

Heterogeneity and Confinement of HIV Prevalence among Pregnant Women Calls for Decentralized HIV Interventions: Analysis of Data from Three Rounds of HIV Sentinel Surveillance in Karnataka: 2013–2017

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Abstract

Background: The HIV sentinel surveillance (HSS) serves to estimate the levels and trend of HIV prevalence among high-risk, bridge, and general population and monitors HIV management at national, state, and district levels. Data from HSS are valuable in understanding the risk factors associated with HIV transmission with particular demographic characteristics. **Objectives:** The objective was to analyze the sociodemographic profile of the pregnant mothers attending the antenatal care (ANC) clinics in Karnataka, in order to understand the dynamics of HIV within the general population in Karnataka. **Materials and Methods:** Study design: this was a cross-sectional study conducted using consecutive sampling method. Study setting: the surveillance was conducted at select antenatal clinics, in Karnataka, India, between January and March, in the years 2013, 2015, and 2017. Methodology: in total, 74,278 eligible pregnant women aged between 15 and 49 years, attending the sentinel sites for the first time during the surveillance period, were included in the study. Information on their sociodemographic characteristics and blood samples was collected. **Results:** HIV prevalence among the ANC clinic attendees has significantly declined, reaching a recent stabilization. The risk factors significantly associated with HIV among pregnant women were age, education, occupation, and marital status. HIV is highly concentrated in the northern and southern districts of Karnataka. **Conclusion:** Despite the declining trends of HIV prevalence in Karnataka, the epidemic is heterogeneous and concentrated within the state, calling for decentralized region-specific interventions.

Keywords: Antenatal care, HIV prevalence, HIV sentinel surveillance, India, Karnataka, sociodemographic

INTRODUCTION

The HIV sentinel surveillance (HSS) data from the high-risk groups (HRGs), bridge population, and pregnant women are used for HIV adult prevalence estimations at the national and state levels.^[1] The HIV prevalence among pregnant women in Karnataka has declined from 1.98% in 2002 to 0.38% in 2017; however, it has the third largest HIV-infected population living in India.^[2] Besides, 13 antenatal care (ANC) sites from 11 districts had HIV prevalence of 1% and above in at least three of the six rounds of HSS.^[3] Traditional commercial sex trade and labor outmigration are common in North Karnataka, resulting in pockets of high HIV prevalence.^[4-6] HIV prevalence among pregnant mothers

being one of the indicators for adult HIV prevalence,^[2] the trend observed among the pregnant women reflects the disease trends among the general population. State- and district-level analysis of

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the background characteristics of ANC attendees will therefore facilitate planning of HIV/AIDS interventions. Here, we present the analysis of the sociodemographic profile of ANC attendees, to identify the possibilities of disease confinement and transmission patterns within Karnataka.

MATERIALS AND METHODS

Study population

All eligible pregnant women aged between 15 and 49 years, attending the ANC clinic for the first time during the 3 months' period of HSS, were included in the study.

Study design

This was a cross-sectional study, conducted biennially with consecutive sampling method. Recruitment was done till reaching the required sample size or till the end of the 3 months' surveillance period, during the respective surveillance years.

Study method

Information on sociodemographics and blood samples from all the eligible respondents, attending designated ANC sentinel sites in Karnataka, was collected. At least two sentinel sites per district, preferably one from urban and other from rural areas, were designated; totaling to 62 sites. The sample size was fixed at 400 for each site,^[7,8] accounting to a total of 74,278 valid samples from all the three rounds. The samples collected from the three rounds were 24,767, 24,711, and 24,800 in 2013, 2015, and 2017, respectively. Recruitment was by consecutive sampling method to eliminate sampling bias. Unlinked anonymous testing strategy followed until 2015, which was changed to linked anonymous testing strategy in 2017. All the collected blood samples were tested for HIV biomarkers by the standard two-test protocol. Complete sampling procedures including sample size, data/sample collection, and subsequent testing were followed as described elsewhere.^[3,9]

Data analysis

Multivariable logistic regression and Chi-square tests were used to find the association between the variables and HIV prevalence. All data were analyzed using software SPSS 26.0 (SPSS Version 26.0. Armonk, NY: IBM Corp.; 2019).^[10]

RESULTS

The HIV prevalence among pregnant women in Karnataka was 0.53%, 0.36%, and 0.38% in 2013, 2015, and 2017, respectively. The distribution and HIV prevalence of the pregnant women based on their sociodemographic characteristics are shown in Table 1. The factors significantly associated with infection risk were age, education, and the "living with" status of the pregnant mothers [Table 1]. In 2013–2017, 12 districts in Karnataka exhibited an overall HIV prevalence of 0.5 and above among pregnant women [Figure 1].

