

Gender differences, routes of transmission, socio-demographic characteristics and prevalence of HIV related infections of adults and children in an HIV cohort from a rural district of India

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Abstract

Despite 67% of HIV infected people in India are rural residents, the epidemiology of HIV in rural areas is not well known. This is an observational cohort study of 11,040 HIV infected people living in a rural district of India. The prevalence of hepatitis B, hepatitis C and syphilis of HIV infected patients were compared to the seroprevalence in 16,641 blood donors from the same area. The age of diagnosis in adults was below 35 years in 70% of cases and 56% were illiterate. One third of women were widows and only 3.6% of adults had a permanent job. Women were diagnosed at earlier age, had lower level of education, had poorer employment conditions and depended more on their relatives than men. In a survey performed to a subgroup of patients, 81% of women referred to have acquired HIV from their spouse, whereas 51% of men acquired HIV from commercial sex. Patients with HIV had significantly higher prevalence of hepatitis B, hepatitis C and syphilis than blood donors. Seroprevalence of HIV-2, hepatitis C and toxoplasmosis were low compared to other sites. Six percent were children (<15 years) and almost half of them had lost one or both of their parents. The study shows the poor socio-economical situation and the high level of illiteracy of people living with HIV in rural India, especially women. Future health programmes of HIV in India should take into account the particularities of the HIV epidemic in rural areas.

Introduction

It is estimated that 2.4 millions of HIV infected people are living in India,¹ which means that the country has the largest burden

of people living with HIV in Asia and is the third country of the world in terms of HIV infected people. Despite that 67% of HIV infected people live in rural areas,² the epidemiology of HIV in rural India is not well known and rural residents have been under-represented in previous studies.³

Except for some northern states, the route of transmission of HIV in India is mainly through heterosexual contacts.¹ Current prevention strategies are based on the assumption that the primary drivers of the epidemic are high risk groups, principally commercial sex workers and men who have sex with men, who transmit the virus to a male bridge population. This bridge population, mainly migrants and truckers, extend the transmission to their female sexual partner and from them to their children. However, recent epidemiological studies suggest a more generalized distribution of HIV in the population.^{4,5}

The aim of this study is to describe socio-demographic and economical characteristics, mechanisms of transmission of HIV and the seroprevalence of HIV related communicable diseases in an HIV cohort from a rural district of India.

Materials and Methods

Andhra Pradesh is the state with highest burden of HIV in India.⁶ Anantapur is a district situated in the South border of Andhra Pradesh with 72% of rural population and adult literacy rate of 74.1% in men and 54.3% in women.⁷ Rural Development Trust (RDT) is a non-governmental organization who has three hospitals in Anantapur. In these hospitals, medical care of HIV infected people is given free of cost, including medicines and consultation or admission charges. In Bathalapalli Hospital, the biggest hospital of RDT, outpatient clinics and 71 beds are allocated exclusively for HIV infected patients where they can receive free specialized medical care for their opportunistic infections or any other health problem. Hence, most of people living with HIV in the district have visited our hospitals.

The Vicente Ferrer HIV Cohort Study (VFHCS) is an open cohort study of all HIV infected patients who have been visited in RDT hospitals since June 2006. Data from patients were collected prospectively since September 2009, and retrospectively from June 2006 to September 2009. Details of route of transmission, HIV associated risk factors and socio-demographic data are collected at enrolment.

All patients from the district of Anantapur who were enrolled in the VFHCS until September 8th 2011 were included in this study. The community of patients was selected by

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self-identification. Scheduled caste community is the lowest caste in the traditional Hindu caste hierarchy and, therefore, suffers social and economic exclusion and disadvantage. Scheduled tribe community is generally geographically isolated with limited economic and social contact with the rest of the population. Other backward castes are a collection of *intermediate* castes that were considered low in the traditional caste hierarchy, but above scheduled castes.⁵

Because patients can be reluctant to reveal information regarding the way of acquisition of HIV and regarding patterns of sexual behaviour, during the month of April 2011 we performed a survey of patients who attended the outpatient clinics of Bathalapalli Hospital. Patients were requested to fill an anonymous questionnaire and place the answers in a box for maintaining confidentiality about the responses. Never the less, in patients who were not able to read or to write, the questionnaire was filled by a counsellor after an interview with the patient.

