

## Improved estimates of India's HIV burden in 2006

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**Background & objectives:** HIV estimates in India were based on HIV sentinel surveillance (HSS) data and several assumptions. Expansion of sentinel surveillance to all districts and community based HIV prevalence measured by National Family Health Survey-3 (NFHS-3) in 2006 provided opportunity to replace many of the assumptions with evidence based information and improve the HIV estimate closer to reality. This article presents a detailed account of the methodology used for the 2006 HIV burden estimates for India.

**Methods:** State-wise adult HIV prevalence among different risk groups observed from HSS 2006 was adjusted for site level variations using a random effects model and for the previous four years the same was back calculated using trend equations derived from a mixed effects logistic regression model based on consistent sites prevalence. The adjusted HIV prevalence among the general population was calibrated to the estimates from NFHS-3. Overall point estimates of adult HIV prevalence in each State for 2002-2006 were derived from the UNAIDS Workbook and projected for the period 1985-2010. The results were put into Spectrum to derive estimates of the number of people living with HIV in all ages and other epidemic impacts.

**Results:** National adult HIV prevalence was 0.36 per cent (range 0.29-0.46%) and the estimated number of people living with HIV was 2.47 million (range 2.0-3.1 million) in 2006. The national adult HIV prevalence remains stable around 0.4 per cent between 2002 and 2006. The States with the highest estimated prevalence were Manipur, Nagaland and Andhra Pradesh. The States with the highest burden were Andhra Pradesh, Maharashtra, Karnataka and Tamil Nadu.

**Interpretation & conclusion:** The improvement in the 2006 estimates of the HIV burden in India is attributable to the expanded sentinel surveillance and representative data from the population-based survey in 2006, combined with an improved analysis. Despite the downward revision, India continues to face a formidable challenge to provide prevention, treatment and care to those in need.

**Key words** Estimate - HIV - house-hold survey - prevalence - sentinel surveillance

India has often been criticized for underestimating its human immunodeficiency virus (HIV) burden<sup>1,2</sup>. Until 2005, the adult HIV prevalence in India was

estimated at around 0.9 per cent with an estimated 5.2 million people living with HIV/AIDS (PLHA)<sup>3</sup>. The estimates were based on sentinel surveillance results.

A formal sentinel surveillance system was established in India in 1998. In this system, most surveillance sites were established in antenatal clinics (ANC) and sexually transmitted disease (STD) clinics (99 and 77 sites, respectively), while a few (9) were established among injecting drug users (IDUs). Owing to the concentrated nature of the HIV epidemic in large parts of the country and the paucity of population based information in the areas with higher prevalence, HIV estimates in past years were derived using sentinel surveillance data in a locally developed estimation method that involved several assumptions. Prevalence among ANC attendees was used as a proxy for the prevalence in the general population and that among STD patients as a proxy for the prevalence among populations with high risk behaviour. The absence or inadequacy of HIV surveillance among female sex workers (FSW) and men having sex with men (MSM) was a weakness of India's surveillance system and consequently also for the estimation of the HIV burden. With the gradual expansion of surveillance over time since 1998 resulting in greater availability of data, FSW and MSM were included in the estimation process but the STD group was not discarded, which led to the possibility of double counting<sup>4</sup>. Moreover, the representativeness of the ANC surveillance sites for the general population had not been verified. The Guntur study<sup>5-7</sup> in Andhra Pradesh demonstrated that (i) application of the HIV rate obtained among people visiting STI clinics in public sector hospitals to the 6 per cent of the adult population assumed to be at high risk; (ii) referral of HIV-positive pregnant women from the private sector to large public hospitals; and (iii) over-representation of pregnant women from lower socio-economic strata who had higher HIV prevalence among those utilizing antenatal services of public hospitals led to over-estimation.

In 2006, improved data were available from multiple sources. Sentinel surveillance among ANC women was expanded covering nearly every district in the country allowing better geographical representation with adequate data for each State to undertake State-specific estimations. Additional sites for high risk groups were included in more States. The on-site monitoring and quality assurance of testing was strengthened. In addition, a nation-wide household HIV sero-survey of the general population was conducted as a part of the third round of the National Family Health Survey<sup>8</sup> (NFHS-3). This provided an opportunity to validate the surveillance data and

assumptions used in the estimation process. Further, in order to improve international comparability, the WHO/UNAIDS-recommended Workbook<sup>9</sup> and Spectrum<sup>10</sup> were adopted for the 2006 HIV burden estimation. We describe here the data and methods used for the 2006 HIV burden estimates for India and compare the resulting estimates with those of earlier years.