Age-specific factors associated with HIV prevalence

Within the younger mothers (15–24 years), risk factors significantly associated with higher prevalence were illiteracy,

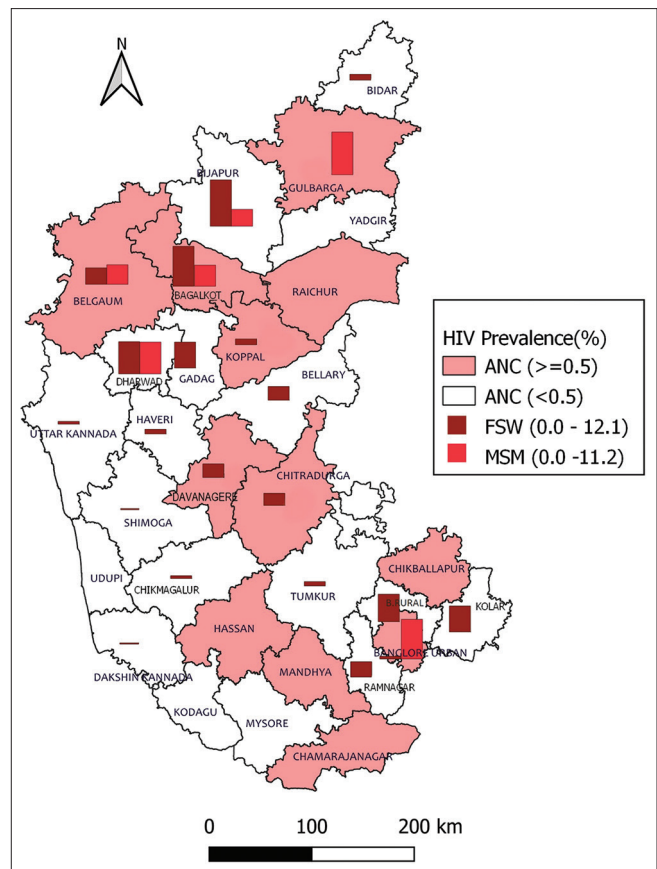


Figure 1: Schematic representation of Karnataka state map showing districts with average HIV prevalence of 0.5% and above during 2013–2017 and HIV prevalence among female sex workers (maroon bars) and men who have sex with men (pink bars) represented in bar graphs. ANC: Antenatal care

being self-employed/owning a large business, and spouse being truckers. Within the older mothers (25–49 years), the risk factors were illiteracy, primigravida, never married, or having a dissolved marriage [Table 2].

DISCUSSION

Comparing the decadal trend in Karnataka, a HIV prevalence of 0.86% was recorded among pregnant mothers in 2007.^[7] The prevalence has gradually declined to 0.38% in 2017 [Figure 2], with a noticeable stabilization, during the last two rounds of HSS. Specifically, a higher HIV prevalence was observed among the HRGs (female sex worker [FSW] and/or men who have sex with men [MSM])^[3] as represented by bar graphs, in and around the 12 districts with an overall prevalence of 0.5 and above among ANC attendees [Figure 1]. This suggests that the high HIV prevalence among the HRGs reflects on the HIV prevalence of the general population.

Traditional sex trade, the Devadasi tradition, is more prevalent in northern Karnataka, correlating to the higher prevalence among FSWs in Bagalkot, Bijapur, and Belgaum districts.^[3,5] HIV prevalence among HRGs and ANC attendees, shows confinement of HIV in the northern and southern districts of

Table 1: Factors associated with HIV infection (2013-2017) in Karnataka state, India

Variable	n (%)	HIV prevalence	OR (95% CI)	P	aOR (95% CI)	P
Age group (years)						
15-24	47,954 (64.6)	0.38	1		1	
25-49	26,324 (35.4)	0.52	1.39 (1.11-1.74)	0.004**	1.34 (1.07-1.68)	0.010*
Education						
Literate	63,809 (86.0)	0.39	1		1	
Illiterate	10,378 (14.0)	0.68	1.78 (1.37-2.32)	<0.001***	1.69 (1.30-2.12)	<0.001***
Living with						
Spouse	73,962 (99.9)	0.42	1		1	
NA [#]	106 (0.1)	3.77	9.23 (3.38-25.21)	<0.001***	8.32 (3.03-22.82)	<0.001***

*Significant at 5% level ($P<0.05$); **Significant at 0.5% level ($P<0.005$); ***Significant at 0.1% level ($P<0.001$); [#]Never married/separated/widowed/divorced. OR: Odds ratio, CI: Confidence interval, aOR: Adjusted odds ratio, NA: Not available

