



## Comparison of prevention of parent-to-child HIV transmission programme & national biennial HIV sentinel surveillance data for tracking HIV epidemic in India

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**Background & objectives:** HIV sentinel surveillance (HSS) among antenatal women in India has been used to track the epidemic for many years. However, reliable tracking at the local level is not possible as ANC sentinel sites are limited in number and cover a smaller sample size at each site. Prevention of parent-to-child-transmission (PPTCT) programme data has a potential advantage due to better geographical coverage, which could provide more precise HIV case estimates; therefore, we compared HSS ANC data with PPTCT programme data for HIV tracking.

**Methods:** Out of the 499 surveillance sites, where HSS and PPTCT programme was being conducted in 2015, 210 sites (140 urban and 70 rural) were selected using a stratified random sampling method. HSS (n=72,981) and PPTCT (n=112,832) data records were linked confidentially. The sociodemographic characteristics of HSS and PPTCT attendees were compared. HIV prevalence from HSS ANC was compared with the PPTCT programme data using Chi-square test. State- and site-level correlation of HIV prevalence was also done. Concordance between HSS and PPTCT HIV positivity was estimated using kappa statistics.

**Results:** The age distribution of HSS and PPTCT attendees was similar (range: 23 to 27 yr); however, HSS ANC participants were better educated, whereas PPTCT recorded a higher proportion of homemakers. The correlation of HIV prevalence between HSS and PPTCT was high (r=0.9) at the State level and moderate at the site level (r=0.7). The HIV positivity agreement between HSS ANC and PPTCT was good (kappa=0.633). A similar prevalence was reported across 26 States, whereas PPTCT had a significantly

lower prevalence than HSS in three States where PPTCT coverage was low. Overall HIV prevalence was 0.31 per cent in HSS and 0.22 per cent in PPTCT ( $P<0.001$ ).

**Interpretation & conclusions:** High-quality PPTCT programme data can provide reliable HIV trends in India. An operational framework for PPTCT-based surveillance should be pilot-tested in a phased manner before replacing HSS with PPTCT.

**Key words** HIV - prevalence - prevention - sentinel surveillance

India is home to the second highest population of people living with HIV after South Africa<sup>1</sup>, though its HIV prevalence at 0.22 per cent among adults is lower than in many countries<sup>2</sup>. HIV burden is estimated in India from the HIV Sentinel Surveillance (HSS) along with National Family Health Survey data<sup>3</sup>. However, the heterogeneity in epidemic levels, trends, patterns and progress made through HIV prevention calls for a better approach to surveillance.

The HSS is conducted among pregnant women in antenatal clinics (ANC) and key populations at community sites. The number of ANC sites has increased from 92 in 1998 to 856 in 2021. Out of 766 districts, 659 had one or more ANC sites. At each site, a consecutive sample of 400 pregnant women, who visit the ANC clinic for the first time during the three-month surveillance period, irrespective of previous visits to the clinic, are enrolled<sup>4</sup>. Without obtaining informed consent a questionnaire is administered, a blood sample is collected and unlinked anonymous testing is done for HIV, *i.e.* the test results are not provided to the participants, but data are used for estimation of HIV prevalence.

In most of the ANC-HSS sites, HIV testing is also done under the Prevention of Parent-to-Child-Transmission (PPTCT) Programme. The PPTCT programme aims to prevent the perinatal transmission of HIV<sup>5</sup>. The HIV test result is provided to the women and if diagnosed positive, free treatment and care services are provided. As on March 2022, there were 34,607 HIV Counselling and Testing Centres across India. The PPTCT programme coverage has increased from 40 per cent in 2014-15 to 84 per cent in 2021-22 and the target is to achieve universal coverage<sup>6</sup>.

