## **Original Research Article**

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# Factors associated with Chlamydia trachomatis and Neisseria gonorrhoeae infection among female sex workers in Nagaland, India

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### **ABSTRACT**

**Background:** There is limited knowledge on the prevalence and correlates of sexually transmitted infections (STI) among women practicing sex work in the high HIV prevalence settings of northeast India, especially in Nagaland. We assessed the prevalence and risk factors of *Chlamydia trachomatis* (CT) and *Neisseria gonorrhoeae* (NG) among female sex workers (FSW) in Dimapur, Nagaland.

**Methods:** 417 FSWs were recruited into this cross–sectional study using Respondent Driven Sampling (RDS) in 2009. Information on socio-demographic characteristics, sexual risk behaviours and exposure to prevention interventions were collected from them and urine samples were tested for NG and CT. Multivariate logistic regression analysis was performed to assess the factors associated with NG and CT.

**Results:** The RDS-adjusted prevalence of HIV, NG and CT was 11.4%, 6.6% and 19.5% respectively. The reported condom use with clients and regular sex partners were only 29.1% and 9.6% respectively. Being in the sex trade within the last 2 years was independently associated with greater risk for NG and CT. Having more than 5 clients was independently associated with greater likelihood for CT and seropositivity for HIV was independently associated with NG.

**Conclusions:** High prevalence of NG/CT was documented among FSWs with relatively new entrants into sex trade having the highest risk. The combination of high STI prevalence and low consistent condom use is likely to contribute to an escalating HIV epidemic in this already high HIV prevalence setting. There is need to strengthen public health measures for screening and management of NG and CT among FSWs.

**Keywords:** FSW, NG, CT

#### INTRODUCTION

Sexually transmitted infections (STI) represent a major public health problem all over the world including India. 1,2 Female sex workers (FSW) are considered a core

group for the transmission of STIs including HIV to the general population through their clients. *Chlamydia trachomatis* (CT) and *Neisseria gonorrhoeae* (NG) are common sexually transmitted infections among FSWs in India.<sup>3,4</sup> A recent survey in high HIV prevalence settings

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in India reported as high as 9.3% prevalence of *gonorrhea* and 22.6% prevalence of *chlamydia* among FSWs.<sup>4</sup> *Chlamydia trachomatis* (CT) and *Neisseria gonorrhoeae* (NG) are infections which have similar modes of transmission and equivalent symptoms.<sup>5</sup> Untreated CT and NG infection, which are usually asymptomatic, are associated with serious health consequences in women such as pelvic inflammatory disease, ectopic pregnancy, chronic pelvic pain, and infertility.<sup>6-8, 10</sup> Apart from being serious diseases in their own right, epidemiological evidences suggest that both CT and NG can also facilitate sexual transmission of HIV infection.<sup>6,10,11</sup>

Given the serious health consequences of untreated NG and CT infection and their role in enhancing HIV transmission, it is essential to understand the prevalence and epidemiology of NG and CT among FSWs in order effective curative and preventive develop interventions. Some studies have been conducted to determine prevalence and risk factors of NG, CT and other STIs among FSWs in southern states of India. 12-14 But, similar research on STIs among FSWs is very limited in the high HIV prevalence settings of northeastern region of India. Nagaland, a northeastern state that consistently reports one of the highest HIV prevalence levels in the country. The importance of female sex workers in driving the HIV epidemic in this state has been increasingly recognized in recent years in Nagaland.<sup>15</sup> Understanding the epidemiology of STIs may strengthen the sexually transmitted infections (STI) and HIV prevention programs in this high HIV prevalence area. In this present analysis, we aim to assess the prevalence and factors associated with NG and CT infections among FSWs in Dimapur district of Nagaland, the main hub of commercial sex in the region using the data of recent round of integrated behavioural and biological assessment (IBBA) study.

