeting only FSWs without also considering gatekeepers' influence may reduce the effectiveness of the intervention. The results imply that combined interventions to improve gatekeeper support and educate women may promote consistent condom use in the commercial sex settings.

Our finding of the initial protective effect of condom use self-efficacy being diminished after perceived establishment support being taken into account in multilevel analysis is different from the result in ordinary logistic regression. Compared to logistic regression, our multilevel analysis might correct the shrinkage in coefficient of perceived gatekeeper support, and correct the overestimation of significance of condom use self-efficacy.⁴⁵ However, future studies are necessary to test whether self-efficacy remains as one of the most important factors that are associated with consistent condom use among FSWs and their clients. Self-efficacy has been found to be significantly associated with behaviors in diverse workplaces.^{46,47} A study among FSWs in the Philippines reported a direct association between actual and perceived gatekeepers' attitudes and condom efficacy and condom use.¹⁹ Likewise, safe sex self-efficacy remained significantly associated with consistent condom use when self-reported environment/structural support was considered among FSWs in the Dominican Republic.¹⁸

Because of the important role of gatekeepers in influencing consistent condom use among this group of FSWs in Guangxi, China, our results imply that among FSWs, interventions to enhance gatekeepers' support might become much important to design multidimensional programs targeting and overcoming structural barriers, including condom availability, social norms, and distribution of resources and power. Potential intervention strategies might include trainings of gatekeepers for them to setup and reinforce the 100% condom use policy and graduated sanction (penalty or reward) system, to create a supportive norm to condom use discussion in workplace and condom use negotiation with clients (e.g., allowing FSWs' refusal of sex if a client does not use a condom, and being supportive to FSWs in dealing with abusive clients), and provide FSWs with free condoms and condom use skill trainings. Work in the Dominican Republic and the Philippines reported gatekeepers' influences in both observational studies and effective interventions,^{16–19,21,48,49} and demonstrated the significance of establishment effects on consistent condom use over and above individual factors. Such establishment-based approaches have appeal over individual ones and need to be included in future intervention designs.

This study used multilevel modeling statistical techniques to account for clustering in the data. However, our study is subject to several limitations. First, our findings may have limited generalizability to other forms of workplaces or other countries. Second, because of the cross-sectional nature of the study, causal relationships were not proven. An event-level study design could prospectively assess the effects of gatekeeper support on condom use. Third, indicators of gatekeeper support were not observed directly but rather inferred from FSWs' perceptions. Future studies need to collect data on direct observation of workplaces and situations and to assess clustering of positive prevention practices by type of establishment and gatekeepers. Fourth, other potential correlates (e.g., client-perpetrated violence) were not considered in the current models. Fifth, consistent condom use measure could have potential bias because of the concern of socially desirable reporting.⁵⁰ Sixth, some measures including gatekeeper support for condom use, condom use self-efficacy, and perceived barriers of condom use had relatively low reliability (e.g., Cronbach alpha <0.60). Seventh, our sample size was too small to include age, location of origin, and duration of work of the FSWs in multilevel analyses.

Our findings highlight the role of establishment-level interventions and programs targeting gatekeepers to promote consistent condom use among FSWs in China. Although we recognized that gatekeeper support matters in this current study, the strategies of mandatory condom use policy and HIV/STI testing programs by the government remain important in HIV/STI prevention among commercial sex. Future studies should focus on a variety of geographical settings, direct assessment of gatekeeper support at the establishment-level, and investigating diverse workplaces to design effective health promotion programs to protect FSWs.

Acknowledgments

Data analysis and preparation of this paper were supported by Grant R01AA018090 from the National Institute on Alcohol Abuse and Alcoholism, National Institutes of Health. Financial support for undertaking the survey was provided by the National Institute of Mental Health and the NIH Office of AIDS Research (R01MH064878–3S1). The authors gratefully acknowledge the methodological assistance from Drs. Xinguang Cheng, Sean-Shong Hwang, and Chenzhang Chen.

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TABLE 1

Metrics and Descriptive Statistics of Characteristics of 318 Female Sex Workers at H County, Guangxi, China, 2004

Variables	Metrics	Range	Mean (Std Dev)/%
Dependent variable			
Consistent condom use	0 = no, 1 = yes	0–1	11.6%
Explanatory variables			
Age	Years	15–38	23.4 (5.0)
Education	Years	0–16	5.6 (3.2)
>9	0 = no, 1 = yes	10–16	6.9%
7–9	0 = no, 1 = yes	7–9	33.2%
≤6	0 = no, 1 = yes	0–6	59.9%
Han ethnicity	0 = no, 1 = yes	0–1	54.4%
Unmarried or divorce	0 = no, 1 = yes	0–1	63.5%
Having a child	0 = no, 1 = yes	0–1	41.7%
Hometown			
Rural	0 = no, 1 = yes	0–1	80.5%
County seat	0 = no, 1 = yes	0–1	14.0%
Medium/large city	0 = no, 1 = yes	0–1	5.5%
Monthly income*	Yuan	50–4000	518 (418.6)
Length of being a sex worker	Months	0.25–66	13.2 (13.1)
Average clients per week*	Persons	0.25–10	1.8 (1.3)
Perceived gatekeeper support	Score	0–5	1.59 (0.93)
HIV/STI knowledge	Score	0–21	10.2 (5.1)
Condom use self-efficacy	Score	0–5	3.2 (1.4)
Alcohol intoxication	0 = no, 1 = yes	0–1	34.6%
Drinking before selling sex	0 = no, 1 = yes	0–1	32.1%
Susceptibility and severity	Score	0–5	2.1 (1.3)
Perceived benefits	Score	0–5	1.9 (1.7)
Perceived barriers	Score	0–6	2.7 (1.6)

* Cases involving missing data were excluded from percentage calculations.

TABLE 2

Odds Ratio and 95% Confidence Interval of Multilevel Logistic Regression (Model 1 and 2) and Logistic Regression (Model 3) of Consistent Condom Use with Clients among 318 Female Sex Workers from 29 Establishments, Guangxi, China, 2004

	Model 1	Model 2	Model 3
	OR (95% CI)	OR (95% CI)	OR (95% CI)
Gatekeeper support		1.80 (1.08–3.03)*	1.59 (1.09–2.31)*
Condom use self-efficacy	1.66 (1.03–2.69)*	1.64 (0.87–3.10)	1.63 (1.12–2.36)*
Knowledge	0.94 (0.86–1.02)	0.90 (0.81–1.00)	0.92 (0.85–1.01)
Education	1.19 (1.02–1.39)*	1.18 (1.01–1.39)*	1.18 (1.03–1.34)*
Drinking before selling sex	0.33 (0.08–1.28)	0.30 (0.07–1.35)	0.42 (0.17–1.02)
Susceptibility and severity	1.13 (0.68–1.86)	1.12 (0.59–2.13)	1.10 (0.82–1.47)

OR indicates odds ratio; CI, confidence interval.

* $P < 0.05$.

In the model selection process, several variables were insignificant and dropped (e.g., age, marital status, Han ethnicity, perceived barriers, and perceived benefits).