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# HIV Transmission Potential Among Local and Migrant Factory Workers in Kolkata, India

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**Abstract** Migrant workers in India play a key role in the spread of HIV. Kolkata is a common destination for workers, who may acquire infection and transmit it to their wives and/or other sexual partners. We investigated sexual relations and condom use by factory workers. Migrant and local factory workers were randomly selected from five wards of Kolkata. Information was collected about demographic and socio-economic characteristics, sexual relationships, condom usage, and perceptions and intent to use condoms. Condom use was very low in both groups of workers, particularly among migrants. Many married workers visited female sex workers but never used condoms. Few intended to use condoms, and if they did, it did not always translate into actual usage. There is great potential for transmission of HIV/sexually transmitted infections by these workers. Carefully designed intervention and education programs in the context of low literacy and cultural norms are urgently needed.

**Keywords** Condoms · India · HIV · Sexually transmitted infections (STIs) · Migrants

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## Introduction

India, with a population of more than one billion, has not been spared from the HIV epidemic. According to the 2005 UNAIDS estimate (UNAIDS 2005), India had 5.7 million people living with HIV. However, with support from UNAIDS and the World Health Organization (WHO) in 2006, a revised estimate from the National AIDS Control Organization (NACO 2007b [www.nacoonline.org/Quick\\_Links/HIV\\_Data](http://www.nacoonline.org/Quick_Links/HIV_Data)) estimated that the HIV prevalence in the country could actually be lower, at ~2.5 million infected people.

Sexual transmission accounts for more than 85% of all HIV infections in India (NACO 2007a National AIDS Control Program III [www.nacoonline.org/National\\_AIDS\\_Control\\_Program/Prevention\\_Strategies](http://www.nacoonline.org/National_AIDS_Control_Program/Prevention_Strategies)). One critical consideration for most sexually transmitted HIV epidemics is the use of condoms during sex. In Thailand and Cambodia, significant success has been achieved in lowering the spread and prevalence of HIV, as well as other bacterial sexually transmitted infections (STIs), through promotion of 100% condom use for commercial sex (WHO 2000). Researchers have found that regular and consistent use of condoms may reduce the transmission of HIV infections by 87–95% (CDC 2002 [www.cdc.gov/nchstp/od/condoms.pdf](http://www.cdc.gov/nchstp/od/condoms.pdf); Foss et al. 2004). NACO in India has also emphasized condom use to reduce the risk of HIV transmission at the population level. Condom use among sexually active individuals in India, however, remains very low in almost all groups of sexually active people, including married men, unmarried men (Dunn et al. 2004), university students (Sachdev 1998), urban slum dwellers (Bhatia et al. 2005), rural men (Dunn et al. 2004), truck drivers (Singh and Malaviya 1994; Ubaidullah 2004), etc., and has been documented even in high-risk groups such as

commercial sex workers (NACO 2001; Dandona et al. 2005a), non-regular sex partners (Kumar et al. 1997), and men having sex with men (Go et al. 2004; Dandona et al. 2005b; Setia et al. 2006). Thus, despite the currently estimated low HIV prevalence, the opportunity for developing a widespread epidemic persists.

Initially, most cases of HIV infection in India remained confined within specific high-risk groups (e.g., commercial sex workers, their clients, and STI patients) in major urban areas and among injecting drug users in the north-eastern states (Sarkar et al. 1993). Later, evidence from different parts of India suggested that in addition to an increasing prevalence among the high-risk groups, HIV had also started to spread from high-risk groups to the general population, and from urban to rural areas (Arole et al. 2005; NACO Annual Report 2002–2003, 2003–2004; Pallikadavath et al. 2005). This urban-to-rural spread has serious implications, considering the vast Indian population (more than 742 million) living in rural areas (Census of India 2001), the often inadequate and/or inaccessible health facilities in rural communities, and its potential social and economic impact on the country (Anand et al. 1999; Pallikadavath et al. 2005). Studies in India have also suggested that two specific rural populations are particularly vulnerable—those along truck routes (Singh and Malaviya 1994) and those who are the sources of labor migrating to urban areas (Lamprey 2002; Solomon et al. 1998). Several studies conducted in other countries have found that migrants are especially vulnerable because of less education, less awareness about HIV/STIs, less access to and utilization of local health care services, and higher risk behaviors related to HIV and STIs. Moreover, their role in transmitting these infections to their homes in rural areas has been suggested (Coffee et al. 2007; Kramer et al. 2008; Lagarde et al. 2003; Li et al. 2006; Smith-Estelle and Gruskin 2003; Sowell et al. 2008). Unfortunately, apart from a few studies (Gupta and Mitra 1999; Panda et al. 2000), little information in this regard is available in India.

