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## ORIGINAL ARTICLE

# The effect of mobility on sexual risk behaviour and HIV infection: a cross-sectional study of men who have sex with men in southern India

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Received 3 September 2013

Revised 14 February 2014

Accepted 9 March 2014

Published Online First

26 March 2014

## ABSTRACT

**Objectives** Mobility is an important factor contributing to the spread of HIV among key population at risk for HIV; however, research linking this relationship among men who have sex with men (MSM) is scarce in India. This study examines the association between mobility and sexual risk behaviour and HIV infection among MSM in southern India.

**Methods** Data are drawn from a cross-sectional biobehavioural survey of 1608 self-identified MSM from four districts of Andhra Pradesh in India, recruited through a probability-based sampling in 2009–2010. Logistic regression models were used to estimate odds ratios and 95% CIs for sexual risk behaviours (unprotected sex with any male partner) and HIV infection based on the mobility status (travelled and had sex in the past year) after adjusting for sociodemographics and risk behaviours.

**Results** Of the 1608 MSM, one-fourth (26%) were mobile. Of these, three-fourths had travelled across districts but within the state (56%), and one-fifth (20%) across states. As compared to non-mobile MSM, a higher proportion of MSM who were mobile across districts (adjusted OR=1.42, 95% CI 1.04 to 1.95) or states (adjusted OR=3.20, 95% CI 1.65 to 6.17) reported having unprotected sex with any male sexual partner. Further, mobility across districts (adjusted OR=1.43, 95% CI 1.01 to 2.03) or states (adjusted OR=2.45, 95% CI 1.46 to 4.10) was significantly associated with HIV infection.

**Conclusions** Mobile MSM have a higher likelihood of contracting HIV. Interventions extending the ways to reach out to MSM with greater mobility may augment ongoing efforts to reduce the spread of HIV/AIDS in India.

## INTRODUCTION

Mobility has been identified as one of the key vehicles in the transmission of HIV around the world.<sup>1–6</sup> Several research studies have shown that men who are occupationally mobile are more likely to indulge in risky sexual behaviour such as unprotected sex, having non-spousal sexual partners while away from home thereby increasing their vulnerability to HIV infection.<sup>2–6–8</sup> Prior research has also highlighted mobility of female sex workers (FSW) as one of the reasons for the spread of HIV, with FSWs travelling frequently in search of work<sup>9–10</sup> and engaging in unprotected sexual encounters.<sup>4–9</sup>

This focus on mobility and HIV/AIDS has so far ignored the mobility of men who have sex with men (MSM) who constitute an important group at elevated risk of HIV infection globally as well as in India when compared with the general population.<sup>11–13</sup> There is an increasing awareness of MSM behaviour in India with about 3% of general male population reporting same sex behaviour.<sup>14</sup> MSM in India do not form a separate sexual network as is observed in Western countries. Instead, they mingle extensively with female partners due to societal pressure.<sup>15–18</sup> High HIV prevalence in this group coupled with the fact that a significant proportion engage in sexual relationships with women makes them an important bridge population between the key population at high risk for HIV and the general population for acquiring or transmitting HIV.<sup>17–19–20</sup> For these reasons, MSM have been considered as one of the core groups in the Indian national response to this epidemic. In high HIV-prevalent states, the government devised a strategy to decrease risky sexual behaviour among MSM. Besides this, Avahan, the India AIDS initiative provided HIV prevention interventions in selected districts over a 10-year period (2003–2013). The package of services included condom promotion and distribution, behaviour change communication for prevention of risky sexual behaviours, treatment of sexually transmitted infections (STI), community mobilisation, and referral for care, support and treatment (CST) services.<sup>21–22</sup> Although the intervention strategies targeted at MSM have led to a steady decline in HIV prevalence at the national level from 2003 to 2010–2011,<sup>23</sup> but still the prevalence is high among them (>5%) in most high-prevalent states in India,<sup>23</sup> making the MSM community still highly vulnerable to HIV infection. Given that the HIV programs in India have led to safer sexual practices among MSM, it is important that the interventions reach all, especially those highly vulnerable to HIV. Since, MSM in India are socially marginalised and same sex behaviour is highly stigmatised, there is widespread denial of such behaviours by those practicing them.<sup>12–16–20</sup> Additionally, those who tend to travel geographically may be particularly more difficult to contact under any programme. At present very little is known about the extent of mobility in this group. An understanding of the degree and pattern of mobility and its relation to HIV risk is needed in order to guide future programmes to



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**To cite:** Ramesh S, Mehrotra P, Mahapatra B, et al. *Sex Transm Infect* 2014;**90**:491–497.

design interventions to increase coverage and to reach those highly vulnerable to HIV infection. The present study, therefore, aims to (1) describe the degree and pattern of mobility among MSM; (2) examine the relationship of mobility with HIV risk behaviour and HIV infection in MSM.