Potentially, PPTCT programme data can also be utilized for HIV surveillance, provided it does not have selection bias at the facility or at the participants' level<sup>7</sup>, and the quality of data recording and reporting is ensured<sup>8</sup>. The HSS data from ANC sites are not considered to be representative of the pregnant women

population, as most of the HSS ANC sites are in urban settings. Moreover, all districts are not covered under HSS. The data are collected in a defined time frame of only three months<sup>9</sup>. The sample size is also small at the district level (400 to 800 depending on whether there are 1 or 2 sites in a district). Smaller sample size typically results in a larger confidence interval. On the other hand, PPTCT programme data have a larger sample size and cover rural areas also. Therefore, there is a policy debate about whether to use PPTCT programme data to determine the trends in HIV prevalence. It is assumed that there is no difference in the prevalence of HIV either estimated by ANC HSS or by PPTCT programme data. Hence, we compared HIV prevalence estimates from ANC-HSS and PPTCT programme data for tracking the epidemic in India.

### Material & Methods

The study was conducted in the department of Community Medicine & School of Public Health, Postgraduate Institute of Medical Education & Research (PGIMER), Chandigarh, from 2015 to 2018 using data collected between January and April 2015 from a sample of ANC HSS sites from across India where PPTCT programme also existed, after obtaining approval from the Institutional Ethics Committee.

**Sample size:** The prevalence of HIV among pregnant women obtained through HIV sentinel surveillance (HSS) and prevention of parent-to-child transmission (PPTCT) programme was considered to be 0.61 per cent and 0.68 per cent, respectively, based on a previous study<sup>10</sup>. Assuming the hypothesized difference of less than or equal to 0.1 per cent in the prevalence to be equivalent, the sample size required at 80 per cent power and 95 per cent confidence interval was estimated to be 27,385.

**Sampling and study sites:** A total of 210 antenatal clinics (ANC) sites were selected for the study out of the 499 sites which had both HSS and PPTCT programme in the year 2015. Inclusion criteria for the sampling frame

were the sites in which (i) HSS and PPTCT were going on at least for the last three years, and (ii) the required sample size was attained for HSS in the last two HSS rounds. A stratified simple random sampling scheme was used to have a proportional representation of urban and rural sites distributed equally among the six zones of States and Union Territories where six regional institutes (RIs) were providing technical support to HSS in India. A list of common sites was arranged alphabetically, zone wise and the sites were stratified into Urban and Rural. From each of the RI zone, 11 rural sites and 22 urban sites were selected randomly. If the rural sites were less than 11 in a particular RI zone, then the extra sites were selected from other RI zones having more rural sites to obtain a total of 70 rural sites in the country. Thus, 140 urban and 70 rural sites were sampled across the country to provide valid estimates at the regional level for urban and rural sites.

From the sampled sites, the data of pregnant women enrolled in the HSS as well as the data of all the pregnant women recorded under the PPTCT programme were collected during the surveillance period. The basic information of the HSS site was recorded on the site description form from the respective State AIDS Control Societies. During HSS, the data forms were filled and a blood sample for HSS was collected by the counsellor from the recruited ANC attendees, as per the operational guidelines of HSS. The counsellors filled out an additional form, *i.e.* the confidential linking form for this study. This form was used to collect personal identification (PID) numbers against HSS sample numbers if the women had provided a blood sample in PPTCT or tested earlier in PPTCT so that the respondents' data from the PPTCT registers can be linked to the data of HSS during the analysis.

The PPTCT data from the Integrated Counselling and Testing Centre (ICTC) register for pregnant women and the ICTC laboratory register maintained by the ICTC counsellor and laboratory technician, respectively, were taken from the start date of the surveillance in the respective study sites till the end of the surveillance period. The data were collected from respective study sites either as photocopies of records by post or as scanned copies electronically by the Principal Investigator.

**Statistical analysis:** The data were scrutinized for consistency and completeness. First, it was ensured that the data entry format was consistent across all the States. Consistent nomenclature was given to all the

variables of the States. Unique IDs (UID) were created for ICTC, LAB and LINK data files for all six zones by concatenating three variables, *i.e.* PID number, site code and subsite code.

The PPTCT data were linked individually to the HSS data using the PID Number against the HSS sample number provided in the confidential linking form at the central coordinating centre with adequate measures for confidentiality. Data were entered into MS excel and the merging of these three files was done in SPSS software version 16 (IBM Corp., Chicago, IL, USA) based on the UIDs after removal of duplicate entries, if any.