More than 90 million males (i.e., more than 25% of adult males) in India are migrants. About 51 million males migrate from rural areas, and nearly a quarter of them migrate from one state to another (Census of India 2001). This is likely to increase further (National Sample Survey 1992–1993; National Sample Survey Report No. 470, 2001; UNESCO 2002), due to growing economic disparities (Haberfeld et al. 1999; PRAXIS 2002; Srivastava 1998). Thus, these vast numbers of migrants may constitute an important risk group for HIV/STIs, especially in acquiring the infection and transmitting it back to the rural population. Hence, considering the dearth of information on this important topic, the present study was

undertaken to gain insights into the possible role of migrants in spreading HIV and STIs by comparing the patterns of sexual risk behaviors and condom use by local and migrant workers, and to identify predictors of condom use and the potential for transmission of HIV and other STIs from migrant workers to the general population. Specifically, we hypothesized that compared to local workers, migrant workers have higher HIV risk behaviors, along with lower use of condoms during sex with high-risk partners, as well as with their usual partners, increasing the possibility of transmitting infection from their high-risk partners to their usual (low-risk) partners.

## Methods

### Study Site and Participants

Kolkata, a metropolitan city in the eastern Indian state of West Bengal, is one of the most common destinations for migrant workers from poorer neighboring states such as Bihar (currently, Bihar and Jharkhand), Orissa, and Uttar Pradesh. According to the latest available information, ~20% of the total population of 13.4 million in Kolkata are migrants (Census of India 1991). About half (53%) of them are male, of whom 33.7% are illiterate and 71.5% are engaged in low-grade work. About 34% of all migrants in Kolkata originate from another state in India.

The present study was conducted among 18–45-year-old male factory workers in five municipal corporation wards (#14, 28, 29, 30 and 35) in Kolkata. In total, we enumerated 811 small- and medium-sized factories in these five wards. Their most common products were shoes and other leather products, textiles, and stationery.

In these 811 factories, there was a total of 7,009 workers—6,753 males (96.3%) and 256 females (3.7%), of whom 6,192 males (91.7%) were aged between 18 and 45 years; 3,050 (49.3%) of them were local workers, 1,285 (20.7%) came from another district within the state (inter-district migrants), and 1,857 (30%) came from another state (inter-state migrants). For this study, 2,850 (93.4%) local workers and 1,764 (95%) inter-state migrant workers (henceforth referred to as “migrant workers”) were eligible to participate. We randomly selected 402 workers in each group (locals and migrants) using a probability-proportionate-to-size (PPS) sampling scheme, where the number of workers selected from each ward was proportionate to the distribution (relative size) of each group of eligible workers in the five selected wards. In total, 11 (1.4%) of the workers approached refused to participate at initial contact; in those cases, we asked the next eligible worker to participate.

## Definitions of Variables and Data Collection

“Migrant workers” were defined as inter-state migrants who had been working in Kolkata for a year or more and visited their home at least once a year. “Local workers” were residents of Kolkata working in the surveyed venues for at least 1 year. All of the 804 selected participants completed an anonymous face-to-face questionnaire-based interview after completing written informed consent. Information was collected on socio-demographic characteristics, including basic migration-related characteristics of the migrants. Condom use patterns were assessed as

“always”, “sometimes”, and “never” with specific types of sex partners. Perceptions about condoms and intention to use them were assessed through a set of statements (Table 1) constructed on five-point Likert scales ranging from “strongly agree” to “strongly disagree”. As measured by Cronbach’s alpha, the internal consistencies of all ten items, and the six perception and the four intention statements, were 0.84, 0.75, and 0.76, respectively. From the given responses, we computed summary scores with reverse coding of the items wherever appropriate. For condom perceptions, scores ranged from 6 to 30 (6 = strongly negative perception, 18 = neither negative nor positive,

**Table 1** Statements to assess perceptions about condoms and intent to use them

Statements to assess perceptions about condoms	Statements to assess intention to use condoms
Condoms are uncomfortable	I (respondent) intend to try condoms
Idea of using condoms is not appealing	Would be comfortable suggesting using condoms with partner
Proper use of condoms can enhance sexual pleasure	Would avoid using condoms if possible
Condoms make sex unenjoyable	Would have no objections if partner suggested using condoms
Condoms are too much trouble	
I (respondent) do not think condoms interfere with enjoyment	