### Material & Methods

HIV prevalence results from 2006 sentinel surveillance and from NFHS-3 became available in March and May 2007 respectively. Three expert meetings were convened between March and July 2007 to advise on the data and methods to be adopted for the 2006 HIV burden estimation. The participants of the meetings were experts from various national and international academic/research organizations. The discussions at these meetings resulted in the adoption of a consensus approach described below.

Estimates were derived in the following steps: (1) for each State the HIV prevalence among ANC was estimated for 2006; (2) for the year 2006 for each State the prevalence among the general population was calibrated to the NFHS-3 result for the State or for the group of remaining States; (3) for each State for the previous years 2002-2005 HIV prevalence among ANC was estimated applying a random effects model to results from consistent sites and adjusted with the calibration factor for NFHS-3; (4) for each State for the years 2002-2006 the number of people with high risk behaviour living with HIV was estimated and added to the above estimate of people living with HIV in the general population; (5) for each State a point estimate of adult prevalence was calculated in Workbook for each year between 2002 and 2006 and adult prevalence curve since the start of the epidemic was generated using the Workbook's projection feature. This curve was used in Spectrum to generate the number of people living with HIV by year, age and sex for each year since the start of the epidemic; (6) State-specific and national uncertainty ranges around the number of people living with HIV and the adult prevalence were generated.

*State-wise HIV prevalence estimates among ANC:* The primary data source for deriving State-specific prevalence levels among the general population was ANC sentinel surveillance. ANC surveillance was expanded from 200 sites in 2002 to 456 in 2006, thus providing improved representation of data at State

level to undertake State-specific estimations. Subjects in these sites were selected by consecutive sampling<sup>11</sup> and tested for HIV by unlinked anonymous testing. Sites with a minimum 75 per cent coverage of the assigned sample of 400 were considered as valid for estimations resulting in 419 valid sites for 2006.

The HIV prevalence among ANC attendees for 2006 was estimated adjusting for inter- and intra-state variations using mixed-effects logistic regression models, separately for each State. Analyses were performed by SAS version 9.1.3<sup>12</sup> using data from valid sites only. Model estimation was performed using PROC GLIMMIX and for each model the outcome was specified as an aggregate sample proportion using events/trials syntax. In case of non-convergence or limited ANC sites within a State, standard logistic regression models were used.

*Calibration of adjusted rates to NFHS-3 results:* NFHS-3 was designed to provide an HIV prevalence estimate among adults; it was designed to cover women age 15-49 yr and men age 15-54 yr for the six high prevalence States (Andhra Pradesh, Karnataka, Maharashtra, Manipur, Nagaland and Tamil Nadu), for Uttar Pradesh which is a low prevalence State, for the 26 remaining States, and for the country as a whole. However, the survey could not be conducted in Nagaland, owing to non co-operation. Over 1,02,000 adult males and females of the households sampled for the survey were tested for HIV status, resulting in an HIV test response rate<sup>8</sup> of 85 per cent among women and 78 per cent among men. The weighted HIV prevalence estimates in the adult population age 15-49 yr for both sexes and the female-male (F:M) and urban-rural (U:R) ratios of HIV infection were taken from the survey data for each of the five high prevalence States surveyed separately and for the remaining States together.

In the high prevalence States, HIV prevalence among ANC attendees was estimated for urban and rural combined as sentinel sites were present in these areas. These were calibrated to the HIV prevalence among women in NFHS-3. A calibration factor 'k' was derived as the ratio of the two estimates. We then applied the U : R ratio of HIV prevalence observed in NFHS-3 in each State to derive the HIV prevalence among urban and rural women. Subsequently the F : M ratio of HIV prevalence, observed in NFHS-3, was applied to urban and rural female prevalence to obtain HIV prevalence among urban and rural males. It resulted in four separate prevalence estimates for

urban and rural females and males. As there were no NFHS-3 data for Nagaland, we used the calibration factor observed in Manipur for this State also, in view of their geographical contiguity and similarity of the epidemic.

