

Indicators of Mobility, Socio-Economic Vulnerabilities and HIV Risk Behaviours Among Mobile Female Sex Workers in India

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Abstract This paper examines the relationship between indicators of mobility, socio-economic vulnerabilities, and HIV risk behaviours among 5,498 mobile female sex workers (FSWs) living in the four high HIV prevalence states in India. Female sex workers with greater degree of mobility reported significantly more often than the FSWs with lesser degree of mobility that they experienced physical violence, and consumed alcohol prior to sex. Further, FSWs with greater degree of mobility reported significantly more often than the FSWs with lesser degree of mobility that they had inconsistent condom use in sex with clients, even after controlling for several demographic characteristics and socio-economic vulnerabilities including experiences of violence. Additionally, short duration visits and visit to the *Jatra* (religious fairs) places found to have significant association with their inconsistent condom use in sex with clients as well as continuation of sex despite having STI symptoms. These findings suggest the need for screening FSWs for higher degree of mobility and to mobilize them to form community networks so as to deal

with violence, reduce alcohol use and promote consistent condom use along the routes of mobility. HIV prevention interventions aimed at FSWs require an increased attention to address the socio-economic vulnerabilities including alcohol use, with particular emphasis on those FSWs who are on the move in India and elsewhere.

Keywords Mobility · HIV · STIs · Condom use · FSWs · Violence · Alcohol use · India · Sex workers

Introduction

Mobility is widely recognized as key facilitating factor in HIV spread around the world [1–8]. Several African studies have documented that men and women who had travelled or migrated recently are at higher risk for HIV and other sexually transmitted infections (STIs) than people who did not travel or migrate [4, 8–10]. The reasons for such heightened risk among highly mobile populations are attributed to low access to care [11] and other social services [4, 12, 13].

Globally as well as in India, female sex workers (FSWs) are believed to be the recipient as well as transmitter of HIV infection [5, 14–16]. Indian FSWs were found to be at higher risk due to increased inconsistent condom use [2, 17] and other vulnerability factors such as violence and migration [1, 5, 18]. Recent studies in India indicate that many sex workers move [5] often as frequently as every 2 weeks [19–22]. The frequent mobility of sex workers is the result of their search for work and also considered as response to escape the social stigma from family and community members [19–22] who in turn increases risk for HIV and contribute to the spread of this infection [23, 24]. Moreover, both HIV and sex work are highly stigmatized

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in India like in many other countries [25]. Sex workers are often subjected to blame, labeling as bad women, strong disapproval and discriminatory treatment [26]. Mobility to avoid stigma has implications for changing sex work venues [3, 26, 27], thus make these FSWs extremely hard to reach with prevention programs.

Though the mobility of sex workers has been identified as the critical component of HIV transmission, limited attention has been paid to investigate the relationships between different indicators of mobility and HIV risk behaviours within the context of socio-economic vulnerabilities. Few existing micro-level studies only have examined this issue, however, they have done so by taking one factor at a time: mobility and HIV risk [5]; violence and HIV risk [28–30]; and migration and lack of access to STI care [7]. The results of these studies cannot be generalized to mobile FSWs because these studies do not control for the effects of socio-economic vulnerabilities which affect both mobility as well as HIV risk behaviours. Hence, research is needed to confirm the link between mobility, socio-economic vulnerabilities and HIV risk behaviours to deepen the insight into factors that can be influenced through programmatic interventions. The present study therefore seeks to: (1) examine the relationship between mobility and current socio-economic vulnerabilities (such as violence, alcohol use prior to sex, under debt); and (2) examine the independent effects of mobility, current socio-economic vulnerabilities on HIV risk behaviors. This study is part of a large scale research project on mobility and HIV risks among FSWs from four high HIV prevalence states of India.