The PPTCT and HSS-linked data were used to compare the HIV positivity among pregnant women attending the chosen study sites. The socio-demographic characteristics of ANC HSS attendees were compared with that of the PPTCT attendees. Scatter plots were examined, and correlation coefficients were calculated between HIV prevalence obtained through ANC HSS and PPTCT at the site as well as State level. Concordance for HIV positivity between women tested in both ANC HSS and PPTCT programme was estimated using kappa statistics. A Chi-square test or t test was used for testing statistical differences between categorical and continuous variables, respectively.

Out of the selected 210 sites, data from 195 sites was available. Another 10 sites were dropped from analysis due to non-availability of PPTCT data as testing kits at ICTC were not available during the surveillance period or PPTCT register was not available, or the PPTCT site was not functional during surveillance or due to poor maintenance of PPTCT registers. Out of the remaining 185 sites, complete data were received only from 176 sites.

Less than 65 per cent of ICTC data was received from the sites of Jammu and Kashmir (60%) and Uttar Pradesh (61.9%). No ICTC data were received from Delhi and none of the sites were selected from UTs (Andaman and Nicobar, Dadra and Nagar Haveli, Daman and Diu, Puducherry and Lakshadweep). Less than 60 per cent of ANC HSS and PPTCT confidential linking data was received from the sites of Assam (53.8%), Mizoram (33.3%) and Bihar (14.2%). No ANC HSS-PPTCT link data were received from Arunachal Pradesh, Delhi and Uttar Pradesh.

The PPTCT (n=120,299) and HSS (n=72,981) data sets, when merged, had 47,402 records in the

merged dataset; from these non-matching records (n=4740) were excluded, and final merged PPTCT and ANC HSS dataset (n=42,662) of matched records was used for comparison of HIV positivity of ANC HSS and PPTCT (positive and negative samples) at the individual level. Thus, samples of 42,662 (58.4%) women were analyzed at individual levels who had complete laboratory results in PPTCT as well as in ANC HSS.

## Results

**Sociodemographic characteristics:** The sociodemographics of pregnant women tested for HIV in ANC-HSS and PPTCT were captured to understand any differences in these characteristics for service uptake. The age of study participants, who were enrolled in ANC HSS and PPTCT programme, ranged from 23 to 27 yr. Age distribution was similar between ANC HSS and PPTCT (Table I). Significant differences were observed in the educational status between ANC HSS participants and PPTCT attendees (Table II). Overall, ANC HSS participants were better educated. However, in Arunachal Pradesh and Tamil Nadu, there was no difference in the education status. PPTCT recorded a higher proportion of homemakers (89.7%) as compared to ANC HSS (86.7%;  $P<0.05$ ).

**Comparison of HIV status:** The correlation between HIV prevalence in ANC HSS and PPTCT programme data was high at the State level ( $r=0.9$ ) (Fig. 1), while it was moderate at the site level ( $r=0.7$ ) (Fig. 2). Overall, HIV prevalence was found to be 0.31 per cent in HSS and 0.22 per cent in PPTCT ( $P<0.001$ ). In urban sites, the prevalence was 0.38 per cent and 0.24 per cent in ANC HSS and PPTCT ( $P<0.001$ ), whereas in rural sites, the prevalence was 0.18 per cent and 0.17 per cent, respectively ( $P>0.05$ ). State-wise comparison of HIV prevalence in ANC HSS and PPTCT programme is presented in Table III.

At the State level, the HIV prevalence estimated by ANC HSS was similar to that reported by PPTCT programme in most of the States except Uttar Pradesh (0.2 vs. 0.1%), Rajasthan (0.2 vs. 0.03%) and Odisha (0.3 vs. 0.1%). The district-level comparison was not made as most of the districts had only one site in HSS, so only a site-level comparison was made.