## METHODS

### Design, setting and sample

Data used in this study are drawn from the Integrated Behavioural and Biological Assessment (IBBA), a cross-sectional survey conducted in 2009–2010 among MSM recruited through time-location cluster sampling in four high HIV-prevalent districts of Andhra Pradesh, India (Hyderabad, Guntur, East Godavari and Visakhapatnam).<sup>24</sup> Although, the survey was undertaken in four high-prevalent states, the recruitment and eligibility criteria differed from state to state. Therefore, we chose to explore the objective using the data from Andhra Pradesh. In Andhra Pradesh, the eligibility criteria for inclusion in the survey was ‘any man or *hijra* (transgender), self-identified MSM, aged 18 years or above, who had sex (oral, manual, or penetrative), paid or unpaid, with another man in the last one month’. The overall survey design and sample size calculation has been described elsewhere.<sup>25</sup>

Face-to-face interviews were conducted by trained investigators in the local language, using a structured questionnaire that included questions on sociodemographic characteristics, sexual behaviour and mobility. Additionally, respondents provided blood samples and were tested for HIV. Details of testing procedures adopted in the survey are available elsewhere.<sup>25</sup> Overall, a sample of 1608 MSM completed the behavioural interview and provided blood samples.

### Ethical considerations

Approval for conducting IBBA was obtained from the ethical review boards of participating institutions and Government of India's Health Ministry Screening Committee. A comprehensive consent process was adopted: respondents were informed about all aspects of the survey, following which oral consent was obtained separately for the behavioural and biological component.

## Measures

### Sociodemographic and sexual behaviour

The sociodemographic characteristics considered in this paper were based on single items in the questionnaire, which included age (<26, 26+), literacy (illiterate, literate), marital status (ever married, never married) and sex work as the primary source of income (no/yes). Respondents were considered to have correct comprehensive knowledge if they correctly identified two major ways of preventing sexual transmission of HIV and rejected two most common misconceptions about HIV transmission. Information on sexual behaviour was captured by asking respondents to self-identify into subcategories of sexual identities such as *kothi* (predominantly receptive during anal sex), *panthi* (predominantly insertive during anal sex), double-decker (receptive and insertive during anal sex), bisexual (engage in homosexual and heterosexual behaviour) and *hijra* (transgender). Age at first sex was measured as a continuous variable and grouped into three categories ( $\leq 15$ , 16–18, 19+). Having multiple male sexual partners was derived through a series of questions that were asked concerning different types of lifetime male sexual partners. The answers were grouped into two categories (<2, 2+). HIV testing behaviour of MSM was derived from survey items that asked whether they had ever undergone HIV testing

(no/yes). Sociodemographic and sexual behaviour characteristics were used as covariates in the multivariate analyses.

### Mobility

Mobility was the key independent measure used in this paper. Respondents were classified as mobile if they had travelled outside their current place of residence (city/town/village) in the past year and had sex at destination. Further, degree of mobility, another key independent variable was derived from the survey item that asked about different places the respondent had travelled outside their current place of residence in the past year and had sex at destination. Those indicating no mobility, that is, no travel outside their current place of residence (city/town/village) in the past year were coded as ‘1’; those reporting travel at least once outside their city/town/village in the past year, but within the district, and had sex at destination were coded as ‘2’; those reporting travel at least once outside the district in the past year, but within the state, and had sex at destination were coded as ‘3’ (this was inclusive of travel within the district also); and those indicating travel at least once outside the state in the past year, and had sex at destination were coded as ‘4’ (this was inclusive of travel within the district and/or state).