Methods

The present study is based on data from a cross-sectional behavioural survey conducted among FSWs in 22 districts with high in-migration across four states in southern (Andhra Pradesh, Karnataka, Tamil Nadu) and western (Maharashtra) India, identified as high epidemic states by the Indian National AIDS Control Organisation prior to the year 2005 [19–22]. These study districts were identified by using unpublished mapping and enumeration data on FSWs collected independently by the State AIDS Control Society and Avahan (India AIDS Initiative of the Bill & Melinda Gates Foundation).

A two-stage sampling procedure was used to select FSWs from both brothel and non-brothel sites. For brothel sites, two-stage systematic sampling was used: at the first stage, lanes/small pockets/areas were selected systematically; and at the second stage, brothel houses in each lane/small sub-area were selected. All FSWs in the selected brothel houses were interviewed by using a screening tool to identify mobile FSWs. In the case of non-brothel sites, two-stage

time location sampling was used: at the first stage, the sites of sex worker cruising points or homes were selected; and at the second stage, the day and timing of visits were systematically selected. All FSWs found during the selected time, day, and cruising sites/homes were interviewed by using a screening tool [5].

About 94% (or 9475) of FSWs who were contacted (10075) initially had agreed to be administered the screening questionnaire. Of these 5611 (59%) FSWs were found eligible for detailed interview according to the study definition of mobile FSWs: those who moved to two or more different locations for sex work during the previous 2 years and one of which included a move across districts.

Ethical approval for the study was obtained from the institutional review boards (IRBs) of Population Council; and the University of Manitoba, Canada. Verbal consent was obtained from all respondents prior to participation at each stage. For ethical considerations, only those FSWs who were at least 18 years of age were finally interviewed. Of the total eligible FSWs (5,611), 113 were excluded: 15 were not interviewed because they were below age 18 years, 21 have refused to participate, 51 withdrawn from interview in the middle, and for additional 26 the data was missing on socio-economic variables. This resulted into a total analytical sample of 5,498 FSWs.

The detailed survey was conducted by multilingual research assistants trained and experienced in qualitative and quantitative data collection techniques. Face-to-face interviews were conducted in private or public locations depending upon the preference of the respondent. The data was collected using handheld PDAs (Palmtop Digital Accessories) in the states of Andhra Pradesh, Maharashtra, and Tamil Nadu; and through printed questionnaires in Karnataka. This was the first time that PDAs were used for survey among FSWs in India [19, 20, 22]. In order to facilitate the acceptance of PDA, respondents were explained about the interviewing technique and shown how the PDA works. The PDA program was used to ensure confidentiality of large scale sensitive data collected in the field. The consistency and quality of data collected through the use of PDAs were assessed weekly by using SPSS. The quality assurance and management of data collected via questionnaires involved immediate review by field staff after completing interviews to ensure accuracy and completeness, same day review by the field supervisor, and weekly transfer of data to the data management team in Dharwad, Karnataka where data were entered and processed monthly to verify consistency and accuracy.

Measures

HIV risk behaviors are measured by using two indicators: (a) reported inconsistent use of condoms, and (b) continued

to have sex while experiencing STI symptoms (ulcers/sores in genital area, swelling in groin area, pain during intercourse, and frequent painful urination). The inconsistent condom use was assessed for each of the following types of sex partners: occasional clients and regular clients. For each of these types of partners, participants were asked the frequency of condom use (indicated by 1 = always, 2 = sometimes, 3 = never) they had sex with partners in the past 1 week and condom use at last time sex. These items were used to create a single variable on inconsistent use of condoms with paying partners. To determine the continuation of sex while experiencing STI symptoms, participants were asked whether they had experienced any of the following four symptoms: ulcers/sores in genital area, swelling in groin area, pain during intercourse, and frequent painful urination. Those indicating yes to any of these symptoms were classified as having experienced STI symptoms in the past 6 months prior to the survey. This variable was combined with answer to another question about whether or not the FSW continued to have sex while experiencing these symptoms (1 = yes, 0 = no). The final index was coded as 1 (continued to have sex while experiencing at least one of the four STI symptoms), and 0 (did not have sex while experiencing at least one of the four symptoms, or did not experience any STI symptom during last 6 months).