At the site level, higher HIV prevalence was reported in five ANC HSS sites as compared to that of PPTCT ( $<0.01$ ), whereas in one site in Mizoram, higher prevalence (3.1%) was reported in PPTCT compared

**Table I.** State-wise age distribution of pregnant women from HIV sentinel surveillance (HSS) in antenatal clinics (ANC) and prevention of parent-to-child transmission programme (PPTCT)

| States            | Age (yr), mean (SD) |              | <i>P</i> |
|-------------------|---------------------|--------------|----------|
|                   | ANC HSS             | PPTCT        |          |
| India             | 23.91 (4.06)        | 23.93 (4.02) | 0.04     |
| Andhra Pradesh    | 22.25 (3.03)        | 22.41 (3.13) | <0.001   |
| Arunachal Pradesh | 25.06 (4.72)        | 24.89 (4.77) | 0.6      |
| Assam             | 23.37 (3.97)        | 23.40 (3.99) | 0.5      |
| Bihar             | 23.76 (3.89)        | 24.11 (4.01) | <0.001   |
| Chandigarh        | 24.79 (3.89)        | 24.81 (3.89) | 0.9      |
| Chhattisgarh      | 23.46 (3.58)        | 23.57 (3.70) | 0.1      |
| Goa               | 26.01 (4.69)        | 26.03 (4.61) | 0.9      |
| Gujarat           | 24.48 (4.06)        | 24.47 (4.00) | 0.9      |
| Haryana           | 23.65 (3.62)        | 24.11 (3.67) | <0.001   |
| Himachal Pradesh  | 25.27 (3.99)        | 25.25 (3.94) | 0.9      |
| Jammu and Kashmir | 25.37 (4.09)        | 25.28 (4.06) | 0.4      |
| Jharkhand         | 22.88 (3.75)        | 23.39 (4.00) | 0.02     |
| Karnataka         | 23.51 (3.68)        | 23.73 (4.04) | <0.001   |
| Kerala            | 26.09 (4.51)        | 25.77 (4.38) | 0.1      |
| Madhya Pradesh    | 23.32 (3.24)        | 23.53 (3.45) | 0.02     |
| Maharashtra       | 23.32 (3.48)        | 23.17 (3.39) | <0.001   |
| Manipur           | 26.60 (5.42)        | 26.53 (5.38) | 0.7      |
| Meghalaya         | 24.13 (5.05)        | 24.07 (5.11) | 0.8      |
| Mizoram           | 26.74 (5.30)        | 26.85 (5.44) | 0.6      |
| Nagaland          | 26.12 (5.28)        | 26.03 (5.25) | 0.4      |
| Odisha            | 23.85 (3.94)        | 23.72 (3.88) | 0.2      |
| Punjab            | 25.56 (3.97)        | 25.21 (3.89) | <0.001   |
| Rajasthan         | 23.92 (3.56)        | 24.10 (3.62) | 0.1      |
| Sikkim            | 26.22 (4.86)        | 26.34 (5.07) | 0.6      |
| Tamil Nadu        | 24.13 (3.69)        | 24.41 (3.79) | 0.01     |
| Tripura           | 22.68 (4.23)        | 22.62 (4.10) | 0.8      |
| Uttar Pradesh     | 24.52 (3.88)        | 24.42 (3.75) | 0.1      |
| Uttarakhand       | 24.57 (3.88)        | 24.31 (3.75) | 0.04     |
| West Bengal       | 22.58 (3.94)        | 22.44 (3.91) | 0.02     |

SD, standard deviation

to ANC HSS (2%). One site in Nagaland, one site in Chhattisgarh and two sites in West Bengal reported positive cases in the PPTCT programme, whereas no positive case was reported by ANC HSS.

At the individual level, HIV test results reported from PPTCT were compared with ANC HSS data among those when complete laboratory results were available from both data sets (Table IV). The agreement