**Table 2** Demographic and socio-economic characteristics of local versus migrant factory workers

Characteristics	Local workers ( <i>n</i> = 402)	Migrant workers ( <i>n</i> = 402)	
Age (years)			
18–24	184 (45.8%)	145 (36.1%)	$\chi^2(4) = 20.11^*$
25–29	83 (20.6%)	82 (20.4%)	
30–34	67 (16.7%)	62 (15.4%)	
35–39	41 (10.2%)	50 (12.4%)	
40–45	27 (6.7%)	63 (15.7%)	
Mean $\pm$ SD	26.72 $\pm$ 6.97	29.00 $\pm$ 8.01	$t(786.9) = 4.30^*$
Education: level achieved			
Illiterate	107 (26.7%)	129 (32.2%)	$\chi^2(4) = 15.81^*$
Primary (grades 1–4)	73 (18.2%)	91 (22.7%)	
Middle (grades 5–8)	150 (37.4%)	116 (28.9%)	
High (grades 9–10)	43 (10.7%)	53 (13.2%)	
Grades 11 and above	28 (7.0%)	12 (3.0%)	
Mean $\pm$ SD	4.82 $\pm$ 3.84	4.11 $\pm$ 3.72	$t(800) = -2.65^*$
Average monthly income (rupees)			
<1,000	46 (11.5%)	40 (10.0%)	$\chi^2(3) = 6.55$
1,000–2,000	223 (55.9%)	259 (64.6%)	
2,000–3,000	91 (22.8%)	73 (18.2%)	
$\geq$ 3,000	39 (9.8%)	29 (7.2%)	
Duration of present job (years)			
Mean $\pm$ SD	7.9 $\pm$ 6.2	9.0 $\pm$ 7.3	$t(783.1) = 2.29^{**}$
Current marital status			
Married	156 (38.8%)	263 (65.4%)	$\chi^2(2) = 58.42^*$
Divorced/widowed/separated	6 (1.5%)	1 (0.2%)	
Never married	240 (59.7%)	138 (34.3%)	

\*  $P < 0.01$

\*\*  $P < 0.05$

and 30 = strongly positive perception). For intent to use condoms, the range was 4–20 (4 = strong lack of intention to use, 12 = neither intent nor lack thereof, and 20 = strong intent). Assessment of knowledge about HIV/AIDS and STIs was limited to asking whether they had ever heard of these infections, and sexual risk behaviors were assessed by asking whether they ever had sex with: (1) a female sex worker (FSW); (2) a girlfriend; (3) any female partner other than wife, FSW, or girlfriend; and/or (4) any male partner.

#### Data Analysis

All data were entered into an EXCEL spreadsheet and analyzed using STATA/SE 8.0 or SPSS 13.0 statistical software. Differences in characteristics between the two groups of workers were assessed through chi-square tests (for proportions) or Student's *t*-test (for means). Where appropriate, we tested differences in means among multiple groups using one-way ANOVA. Multivariate logistic regression analyses were used to identify independent predictors of not using condoms, adjusting for effects of other relevant variables, regardless of their magnitude of association in the descriptive analyses.

The study was approved by the institutional review boards of the National Institute for Cholera and Enteric Diseases (India) and the University of California, Los Angeles.

#### Results

Of the 402 migrant workers surveyed, the majority (302; 75.1%) came from the state of Bihar, which is adjacent to West Bengal. Most of these workers (350; 87.1%) originated from a rural area; only a few were from a suburban area (27; 6.7%) or a town or city (25; 6.2%). On average, they had stayed in Kolkata for 12.7 years (range 1–35 years). The majority of these workers (271; 67.4%) visited their homes more than once a year (up to 11 times per year); 68 (16.9%) visited at least once a month, and 63 (15.7%) visited only once a year. The demographic and socio-economic characteristics of the two groups of workers are presented in Table 2. Overall, local workers were younger and had higher levels of education than the migrant workers. Although they had a higher monthly income, the difference was not significant. However, compared to the locals, migrants had worked longer at their jobs [mean duration, 7.9 vs. 9.0 years;  $t(783.1) = 2.29$ ,  $P < 0.05$ ]. Migrant workers were more likely than local workers to be married [65.4% vs. 38.8%;  $\chi^2(2) = 58.4$ ,  $P < 0.01$ ]. While most (94.9%) of the local married workers were living with their wives, less than a third

(28.5%) of the married migrant workers were. We found that 65.7 and 79.4% of local and migrant factory workers, respectively, had ever had sex [ $\chi^2(1) = 18.88$ ,  $P < 0.01$ ] (data not shown). Among those who ever had sex, the type of sexual partners reported by the locals and migrants, respectively, included wives [61.4% vs. 82.0%;  $\chi^2(1) = 31.09$ ,  $P < 0.01$ ], regular girlfriends [10.9% vs. 6.8%;  $\chi^2(1) = 3.15$ ,  $P > 0.05$ ], FSWs [57.2% vs. 37.9%;  $\chi^2(1) = 21.73$ ,  $P < 0.01$ ], other female sex partners (other than wife, girlfriend or FSW) [14.4% vs. 12.1%;  $\chi^2(1) = 0.69$ ,  $P > 0.05$ ], and other male partners [13.5% vs. 7.4%;  $\chi^2(1) = 5.78$ ,  $P < 0.05$ ].