Mobility is measured from the responses to four questions reflecting the degree and nature of mobility: moved to four or more places during 2 years prior to the survey (no = 0, yes = 1), stayed for 1 month or less at previous two places (no = 0, yes = 1), visited *jatra* ('special religious festivals') place (no = 0, yes = 1), and visited a place frequented by seasonal male migrant workers (no = 0, yes = 1).

Pre-existing vulnerabilities of FSWs include their education, caste, age at entry into sex work, reason for entry into sex work and marital status at the time of sex work entry. These factors reflect conditions that existed before FSWs entered sex work, and are assumed to influence their mobility as well as their condom use behavior. These variables are controlled in the analyses to examine the relationship between mobility, current socio-economic vulnerabilities and HIV risk behaviors.

Current socio-economic vulnerabilities of FSWs include their experiences of physical violence and/or sexual violence in the last 6 months prior to survey (no = 0, yes = 1), alcohol use before sex in the current place (no = 0, yes = 1), and currently under debt (no = 0, yes = 1). Information collected in the survey on experiences to physical violence and sexual violence separately were combined at the time of analyses to compute a single variable on "Whether or not the individual has experienced any kind of violence (either physical or sexual violence)".

Further, information on last time they have experienced violence was used to compute the variable on experience of violence in 6 months prior to the survey.

Program exposure of FSWs includes information about their contacts with outreach workers from government, Avahan funded programs, and/or non-governmental organisations (NGOs) in the current place. Those indicating no contacts with outreach workers were coded as "0, no exposure" and those indicating contact were coded as "1, exposed to the HIV prevention program". This measure was used as a controlling variable in the statistical analyses.

Statistical Analyses

Univariate analysis was used to calculate percentages on mobility and HIV risk indicators. Bi-variate analyses were used to understand the association between the indicators of mobility and HIV risk and Chi-square statistic was used to test their significance. The level of significance for all analyses was set at $P < 0.05$. A series of multiple logistic regression models were used to examine the effects of mobility and current socio-economic vulnerabilities on HIV risk behaviors. All statistical analyses were conducted using STATA version 8.2 [31].

Results

Of the sample of 5,498 mobile FSWs interviewed, 3,811 (69%) visited four or more places in the past 2 years, 1,673 (30%) visited *jatra* place and 435 (8%) visited places frequented by seasonal male migrant workers for sex work in the last 2 years prior to the survey (Table 1). These dimensions of mobility are not mutually exclusive. There is a considerable overlap among them. For example, 4% of FSWs are classified as mobile on all the three dimensions, i.e., they visited 4 or more places within last 2 years and visited *jatra* place as well as visited the places frequented by seasonal migrants; 22% were classified mobile on 2 of 3 dimensions; and 51% were classified as mobile on one of the three dimensions of mobility. The remaining 23% were classified as less-mobile on all the three dimensions, i.e., they visited 2–3 places during past 2 years and did not visit *jatra* place and did not visit a place frequented by male migrant workers. The degree of mobility was high among FSWs who entered into sex work for economic reasons (72%) and among those who entered into sex work in 2 years preceding the survey (76%). Relatively a higher proportion of FSWs from Karnataka (94%), Tamil Nadu (74%) and Andhra Pradesh (69%) moved to 4 or places in 2 years prior to the survey when compared to FSWs in Maharashtra (34%).

Table 1 Socio-demographic profile and indicators of mobility for mobile female sex workers, India