**Table II.** State-wise education status of pregnant women in HSS in ANC and prevention of PPTCT

| States            | ANC HSS |                |             |               |                       | PPTCT   |                |             |               |                       | P      |
|-------------------|---------|----------------|-------------|---------------|-----------------------|---------|----------------|-------------|---------------|-----------------------|--------|
|                   | n       | Illiterate (%) | Primary (%) | Secondary (%) | College and above (%) | n       | Illiterate (%) | Primary (%) | Secondary (%) | College and above (%) |        |
| India             | 72,067  | 15.2           | 16.9        | 44.0          | 23.8                  | 112,832 | 18.5           | 29.0        | 40.0          | 12.6                  | <0.001 |
| Andhra Pradesh    | 5134    | 26.7           | 26.1        | 31.2          | 16.0                  | 5107    | 23.6           | 27.8        | 35.2          | 13.5                  | <0.001 |
| Arunachal Pradesh | 398     | 18.6           | 30.4        | 45.2          | 5.8                   | 489     | 18.2           | 29.2        | 43.6          | 9                     | 0.3    |
| Assam             | 3989    | 12.2           | 14.6        | 52.2          | 21.0                  | 5804    | 13.2           | 15.4        | 61.5          | 9.9                   | <0.001 |
| Bihar             | 1600    | 33.3           | 21.1        | 26.7          | 19.0                  | 3676    | 35.1           | 38.7        | 19.3          | 6.8                   | <0.001 |
| Chandigarh        | 400     | 9.8            | 13.3        | 38.0          | 39.0                  | 612     | 13.6           | 50.8        | 18.3          | 17.3                  | <0.001 |
| Chhattisgarh      | 3459    | 12.4           | 19.0        | 50.7          | 18.0                  | 7094    | 17.8           | 33.1        | 43.1          | 5.9                   | <0.001 |
| Goa               | 399     | 9.8            | 6.8         | 61.4          | 22.1                  | 410     | 13.7           | 3.9         | 72.6          | 9.8                   | <0.001 |
| Gujarat           | 2396    | 25.3           | 22.7        | 39.9          | 12.0                  | 5638    | 27.4           | 38.7        | 26.3          | 7.2                   | <0.001 |
| Haryana           | 3068    | 18.5           | 18.4        | 36.8          | 26.2                  | 8058    | 22.3           | 28.7        | 39.0          | 10.0                  | <0.001 |
| Himachal Pradesh  | 1199    | 3.3            | 4.8         | 34.9          | 57.0                  | 1352    | 4.9            | 4.3         | 70.3          | 20.6                  | <0.001 |
| Jammu and Kashmir | 2394    | 26.0           | 9.6         | 35.9          | 28.5                  | 2931    | 28.2           | 14.3        | 44.6          | 12.9                  | <0.001 |
| Jharkhand         | 397     | 21.7           | 22.2        | 41.8          | 14.4                  | 649     | 33.7           | 21.0        | 40.7          | 4.6                   | <0.001 |