Hepatitis B surface antigen (HBs Ag) and

Venereal Disease Research Laboratory (VDRL) test are investigated routinely in all patients. Serology of hepatitis C and toxoplasmosis were requested also routinely until September 2009, so the seroprevalence of these infections were calculated utilizing results obtained before September 2009. To compare seroprevalences of HIV infected people with the general population, serology of syphilis, hepatitis C, hepatitis B and HIV of blood donors were obtained from the blood bank records of Bathalapalli Hospital from January 2009 to September 26th 2011.

Statistical analysis was performed using Stata Statistical Software (Stata Corporation. Release 11. College Station, Texas, USA). The study was approved by the ethical committee of the RDT Institutional Review Board.

Results

There were 11040 patients included in the study. Of them, 667 (6%) were diagnosed at age below 15 years and 10373 (94%) were diagnosed at age above 15 years. Socio-demographic characteristics of adults are described in Table 1. The proportion of male patients was 54%. Almost 70% of adults were diagnosed at age below 35 years, and women were diagnosed at younger age than men. The proportion of widowed patients was significantly higher in women. In general, men had less number of children and higher level of education. The proportion of women living in other relatives' houses was higher than in men. The number of men working as unskilled daily labourers was significantly lower than women, even though 25% of women were working as homemakers. Monthly income was above 4000 Indian Rupees (approximately 20\$) in only 40% of patients, 23% of women and 53% of men. In both sexes, the job insecurity was very important as only 3.7% of patients had a permanent contract. More than 60% of males had a history of smoking or consuming alcohol *versus* less than 1% of females.

The most common transmission route was heterosexual transmission (88.2%) followed by vertical transmission (5.7%), unknown route of transmission (4.7%), blood transfusion (1.2%) and homosexual transmission (0.17%). Routes of HIV transmission in adults and HIV associated risk factors are described in Table 2. In up to 21% of men, the HIV status of the living wife was not known. In 7% of women, the first partner was HIV negative. The proportion of sexual transmitted diseases was similar in both sexes. Women received more often blood transfusions than men. The number of men who used intravenous drugs was very small.

Out of 1027 patients, 994 accepted to participate in a survey for studying mechanisms of transmission of HIV (Table 3). In illiterate

Table 1. Socio-demographic characteristics of HIV infected adults.