### Pattern of mobility

The pattern (direction) initiated from different districts was derived from the survey items that asked about their current place of residence and names of other places (district/state) the respondent had travelled to and had sex in the past year. Volume of mobility (load proportion of MSM reporting travel in that direction) on each route, was categorised based on the load from heaviest to lightest ( $\geq 30\%$ , 20–29%, 10–19%, 5–9%). Mobility to any place with a volume below 5% was not considered as it does not constitute a major route of mobility.

### Sexual risk behaviour and HIV

The survey collected information on condom use behaviour with a regular male partner, regular *hijra* partner, commercial male partner(s) who paid to have sex with the respondent, male/*hijra* partner(s) whom the respondent paid to have sex, and other non-commercial/non-regular partner(s). These items in the survey instrument were used to create inconsistent condom use variable, a dichotomous composite measure whereby a respondent was classified as inconsistent if respondent reported (a) not using a condom at last sex with any male/*hijra* sexual partner (paid or unpaid), (b) not using a condom, in general, in all sexual encounters with a paid or unpaid male/*hijra* sexual partner.

HIV status was determined based on the laboratory test results, and the respondents were considered HIV positive if their blood samples tested positive on the Microelisa test, and confirmed by the Genedia HIV ½ ELISA V.3.0 test.

### Statistical analyses

Data were analysed using STATA V.11.1.  $\chi^2$  test was used to assess the difference in mobility status by sociodemographic and sexual practices of MSM. A series of multivariate logistic regression models were constructed to measure the association of mobility and degree of mobility with inconsistent condom use with any male/*hijra* partner and HIV serostatus. Unadjusted and adjusted ORs and corresponding 95% CIs are presented. Sampling weights were used to account for differential probabilities of selection of MSM across districts and differential non-response rates. The weighting methodology has been described elsewhere.<sup>25</sup> To facilitate interpretation, the results are also

presented as adjusted proportions. The adjusted proportions are the expected proportions of the outcome variable for each category of the exposure variable after controlling for differences in the background variables. After fitting the logistic regression model, the proportion of MSM reporting inconsistent condom use with any male/*hijra* partner was calculated for each category of mobility status, using the estimated coefficients after adjusting (setting these variables to their mean value) for age, literacy, marital status, source of income, self-identity, age at sexual debut with a male, awareness of Avahan HIV prevention programme, comprehensive knowledge about HIV, voluntary HIV testing and having multiple/different male partners. Similarly, proportion of HIV positive by each category of mobility status was calculated after adjusting for age, literacy, marital status, source of income, self-identity, age at sexual debut with a man, having multiple/different male partners, awareness of Avahan HIV prevention programme, comprehensive knowledge about HIV, voluntary HIV testing and inconsistent condom use.<sup>26 27</sup>

## RESULTS

A total of 422 (26%) respondents indicated that they had travelled at least once outside their current place of residence and had sex at destination in the past year. Of these 422 MSM, more than half (56%) had travelled at least once across the district, and about one-fifth (20%) had travelled across the state. As indicated in table 1, there were interdistrict variability in the extent of mobility, with MSM in East Godavari being most mobile (32%) and those in Guntur being least mobile (23%), but in terms of mobility across the state, Hyderabad topped the list (11%). Significantly higher proportion of MSM who were 25 years or older (29% vs 24%,  $p<0.05$ ), who were never married (29% vs 23%,  $p<0.01$ ) reported mobility as compared to their counterparts. Mobility by self-identity of respondents indicated that a higher proportion of *hijra* (41%) and *kothi* (35%) reported mobility in the past year than double-deckers (29%) or bisexuals (19%), with *panthi* (14%) being the least mobile. Half the MSM (50%) who reported sex work as their main source of income were mobile, and the majority of these moves were across the state. A higher proportion of MSM whose sexual debut with a male was at an early age ( $\leq 15$ : 40%), who had more than one lifetime sexual partner (31% vs 12%,  $p<0.001$ ), reported mobility compared to their counterparts. Mobility was high among those who reported being aware of Avahan HIV prevention programmes (29% vs 24%,  $p<0.05$ ), whereas those with comprehensive knowledge (22% vs 28%,  $p<0.05$ ); who underwent HIV testing voluntarily (22% vs 28%,  $p<0.05$ ), reported less mobility compared to their counterparts.