Characteristics	Percent	Number of moves in the past 2 years		Average duration of stay in a visit		Visit to Jatarata areas		Visited seasonal migrant places		
		2–3 moves	4 or more moves	More than 1 month	One month or less	No	Yes	No	Yes	
Sample size	5498	1687	3811	1401	4097	3825	1673	5063	435	
Total %	100.0	30.7	69.3	25.5	74.5	69.6	30.4	92.1	7.9	
<i>Current age</i>										
35+ years	24.2 (1329)	33.6	66.4	29.1	70.9	71.3	28.7	91.5	8.5	
Less than 35 years	75.8 (4169)	29.8	70.2	24.3	75.7	69.0	31.0	92.3	7.7	
<i>Education</i>										
High school or higher	47.7 (2620)	27.5	72.5	21.6	78.4	76.0	24.0	92.7	7.3	
Less than high school	52.3 (2878)	33.6	66.4	29.0	71.0	63.7	36.3	91.5	8.5	
<i>Caste</i>										
Non-SC/ST	55.3 (3039)	27.7	72.3	20.3	79.7	72.3	27.7	92.9	7.1	
SC/ST	44.7 (2459)	34.4	65.6	31.9	68.1	66.2	33.8	91.1	8.9	
<i>Reason for entering into sex work</i>										
Own choice/tradition	11.0 (607)	47.9	52.1	40.5	59.5	69.5	30.5	91.9	8.1	
Force/economic/other reasons	89.0 (4891)	28.5	71.5	23.6	76.4	69.6	30.4	92.1	7.9	
<i>Marital status</i>										
Divorced/widowed	51.9 (2853)	28.0	72.0	25.4	74.6	64.0	36.0	91.4	8.6	
Unmarried	14.5 (795)	33.5	66.5	33.6	66.4	75.7	24.3	94.5	5.5	
Married	33.6 (1850)	33.5	66.5	22.2	77.8	75.5	24.5	92.2	7.8	
<i>Duration into sex work</i>										
11+ years	7.6 (416)	39.2	60.8	38.9	61.1	64.7	35.3	90.9	9.1	
6–10 years	27.7 (1522)	35.5	64.5	28.1	71.9	65.9	34.1	89.5	10.5	
3–5 years	44.7 (2456)	29.3	70.7	25.1	74.9	70.7	29.3	92.5	7.5	
0–2 years	20.1 (1104)	23.9	76.1	17.8	82.2	73.9	26.1	95.2	4.8	
<i>State</i>										
Tamil Nadu	23.2 (1276)	26.0	74.0	13.6	86.4	87.4	12.6	95.1	4.9	
Andhra Pradesh	27.9 (1533)	31.5	68.5	9.9	90.1	55.8	44.2	85.2	14.8	
Karnataka	27.3 (1500)	5.9	94.1	2.6	97.4	69.1	30.9	94.3	5.7	
Maharashtra	21.6 (1189)	65.9	34.1	87.2	12.8	68.9	31.1	95.0	5.0	

Almost all the mobile FSWs (99.2%) in the survey reported to have sex with at least one occasional client, 94 percent reported sex with at least one regular client in the last 1 week prior to the survey. The reported inconsistent condom use with these two types of clients was 29% with occasional clients and 37% with regular clients. Overall, about 38% (2088/5498) of FSWs reported inconsistent condom use in sex with at least one of the two types of clients: occasional and regular clients. Little more than half of the mobile FSWs reported at least one of the following STI symptoms: ulcers/sores in genital area (11%, 605/5498), swelling in groin area (16%, 876/5498), pain during intercourse (37%, 2034/5498), and frequent painful urination (34%, 1868/5498). Almost one-third of the total mobile FSWs continued to have sex while experiencing

STI symptoms. Experience of STI symptoms predisposes FSWs to a higher risk of acquiring HIV and continuation of sex while experiencing these symptoms is likely to heightens their risk for HIV.

Table 2 presents the results of the association between indicators of mobility and socio-economic vulnerabilities. The results show that FSWs with higher degree of mobility in comparison to those with lower degree of mobility are significantly more likely to experience physical violence (25.8 vs. 35.1%; AOR = 1.4; 95% CI: 1.2–1.6; $P < 0.001$), and consume alcohol prior to sex (54 vs. 60.5%; AOR = 1.2; 95% CI: 1.0–1.3; $P < 0.05$). Similarly, the odds of experiencing violence by FSWs who visit jatra areas is 2 times (95% CI: 1.8–2.4; $P < 0.001$) higher than by those FSWs who did not visit

Table 2 Current socio-economic vulnerabilities by different indicators of mobility