The sample sizes covered under NFHS-3 in low and moderate prevalence States were small to provide State level estimates. Therefore, an aggregate HIV prevalence of all the low and moderate prevalence States was computed. Similarly, HIV prevalence among ANC attendees was computed taking all these States together. As ANC sentinel sites in low and moderate prevalence States were located in urban areas, a common 'k' for these States was computed as the ratio of HIV prevalence among ANC attendees and HIV prevalence in urban sample of NFHS-3. This factor was used to calibrate HIV prevalence among ANC women. The prevalence estimates for rural women and urban males and females were obtained by applying U:R and F:M ratios of these States, observed in NFHS-3.

*Trends of HIV prevalence for the general population in 2002-2006:* We calculated the prevalence estimates for each year from 2002 to 2005 by using trends based on consistent sites. Mixed-effects logistic regression models (accounting for the clustering within the sites with specification of random effects on the intercept) were used to estimate linear trends in HIV prevalence among ANC attendees. Variables included in this model were year, State and State  $\times$  year. The interaction term was added into the model to allow for the estimation of trends separately by State. Model parameters from the mixed-effects logistic regression along with calibrated 2006 State-specific prevalence estimates were used in the calculation of prevalence for the years 2002 to 2005. States with a limited number of consistent sites were combined to increase the sample size and to afford the estimation of State-specific trends in HIV prevalence. States were combined on the basis of geographic and/or cultural similarity and were assumed to share similar trends in HIV prevalence.

Between 2002 and 2006, the U:R ratio of HIV prevalence among women in moderate and low HIV prevalence States was taken as constant at 3.1:1 (observed in NFHS-3). In the case of high prevalence States, the State-specific U:R ratios in HIV prevalence observed in NFHS-3, *i.e.* 0.86:1 in Andhra Pradesh, 0.68:1 in Karnataka, 0.85:1 in Maharashtra, 1.22:1 in Manipur and 0.54:1 in Tamil Nadu, were considered

as constant for the calculations for years 2002-2006. Based on these assumptions, the prevalence among urban and rural women and men were derived for the years 2002-2005.

*HIV among groups with high risk behaviour (HRG):* Surveillance for HRG was expanded from 18 sites in 2002 to 234 in 2006. In 2006 surveillance data were available from 137, 51, 31 and 15 sentinel sites for FSW, IDU, MSM and long distance truckers respectively. Subjects in these sites were selected by consecutive sampling from established health facilities (e.g., drop-in centers, detoxification centers *etc.*) or by camp approach where such health facilities were not available. Subjects were tested for HIV by unlinked anonymous testing<sup>11</sup>. Sites with a minimum of 75 per cent coverage of the assigned sample size 250 were considered as valid for estimations.

In 2006, mixed-effects logistic regression models were used to derive prevalence estimates among FSW, MSM, and IDU. To account for the clustering of patients within HRG sites, random effects were specified on the intercept. Estimates were calculated for each HRG using the following State groupings:

FSW 2002-2006	Andhra Pradesh, Karnataka, Maharashtra and Tamil Nadu (combined), Nagaland and Manipur (combined), remaining States (combined)
MSM 2002-2006	High prevalence States (combined), Gujarat, remaining States (combined)
IDU 2002-2006	Manipur, Nagaland, Mizoram, Maharashtra, Tamil Nadu, Delhi, Chandigarh, Punjab, select Metropolitan cities (Bangalore, Chennai Kolkatta and Mumbai) combined and the remaining States (combined) Note: Combined prevalence of Metropolitan cities was used for Andhra Pradesh and Karnataka as there were no IDU sites in these States.

HIV prevalence amongst long distance truckers was available only for 15 sites from four States, Kerala, Orissa, Punjab and West Bengal for 2006. The median HIV prevalence for these sites was used in all States assuming the prevalence among this group would be similar across the States.