### Pattern of mobility

Figure 1 indicated the pattern of movement among mobile MSM in Andhra Pradesh. We observed that the mobility pattern in the coastal districts, namely East Godavari, Visakhapatnam and Guntur were similar. They were more likely to travel within the state. Hyderabad emerged as the most likely destination within the state. But compared with other places of origin, those who resided in Hyderabad were more likely to travel outside the state than within. Maharashtra was reported by all as the most common destination outside of Andhra Pradesh.

### Association between mobility and sexual risk behaviour

Mobility was significantly associated with sexual risk behaviour. As indicated in table 2 mobile MSM were more likely to report unprotected sexual encounter with any male sexual partner

(74% vs 63%, adjusted OR=1.7, 95% CI 1.3 to 2.2) compared to their non-mobile counterparts. Further, a higher proportion of MSM who were mobile across districts (71% vs 63%, adjusted OR=1.4, 95% CI 1.1 to 1.9) or states (80% vs 63%, adjusted OR=2.4, 95% CI 1.2 to 4.8) reported inconsistent condom use with any male/*hijra* sexual partner as compared with non-mobile MSM.

### Association between mobility and HIV infection

The odds of being infected with HIV were higher among MSM who travelled outside their current place of residence and had sex at destination than those who did not (adjusted OR=1.7, 95% CI 1.2 to 2.2). Further, this association was stronger as the degree of mobility increased. Compared with non-mobile MSM, respondents who travelled outside the district but within the state had 70% higher likelihood of being infected with HIV, whereas those who travelled outside the state were two times more likely to be diagnosed as HIV positive (adjusted OR=2.2, 95% CI 1.3 to 3.8).

## DISCUSSION

In the current study which was aimed at understanding the mobility status and its relationship with HIV risk behaviour and HIV prevalence, we found that, more than one-fourth of MSM travelled outside their current place of residence and had sex at destination in this high HIV-prevalent state of southern India. Mobility status, however, differed by districts, sexual identities, age at sexual debut with a male, main source of income and marital status. Our study indicated that mobility adversely affects the vulnerability of MSM to HIV. Furthermore, the likelihood of being diagnosed with HIV increased with increase in the degree of mobility. As observed in prior research with FSWs and male migrants, mobility, per se, may not be associated with HIV; it may increase the vulnerability to risky sexual behaviour.<sup>1 6 28–30</sup> In the current study, similar results indicate that MSM who reported greater mobility were engaged in greater sexual risk activities that were likely to expose them to HIV infection.

There was district level variability in the pattern of mobility. Within the state, Hyderabad emerged as the most likely destination, which suggests that many visited this cosmopolitan city to practice their preferred lifestyle, but, mobile MSM residing in Hyderabad were more likely to travel outside the state than within. Maharashtra was the most common destination outside of Andhra Pradesh, as has been observed in other populations such as FSWs.<sup>9</sup> Although only a small proportion of MSM reported mobility across the state, but these highly mobile MSM reported low condom use and also experienced higher rates of HIV compared to non-mobile MSM.

Differences were observed in the degree of mobility among MSM according to whether they practiced receptive or insertive anal sex. Mobility was higher among *hijras* and *kothis*, compared to double-deckers, bisexuals and *panthis*. A possible reason could be that *hijras* and *kothis* are more likely to depend on sex work as their main source of income compared to other MSM.<sup>31 32</sup> Greater mobility probably helped them increase their client base. Additionally, the small percentage of MSM reporting sex work as their main source of income, could be due to the stigmatised nature of male sex work in general.<sup>31</sup> However, mobility in this subgroup was observed to be very high. This is of concern, because research in other populations, such as FSWs and migrant workers, has shown that employment-related mobility is a significant factor for sexual risk behaviour, exposing them to HIV infection.<sup>1 2 6</sup>

**Table 1** Mobility status by sociodemographic and sexual practices of men who have sex with men in Andhra Pradesh, India (n=1608)