Indicators of mobility	N	%	Experienced either physical or sexual violence ^a		Used alcohol before sex		Currently in debt	
			%	AOR ^c (95% CI)	%	AOR ^c (95% CI)	%	AOR ^c (95% CI)
Number of moves								
2–3 moves	1687	30.7	25.8	1.00	54.0	1.00	41.6	1.00
4 or more	3811	69.3	35.1	1.4 (1.2–1.6)**	60.5	1.2 (1.0–1.3)*	47.0	0.9 (0.8–1.1)
Average duration of stay in previous two places								
More than 1 month	1401	25.5	26.3	1.00	48.5	1.00	35.2	1.00
One month or less	4097	74.5	34.2	1.4 (1.2–1.6)**	61.9	1.6 (1.4–1.8)**	48.8	1.7 (1.5–2.0)**
Visited <i>Jatra</i> ^b places								
No	3825	69.6	26.0	1.00	57.4	1.00	40.4	1.00
Yes	1673	30.4	46.5	2.1 (1.8–2.4)**	61.1	0.9 (0.8–1.1)	56.8	1.6 (1.4–1.8)**
Visited place of seasonal male migrants								
No	5063	92.1	31.2	1.00	57.6	1.00	43.5	1.00
Yes	435	7.9	44.4	1.3 (1.0–1.6)*	69.0	1.5 (1.2–1.9)**	67.6	2.2 (1.8–2.7)**
Total	5498	100.0	32.2		58.5		45.4	

^a In 6 months prior to the survey

^b *Jatra* implies 'the pilgrimage sites in groups for religious festivities and celebrations. There are designated places and times in a year when people conduct these religious *jatras*

^c Controlled for current age, education, marital status, caste, duration into sex work, reason for entry into sex work, program exposure and state
** $P < 0.001$, * $P < 0.05$

jatra places. FSWs with visits to *jatra* places (or) places of seasonal male migrants are significantly more likely to have financial debt.

The data were further analysed to understand the relationships between mobility, socio-economic vulnerabilities and HIV risk behaviors. The proportion of FSWs who reported inconsistent condom use with clients differs significantly between those with high and low degree of mobility (Table 3). FSWs with high degree of mobility reported higher inconsistent condom use than those with low degree of mobility (46.2 vs. 22.6%; AOR: 2.4; 95% CI: 2.1–2.8; $P < 0.001$). The odds of inconsistent condom use is high among those who spends lesser duration than those who spends more time while visiting places (43.7 vs. 25.1%; AOR: 1.7; 95% CI: 1.5–1.8; $P < 0.001$). More importantly, the odds of reporting inconsistent condom use with clients for FSWs with experiences of recent violence is 2.6 times (95% CI: 2.3–3.0; $P < 0.001$) more as compared to those who did not experience violence. The odds of continuing sex while experiencing STI symptoms among those who visited *jatra* places or places frequented by male migrant workers is higher than among those who did not visit these places. The presence of socioeconomic vulnerabilities also increases the odds of continuing sex while experiencing STI symptoms. Program exposure included in the present study of being in contact with outreach workers from NGOs did not show any association with both inconsistent condom use and STI risk.

Discussion

This cross-sectional investigation of HIV risk among mobile FSWs in four states of India indicates that higher degree of mobility, short duration visits and visit to *jatra* places are significantly associated with higher inconsistent condom use in sex with clients. This effect in part reflect the fact that a higher proportion of mobile FSWs come from disadvantaged strata of the society and continue to face higher socio-economic vulnerabilities such as experiencing violence, use of alcohol [5] and have relatively little economic independence than less mobile FSWs. The observed effect of different indicators of mobility on HIV risk behaviours, however, is independent of the current socio-economic vulnerabilities, and program exposure. Importantly, the findings from the current study, which is among the first to examine the relation between different indicators of mobility and HIV risk behaviours among mobile FSWs, provide empirical evidence to assertions made in the literature [23, 27] that mobility and the conditions under which FSWs move increases their HIV risk. A higher degree of mobility with lesser durations of stay, therefore, may be considered as a risk marker for sex worker's HIV risk.