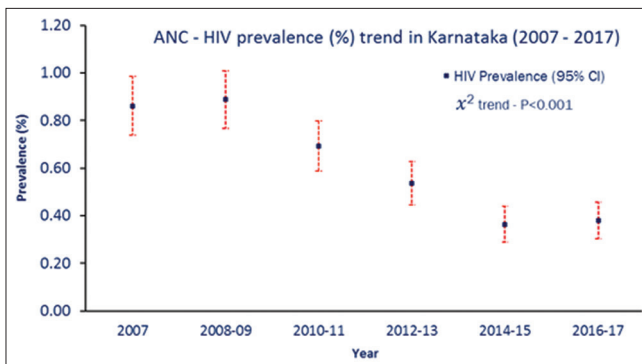


Figure 2: HIV prevalence trend among pregnant mothers attending antenatal care clinic in Karnataka over 10 years

Karnataka. Given that a major proportion of the respondents were homemakers, probability of the women acquiring the infection from their spouses is higher. Although this study is inconclusive about the HIV status of the respondents' spouses, previous studies have reported that heterosexual act contributes to about 87% of HIV transmission.^[11] Accordingly, about 84% of the infected pregnant mothers in Karnataka included in the study were homemakers. Hence, it would be appropriate to assume that the disease transmission to these women, has been primarily through heterosexual route through their spouses who are most likely to be the clients of FSWs or MSM.

To define the disease confinement in Karnataka, the 12 districts with a combined HIV prevalence of 0.5 and above in the last three rounds of HSS were considered. These 12 districts accounted to about 60% of the total infected cases in Karnataka. Further, to understand the transmission trend, occupation of the respondents' spouse was analyzed. The results indicated that about 46.8% of the infected mothers were spouses of laborers (agricultural/nonagricultural) and 16.3% of the infected mothers were spouses of transport workers (local/long-distant truckers [LDTs]).

Education, early marriage, and early childbearing

The higher the education, the lower has been the risk of acquiring the infection. Apart from general awareness, education eliminates the prevailing social stigma on HIV, facilitating better management. According to the National

Family and Health Survey-4, in Karnataka, literacy among women was higher in the urban regions than that in the rural regions. More specifically, lower literary rates were recorded in the northern districts of Karnataka than the western and southern districts, which reflected on the age of marriage and childbearing of women.^[12] The proportion of child marriage and teen pregnancies was comparatively higher in the northern Karnataka districts. Ignorance of young women owing to their lower literacy rate, early marriage, and early childbearing are potential risk factors associated with HIV infection.^[13-15] Measures to eliminate child marriages and early pregnancies in northern Karnataka can reduce the risk of disease transmission. While about 50% of women and about 65.9% of men in Karnataka were aware that consistent condom use prevents HIV, the comprehensive knowledge on HIV/AIDS was as low as 9.5% among women and 26.3% among men in Karnataka.^[12] This indicates that high levels of misconception of HIV and its transmission prevail among the general population, that need to be addressed.

Migration

Northern Karnataka is comparatively underdeveloped by infrastructure and basic facilities with when compared to South Karnataka.^[16] Outmigration among laborers to neighboring districts and states is common in northern Karnataka.^[17] Specifically, seasonal migration of agricultural laborers and agricultural cultivators with marginal income, from rural regions of North Karnataka to Maharashtra, has been reported.^[18] Concurrently, considerable outmigration of FSWs between the borders of Karnataka–Maharashtra in the districts of Bagalkot, Bijapur, and Belgaum has also been reported. Migrant and mobile FSWs often fail to negotiate safe sex practices, resulting in increased infection risk.^[19] This suggests a correlation between the high HIV prevalence among FSW and pregnant women in North Karnataka, wherein the seasonal migrants could play a substantial role in the disease spread.

Transport workers

While the Targeted Interventions (TIs) focus on truckers, local transport workers are often neglected. The spouses of the infected women were mostly laborers and transport workers,

Table 2: Age-specific factors associated with HIV infection (2013-2017) in Karnataka