#### **METHODS**

The IBBA is a cross-sectional study carried out in 29 districts across six of the highest HIV prevalence states in India, including Dimpaur district in Nagaland, Northeast India. The IBBA collected both biological and behavioral data from January to February 2009. A FSW was defined as a female, aged 18 years or older, who had sex with men in exchange for cash or kind at least once within the past one month. The ethical review bodies of the participating institutions (Family Health International, Regional Medical Research Center, and National AIDS Research Institute) provided ethical clearance to carry out the study.

Respondent driven sampling (RDS) was used to recruit participants in the study. Methodological details including sampling procedures have been described in length elsewhere. 15-17 RDS is a modified form of chain-referral sampling, where subsequent respondents are recruited by previous respondents through their social

networks. The sampling of the study began with 10 purposively selected diverse respondents (called "seeds') from the target population who met the eligibility criteria. Then, each seed was given three uniquely coded coupons to recruit three eligible peers from their networks. Those recruits, in turn, recruited other peers for subsequent waves. Such peer to peer recruitment process continued until the pre-determined sample size was achieved. A sample size of 400 was calculated for the study. <sup>17</sup>

After obtaining informed consent, data were collected anonymously from eligible respondents using a predesigned and pre-tested questionnaire. The standardized questionnaire collected a wide range of information including-socio-demographic characteristics of respondents, sexual history, sexual risk behaviours and exposure to interventions. Consistent condom use was defined as condom use every time during a sex act with different types of sexual partners (regular non-paid partners and clients).

Urine samples were tested with nucleic acid amplification assay (Gen-Probe APTIMA Combo 2 assay; *Gen-Probe Inc, San Diago, USA*) for the detection of *Neisseria gonorrhoeae (NG)* and *Chlamydia trachomatis (CT)* as described in the product insert.<sup>4</sup> Due to an unanticipated communication failure we were unable to transport 45 samples to the testing laboratory, and thus NG and CT testing was not done on those particular samples, so they have been excluded from all analysis related to NG/CT. Blood samples were collected for HIV serological testing from all the participants. Serum samples were also tested for HIV by Microelisa (J. Mitra and Company, India), and positive tests were confirmed by Genedia HIV 1/2 ELISA 3.0 (Green Cross Life Science Corporation, South Korea).

RDS-adjusted prevalence of *gonorrhea* and *chlamydia* was estimated. Logistic regression analyses was used to estimate crude and adjusted odds ratios (OR, 95% confidence interval) using SPSS software (South Asia Pvt. Ltd., Bangalore, India) to identify the factors associated with NG and CT among FSWs after adjusting for the RDS sampling process. All the variables tested in the univariate analysis were included in the multivariate model regardless of their statistical significance in the univariate analysis. The individualized weights generated for the dependent variable (i.e. CT or NG infection) using RDS Analysis Tool version 5.6.0 were applied to the logistic regression analysis using SPSS in order to adjust for the RDS sampling process.<sup>18</sup>

#### **RESULTS**

A total of 417 FSWs were sampled in the study. The mean and median ages of the participants were 27 and 25 years respectively. Among the 417 FSWs, 59.2% of respondents were illiterate, 37.6% were currently married, 17% were widowed and 20.9% were divorced or separated as shown in Table 1.

Table 1: Characteristics of FSWs participants.

Categories	Total, n(%)
Current age #	
18-19	48 (11.6)
20-24	120 (28.9)
25+	246 (59.4)
Mean age	27 years
<b>Educational status</b>	
Illiterate	247 (59.2)
Literate	170 (40.8)
Marital status	
Widowed	71 (17.0)
Divorced/separated	87 (20.9)
Currently married	157 (37.6)
Never married	102 (24.5)
Age at first sex (in years) #	
<=15	173 (43.8)
> 16	222 (56.2)
Mean age of first sex	16 years
Duration of sex work (in years) #	·
< 2	130 (33.1)
2-4	163 (41.5)
>=5	100 (25.4)
Mean duration	3.5 years
Client volume in past week #	
0-4	296 (72.5)
>=5	112 (27.5)
Mean client volume	3 clients
Every time condom used with regular main partners <sup>‡</sup>	
Never/Not every time	263 (90.4)
Every time	28 (9.6)
Every time condom used with occasional & regular clients #	20 (3.0)
Never/Not every time	293 (70.9)
Every time	120(29.1)
Ever contacted by peer	120(2).1)
No/not aware about Avahan (an NGO)	246 (59.0)
Yes	171 (41.0)
Registered with Avahan NGO	171 (41.0)
No/not aware about Avahan	258 (61.9)
Yes	159 (38.1)
	137 (30.1)
Ever visited clinic run by Avahan NGO	270 (64.7)
No/not aware about Avahan	270 (64.7) 147 (35.3)
Yes	147 (35.3)
HIV status	274 (90.7)
Negative	374 (89.7)
Positive	43 (10.3)