As shown in Table 3, a large proportion of the participants had never used a condom during sex, particularly the migrant workers. When condom use was dichotomized into “ever” and “never”, compared to local workers, significantly more migrant workers never used condoms with their wives [ $\chi^2(1) = 21.78$ ,  $P < 0.01$ ], sex workers [ $\chi^2(1) = 18.88$ ,  $P < 0.05$ ], or other partners [ $\chi^2(1) = 7.46$ ,  $P < 0.01$ ]. Six percent of migrant workers and 8.7% of local workers admitted to having sex with other men, and none had used condoms with them. No differences were noted for having sex with girlfriends. As a large proportion in each group never used condoms, we also explored the relationship between the workers' demographic characteristics and non-use of condoms with wives or FSWs

**Table 3** Use of condoms with various sex partners by local and migrant factory workers

Type of sex partner	Local workers	Migrant workers
Wife		
Always	2 (1.2%)	1 (0.4%)
Sometimes	80 (49.7%)	74 (28.0%)
Never	79 (49.1%)	189 (71.6%)
Girlfriend		
Always	2 (6.9%)	1 (4.5%)
Sometimes	2 (6.9%)	3 (13.6%)
Never	25 (86.2%)	18 (81.8%)
Other female sex partners		
Always	5 (13.2%)	4 (10.3%)
Sometimes	11 (28.9%)	2 (5.1%)
Never	22 (57.9%)	33 (84.6%)
Female sex workers		
Always	43 (29.9%)	26 (21.7%)
Sometimes	52 (36.1%)	36 (30.0%)
Never	49 (34.0%)	58 (48.3%)
Another male partner		
Never	35 (100.0%)	24 (100.0%)

Number of workers in each group represents workers having respective type of sex partners

**Table 4** Relationship between workers' demographic characteristics and non-use of condoms with wife or female sex workers (FSWs)

Characteristics	Local workers		Migrant workers	
	% Never used condoms with wife (if married)	% Never used condoms with FSW (if visited)	% Never used condoms with wife (if married)	% Never used condoms with FSW (if visited)
Age groups (years)				
18–24	63.2	31.6	69.4	30.8
25–29	53.7	21.6	80.0	39.1
30–34	40.9	44.4	63.8	56.5
35–39	50.0	38.5	74.5	70.6
40–45	42.9	60.0	69.8	66.7
	$\chi^2(4) = 3.36$	$\chi^2(4) = 7.11$	$\chi^2(4) = 4.19$	$\chi^2(4) = 12.01^*$
Education level (grades)				
Illiterate (0)	60.7	42.1	76.0	57.5
Primary (1–4)	45.5	40.7	73.8	50.0
Middle (5–8)	38.2	28.8	68.9	43.8
High (9–12)	55.6	30.8	64.5	30.0
College (>12)	42.9	14.3	33.3	25.0
	$\chi^2(4) = 6.07$	$\chi^2(4) = 3.64$	$\chi^2(4) = 6.41$	$\chi^2(4) = 3.87$
Marital status				
Ever married	49.1	38.2	71.6	55.2
Never married	–	30.3	–	30.3
		$\chi^2(1) = 1.02$		$\chi^2(1) = 5.92^*$
Ever heard of HIV/AIDS				
Yes	47.3	33.3	69.3	47.2
No	70.0	50.0	83.8	57.1
	$\chi^2(1) = 1.93$	$\chi^2(1) = 0.48$	$\chi^2(1) = 3.25$	$\chi^2(1) = 0.49$
Place of origin (for migrants)				
Rural area	–	–	72.9	50.5
Urban/semi-urban area			60.7	27.3
			$\chi^2(1) = 1.82$	$\chi^2(1) = 2.15$
Duration of stay in Kolkata				
1–5 years	–	–	72.4	37.5
5–10 years			75.5	54.5
Over 10 years			70.4	50.0
			$\chi^2(2) = 0.50$	$\chi^2(2) = 1.55$

\*  $P < 0.05$ 

(Table 4). Table 4 demonstrates that condom use with wives was similar across age groups in both groups of workers, and a high proportion (particularly migrants) never used condoms with their wives. Older workers in both groups were less likely to use condoms with sex workers, significantly so among migrants. Although level of education had no statistically significant effect on condom use either with wives or with FSWs by either group, workers with less education were less likely to use condoms. Similarly, there was no statistical difference in condom usage between workers who had ever heard of HIV/AIDS and those who had not. Not hearing about HIV/

AIDS was more common among those not using condoms in both groups. Married participants in both groups (particularly migrants) were more likely to not use condoms with FSWs than unmarried participants. Among migrants, the likelihood of not using condoms with either wives or FSWs was higher if they originated from a rural area; duration of stay in Kolkata did not affect their condom use. These findings probably reflect the fact that compared to unmarried workers, married workers were older, had less education, and were less likely to have heard about HIV/AIDS than the younger workers, and hence were less likely to use condoms.