| Karnataka         | 7988    | 18.0           | 23.7        | 39.8          | 18.5                  | 9432    | 16.1           | 32.5        | 37.3          | 14.2                  | <0.001 |
| Kerala            | 796     | 0.7            | 26.1        | 25.4          | 47.8                  | 2493    | 0.3            | 32.2        | 27.3          | 40.2                  | 0.01   |
| Madhya Pradesh    | 2374    | 21.4           | 22.1        | 36.2          | 20.3                  | 3108    | 24.4           | 33.9        | 30.6          | 11.1                  | <0.001 |
| Maharashtra       | 7587    | 7.1            | 11.1        | 56.0          | 25.9                  | 13,123  | 8.7            | 22.5        | 45.6          | 23.2                  | <0.001 |
| Manipur           | 1592    | 8.5            | 12.5        | 54.6          | 24.3                  | 1530    | 8.0            | 23.1        | 58.1          | 10.8                  | <0.001 |
| Meghalaya         | 772     | 28.6           | 39.4        | 25.0          | 7.0                   | 755     | 26.5           | 49.1        | 20.0          | 4.4                   | <0.001 |
| Mizoram           | 1181    | 1.9            | 13.0        | 59.8          | 25.2                  | 1295    | 1.5            | 14.4        | 72.9          | 11.3                  | <0.001 |
| Nagaland          | 2593    | 12.0           | 18.3        | 46.1          | 23.6                  | 3091    | 11.26          | 31.03       | 50.99         | 6.73                  | <0.001 |
| Odisha            | 2795    | 12.0           | 24.1        | 48.5          | 15.4                  | 4584    | 10.3           | 20.7        | 55.9          | 13.1                  | <0.001 |
| Punjab            | 1687    | 19.5           | 20.2        | 34.6          | 25.7                  | 3482    | 13.5           | 34.8        | 46.7          | 5.1                   | <0.001 |
| Rajasthan         | 1597    | 22.7           | 21.8        | 32.1          | 23.4                  | 5739    | 44.2           | 34.1        | 29.3          | 12.8                  | <0.001 |
| Sikkim            | 398     | 3.0            | 19.6        | 54.8          | 22.6                  | 680     | 4.9            | 31.8        | 51            | 12.4                  | <0.001 |
| Tamil Nadu        | 2799    | 3.3            | 15.7        | 51.2          | 29.9                  | 2079    | 3.6            | 17.8        | 51.6          | 26.9                  | 0.1    |
| Tripura           | 400     | 0.8            | 15.8        | 63.3          | 20.3                  | 1472    | 0.9            | 23.4        | 66.1          | 9.6                   | <0.001 |
| Uttar Pradesh     | 4702    | 31.7           | 17          | 23.2          | 28.1                  | 10,052  | 38.9           | 27.7        | 18.9          | 14.5                  | <0.001 |
| Uttarakhand       | 1996    | 8.6            | 20.3        | 30.6          | 40.5                  | 1641    | 12.1           | 30.6        | 30.7          | 26.6                  | <0.001 |
| West Bengal       | 5977    | 13.3           | 26.8        | 48.2          | 11.6                  | 10,822  | 13.62          | 32.32       | 46.78         | 7.27                  | <0.001 |