Variables	Age (years)				χ^2 test [@] , P
	15-24		25-49		
	HIV (%)	OR (95% CI)	HIV (%)	OR (95% CI)	
Education					
Literate	0.35	1	0.46	1	0.024*
Illiterate	0.60	1.73 (1.19-2.52)**	0.79	1.71 (1.17-2.50)**	0.236
Order of current pregnancy					
First	0.39	1	0.68	1	0.002**
Second	0.37	0.93 (0.68-1.28)	0.47	0.69 (0.46-1.03)	0.169
Third	0.32	0.89 (0.43-1.57)	0.47	0.69 (0.43-1.11)	0.200
Fourth/more	0.00	0.00	0.46	0.68 (0.33-1.39)	0.290
Residence					
Urban	0.34	1	0.48	1	0.049*
Rural	0.40	1.19 (0.88-1.61)	0.53	1.10 (0.78-1.56)	0.042*
Occupation respondent					
Agricultural laborer	0.49	1	0.59	1	0.577
Nonagricultural laborer	0.29	0.59 (0.20-1.73)	0.70	1.19 (0.48-2.93)	0.139
Domestic servant	0.12	0.25 (0.06-1.08)	0.60	1.02 (0.34-3.08)	0.042*
Skilled/semi-skilled worker	0.20	0.41 (0.06-3.08)	0.54	0.92 (0.36-2.37)	0.338
Petty business/small shop	0.52	1.08 (0.14-8.11)	0.00	-	0.361
Large business/self employed	4.26	9.12 (2.06-40.30)**	0.00	-	0.245
Service (government/private)	0.47	0.97 (0.22-4.16)	0.33	0.57 (0.16-1.96)	0.707
Student	0.77	1.59 (0.21-11.97)	0.00	-	0.694
Agricultural cultivator/landholder	0.49	1.01	1.20	2.50 (0.59-7.15)	0.307
Homemaker	0.37	0.77 (0.48-1.24)	0.51	0.86 (0.50-1.48)	0.018*
Occupation spouse					
Agricultural laborer	0.42	1	0.50	1	0.466
Nonagricultural laborer	0.39	0.94 (0.62-1.41)	0.45	0.91 (0.54-1.53)	0.518
Skilled/semi-skilled worker	0.29	0.69 (0.39-1.22)	0.37	0.75 (0.38-1.49)	0.482
Petty business/small shop	0.34	0.83 (0.45-1.55)	0.71	1.44 (0.77-2.71)	0.049*
Large business/self employed	0.38	0.91 (0.32-2.53)	0.43	0.86 (0.26-2.85)	0.863
Service (government/private)	0.24	0.57 (0.29-1.14)	0.34	0.69 (0.33-1.42)	0.419
Student	3.23	8.00 (1.07-59.97)	0.00	-	0.684
Hotel staff	0.00	0.00	1.11	2.25 (0.98-5.19)	0.006*
Truck driver/helper	0.99	2.40 (1.24-4.97)*	1.21	2.47 (1.01-6.00)	0.688
Local transport worker [§]	0.40	0.97 (0.55-1.70)	0.57	1.16 (0.57-2.34)	0.356
Agricultural cultivator/landholder	0.38	0.91 (0.50-1.67)	0.60	1.22 (0.60-2.47)	0.241
Unemployed	0.00	0.00	2.27	4.67 (0.62-35.11)	0.208
Living with					
Spouse	0.38	1	0.51	1	0.007*
NA [#]	1.33	3.59 (0.50-25.96)	9.68	20.87 (6.27-69.48)***	0.040*
Spouse migration					
No	0.37	1	0.50	1	0.011*
Yes	0.47	1.27 (0.31-5.13)	1.26	2.54 (0.93-6.90)	0.237

*Significant at 5% level ($P < 0.05$), **Significant at 0.5% level ($P < 0.005$), ***Significant at 0.1% level ($P < 0.001$), @Comparison of HIV prevalence between the age groups (15-24 vs. 25-49); #Never married/separated/widowed/divorcee, §Local transport workers include auto/taxi driver, hand cart pullers, rickshaw pullers etc.. OR: Odds ratio, CI: Confidence interval, NA: Not available

however the proportion varied between the regions. Majority of the infected women reported their spouse occupation to be laborer in the North, whereas in the South, almost half of the infected women reported their spouse occupation to be transport workers. Besides, the HIV prevalence among long-distant workers was reported as 2% in Bengaluru urban in 2017.^[3] The TIs for LDT in Karnataka have been gradually reduced since 2007 and currently only three are operational.^[20] Expansion of

TIs for LDTs along with integrated TIs for all transport workers at identified hotspots, especially in South Karnataka districts, might curb disease transmission in these regions.

Based on the data from the rounds of HSS, a high prevalence of HIV was observed in North and South Karnataka, as compared to that of the central and west regions. However, heterogeneity exists in the pattern of HIV transmission. From the analysis of

the HIV-infected pregnant women, it is suggested that seasonal migration of laborers in North Karnataka and transport workers in South Karnataka, alongside high HIV prevalence among HRGs, might be the underlying causes of disease transmission. Hence, decentralized, region-specific interventions are recommended to achieve accelerated declining trend, which is the need of the hour.

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Conflicts of interest

There are no conflicts of interest.

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