As many as 43.9% of unmarried local participants and 40.6% of unmarried migrants had engaged in sex. Extramarital sex was also common. Among the currently married workers, 44.2% of the locals and 33.1% of the migrants had visited sex workers [ $\chi^2(1) = 5.21$ ,  $P < 0.05$ ]. Only 24.6% of these locals and 13.8% of these migrants always used condoms with sex workers; 38.8% of these locals and 54.6% of these migrants never used condoms [ $\chi^2(1) = 3.79$ ,  $P > 0.05$ ] with sex workers (data not shown). Thus, condom use with sex workers was even lower among married workers, raising serious concerns about the high potential for transmission of HIV and other STIs from this high-risk group to their wives.

To determine the possible reasons for such low condom use, we assessed participants' perceptions and intentions of condom use. Table 5 shows that on average, both groups of participants' perceptions were neither negative nor positive; migrants had slightly negative perceptions, and locals, slightly positive. On the other hand, both groups showed some intent to use condoms, with locals showing a stronger intent than migrants. In both groups, perception and intention were significantly dependent on age, marital status, and whether they had ever heard of HIV/AIDS and STIs; among migrants, this also depended on education level (Table 6).

To determine whether there was any existing relationship between perceptions of condoms and intent to use them, we calculated overall correlation among them, which showed a significant positive correlation (0.66,  $P < 0.01$ ), as evidenced in the scatterplot in Fig. 1. A correlation between positive perceptions and intent to use condoms was also evident in both groups of workers. Moreover, a significant positive association ( $P < 0.05$ ) was also noted between different levels of intent to use condoms and actual usage (Fig. 2).

Despite the correlation, the participants did not have high levels of either positive perceptions about condoms or intent to use them (Table 5). This probably led to very low condom usage, even with sex workers, especially among the migrants. Married participants were more involved in high-risk sex, and condom use was very low with their wives, indicating a high potential for transmission of HIV or other STIs from these individuals to their wives.

Within our data, we tried to identify the factors that correlated with condom use by the participants with wives or FSWs. Table 7 presents the results of logistic regression analysis that incorporated the workers' socio-economic characteristics, perceptions of condoms and intent to use them, and sexual experience. Table 7 shows that there is a trend (albeit non-significant) that younger participants among the locals were less likely to use condoms with their wives, while older migrants were less likely to use condoms with FSWs. Migrant workers in the 25- to 29-year age group were also significantly less likely to use condoms with their wives than older (40- to 45-year-old) migrants. Education level and monthly income had no relationship with condom use; however, there was a non-significant trend that participants with less education used condoms less frequently. Condom use also did not depend on whether the workers had ever heard of HIV/AIDS or whether they had other sex partners.

Although condom use with FSWs did not depend on marital status, use with wives did depend upon whether the participants visited FSWs; if they visited FSWs, they were more likely to use condoms with their wives. This effect was statistically significant among the migrants. Workers with stronger intent to use condoms were significantly more likely to use them with their wives (both locals and migrants) or FSWs (locals only); however, migrants with

**Table 5** Participants' perceptions about condoms and intent to use them

Characteristics	Local workers ( <i>n</i> = 402)	Migrant workers ( <i>n</i> = 402)	
Ever heard about condoms	395 (98.3%)	376 (93.8%)	$\chi^2(1) = 10.59^*$
If having heard about condoms, number of years since first hearing about them (mean $\pm$ SD)	8.1 $\pm$ 5.3	8.9 $\pm$ 6.5	$t(721.9) = 1.83$
Summary score of awareness/perceptions of condoms (on a scale of 6 to 30 <sup>a</sup> ) (mean $\pm$ SD)	18.9 $\pm$ 3.8	17.9 $\pm$ 3.7	$t(802) = 4.02^*$
Summary score of intention to use condoms (on a scale of 4 to 20 <sup>b</sup> )	14.1 $\pm$ 3.4	12.6 $\pm$ 3.7	$t(795.3) = 6.11^*$

\*  $P < 0.01$

<sup>a</sup> 6 = strongly negative perception, 18 = neither negative nor positive perception, 30 = strongly positive perception

<sup>b</sup> 4 = strong lack of intent to use, 12 = neither intent to use nor lack thereof, 20 = strong intent to use

