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Abstract
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Background
 Reducing the transmission of HIV and other sexually transmitted infections (STIs) remains a public health priority in India [1]. As in other parts of Asia, although HIV epidemiology is thought to be fundamentally complex [2], with elevated risk among several ‘high-risk’

sub-populations, such as men who have sex with men (MSM) [3-8], the predominant driver of HIV transmission in India remains sex work [8-11].

Within the context of sex work, it has been recognized that considerable variation exists in the relationships between female sex workers (FSWs) and their clients, and the behaviours and interactions between the two groups, resulting in substantial heterogeneity in the nature of risk for HIV transmission [12-16]. Ultimately, the differences in the social and structural organisation

of sex work are manifested by variations in HIV and STI prevalence among different FSW populations [15,16].

Although high prevalence of HIV/STIs and risk behaviours associated with ongoing transmission has been observed in clients globally [17-20], with a handful of exceptions [21,22], very little is known about the prevalence and correlates of HIV/STIs among clients in India. One previous study of clients from 12 districts in India found that HIV prevalence ranged from 2% to 10%, depending on district. Although no statistically significant associations were found between HIV and factors included in their analysis, the authors found that two measures of high risk behaviour, volume of sex acts and inconsistent condom use, were positively associated with older age and having a mix of both commercial and non-commercial partners [21]. These findings align with the notion of clients as an important bridging population, with the potential to further the transmission of HIV and other STIs to both commercial and non-commercial partners, described in other localities [2,11,23,24].

Given the high rates, by Indian men, of both commercial sex partnerships and inconsistent condom use [25], and the lack of access to basic HIV prevention services

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across districts. Having an intimate partner was associated with higher levels of HSV-2 ($p < .0001$); HSV-2 prevalence among clients with intimate partners was 34%, while it was 18% among those without intimate partners. Condom use at last sex with an intimate partner was associated with CT/NG prevalence ($p = .008$).

Duration of visiting FSWs was positively associated with the prevalence of both HIV ($p = .001$) and HSV-2 ($p < .0001$). For example, HIV prevalence was 2% among respondents who had been visiting FSWs for a year or less and 8% among those with 10 or more years visiting FSWs. Place of solicitation was associated with HIV ($p = .003$). Clients who visited brothels had the highest HIV prevalence (9%), while those visiting lodges had the highest CT/NG prevalence (7%). Condom use was associated with the prevalence of HSV-2. Prevalence was higher among clients reporting never using condoms with their occasional (33% vs. 26%, $p = .003$) FSW partners.

Conclusion

Additional file 2 also shows the degree to which pathogens were related. HIV prevalence was positively and

significantly related to syphilis and HSV-2 prevalence. For example, 21% of clients with syphilis were also HIV-positive, compared to 5% of clients that were not infected with syphilis ($p < .0001$). Similarly, elevated prevalence of HIV was seen amongst respondents who were HSV-2-positive; 16% of HSV-2-positive respondents were HIV-positive, compared to 2% of those that were not HSV-2-positive ($p < .0001$). Correspondingly, the prevalence of HSV-2 in those respondents who were HIV-positive was 79%, compared to 25% in HIV-negative respondents.

Table 1 shows the adjusted odds ratios (AOR) and 95% confidence intervals (95%CI) from multivariable logistic regression models examining factors associated with each individual pathogen. For HIV, respondents with a longer duration of visiting FSWs were at higher odds of being HIV-positive (AOR: 1.1; 95%CI: 1.0-1.1, $p < .0001$), adjusted for all other factors in the model. Respondents from Bagalkot (AOR: 2.9; 95%CI: 1.7-5.1, $p < .0001$), those reporting “service industry” as their primary occupation (AOR: 2.8; 95%CI: 1.5-5.2, $p < .01$), and those

soliciting FSWs in brothels (AOR: 2.4; 95%CI: 1.2, 4.7, $p < .01$) were all at increased risk of being HIV-positive. Respondents from Bangalore (AOR: 0.4; 95%CI: 0.2-0.7, $p < .01$), relative to other districts were at decreased risk of HIV. For HSV-2 a longer duration of visiting FSWs (AOR: 1.1; 95%CI: 1.1-1.1, $p < .001$), and being from Bagalkot, relative to other districts (AOR: 1.6; 95%CI: 1.2-2.3, $p < .01$) were all associated with increased HIV risk. Respondents from Bagalkot were least likely to be positive for syphilis (AOR: 0.4; 95%CI: 0.2-1.0, $p < .05$).

Table 2 shows the results from the multivariable models examining the association between co-infection with

another STI and being HIV-positive. In the adjusted analysis, being positive for HSV-2 (AOR: 10.4; 95%CI: 6.1-17.7, $p < .0001$) and syphilis (AOR: 2.5; 95%CI: 1.0-6.0, $p < .05$) were both independently associated with HIV infection. It is important to note that the direction of causality of HIV, HSV-2 and syphilis cannot be determined through the cross-sectional nature of the data.

Discussion

This cross-sectional study characterised the prevalence of HIV and STIs among a sample of clients from six districts in Karnataka state, southern India. The results demonstrated substantial heterogeneity in the prevalence of HIV and other STIs, both by district and by type of pathogen. A strong and positive relationship between HIV infection and co-infection with other pathogens was detected. These results illustrate the complexity, not only in understanding the epidemiology of HIV and its interaction with other STIs [31,32], but also in the management of HIV-infected persons [31,33].

[21], the *raison d'être* of biological risk does not always necessarily translate into actual, or operationalised risk.

higher risk of HIV amongst brothel-based FSWs,
improved strategies to engage with both clients and



1. M. ... HI ... 2008 81 342-344.
1. HI ... C ... 2010, 53(1) 131-133.