In the Workbook, besides the general population, the following groups were included: IDU, MSM, FSW and half of the estimated number of long distance truckers and helpers. State-wise data on the size of IDU, FSW, and MSM groups were drawn from the National AIDS Control Programme-III (NACP-III) document, prepared by an expert committee on size

estimation through a consultative process by reviewing the mapping and size estimation of HRG undertaken in each State<sup>13</sup>. This document also had recorded the national estimate for the number of long distance truckers as 3 to 3.5 million. A review of various studies on the number of truckers in this document also said that each trucker has at least one helper. Hence the national estimate for the size of truckers and helpers was considered to be six million. Following the suggestion of the expert committee 50 per cent, *i.e.*, 3 million was included in the Workbook. They were distributed among the States following the distribution of transport related workers in the 2001 Census<sup>14</sup> and were used as the size of long distance truckers in the States.

*Generation of point estimates of adult prevalence by State:* Population sizes as well as adjusted and calibrated prevalence estimates, for each risk group mentioned above, were entered into the Workbook<sup>15</sup>. The remaining population was classified into four groups, namely, urban females (UF), rural females (RF), urban males (UM) and rural males (RM). The sizes of these groups were determined by subtracting the sizes of the aforementioned HRG from the population estimates provided by the report of the Technical Group on Population Projections<sup>16</sup>. Workbooks were created for each State and for each year in the 2002-2006 separately, resulting in an annual State-specific estimate of adult prevalence. A prevalence curve was then generated for each State from 1985 to 2010, by entering the annual prevalence estimates from 2002-2006 in the curve fitter provided in the Workbook. In States which had shown a declining trend, a double logistic curve was fitted and for the remaining States a single logistic curve was fitted. Numeric values of the curve were read into the Spectrum<sup>17</sup> model. The Spectrum model is designed for estimation and projection of impact indicators based on estimated adult prevalence over time combined with a set of assumptions. We used the time series data on the total fertility rate (TFR), the life expectancy for both the sexes separately from the Sample Registration System<sup>14</sup>, antiretroviral treatment (ART) and prevention of mother to child transmission (PMTCT) data from service statistics of NACO, and the age and sex distribution of population from the 2001 Census of India report<sup>18</sup>. The age patterns of HIV prevalence set for concentrated epidemics were retained, but the male: female ratios (as estimated from NFHS-3 in 2005-06) were kept constant over time.

*Uncertainty bounds:* Uncertainty bounds for the national prevalence rate estimate and the number of people living with HIV were generated by using Spectrum<sup>10</sup> model. This involved generating up to 1000 logistic curve fits by varying annual estimates. The uncertainty analysis was processed using these curves combined with distributions around key assumptions in Spectrum.

### Results

HIV prevalence among adults (15-49 yr) was 0.36 per cent (uncertainty bounds 0.29-0.46%) in 2006. Overall prevalence in the high prevalence States was 0.8 per cent and in low and moderate epidemic States was 0.2 per cent. Prevalence was highest in Manipur at 1.70 per cent followed by Nagaland at 1.41 per cent, and Andhra Pradesh at 1.04 per cent (Fig. 1).

The estimated number of PLHA in the population of all ages was 2.5 million (uncertainty bounds 2.0 - 3.1 million). The number of people living with HIV was highest in Andhra Pradesh at 525,560 (range 420,448-651,694) followed by Maharashtra at 495,488

(range 396,390-614,405), Karnataka at 276,129 (range 220,903-342,400) and Tamil Nadu at 246,473 (range 197,178-305,626) (Fig. 2).

The Table shows the estimated adult prevalence and the total number of PLHA from 2002 to 2006 in States and all India. Adult prevalence decreased slightly from 0.45 per cent (range 0.36-0.58%) in 2002 to 0.36 per cent (range 0.29-0.46%) in 2006. The overlap of the plausible ranges of the estimates of adult prevalence in 2002 and 2006 indicated that the decrease was not statistically significant.

The adult HIV prevalence among women was estimated at 0.25 per cent (range 0.18-0.39%) in 2006, while that among men was 0.44 per cent (range 0.30-0.68%). Of the 2.47 (range 2.0-3.1) million PLHA in 2006, 89 per cent were adults in the 15-49 yr age group, 7 per cent were over 49 yr of age and 4 per cent were children.