The findings of this study provide empirical evidence to improve our understanding about the elements of mobility that are associated with elevated HIV risk. The high level of inconsistent condom use among mobile FSWs suggests

Table 3 Impact of mobility and current socio-economic vulnerabilities on HIV risk behaviours

Indicators of mobility	Inconsistent condom use in sex with clients ^a			Continued sex while experiencing STI symptoms		
	%	OR (95% CI)	AOR (95% CI)	%	OR (95% CI)	AOR (95% CI)
Number of moves						
2–3 moves	22.6	1.00	1.00	22.5	1.00	1.00
4 or more	46.2	2.9 (2.6–3.4)**	2.4 (2.1–2.8)**	20.8	0.9 (0.8–1.1)	0.9 (0.8–1.1)
Average duration of stay in previous two places						
More than 1 month	25.1	1.00	1.00	29.8	1.00	1.00
One month or less	43.7	2.3 (2.0–2.6)**	1.7 (1.5–1.8)**	18.5	0.5 (0.4–0.6)**	1.1 (0.9–1.2)
Visited <i>Jatra</i> ^b places						
No	36.1	1.00	1.00	17.2	1.00	1.00
Yes	45.4	1.5 (1.3–1.7)**	1.2 (1.0–1.4)*	31.0	2.2 (1.9–2.5)**	1.6 (1.4–1.9)**
Visited place of seasonal male migrants						
No	39.2	1.00	1.00	19.7	1.00	1.00
Yes	35.9	0.9 (0.7–1.1)	0.8 (0.6–1.0)	41.1	2.9 (2.3–3.5)**	2.1 (1.7–2.6)**
Experienced physical violence						
No	31.1	1.00	1.00	16.9	1.00	1.00
Yes	55.5	2.8 (2.5–3.1)**	2.6 (2.3–3.0)**	30.6	2.2 (1.9–2.5)**	1.8 (1.6–2.1)**
Use alcohol before sex						
No	34.3	1.00	1.00	16.4	1.00	1.7 (1.5–2.0)**
Yes	42.2	1.4 (1.2–1.6)**	1.3 (1.1–1.5)**	24.9	1.7 (1.5–1.9)**	
Currently in debt						
No	41.1	1.00	1.00	17.5	1.00	1.00
Yes	36.4	0.8 (0.7–0.9)**	0.6 (0.5–0.7)**	26.0	1.7 (1.5–1.9)**	1.5 (1.3–1.7)**
Program exposure						
No	40.2	1.00	1.00	19.7	1.00	1.00
Yes	38.4	0.9 (0.7–1.04)	0.9 (0.7–1.1)	18.1	0.9 (0.8–1.05)	0.8 (0.7–1.0)*

AOR Adjusted odds ratio (controlled for current age, education, marital status, caste, state, duration into sex work, reason for entry into sex work, program exposure in addition to the variables in the above table), OR Unadjusted odds ratio

^a Inconsistent condom use in sex with occasional or regular clients in 1 week prior to the survey (0 no; 1 yes)

^b *Jatra* implies 'the pilgrimage sites in groups for religious festivities and celebrations. There are designated places and times in a year when people conduct these religious jstras

** $P < 0.001$, * $P < 0.05$

their contribution in continuing transmission of HIV along the mobility routes, including urban and rural areas across different districts. Higher HIV prevalence among young FSWs in India [32] and their strategic mobility at later ages through the facilitation of agents, brothel owners, pimps or madams could have an impact on the transmission of HIV into different populations. Additionally, the previously published research indicated that a high proportion of FSWs and the clients in India use alcohol prior to or during sex [5]. Alcohol may be used by FSWs to cope with the stress and violence associated with commercial sex work [22, 33]. Thus, strategic planning is required to develop and implement campaigns promoting '100% condom use' [34] so that FSWs continue to use condoms even if they are on the move. Although India based successful interventions using collectivization [18] have addressed some of the contextual factors associated with increased HIV risk, they

were largely focused on FSWs who stayed in one place for sex work for longer period. It cannot be ascertained whether similar interventions would be feasible or successful for the group of mobile FSWs [5, 27]. The association between mobility and inconsistent condom use is significant in almost all the study states except for Tamil Nadu, where more than 90% of the FSWs reported consistent condom use in sex with clients [19–22].