<sup>&</sup>lt;sup>#</sup> data with missing cases <sup>≠</sup> based on respondents who reported having regular main partners.

The mean age of sexual debut was 16 years and nearly 43.8% reported having their sexual debut at or before the age of 15 years. About 33% of respondents reported being in sex work for the last 2 years, while only 25.4% said they had been in sex work for 5 or more years. The average number of clients entertained in the last working week was 3 clients, and most of the respondents (72.5%)

reported entertaining less than 5 clients. Reported condom use with sexual clients and regular sex partners was 29.1% and 9.6% respectively. Only 38.1% of respondents had registered with an NGO, 41% had been contacted by peer workers and 35.3% had ever visited an NGO-run STI clinic.

The crude prevalence of HIV, NG and CT were 10.3%, 7.2% and 17.7%, respectively. RDS-adjusted prevalence of HIV, NG and CT were 11.4%, 6.6% and 19.5%

respectively. Co-infection of both NG and CT was evident in 4.3% of FSWs, and the prevalence of NG and/or CT was 23.7%.

Table 2: Neisseria gonorrhoeae (NG) prevalence (PR) by different characteristics and risky behaviours among the FSWs in Dimapur; and factor associated with NG seropositivity in univariate and multivariate logistic regression analysis.

	n	NG PR	Weighted OR (95% CI)	
Variables	(N=371)	(%)	Univariate	Adjusted
Current age #				J
18-19	44	4 (9.1)	1.05 (0.32-3.49)	0.99 (0.22-4.38)
20-24	105	7 (6.7)	0.75 (0.29-1.95)	0.67 (0.23-2.00)
25+	219	19 (8.7)	Reference	Reference
<b>Educational status</b>		· , ,		
Illiterate	224	19 (8.5)	1.15 (0.50-2.60)	0.97 (0.36-2.64)
Literate	147	11 (7.5)	Reference	Reference
Marital status		` ,		
Widowed	65	2 (3.1)	0.49 (0.08-2.93)	0.44 (0.06-3.43)
Divorced/separated	78	9 (11.5)	2.03 (0.61-6.82)	1.43 (0.31-6.65)
Currently married	145	14 (9.7)	1.67 (0.54-5.13)	1.44 (0.33-6.26)
Never married	83	5 (6.0)	Reference	Reference
Age at first sex #				
<=15 years	164	17 (10.4)	1.55 (0.69-3.44)	1.85 (0.71-4.81)
> 16 years	187	13 (7.0)	Reference	Reference
Duration of sex work #				
< 2 years	120	15 (12.5)	4.09 (1.06-15.82)*	6.28 (1.42-27.72)*
2-4 years	141	12 (8.5)	2.67 (0.67-10.55)	2.94 (0.68-12.71)
>=5 years	89	3 (3.4)	Reference	Reference
Client volume in past week #				
0-4	267	20 (7.5)	Reference	Reference
>=5	95	9 (9.5)	1.29 (0.54-3.09)	1.76 (0.66-4.73)
Every time condom used with regular				
main partners <sup>#</sup>				
Not every time	231	17 (7.4)	Reference	Reference
Every time/No partner	137	13 (9.5)	1.32 (0.59-2.94)	1.09 (0.43-2.79)
Every time condom used with occasional				
& regular clients #				
No	259	24 (9.3)	1.73 (0.65-4.63)	1.76 (0.73-4.23)
Yes	108	6 (5.6)	Reference	Reference
Ever contacted by peer			T. 0	T. 0
No/not aware about Avahan	217	15 (6.9)	Reference	Reference
Yes	154	15 (9.7)	1.45 (0.66-3.21)	0.77 (0.14-4.05)
Registered with Avahan NGO				-
No/not aware about Avahan	224	15 (6.7)	Reference	Reference
Yes	147	15 (10.2)	1.58 (0.72-3.50)	2.24 (0.32-15.75)
Ever visited clinic run by Avahan NGO			T. 0	T. 0
No/not aware about Avahan	237	16 (6.8)	Reference	Reference
Yes	134	14 (10.4)	1.61 (0.73-3.57)	0.96 (0.24-3.82)
HIV status				
Negative	335	21 (6.3)	Reference	Reference
Positive	36	9 (25.0)	4.98 (1.99-12.50)**	4.66 (1.54-14.09)**