	Total N (%)	Women N (%)	Men N (%)	P-value
Age at diagnosis (years)				<0.001
15-25	2547 (24.55)	1783 (37.74)	764 (13.52)	
25-35	4498 (43.36)	1916 (40.56)	2582 (45.71)	
35-45	2281 (21.99)	739 (15.64)	1542 (27.3)	
>45	1047 (10.09)	286 (6.05)	761 (13.47)	
Marital status				<0.001
Single	564 (5.57)	51 (1.1)	513 (9.33)	
Married	7088 (70.05)	2716 (58.78)	4372 (79.52)	
Separated	551 (5.44)	311 (6.73)	240 (4.37)	
Widowed	1916 (18.93)	1543 (33.39)	373 (6.78)	
Number of children				<0.001
0	2695 (25.98)	1031 (21.82)	1664 (29.46)	
1	3469 (33.44)	1734 (36.71)	1735 (30.71)	
2	2966 (28.59)	1393 (29.49)	1573 (27.85)	
3	939 (9.05)	435 (9.21)	504 (8.92)	
>3	304 (2.93)	131 (2.77)	173 (3.06)	
Community				<0.001
Other caste	2496 (24.06)	1060 (22.44)	1436 (25.42)	
Other backward caste	4846 (46.72)	2206 (46.7)	2640 (46.73)	
Scheduled caste	2235 (21.55)	1059 (22.42)	1176 (20.82)	
Scheduled tribe	796 (7.67)	399 (8.45)	397 (7.03)	
Education				<0.001
Higher	320 (3.18)	83 (1.81)	237 (4.33)	
Secondary	2579 (25.64)	885 (19.28)	1694 (30.97)	
Primary	1603 (15.94)	540 (11.76)	1063 (19.44)	
No education	5557 (55.24)	3082 (67.15)	2475 (45.26)	
Literacy				<0.001
Able to read and write	3984 (39.62)	1327 (28.95)	2657 (48.56)	
Able to read	464 (4.61)	164 (3.58)	300 (5.48)	
Illiterate	5607 (55.76)	3092 (67.47)	2515 (45.96)	
Living with				<0.001
Spouse	6797 (67.08)	2539 (54.98)	4258 (77.21)	
Parents	1144 (11.29)	552 (11.95)	592 (10.73)	
Relatives	294 (2.9)	198 (4.29)	96 (1.74)	
Son or daughter	1301 (12.84)	1025 (22.2)	276 (5)	
Alone	574 (5.66)	292 (6.32)	282 (5.11)	
In orphanage	23 (0.23)	12 (0.26)	11 (0.2)	
Occupation				<0.001
Own business	403 (3.99)	77 (1.68)	326 (5.92)	
Student	102 (1.01)	37 (0.81)	65 (1.18)	
Unskilled daily labourer	4706 (46.59)	2468 (53.72)	2238 (40.65)	
Driver	658 (6.51)	2 (0.04)	656 (11.91)	
Factory worker	39 (0.39)	8 (0.17)	31 (0.56)	
Farmer	803 (7.95)	111 (2.42)	692 (12.57)	
Health worker	116 (1.15)	91 (1.98)	25 (0.45)	
Housewife	1177 (11.65)	1177 (25.62)	0 (0)	
Others	1765 (17.48)	474 (10.32)	1291 (23.45)	
Sex worker	16 (0.16)	15 (0.33)	1 (0.02)	
Never worked	182 (1.8)	93 (2.02)	89 (1.62)	
Weaver	133 (1.32)	41 (0.89)	92 (1.67)	
Monthly income (INR*)				<0.001
<1000	4062 (42.22)	1976 (46.4)	2086 (38.91)	
1001 - 2000	1719 (17.87)	588 (13.81)	1131 (21.1)	
2001 - 3000	614 (6.38)	154 (3.62)	460 (8.58)	
>3000	1528 (15.88)	262 (6.15)	1266 (23.61)	
Not applicable	1697 (17.64)	1279 (30.03)	418 (7.8)	
Type of job contract				<0.001
Permanent	316 (3.66)	144 (3.68)	172 (3.64)	
Temporal	6624 (76.74)	2672 (68.32)	3952 (83.71)	
Unemployed	1692 (19.6)	1095 (28)	597 (12.65)	

To be continued on next page

patients, 53% of women and 35% of men, the survey was not anonymous as they needed the help of a counsellor for answering the questions. The survey population had slightly higher level of education and higher proportion of female patients than the cohort population. Migration was more common if men. Half of women did not have an active sexual life compared to 22% of men. In patients with active sexual life, 62% used condom in all occasions, 17% sometimes and 21% never used condoms. More than half of men acquired HIV infection through contacts with commercial sex workers, whereas women acquired HIV mainly from their spouse. However, 44% of men did not acquire HIV from commercial sex or their spouse. This group had higher level of education ($P=0.048$) and lower number of sexual partners ($P<0.001$). In women, transmission of HIV other than from their husband was related to having higher number of sexual partners ($P=0.012$). The number of sexual partners was higher in men than in women. In men, having four or more sexual partners was related to previous migration ($P=0.017$) and acquisition of HIV through commercial sex ($P<0.001$).

The prevalence of HIV among 16641 blood donors was 0.32%. Seroprevalence of hepatitis C serology, HBs Ag and VDRL test among the blood donors were 0.07%, 2.52% and 0.16% respectively. Patients with HIV infection had significant higher prevalence of hepatitis C, HBs Ag and VDRL test than blood donors ($P<0.001$ in the three cases). Seroprevalences in HIV patients are presented in Table 4. HIV type 2 was more prevalent in women, whereas HBs Ag was more prevalent in men.