Characteristics	MSM (total sample)* % (n)	Mobile†‡ %	Mobile within district†‡ %	Mobile across district†‡ %	Mobile across state†‡ %
Total	1608	26.3	6.4	14.6	5.3
District		p=0.026	p<0.001		
East Godavari	18.8 (303)	32.1	8.9	20.8	2.5
Guntur	31.9 (513)	22.6	9.1	10.8	2.7
Hyderabad	35.1 (564)	27.1	2.1	14.4	10.6
Visakhapatnam	14.2 (228)	24.5	7.6	15.4	1.5
Age (years)		p=0.013	p=0.075		
<26	53.0 (853)	23.7	5.5	13.1	5.1
26+	47.0 (755)	29.2	7.4	16.3	5.4
Mean (SD)	27.2 (7.4)	26.9 (6.8)	26.2 (6.6)	27.0 (6.8)	27.7 (7.6)
Literacy§		p=0.146	p=0.002		
Illiterate	17.7 (284)	22.7	9.3	8.1	5.3
Literate	82.3 (1324)	27.01	5.8	16.0	5.2
Marital status		p=0.006	p<0.001		
Never married	62.2 (1001)	28.5	6.8	14.0	7.7
Ever married	37.8 (607)	22.5	5.8	15.5	1.1
Primary source of income: sex work		p<0.001	p<0.001		
No	93.4 (1502)	24.6	6.6	14.8	3.1
Yes	6.6 (106)	50.2	3.4	11.1	35.7
Self-identity¶		p<0.001	p<0.001		
Kothi	39.7 (639)	34.8	5.6	19.5	9.7
Panthi	20.0 (321)	14.3	9.8	3.8	0.8
Double-decker	12.8 (206)	29.0	10.1	17.7	1.2
Bisexual	24.3 (390)	18.6	3.8	13.9	0.8
Hijra	3.2 (52)	40.9	0.5	12.9	27.5
Age at first sex with a man		p<0.001	p<0.001		
≤15	25.9 (417)	40.3	5.6	23.8	10.9
16–18	49.7 (799)	27.3	9.0	14.3	3.9
19+	24.4 (392)	9.2	1.9	5.4	1.9
Having multiple lifetime male sexual partners		p<0.001	p<0.001		
<2	23.6 (379)	11.6	2.9	8.1	0.5
2+	76.4 (1229)	30.8	7.5	16.6	6.7
Aware of Avahan HIV prevention programme		p=0.019	p<0.001		
No	52.3 (841)	23.8	4.9	11.8	7.2
Yes	47.7 (767)	28.9	8.1	17.7	3.2
Comprehensive correct knowledge about HIV/AIDS**		p=0.013	p=0.010		
No	72.6 (1168)	27.9	6.5	16.4	5.1
Yes	27.4 (440)	21.8	6.2	9.9	5.7
Voluntary HIV testing		p=0.013	p=0.006		
No	67.6 (1087)	28.1	6.4	16.7	4.9
Yes	32.4 (521)	22.4	6.4	10.1	5.9

\*Column percentage.

†Row percentage.

‡Mobile: travelled outside their current place of residence and had sex at destination in the past year.

§Literate: could read and/or write with or without formal education.

¶Self-identity: how the respondents identify themselves; *kothi*: predominantly receptive during anal sex; *panthi*: predominantly insertive during anal sex; double-decker: receptive and insertive during anal sex; bisexual: engage in homosexual and heterosexual relationships; *hijra*: male to female transgender.