<sup>#</sup> data with missing cases; OR – odds ratio; CI – confidence interval

The results of univariate and multivariate regression analysis for NG are presented in Table 2. In the univariate analysis, FSWs who tested positive for NG were more likely to have entered sex work within the last

2 years (OR=4.09, CI: 1.06-15.82) and to be seropositive for HIV (OR=4.98, CI: 1.99-12.50). In multivariate analysis, entering into sex work within the last two years (OR=6.28, CI: 1.42-27.72) and HIV seropositivity

<sup>\*</sup>p < 0.05, \*\*p < 0.01 in logistic regression analysis.

(OR=4.66, CI: 1.54-14.09) remained statistically significant factors associated with NG infection.

Table 3: Chlamydia trachomatics (CT) prevalence (PR) by different characteristics and risky behaviours among the FSWs in Dimapur; and factor associated with NG seropositivity in univariate and multivariate logistic regression analysis.

Variables	n (N=372)	CT PR (%)	Weighted OR (95% CI)		
			Univariate	Adjusted	
Current age #					
18-19	44	6 (13.6)	0.75 (0.29-1.89)	1.11 (0.37-3.30)	
20-24	107	29 (27.1)	1.76 (1.01-3.06)*	2.39 (1.22-4.72)*	
25+	218	38 (17.4)	Reference	Reference	
Educational status					
Illiterate	225	45 (20.0)	1.02 (0.60-1.71)	0.69 (0.35-1.37)	
Literate	147	29 (19.7)	Reference	Reference	
Marital status					
Widowed	64	12 (18.8)	1.36 (0.57-3.27)	2.00 (0.62-6.42)	
Divorced/separated	79	19 (24.1)	1.87 (0.84-4.16)	2.28 (0.81-6.42)	
Currently married	146	31 (21.2)	1.60 (0.77-3.30)	2.23 (0.85-5.86)	
Never married	83	12 (14.5)	Reference	Reference	
Age at first sex #					
<=15 years	163	35 (21.5)	1.20 (0.71-2.03)	1.19 (0.63-2.24)	
> 16 years	189	35 (18.5)	Reference	Reference	
Duration of sex work #					
< 2 years	121	30 (24.8)	2.09 (1.00-4.35)*	2.53 (1.06-6.02)*	
2-4 years	142	27 (19.0)	1.49 (0.71-3.11)	1.64 (0.70-3.82)	
>=5 years	88	12 (13.6)	Reference	Reference	
Client volume in past week #					
0-4	268	49 (18.3)	Reference	Reference	
>=5	95	23 (24.2)	1.43 (0.81-2.50)	1.97 (1.02-3.81)*	
Every time condom used with regular					
main partners <sup># a</sup>					
Not every time	231	39 (16.9)	Reference	Reference	
Every time/No partner	138	35 (25.4)	1.67 (1.00-2.80)*	1.60 (0.85-3.02)	
Every time condom used with occasional					
& regular clients #					
Not every time	258	47 (18.2)	0.80 (0.46-1.38)	0.86 (0.48-1.56)	
Every time/no clients	110	24 (21.8)	Reference	Reference	
Ever contacted by peer					
No/not aware about Avahan	217	42 (19.4)	Reference	Reference	
Yes	155	32 (20.6)	1.08 (0.65-1.81)	0.83 (0.26-2.61)	
Registered with Avahan NGO					
No/not aware about Avahan	224	43 (19.2)	Reference	Reference	
Yes	148	31 (20.9)	1.11 (0.67-1.87)	1.95 (0.55-6.96)	
Ever visited clinic run by Avahan NGO					
No/not aware about Avahan	237	49 (20.7)	Reference	Reference	
Yes	135	25 (18.9)	0.87 (0.51-1.49)	0.51 (0.20-1.31)	
HIV status					
Negative	335	65 (19.4)	Reference	Reference	
Positive	37	9 (24.3)	1.33 (0.60-2.96)	1.06 (0.40-2.86)	