**Table 6** Association of workers' characteristics with their perceptions about condoms and intent to use them

Characteristics	Local workers ( <i>n</i> = 402)		Migrant workers ( <i>n</i> = 402)	
	Perception score (mean ± SD)	Intention score (mean ± SD)	Perception score (mean ± SD)	Intention score (mean ± SD)
Age groups (years)				
18–24	19.4 ± 3.8	14.7 ± 3.2	18.3 ± 3.5	13.3 ± 3.6
25–29	19.0 ± 3.8	14.5 ± 3.2	18.5 ± 3.3	13.0 ± 3.3
30–34	19.4 ± 3.6	14.4 ± 3.0	16.9 ± 4.4	12.4 ± 3.7
35–39	17.5 ± 3.9	12.1 ± 3.6	17.5 ± 4.1	12.3 ± 3.6
40–45	16.7 ± 3.5	11.3 ± 3.9	17.2 ± 3.6	10.6 ± 3.9
	<i>F</i> (4) <sup>a</sup> = 4.6**	<i>F</i> (4) = 10.6**	<i>F</i> (4) = 2.6*	<i>F</i> (4) = 6.4**
Education level (grades)				
Illiterate (0)	19.4 ± 3.9	14.3 ± 3.4	18.6 ± 3.5	13.3 ± 3.8
Primary (1–4)	17.9 ± 4.0	13.4 ± 3.7	17.9 ± 3.7	12.2 ± 3.4
Middle (5–8)	19.0 ± 3.9	14.1 ± 3.3	17.0 ± 3.9	11.8 ± 3.9
High (9–12)	18.9 ± 3.6	14.1 ± 3.2	17.8 ± 3.4	12.7 ± 3.4
College (>12)	19.7 ± 2.7	15.5 ± 3.0	17.1 ± 4.9	12.8 ± 3.9
	<i>F</i> (4) = 1.8	<i>F</i> (4) = 1.9	<i>F</i> (4) = 3.1*	<i>F</i> (4) = 2.8*
Marital status				
Ever married	18.1 ± 4.2	13.1 ± 3.7	17.6 ± 4.0	12.1 ± 3.7
Never married	19.5 ± 3.5	14.8 ± 3.1	18.4 ± 3.1	13.5 ± 3.5
	<i>F</i> (1) = 14.4**	<i>F</i> (1) = 24.3**	<i>F</i> (1) = 4.3*	<i>F</i> (1) = 12.5**
Ever heard of HIV/AIDS				
Yes	19.0 ± 3.9	14.2 ± 3.4	18.0 ± 3.8	12.8 ± 3.8
No	16.9 ± 3.4	11.2 ± 2.9	16.7 ± 3.4	11.1 ± 3.1
	<i>F</i> (1) = 4.5*	<i>F</i> (1) = 12.3**	<i>F</i> (1) = 5.1*	<i>F</i> (1) = 8.6**
Ever heard of STIs				
Yes	19.5 ± 3.7	14.5 ± 3.2	18.2 ± 3.6	12.4 ± 3.7
No	17.9 ± 3.9	13.3 ± 3.8	17.3 ± 3.8	12.8 ± 3.6
	<i>F</i> (1) = 15.6**	<i>F</i> (1) = 10.3**	<i>F</i> (1) = 4.9*	<i>F</i> (1) = 1.1
Place of origin (for migrants)				
Rural area	–	–	17.9 ± 3.7	12.4 ± 3.7
Urban/semi-urban area			17.7 ± 3.9	13.3 ± 3.7
			<i>F</i> (1) = 0.1	<i>F</i> (1) = 2.5
Duration of stay in Kolkata (for migrants)				
1–5 years	–	–	18.4 ± 3.4	13.2 ± 3.4
5–10 years			18.3 ± 3.5	12.9 ± 3.6
Over 10 years			17.4 ± 3.9	12.1 ± 3.9
			<i>F</i> (2) = 2.9	<i>F</i> (2) = 2.9

\* *P* < 0.05\*\* *P* < 0.01<sup>a</sup> ANOVA *F*(*df*)

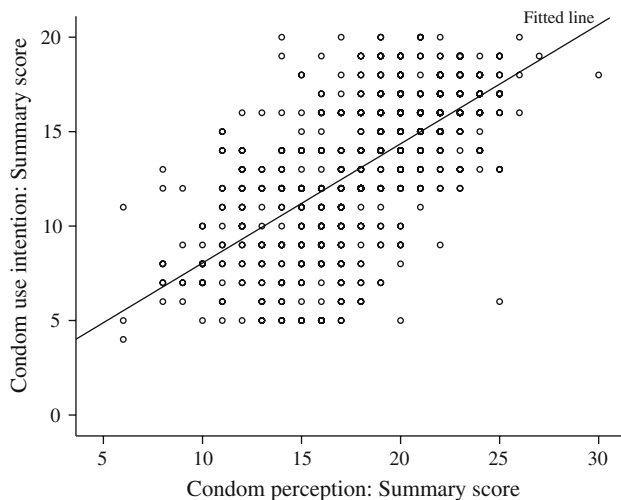
more positive perceptions about condoms actually used them significantly less with their wives.

