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, 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, the epidemiology of HIV in rural India is not well known and rural residents have been under-represented in previous studies.

Except for some northern states, the route of transmission of HIV in India is mainly through heterosexual contacts. 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.

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. 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.

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 heath 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 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 inter-mEDIATE castes that were considered low in the traditional caste hierarchy, but above scheduled castes.

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 questionaire 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 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 women received more transfusions than 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 less than 1% of females.

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

| Marital status      | Total   | Women   | Men   |
|---------------------|---------|---------|-------|
| Single              | 564 (5.57) | 51 (1.1) | 513 (9.33) |
| Married             | 7088 (70.85) | 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  | Total   | Women   | Men   |
|---------------------|---------|---------|-------|
| 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 (27.83) |
| 3                   | 939 (9.05) | 435 (9.21) | 504 (8.92) |
| >3                  | 304 (2.93) | 131 (2.77) | 173 (3.06) |

| Community            | Total   | Women   | Men   |
|----------------------|---------|---------|-------|
| 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            | Total   | Women   | Men   |
|----------------------|---------|---------|-------|
| Higher               | 320 (3.18) | 83 (1.81) | 237 (4.33) |
| Secondary            | 2579 (25.04) | 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             | Total   | Women   | Men   |
|----------------------|---------|---------|-------|
| Able to read and write | 3984 (39.62) | 1227 (25.95) | 2657 (48.56) |
| Able to read         | 464 (4.61) | 164 (3.58) | 300 (5.48) |
| Illiterate           | 5007 (49.76) | 3092 (67.47) | 2515 (45.96) |

| Living with          | Total   | Women   | Men   |
|----------------------|---------|---------|-------|
| 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           | Total   | Women   | Men   |
|----------------------|---------|---------|-------|
| 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 (17.46) | 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*) | Total   | Women   | Men   |
|-----------------------|---------|---------|-------|
| <1000                 | 4062 (42.22) | 1976 (46.4) | 2086 (38.91) |
| 1001 - 2000           | 1719 (17.87) | 588 (13.81) | 1131 (21.11) |
| 2001 - 3000           | 614 (6.38) | 154 (3.62) | 460 (8.58) |
| >3000                 | 5128 (51.88) | 262 (6.15) | 1266 (23.61) |
| Not applicable        | 1697 (17.64) | 1279 (30.03) | 418 (7.8) |

| Type of job contract  | Total   | Women   | Men   |
|-----------------------|---------|---------|-------|
| Permanent             | 316 (3.66) | 144 (3.88) | 172 (3.24) |
| Temporal              | 6624 (76.74) | 2672 (68.32) | 3952 (71.91) |
| Unemployed            | 1692 (19.6) | 1005 (28) | 597 (10.65) |

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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. 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). 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).

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.\(^4\) In accordance to the information provided by the National Aids Control Organization (NACO) of India,\(^4\) 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 (13.0)  | 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 (5.88) |         |
| 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)   |         |

### 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.\(^4\) In accordance to the information provided by the National Aids Control Organization (NACO) of India,\(^4\) 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-

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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,\(^4\) 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 (36.89)  | 160 (31.87)   | 206 (46.92) |
| Sometimes                | 104 (10.15)  | 41 (8.17)     | 63 (13.45)  |
| Never                    | 124 (12.18)  | 50 (9.96)     | 74 (16.86)  |
| No sex                   | 347 (34.88)  | 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 (10.95)   | 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=994) | Women (N=533) | Men (N=461) | 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                 | 376 (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.
AIDS treatment and prevention measures in India should take into account the particularities of the HIV epidemic in rural areas.

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