Children are described in Table 5. The proportion of males and females was similar. Only 10% of children were diagnosed before aged 18 moths and 49% of them had lost both or one of their parents. Community distribution in children was similar to adults. Almost 46% of children were not studying. As expected, the most important route of transmission was from mother to child, although it was observed that 8% of female children were infected through heterosexual contacts. None of the children was infected by HIV type 2.

Discussion

In this rural setting, the routes of HIV transmission were similar to those described in other parts of India, except for the lower proportion of people infected through homosexual sex or injecting drug use.⁶ In accordance to the information provided by the National Aids Control Organization (NACO) of India,⁶ we found that 90% of sexual partners of HIV infected women in whom the HIV status was known were HIV infected. However, in the sur-

Table 1. Continued from previous page.

	Total N (%)	Women N (%)	Men N (%)	P-value
House				<0.001
Owned	4368 (47.83)	2016 (47.72)	2352 (47.93)	
Rented	2853 (31.24)	1417 (33.54)	1436 (29.26)	
None	1369 (14.99)	601 (14.22)	768 (15.65)	
Others	542 (5.94)	191 (4.52)	351 (7.15)	
Land property				<0.001
Yes	1164 (12.81)	434 (10.33)	730 (14.94)	
Rented	68 (0.75)	7 (0.17)	61 (1.25)	
Others	215 (2.37)	103 (2.45)	112 (2.29)	
No	7642 (84.08)	3659 (87.06)	3983 (81.52)	
Alcohol consumption				<0.001
Current	1689 (17.15)	15 (0.34)	1674 (30.63)	
Previous	1787 (18.15)	25 (0.57)	1762 (32.24)	
Never	6372 (64.7)	4343 (99.09)	2029 (37.13)	
Smoker				<0.001
Current	1794 (18.23)	11 (0.25)	1783 (32.62)	
Previous	1722 (17.5)	22 (0.5)	1700 (31.1)	
Never	6325 (64.27)	4342 (99.25)	1983 (36.28)	

*INR, Indian Rupee (1 American \$=50 INR, approximately).

Table 2. Seroprevalence of infections related to HIV in adults.

	Total N (%)	Women N (%)	Men N (%)	P-value
Transmission route				<0.001
Heterosexual	9502 (93.42)	4096 (88.66)	5406 (97.39)	
Unknown	508 (4.99)	414 (8.96)	94 (1.69)	
Blood transfusion	128 (1.26)	100 (2.16)	28 (0.5)	
Homosexual	18 (0.18)	0 (0)	18 (0.32)	
Vertical	15 (0.15)	10 (0.22)	5 (0.09)	
First partner				<0.001
Alive, HIV negative	1723 (18.3)	304 (6.8)	1419 (28.7)	
Died, HIV negative	14 (0.1)	6 (0.1)	8 (0.2)	
Alive, HIV positive	4029 (42.8)	2005 (45)	2024 (40.9)	
Died, HIV positive	1154 (12.3)	997 (22.4)	157 (3.2)	
Alive, HIV unknown	1658 (17.6)	599 (13.5)	1059 (21.4)	
Died, HIV unknown	826 (8.8)	542 (12.2)	284 (5.7)	
Contraceptive method				<0.001
Condom	2103 (22.44)	568 (13.07)	1535 (30.54)	
Tubectomy	1630 (17.39)	1530 (35.2)	100 (1.99)	
Vasectomy	2 (0.02)	2 (0.05)	0 (0)	
Others	6 (0.06)	3 (0.07)	3 (0.06)	
None	2055 (21.92)	780 (17.94)	1275 (25.37)	
Not applicable	3577 (38.16)	1464 (33.68)	2113 (42.04)	
Previous sexual transmitted diseases		0.28		
No	9216 (93.22)	4096 (93.47)	5120 (93.02)	
Yes	584 (5.91)	255 (5.82)	329 (5.98)	
No answer	86 (0.87)	31 (0.71)	55 (1)	
Previous blood transfusion				<0.001
No	10029 (98.58)	4507 (97.51)	5522 (99.48)	
Yes	144 (1.42)	115 (2.49)	29 (0.52)	
Previous intravenous drug use				0.041
No	10167 (99.95)	4620 (100)	5547 (99.91)	
Yes	5 (0.05)	0 (0)	5 (0.09)	

vey performed to 944 patients who attended the outpatient clinic in April 2011, almost 44% of men denied to have acquired HIV from commercial sex workers or their spouse, and this group had higher level of education and lower number of life sex partners than those who acquired the infection through commercial sex workers. Data from the National Behavioural