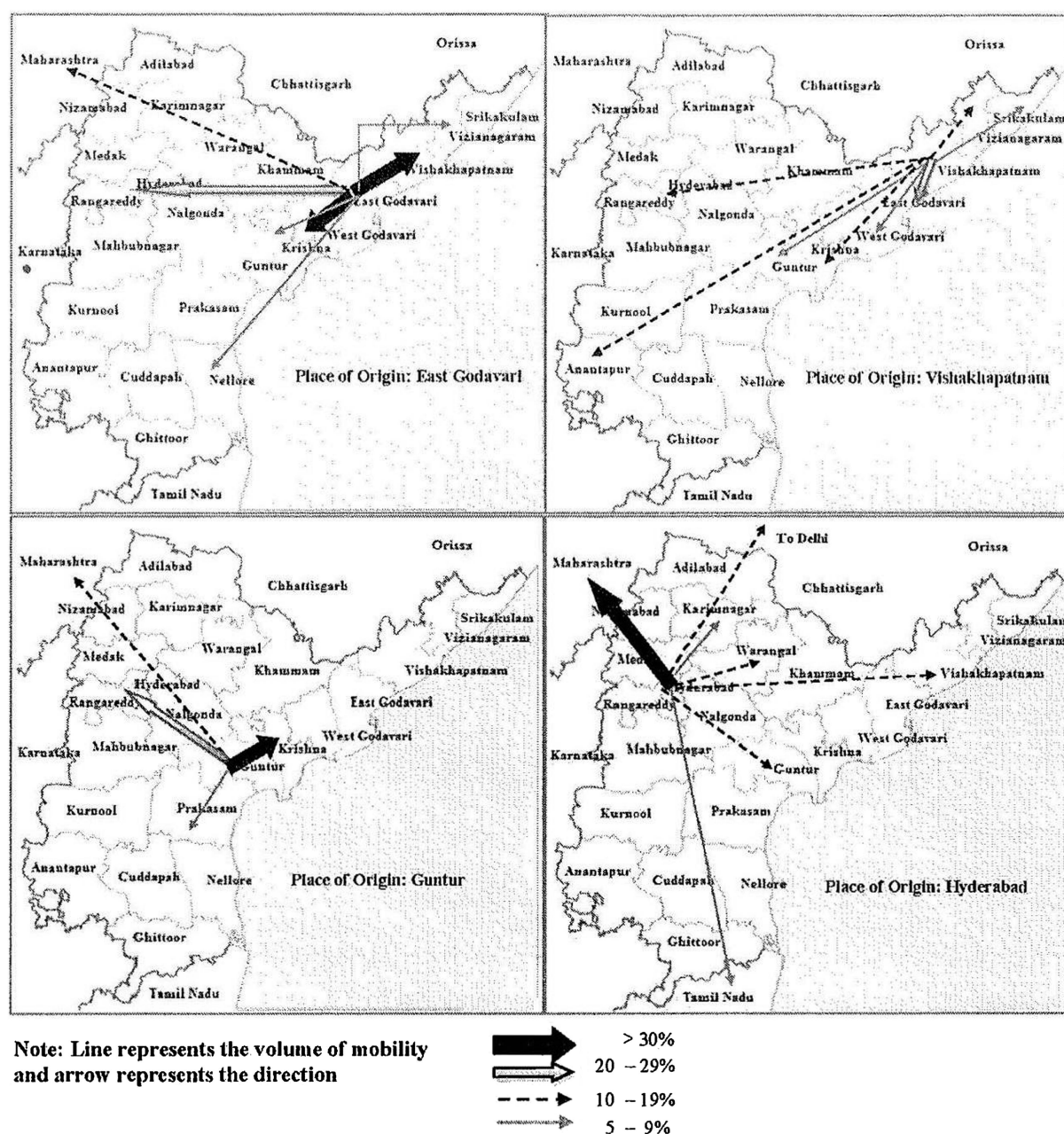
\*\*Comprehensive correct knowledge about HIV: correctly identified two major ways of preventing sexual transmission of HIV and rejected two most common misconceptions about HIV transmission.

††p Value based on  $\chi^2$  test of independence for categorical variables.

Although mobility was high among those who reported knowledge about HIV prevention programs, but when it came to comprehensive correct knowledge about HIV/AIDS, higher mobility was reported among those with incorrect comprehensive knowledge. Furthermore, a lower proportion of MSM who reported having undergone HIV testing were mobile as compared with their counterparts. This indicates that mere knowledge about prevention programmes is not adequate enough to change behaviour among MSM.

While this study underlines the strong association between mobility and the prevalence of HIV among MSM, the results should be interpreted in light of certain limitations. First, the key independent variable and sexual risk behaviour considered in this study were based on self-reported responses, and the limitation of self-reported data is widely recognised. Moreover, condom use may have been over-reported due to social desirability bias, following the promotion of safer behaviours through interventions. Second, while our study analyses recent





**Figure 1** Pattern of movement among mobile men who have sex with men in Andhra Pradesh, India.

mobility status, HIV seropositivity data reflect only prevalence. Therefore, we cannot determine a temporal relationship, as the time of HIV infection cannot be established from this research data. Finally, the findings of this study cannot be generalised to all MSM across India as the term ‘men who have sex with men’ in India has a great degree of complexity and is characterised by inter-regional and intraregional differences in the definition.<sup>25</sup> Nonetheless, these limitations do not compromise the internal validity of the data: our findings are consistent with previous studies that assessed the association between mobility and sexual risk behaviours/HIV in other populations, and advance the knowledge on the linkages between this risk factor and sexual risk behaviours/HIV among MSM.<sup>20</sup> Future research could provide critical information that would have implications for HIV programming. For example, studies that include frequency

and seasonality of mobility, reasons for travel, access to interventions at destination, and the volume of sex work along the routes of mobility, could help programmes deliver appropriate structural interventions.