HSS, HIV sentinel surveillance; ANC, antenatal clinics

between ANC HSS and PPTCT data was found to be high (kappa coefficient 0.633). The accuracy was found to be 99.8 per cent when the number of positives and negatives in the final merged dataset of both programmes were divided by the total number tested in both the programmes (n=42,662).

### Discussion

A significant correlation was found between HIV prevalence reported from ANC HSS and PPTCT at the

study sites and State levels. The concordance at the individual level was also high. Overall, HIV prevalence estimates from these two sources were statistically similar in most States. However, in a few States where PPTCT programme coverage was lower, a significant difference in HIV prevalence was observed. Higher HIV prevalence was also estimated in urban sites in ANC HSS. This finding is in line with previously conducted studies that showed higher HIV prevalence in ANC HSS<sup>7,9,11</sup>.

**Table III.** State-wise comparison of HIV prevalence among pregnant women in HSS in ANC and prevention of PPTCT

| States            | HIV prevalence |           |         |           | P      |
|-------------------|----------------|-----------|---------|-----------|--------|
|                   | ANC HSS        |           | PPTCT   |           |        |
|                   | N              | n (%)     | N       | n (%)     |        |
| India             | 72,981         | 228 (0.3) | 120,299 | 262 (0.2) | <0.001 |
| Andhra Pradesh    | 5162           | 18 (0.3)  | 5292    | 14 (0.3)  | 0.1    |
| Arunachal         | 400            | 0         | 489     | 0         | -      |
| Assam             | 3994           | 2 (0.1)   | 5784    | 1 (0.02)  | 0.2    |
| Bihar             | 2000           | 10 (0.5)  | 3696    | 12 (0.3)  | 0.2    |
| Chandigarh        | 400            | 1 (0.3)   | 631     | 1 (0.2)   | 0.4    |
| Chhattisgarh      | 3462           | 14 (0.4)  | 7097    | 16 (0.2)  | 0.05   |
| Goa               | 400            | 0         | 404     | 0         | -      |
| Gujarat           | 2398           | 14 (0.6)  | 5546    | 19 (0.3)  | 0.06   |
| Haryana           | 3072           | 10 (0.3)  | 7903    | 16 (0.2)  | 0.1    |
| Himachal Pradesh  | 1200           | 0         | 1385    | 1 (0.1)   | 0.3    |
| Jammu and Kashmir | 2399           | 3 (0.1)   | 3005    | 2 (0.1)   | 0.3    |
| Jharkhand         | 400            | 1 (0.3)   | 649     | 0         | 0.2    |
| Karnataka         | 7996           | 17 (0.2)  | 9973    | 24 (0.2)  | 0.3    |
| Kerala            | 799            | 0         | 2498    | 0         | -      |
| Madhya Pradesh    | 2375           | 0         | 3109    | 1 (0.03)  | 0.3    |
| Maharashtra       | 7594           | 23 (0.3)  | 12,357  | 37 (0.3)  | 0.5    |
| Manipur           | 1596           | 14 (0.9)  | 1534    | 8 (0.5)   | 0.1    |
| Meghalaya         | 773            | 1 (0.1)   | 755     | 3 (0.4)   | 0.2    |
| Mizoram           | 1181           | 17 (1.4)  | 1295    | 19 (1.5)  | 0.5    |
| Nagaland          | 2603           | 39 (1.5)  | 3117    | 47 (1.5)  | 0.5    |
| Odisha            | 2799           | 8 (0.3)   | 4591    | 4 (0.1)   | 0.02   |
| Punjab            | 1688           | 8 (0.5)   | 3518    | 9 (0.3)   | 0.1    |
| Rajasthan         | 1598           | 3 (0.2)   | 5808    | 2 (0.03)  | 0.03   |
| Sikkim            | 400            | 1 (0.3)   | 680     | 0         | 0.2    |
| Tamil Nadu        | 2799           | 8 (0.3)   | 2091    | 6 (0.3)   | 0.5    |
| Tripura           | 400            | 1 (0.3)   | 1472    | 0         | 0.1    |
| Uttar Pradesh     | 5109           | 12 (0.2)  | 11,185  | 10 (0.1)  | 0.01   |
| Uttarakhand       | 2000           | 0         | 1652    | 0         | -      |
| West Bengal       | 5984           | 3 (0.1)   | 10,819  | 12 (0.1)  | 0.1    |

N, number tested; n, number of positive cases

The socio-economic status of participants in ANC HSS was higher compared to PPTCT, indicating a selection bias that might account for the higher prevalence of HIV in ANC HSS. Higher estimates of HIV prevalence by ANC HSS could also be due to the use of a two-test strategy for HIV testing in HSS as compared to the three-test strategy followed in PPTCT, but Kale *et al*<sup>12</sup> showed that both two- and three-test algorithms provide similar results for most (>99%) of the HIV-positive specimen.

High correlation between HSS and PPTCT at the State level (0.9) in the present study is similar to a study conducted by Kumar *et al*<sup>10</sup>, whereas Joshi *et al*<sup>9</sup> showed a moderate correlation (0.74). Analysis of ANC surveillance and routine ANC programme data at the aggregate level in 15 countries of Africa found a consistent HIV prevalence measured in both programmes in most countries<sup>13</sup>.

At an individual level, the level of agreement between HSS and PPTCT was good (k=0.6) in our

| Table IV. Comparison of HIV positivity of HSS in ANC and prevention of parent-to-child transmission (positive and negative) |                          |                                 |          |                              |
|-----------------------------------------------------------------------------------------------------------------------------|--------------------------|---------------------------------|----------|------------------------------|
| Comparison of HIV positivity rates (k-0.633)                                                                                | ANC HSS                  |                                 |          |                              |
|                                                                                                                             | Number of pregnant women | Positive                        | Negative | Total                        |
| PPTCT programme                                                                                                             | Positive                 | 64                              | 30       | 94 (PPTCT positivity: 0.22%) |
|                                                                                                                             | Negative                 | 44                              | 42,524   | 42,568                       |
|                                                                                                                             | Total                    | 108 (ANC HSS positivity: 0.25%) | 42,554   | 42,662                       |