Surveillance Survey in 2006,⁸ showed that the proportion of people aged 15-24 years who had sex with non-regular partner in the last 12 months in rural Andhra Pradesh was 17.4%, 30.5% of men and 3.7% of women, and 38% did not use condom. These findings indicate that the HIV epidemic in India is evolving from a high risk group concentrated epidemic to a

more generalized distribution of HIV in the population.

The results of this study show the poor socio-economical situation that people living with HIV are enduring in this rural setting, especially women and children. Women are infected of HIV at younger age, have lower levels of education, depend more often on the

Table 3. Characteristics and responses of patients who participated in a survey to investigate mechanisms of transmission of HIV.

	Total (N=994)	Women (N=533)	Men (N=461)
Education			
Higher	35 (3.54)	9 (1.7)	26 (5.66)
Secondary	294 (29.76)	119 (22.5)	175 (38.13)
Primary	157 (15.89)	74 (13.99)	83 (18.08)
No education	502 (50.81)	327 (61.81)	175 (38.13)
Migration			
No	804 (80.89)	496 (93.06)	308 (66.81)
Yes	190 (19.11)	37 (6.94)	153 (33.19)
Condom use			
Always	366 (38.89)	160 (31.87)	206 (46.92)
Sometimes	104 (11.05)	41 (8.17)	63 (14.35)
Never	124 (13.18)	50 (9.96)	74 (16.86)
No sex	347 (36.88)	251 (50)	96 (21.87)
Way of HIV transmission			
Commercial sex	245 (25.03)	14 (2.65)	231 (51.33)
Spouse	448 (45.76)	428 (80.91)	20 (4.44)
Others	286 (29.21)	87 (16.45)	199 (44.22)
Number of sexual partners			
1	142 (33.02)	78 (77.23)	64 (19.45)
2	117 (27.21)	14 (13.86)	103 (31.31)
3	47 (10.93)	2 (1.98)	45 (13.68)
4	43 (10)	2 (1.98)	41 (12.46)
>4	81 (18.84)	5 (4.95)	76 (23.1)

Table 4. Seroprevalence of infections related to HIV in adults.

	Total N (%)	Women N (%)	Men N (%)	P-value
HIV type				<0.001
HIV 1	7954 (99.35)	3454 (98.97)	4500 (99.65)	
HIV 2	52 (0.65)	36 (1.03)	16 (0.35)	
Toxoplasma serology				0.976
Negative	708 (85.3)	297 (85.34)	411 (85.27)	
Positive	122 (14.7)	51 (14.66)	71 (14.73)	
VDRL test				0.137
Negative	4551 (92.54)	2005 (93.17)	2546 (92.05)	
Positive	367 (7.46)	147 (6.83)	220 (7.95)	
Hepatitis C serology				0.645
Negative	765 (98.71)	327 (98.49)	438 (98.87)	
Positive	10 (1.29)	5 (1.51)	5 (1.13)	
Hepatitis B surface Ag				<0.001
Negative	4592 (92.51)	2055 (95.05)	2537 (90.54)	
Positive	372 (7.49)	107 (4.95)	265 (9.46)	

HBs Ag, Hepatitis B surface antigen; VDRL, Venereal Disease Research Laboratory.

Table 5. Description of HIV infected children.