## Discussion

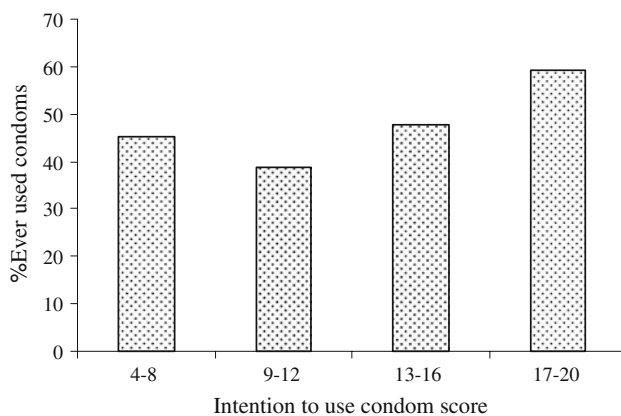
We observed that locals engaged in sex with a wider variety of partners than migrants. This probably reflected older age and higher proportion of married men among the migrants than among the locals in this

study. Consistent condom use has been shown to reduce the risk of acquiring STIs, including HIV, and also reduces the transmission of these pathogens to sexual partners (CDC 2002 [www.cdc.gov/nchstp/od/condoms.pdf](http://www.cdc.gov/nchstp/od/condoms.pdf)). Condom use is now well recognized as one of the major approaches to control HIV and other STIs. Since the recognition of increasing spread of HIV infection among comparatively lower risk groups through heterosexual contact, condom use has gained even more importance. However, the impact of condoms has not





**Fig. 1** Correlation between perceptions about condoms and intent to use them



**Fig. 2** Relation between intention to use condoms and actual use among all workers who ever had sex ( $\chi^2(3) = 10.35, P < 0.05$ )

been substantial in many areas, due to very low and/or inconsistent use among those at risk. Research in most societies has repeatedly demonstrated negligible condom use even in high-risk settings, creating the opportunity for transmission of HIV and other STIs from high-risk populations to comparatively low-risk populations. This is facilitated by those who act as a bridge for such transmission; i.e., acquiring infection from high-risk groups and spreading them to low-risk groups, such as wives and usual sex partners. Migrant workers are often considered to be one such bridge population (Anderson et al. 2003; Lau and Thomas 2001; Lurie et al. 2003).

In the present study, condom use was consistently low among both local and migrant workers, but particularly among migrants. Overall, only 46.5% of the participants who had ever had sex had ever used condoms, indicating a large proportion who had never used condoms.

Furthermore, a surprising number of participants, especially local workers, admitted to having sex with males, with whom they never used condoms. As hypothesized, compared to local participants, condom use by the migrant participants was significantly less with wives, FSWs, and other sex partners. A high percentage of married participants in both groups visited sex workers, and only 19.4% of them always used condoms with FSWs (26.5% of locals vs. 13.8% of migrants). This was alarming, considering the high likelihood that HIV or other STIs could be transmitted from a core risk group (FSWs) to the wives of these participants, particularly those of migrants. This study also indicated that among these workers, overall, greater intent to use condoms led to greater use of condoms, but not significantly so. Among migrants, although more positive perceptions about condoms increased condom use with FSWs, it was inversely related to condom use with wives. Moreover, neither of the groups showed a very high level of positive perceptions about condoms or intent to use them, and both groups revealed considerable sexual risk behaviors. Although more positive perceptions about condom use were correlated with greater intention to use them, the relationship did not increase intent to a level sufficient to have a significant impact on reducing HIV/STI transmission. Further, intention does not always correlate to action (Ma et al. 2007).

Since this was an initial exploration of migrants in India as a risk group for HIV/STIs, there were several limitations to this study. First, other types of male migrants, most notably inter-district migrants, were excluded due to resource constraints. However, any differences in characteristics between the locals and migrants would likely be most marked, and thereby most easily distinguished between locals and inter-state migrants. Second, the study neither explored the effects of separation from families and cultural factors in predicting risk behaviors of these workers, nor did it try to demonstrate any linkage between sexual risk behaviors of migrants in the settings where they live and work and HIV/STD infection among sex partners in their home communities. Third, we did not assess the extent of sexual activity with different sex partners or the degree to which the desire to have children might have contributed to low rates of condom use by men with their wives, which would provide further information about the risk for HIV and its transmission. Nevertheless, the kind of circumstantial evidence provided by this study is disturbing and a cause for alarm in India, and suggests that more studies focus on examining the linkage between migrants' circumstances in one setting and HIV/STD infection of their sex partners in another setting. Moreover, this study identifies migrant workers as a risk group