The estimated proportion of adult PLHA among groups with high risk behaviour compared with the total

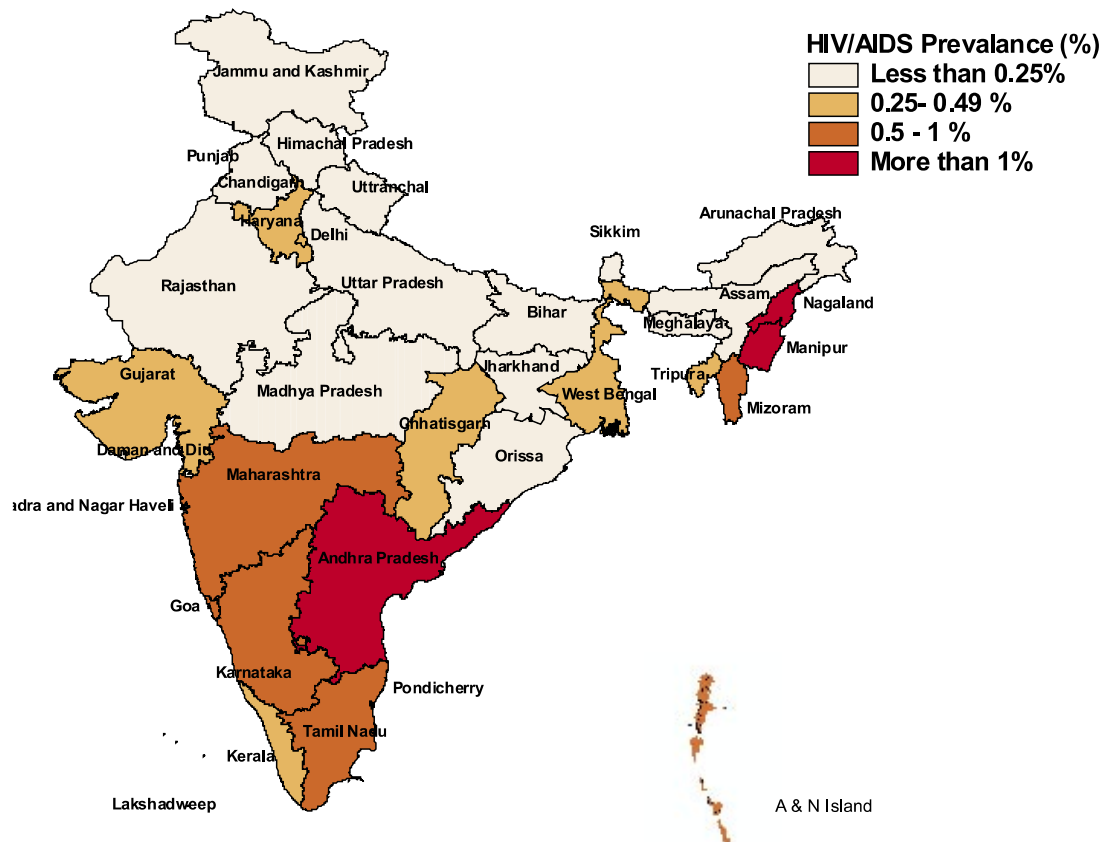


Fig. 1. Adult HIV/AIDS prevalence, India, 2006.