<sup>#</sup> data with missing cases; OR - odds ratio; CI - confidence interval; \*p < 0.05, \*\*p < 0.01 in logistic regression analysis.

Table 3 shows the results of univariate and multivariate regression analysis for CT. Duration of sex work was found to be significantly associated with CT infection. Those who entered sex work within the last 2 years were more likely to test positive for CT in univariate (OR=2.09, CI: 1.00-4.35) as well as in multivariate

analysis (OR=2.53, CI: 1.06-6.02). Being in the age group of 20-24 years was also found to be significantly associated with test positive for CT in both univariate and multivariate analysis. Additionally, the volume of clients emerged as statistically significant in the multivariate analysis. Serving 5 or more clients was found to be

significantly associated with increased risk of CT infection (OR=1.97, CI: 1.02-3.81). No other sociodemographic, sexual behaviour or program exposure variables showed significant associations with either NG or CT.

#### **DISCUSSION**

This study documented a relatively high prevalence of NG and CT infection among the FSWs in Dimapur, Nagaland. The prevalence of NG and CT among FSWs in Dimapur was higher than all the other high HIV prevalence districts where the IBBA study was conducted in 2009. The prevalence of both infections remained unaltered from the baseline assessment undertaken in 2006, underscoring the need for the continued prevention efforts.

In this study, recent entry into sex work was significantly associated with increased risk of both CT and NG infection. This could reflect lack of exposure among new FSWs to prevention information, poorer access to STI services and peer led programs, lack of skill and limited experience in negotiating safer sex with clients. 19, 20 However, our analysis (results not shown) did not suggest that new FSWs were any less likely to engage in unsafe sex or to access programs and services compared to longer duration FSWs. Another possible explanation for relatively low prevalence of CT and NG among longer working FSWs is that longer working FSWs may develop some degree of protective immunity against re-infection of NG/CT after previous genital infection and therefore risk for re-infection may be greatly reduced. 19, 21-23 There is also some evidence suggesting that new FSWs tend to have clients/sexual partners who are different i.e. higher risk compared to clients of longer duration FSWs. 15, 19 More research is needed to better explain these issues, as detailed clients characteristics were not gathered in this study.

Higher client volume was found to be independently associated with increased risk of CT in this study, which is consistent with previous reports. Although not found to be statistically significant, the association between NG and client turnover was also found to be in the expected direction. This result is not surprising as serving more clients means a greater risk of exposure to sexually transmitted infection, particularly in a vulnerable population group such as FSWs in Dimapur where consistent condom use is low. Is

We found that the prevalence of consistent condom use with clients continues to be low among FSWs in Dimapur, even though there has been an overall improvement when compared with baseline. Consistent condom use with regular sexual partners was even lower with only 9.6% reporting consistent condom use. The use of condoms consistently with clients was not found to be protective against NG/CT in this study. Similar to the

findings of this study, we found no association between consistent condom use and HIV among FSWs in Dimapur in a previous study. 14 Such lack of association has also been reported in other countries.<sup>24</sup> Frequent findings of lack of association between condom use and STI/HIV in Dimapur suggest that incorrect use of condom may be an important possible factor. It is suggested that consistent and correct use of condoms, not consistent use by itself, provides maximal protection against STIs. 25, 26 However, we did not collect data on correct use of condom in this study. Therefore, further studies are needed to better explain the factors that adversely influence the effectiveness of condoms in preventing STIs in this population. It is also possible that they were infected before starting to use condoms consistently.<sup>24</sup>