	N (%)
Sex	
Male	329 (49.33)
Female	338 (50.67)
Age at diagnosis (years)	
0-1.5	70 (10.49)
1.5-5	273 (40.93)
5-10	221 (33.13)
10-15	103 (15.44)
Parents	
Alive	316 (50.97)
Father died	160 (25.81)
Both died	85 (13.71)
Mother died	59 (9.52)
Living with	
Parents	508 (80.51)
Relatives	85 (13.47)
In orphanage	17 (2.69)
Alone	2 (0.32)
Spouse	19 (3.01)
Community	
Other caste	142 (21.29)
Other backward caste	327 (49.03)
Scheduled caste	152 (22.79)
Scheduled tribe	46 (6.9)
Occupation	
Not studying	261 (41.3)
Student	340 (53.8)
College student	3 (0.47)
Unskilled daily labourer	15 (2.37)
Housewife	6 (0.95)
Others	7 (1.12)
Transmission route	
Vertical	600 (94.34)
Heterosexual	32 (5.03)
Blood transfusion	1 (0.16)
Unknown	3 (0.47)
HIV type	
HIV 1	487 (100)
Toxoplasma serology	
Negative	111 (97.37)
Positive	3 (2.63)
VDRL test	
Negative	285 (95.96)
Positive	12 (4.04)
Hepatitis C serology	
Negative	111 (99.11)
Positive	1 (0.89)
Hepatitis B surface Ag	
Negative	333 (97.37)
Positive	9 (2.63)

HBs Ag, Hepatitis B surface antigen; VDRL, Venereal Disease Research Laboratory.

support of other relatives and have poorer economical and occupational situations than HIV infected men. Moreover, one third of the women were widows. In a survey of 2068 HIV households in India, it was observed a similar age distribution and marital status, except for a higher proportion of unmarried persons than in our cohort.⁹ However, the proportion of illiteracy was 24% in men and 30% in women, which is lower than ours, and the job situations was also better, as 23% of men and 13% of women were salary earners and only 25% of men and 28% of women were unskilled daily labourer. It is noteworthy that 10% of the patients were diagnosed at age above 45 years, which is similar to the proportion described in some American and European cohorts.^{10,11}

According to NACO, the proportion of women infected by HIV is increasing steadily,⁶ and it was estimated to be 39% in 2009. In our study, 46% of people living with HIV were women. These data show a progressive feminization of the HIV epidemic in India. Moreover, in up to 24% of men's sexual partners who were alive, HIV was not tested suggesting the difficulties for HIV infected men to disclose their infection to their partners.

Although it is estimated that 3.5% of the 2.4 million of people living with HIV in India are children,¹ epidemiological data of paediatric HIV in India are scarce. In this study, half or the children were orphans, which is in accordance to the proportion of orphan children found in other Indian studies performed in urban settings.^{12,13}

Compared to two previous seroprevalence studies among blood donors in two urban hospitals in the North of India,^{14,15} we found similar proportions of hepatitis B and HIV infections and lower proportion of syphilis and hepatitis C. In HIV patients, hepatitis B was more common and hepatitis C was more rare than previously reported in other sites of India,^{16,17} probably because of the higher proportion of heterosexual transmission in our area. The proportion of HIV type 2 was also lower than in other studies from South India.¹⁸ As seen in some studies in Africa,^{18,19} HIV-2 was more common in women than in men, although the reason for this finding is not clear. Toxoplasmosis serology was also less common than in other Indian study,²⁰ perhaps reflecting the lack of meat and row vegetable in the diet of this area.

The study has some limitations. Patients may have been reluctant to reveal aspects related to the route of transmission or sexual behaviour. Although we tried to avoid this problem passing an anonymous questionnaire to the patients, this was not possible in 45% of them due to illiteracy.

In conclusion, the results of this study add new epidemiological information of the HIV

infection in rural India and show the important differences between men and women. HIV infected people from this area live in a very poor socio-economical situation with high level of illiteracy, unstable jobs and low salaries. This situation is especially delicate in women and children as one third of women are widows and almost half of children have lost at least one of their parents. We found that homosexual and intravenous drug use transmissions are rare in this rural setting. The study also shows that a sizable proportion of men did not acquire HIV from commercial sex workers, suggesting that the high risk group model for HIV transmission may not be fully applicable in this area, especially among people with higher levels of education. Future HIV preventive measures and health programmes in India should take into account the particularities of the HIV epidemic in rural areas.

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