**Table 7** Predictors of never using condoms with wife or FSWs: adjusted logistic regression analysis [OR (95% CI of OR)]

	Never used condoms with wife among ever married		Never used condoms during FSW visits	
	Local workers (n = 155)	Migrant workers (n = 262)	Local workers (n = 142)	Migrant workers (n = 119)
Age group (years)				
18–24	3.7 (0.8–16.6)	1.5 (0.5–4.2)	0.3 (0.1–1.9)	0.2 (0.0–1.0)
25–29	2.5 (0.7–8.8)	3.0 (1.1–7.9)*	0.3 (0.1–1.7)	0.3 (0.1–1.4)
30–34	1.8 (0.5–6.6)	1.3 (0.6–3.2)	0.6 (0.1–3.4)	0.8 (0.2–4.0)
35–39	1.4 (0.4–4.9)	2.2 (0.8–5.8)	0.3 (0.0–2.6)	1.4 (0.2–8.2)
40–45	Reference	Reference	Reference	Reference
Education (grades)				
Illiterate (0)	1.1 (0.1–8.2)	3.3 (0.4–26.1)	3.2 (0.2–40.5)	2.5 (0.1–41.3)
Primary (1–4)	0.4 (0.1–3.3)	2.7 (0.3–21.7)	3.2 (0.2–45.9)	1.7 (0.1–26.8)
Middle (5–8)	0.4 (0.1–2.9)	1.9 (0.2–15.6)	2.6 (0.2–33.5)	2.1 (0.1–34.3)
High (9–12)	0.8 (0.1–9.1)	1.2 (0.1–11.7)	1.9 (0.1–31.2)	0.7 (0.0–14.9)
College (>12)	Reference	Reference	Reference	Reference
Average income (rupees/month)				
<1,000	1.2 (0.2–7.3)	0.7 (0.1–3.8)	3.4 (0.4–27.2)	3.7 (0.3–51.7)
1,000 to <2,000	1.3 (0.3–5.4)	0.9 (0.2–3.3)	1.5 (0.3–6.9)	1.6 (0.2–11.4)
2,000 to <3,000	1.8 (0.4–7.8)	0.8 (0.2–3.5)	1.5 (0.3–7.9)	0.9 (0.1–8.0)
≥3,000	Reference	Reference	Reference	Reference
Marital status				
Never married	–	–	0.9 (0.3–2.5)	0.8 (0.2–3.0)
Ever married			Reference	Reference
Ever heard of HIV/AIDS				
Yes	0.4 (0.1–1.9)	0.6 (0.2–1.9)	1.1 (0.1–10.5)	0.7 (0.2–3.2)
No	Reference	Reference	Reference	Reference
Ever visited a FSW				
Yes	0.5 (0.2–1.1)	0.4 (0.2–0.7)**	–	–
No	Reference	Reference		
Had sex partners other than wife or FSW				
Yes	1.1 (0.4–3.1)	1.4 (0.6–3.6)	0.7 (0.3–1.3)	0.9 (0.3–2.5)
No	Reference	Reference	Reference	Reference
Perceptions about condoms (scores)				
6–12	Reference	Reference	Reference	Reference
13–18	1.9 (0.6–6.1)	4.4 (1.7–11.3)**	2.0 (0.6–7.2)	8.6 (1.4–52.4)*
19–24	1.2 (0.3–4.7)	6.4 (1.9–21.2)**	4.8 (0.9–24.2)	4.9 (0.5–46.2)
25–30	–	33.2 (2.0–543.5)*	3.5 (0.2–65.0)	1.9 (0.0–104.7)
Intention to use condoms (scores)				
4–8	Reference	Reference	Reference	Reference
9–12	0.7 (0.2–2.6)	0.8 (0.3–2.1)	0.4 (0.1–1.7)	0.4 (0.1–1.6)
13–16	0.8 (0.2–3.2)	0.3 (0.1–0.9)*	0.1 (0.0–0.7)*	0.4 (0.1–2.0)
17–20	0.1 (0.0–0.9)*	0.1 (0.0–0.4)**	0.1 (0.0–0.5)*	1.4 (0.2–11.6)

\*  $P < 0.05$ \*\*  $P < 0.01$ 

for HIV infection in India, with the potential to spread the infection from urban high-risk groups to the general rural population. There is an urgent need for intervention programs to increase the knowledge, perceptions, and intention to use condoms among these workers, designed in the context of low literacy and cultural norms, so that

workers develop a clear idea about why they should use condoms, in what circumstances, with whom, and how.

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