The findings in this study suggest an important subgroup that needs to be the focus for future intervention programmes and research; that is, MSM who travel outside their current place of residence and have sex at destination. Additional programmatic attention needs to be given to those who are most disadvantaged sociodemographically such as MSM who were never married, who reported sex work as their main source of income, *kothis* and *hijras* and those whose sexual debut with a man was at a very early age. Compared to other high-risk populations, MSM are more difficult to reach because of the hidden nature of their activities. Additionally, those who are mobile might be even

**Table 2** Association between mobility status past year with sexual risk behaviour and HIV serostatus among men who have sex with men in Andhra Pradesh, India (n=1608)

	Inconsistent condom use with any male/Hijra partner			HIV +ve		
	%*	Crude OR (95% CI)	Adjusted OR <sup>†</sup> (95% CI)	%*	Crude OR (95% CI)	Adjusted OR <sup>†</sup> (95% CI)
Mobile§						
No	62.8	Referent	Referent	17.2	Referent	Referent
Yes	74.1	1.8 (1.4 to 2.3)***	1.7 (1.3 to 2.2)***	25.5	1.4 (1.1 to 1.8)*	1.7 (1.2 to 2.2)**
Degree of mobility§						
Never mobile	62.8	Referent	Referent	17.2	Referent	Referent
Mobile within district	78.7	1.9 (1.2 to 3.0)**	2.2 (1.3 to 3.6)**	22.0	1.1 (0.6 to 1.8)	1.4 (0.8 to 2.3)
Mobile across district but within the state	70.5	1.4 (1.1 to 1.9)*	1.4 (1.1 to 1.9)*	25.3	1.3 (0.9 to 1.8)	1.7 (1.2 to 2.4)**
Mobile across state	80.2	4.1 (2.1 to 7.7)***	2.4 (1.2 to 4.8)*	31.2	2.2 (1.4 to 3.6)***	2.2 (1.3 to 3.8)**

\*Adjusted percentages.

<sup>†</sup>Adjusted for age, literacy, marital status, source of income, self-identity, age at sexual debut with a male, aware of Avahan HIV prevention programme, comprehensive knowledge about HIV, voluntary HIV testing, having multiple different male partners.<sup>‡</sup>Adjusted for age, literacy, marital status, source of income, self-identity, age at sexual debut with a man, having multiple different male partners, aware of Avahan HIV prevention programme, comprehensive knowledge about HIV, voluntary HIV testing, inconsistent condom use.

§Mobile: travelled outside their current place of residence and had sex at destination in the past year.

\*p&lt;0.05; \*\*p&lt;0.01; \*\*\*p&lt;0.001.

more difficult to reach through any programme. Therefore, there is a need to develop strategies to identify men who engage in same sex behaviour, especially those most vulnerable to HIV, and guide them towards HIV prevention services, which may go a long way in preventing HIV among MSM and also among the general population.

### Key messages

- More than a quarter of MSM travel outside their current place of residence and have sex at destination.
- Mobile MSM are more likely to engage in risky sexual behaviour compared to non-mobile MSM.
- HIV rates increase with increase in the degree of mobility among MSM.
- There is a need for HIV prevention interventions to develop strategies to reach and address the vulnerabilities of mobile MSM.

**Handling editor** Jackie A Cassell

**Acknowledgements** This study was funded by a grant to the Population Council from the Bill & Melinda Gates Foundation, through Avahan, the India AIDS Initiative. The views expressed herein are those of the authors and do not necessarily reflect the official policy or position of the Bill & Melinda Gates Foundation and Avahan.

**Contributors** SR led conceptualisation, conducted all analyses, and wrote the manuscript. PM and DG revised the manuscript and edited the paper. BM and KN assisted with the analyses. NS assisted with conceptualisation of analytic approach and interpretation of study findings. All authors have read and approved this final submitted manuscript.

**Funding** The Bill & Melinda Gates Foundation.

**Competing interests** None.

**Ethics approval** Government of India's Health Ministry Screening Committee.

**Provenance and peer review** Not commissioned; externally peer reviewed.

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