As expected, NG infection was strongly associated with HIV seropositivity. However, contrary to our expectation, CT infection was not found to be significantly associated with HIV seropositivity, although prevalence of CT was found to be higher among HIV-positives than among HIV-negative. We also found a strong positive correlation between NG and CT infection (result not shown). The co-occurrence of these infections may be explained by the sexual co-transmission of these organisms<sup>27</sup> as well as the risk factors common to both infections. Also, it is suggested that the presence of one of these STIs could facilitate transmission of another.<sup>27</sup> The high rate of STIs is concerning because their presence augments the likelihood of acquiring and transmitting HIV. The facilitating role of STIs in transmitting HIV is amplified in this population by the low rate of consistent condom use.<sup>15</sup>

Interestingly no demographic or program-exposure variables were found to be significantly associated with NG and CT in this study. This contrasts with our previous study in Dimapur that showed greater vulnerability of married FSWs (widowed or divorced FSWs in particular) to HIV compared to unmarried groups. <sup>15</sup> However, the association between marital status and NG/CT was in the expected direction in this study, but did not reach statistical significance. This may be because the sample size lacked the statistical power to detect a real difference. Another possible explanation is that the susceptibility of more vulnerable groups (here married group) to re-infection may be reduced because of acquired immunity as a result of prior infection. <sup>23</sup>

Our findings suggest that there is a large program gap despite the fact that there has been a modest improvement in the program exposure in the population as compared to baseline<sup>4</sup>, underscoring the need for further efforts to improve the program reach. Lack of association between NG/CT with program exposure suggests that the STI management component of the HIV prevention program is not as effective as it needs to be, highlighting the need to strengthen this component of HIV prevention program.

The findings should be interpreted in the light of certain limitations of this study. Due to the cross-sectional nature of the study design, it is difficult to draw temporal or causal inferences from this study. Since nucleic acid amplification test can detect active infection, the identified factors associated with NG and CT in the study may be true risk factors. The self-reported data on sexual behaviours and program exposures may also be confounded by recall error or social desirability bias leading to over or under reporting of certain information. Further, we did not collect detailed information about sexual partners, although characteristics of sexual partners are known to be an important predictor of sexually transmitted infections among FSWs. 15, 28 We used RDS to recruit FSWs in the study because random sampling of the target population was not feasible. RDS is considered to be the best alternative sampling option when random sampling of hidden populations is not possible. RDS is based on a statistical theory that suggests that if peer recruitment proceeds through a sufficiently large number of waves, the composition of the sample will stabilize (also known as reaching "equilibrium"), becoming independent of the seeds from which recruitment began, and thereby overcoming any bias the non-random choice of seeds may have introduced.<sup>29</sup> After reaching equilibrium the sample becomes representative of the study population.<sup>30</sup> Our wave-wise analysis suggests that equilibrium for most of the key characteristics was achieved in this study by the 5<sup>th</sup> -6<sup>th</sup> waves.

#### **CONCLUSION**

This epidemiological study from Nagaland has documented highest prevalence of NG and CT infection among FSWs in India. The study also highlights that relatively new entrants into sex work were more vulnerable to NG and CT infections underscoring the importance for paying greater attention to newer FSWs. The high prevalence of STIs and low prevalence of consistent condom use is a dangerous combination that is likely to directly contribute to a sex work-driven HIV epidemic in this already high HIV prevalence setting. The problem is compounded by the fact that coverage of STI treatment services is still far from the optimal level. The findings of this study suggest the urgent need to strengthen public health measures for screening and management of NG and CT, especially among FSWs; and to improve current condom promotion strategies to enhance their effectiveness.

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