The current results on association between higher degree of mobility and increased risk for HIV suggest a need for an increased attention in designing programmatic interventions to address structural and contextual factors to reduce the degree of mobility and to increase the consistent condom use not only at the place of destination but also along the routes of mobility. The intervention programs should develop mechanisms to identify FSWs who move frequently from one place to another and understand the

contexts under which they move or the local conditions that led FSWs to move. Perhaps the most crucial means through which mobility impacts the risk to HIV is her lack of power to negotiate and use condoms. This may be especially true with the regular paying but, more importantly non-paying clients. The newer environment, competition to acquire more and regular clients, lack of social support or protective structures, and high economic need are some of the contextual factors that appear to drive inconsistent condom use by mobile FSWs with these clients. Programs should strategically develop mobile FSWs community networks so as to provide protective environments along the routes of mobility.

Although the findings of this analysis indicate important programmatic implications based on empirical evidence on linkages between indicators of mobility and HIV risk, they must be interpreted cautiously in light of several study limitations. Firstly, the study population included mobile FSWs and did not include non-mobile FSWs. The findings of this study therefore refer to the linkages between different indicators of mobility and HIV risk, and not to mobility *per se*, i.e., not to those who move in comparison to those who do not. Secondly, this study indicates that each of the factors included in the analysis—socio-demographic characteristics and related vulnerabilities— independently increase the risk of acquiring HIV among the mobile FSWs. These factors may also increase the risk of acquiring HIV among the non-mobile FSWs; but we cannot validate these effects from the current analysis because our sample did not include non-mobile sex workers. Thirdly, the items used for analyses rely on self-reported responses and are subjected to social desirability and memory bias. Moreover, the independent effect of mobility on HIV risk could also question the sufficiency of the factors included in the analysis or deficiencies in their measurements or unmeasured factors not included in the analysis. For example, program exposure could be measured by the intensity and contents of contacts between FSWs and outreach workers. While the future research could address some of these study limitations, this large scale study documents for the first time empirical evidence on the effect of mobility indicators on HIV risks among major population affected by HIV within the country.

The two variables of HIV risk used in this paper considered responses from multiple questions. The first indicator about inconsistent condom use combines responses to four questions about inconsistent condom use with occasional and regular clients in the last 1 week, and condom use at last time sex with occasional and regular clients. Similarly the second indicator on continued sex while experiencing STI symptom in the past 6 months combines answers to five questions; four regarding STI symptoms and one regarding continuation of sex. Although, the recall

bias is inherent in these types of behavioural research; the results however, indicate the minimum number of FSWs who are at risk for HIV due to their possible exposure to STIs.

While we recognize the bias inherent in the self reports of consistent condom use and experience of STI symptoms, the degree of this bias is minimized by considering multiple questions and most recent period. Despite several careful considerations in the survey, the bias cannot be fully eliminated [35] in self-reported responses and hence the results must be interpreted cautiously recognizing that they are only indicative of exposure to HIV and do not reflect the presence of HIV.

Finally, the higher degree of mobility with short durations of stay can become an important marker of HIV risk for implementing prevention interventions among FSWs. Additionally, the disadvantaged conditions of mobile FSWs and their continued negative life situations such as existing socio-economic vulnerabilities along the routes of mobility raise the need for developing newer strategies in HIV prevention programs in India and elsewhere. Some of the strategies for HIV prevention initiatives among mobile FSWs could include screening for higher degree of mobility among FSWs, tracking their HIV risk behaviors along the routes of mobility, providing preventive messages and information on availability of program services through mobile phones or other communication mechanisms, and mobilization of mobile FSW community networks.

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