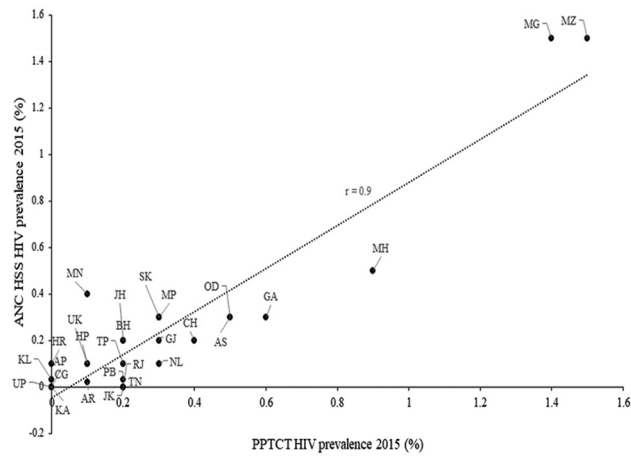


Fig. 1. Correlation between HIV prevalence of ANC HSS and PPTCT programme state-wise. HSS, HIV sentinel surveillance; ANC, antenatal clinics; PPTCT, prevention of parent-to-child transmission

study, but the positive per cent agreement (PPA) was 53.6 per cent (64/108), whereas studies from Brazil, Mozambique, Zimbabwe and Rwanda have reported higher PPA<sup>14-17</sup>. Lower PPA in our study could be due to the inability to link complete ANC HSS data to PPTCT data. Another limitation of the study was that the study sites were sampled only from those sites where both ANC HSS and PPTCT were functioning for the last three years and where the adequate sample for ANC HSS was achieved, thus limiting the generalizability of the study. Moreover, operational aspects of the ANC HSS and PPTCT especially those related to quality assurance, were not the focus of the study, which are an important consideration while deciding whether to utilize PPTCT data for tracking the HIV epidemic in India. One of the strengths of this study was that in addition to the comparison of HIV prevalence at the group level during the same period and at the same sites, the comparison was also made using individual-level data of PPTCT programme with ANC HSS data. This study is unique in that it investigated the distribution of

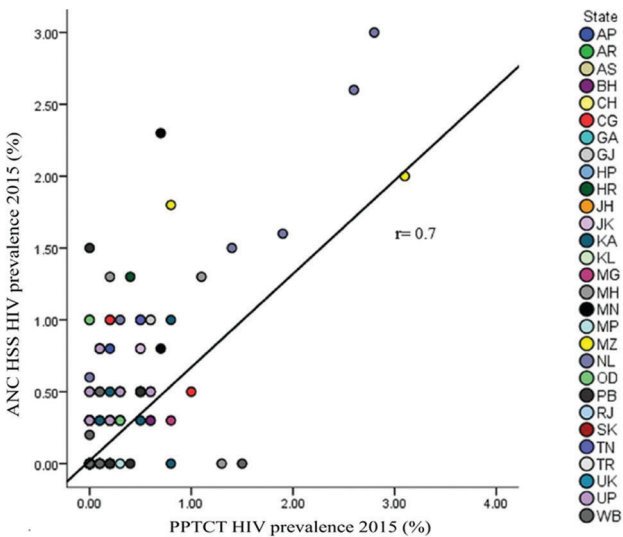


Fig. 2. Correlation between HIV prevalence of ANC HSS and PPTCT programme site-wise. HSS, HIV sentinel surveillance; ANC, antenatal clinics; PPTCT, prevention of parent-to-child transmission

sociodemographic characteristics between ANC HSS and PPTCT attendees both at the State and site levels to study the role of confounders.

Some countries have been transitioning to using routinely collected PPTCT programme data after carefully addressing the gaps in their respective countries. Billong *et al*<sup>18</sup> mention that due to financial challenges frequency of HSS remains low in low- and middle-income countries<sup>18</sup>. Although we did not capture cost of ANC HSS and PPTCT programmes in this study, the utilization of PPTCT data for tracking HIV will save costs associated with ANC HSS activities such as training, human resources, logistics, testing kits and other consumables.

In conclusion, HIV prevalence estimates from PPTCT and ANC HSS were found to be similar in most of the States of India. The wider availability of PPTCT

data across the district, including from community-based HIV screening and testing, can provide reliable HIV trends at the site, district and State levels in States/ Union Territories where high PPTCT coverage has been achieved, thus, saving on the cost of conducting ANC-HSS. An operational framework for PPTCT-based HIV surveillance, including methodology and statistical modelling should be piloted in a phased manner before switching from ANC HSS to PPTCT at the national level.

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