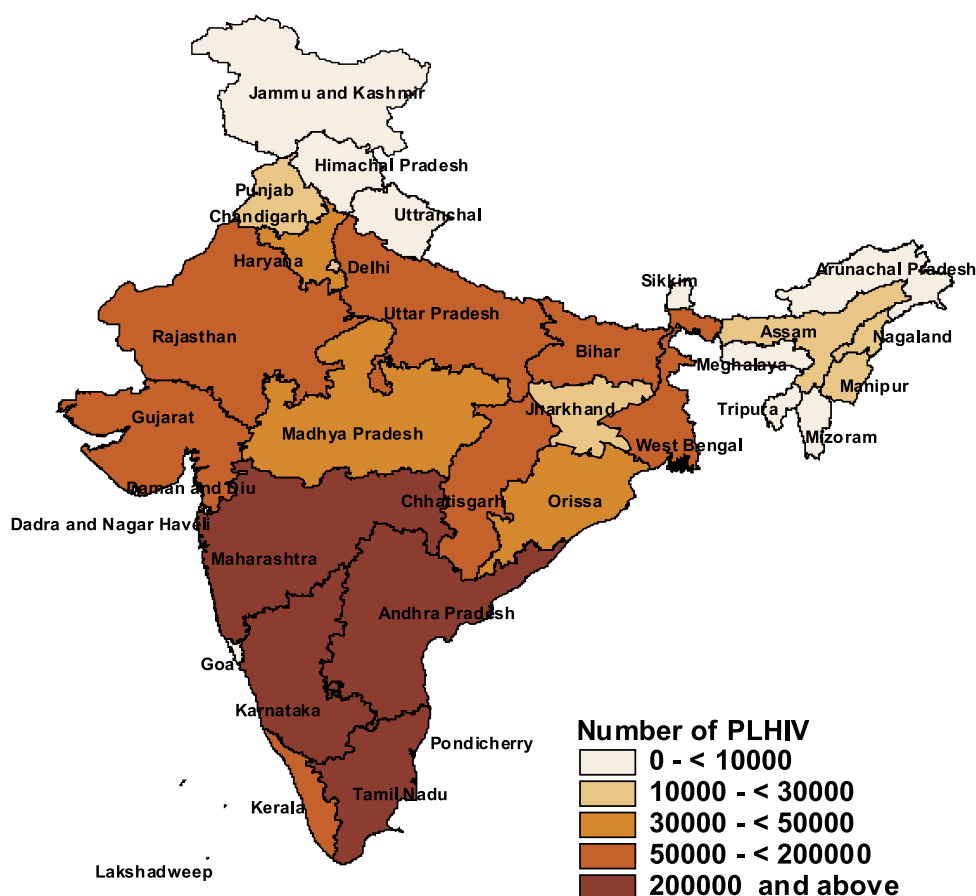


Fig. 2. Number of people living with HIV/AIDS, India, 2006.

number of adult PLHA was 14 per cent. Overall, 62 per cent of PLHA in all ages were in the following four high prevalence States: Andhra Pradesh, Maharashtra, Karnataka, and Tamil Nadu.

**Discussion**

The new estimates for 2006 of adult HIV prevalence [0.36% (range 0.29-0.46%)] and the number of PLHA of all ages [2.5 million (range 2.0-3.1 million)] represent a major downward revision from the 0.91 per cent and 5.7 million, respectively, reported by the UNAIDS<sup>19</sup> for 2005. This 2005 estimate was essentially based on the adult prevalence reported by National AIDS Control Organization using the previous methodology<sup>3</sup>.

There were two major changes in the current method of estimation. First, HIV prevalence among antenatal clinic attendees was adjusted and calibrated to NFHS-3 estimates as opposed to the use of unadjusted median prevalence used in the past. Secondly, in the

2006 estimation STD patients were not included as a separate estimation group representing people with high risk behaviour. It is important to consider the justification and impact of these changes. In India, utilization of antenatal services of the public sector is poor (28.7%), 50 per cent of women marry before the age of 18 yr and complete the family by the age of 26 yr<sup>8</sup>. Thus, antenatal clinic attendees are young, sexually more active and have had unprotected sex to be pregnant. Thus, they are not representative of all adult women, and HIV prevalence observed among them is likely to be higher than that in the general population. Dandona *et al*<sup>4</sup> reported from their study in Guntur district that public antenatal care facilities were preferred by women of lower socio-economic strata among whom HIV prevalence was higher and those antenatal mothers detected positive for HIV in the private sector were selectively referred to public facilities, leading to exaggeration of HIV prevalence in ANC sites. In a community-based study

**Table.** Estimated adult HIV prevalence and people living with HIV/AIDS (PLHA) 2002-2006

	Adult HIV prevalence					People living with HIV - All ages				
	2002	2003	2004	2005	2006	2002	2003	2004	2005	2006
Andhra Pradesh	1.16	1.13	1.12	1.06	1.05	543836	543219	538699	532406	525560
Karnataka	0.85	0.80	0.81	0.79	0.81	271548	274503	275926	276249	276129
Maharashtra	1.08	0.94	0.94	0.80	0.74	639547	606065	567109	528515	495488
Manipur	2.42	2.20	1.96	1.87	1.67	31390	29857	28164	26492	25089
Nagaland	2.00	1.78	1.55	1.43	1.26	22393	22044	21370	20397	19186
Tamil Nadu	0.93	0.72	0.59	0.47	0.39	297386	288137	275748	262429	246473
Goa	1.01	0.92	0.84	0.77	0.73	8715	8286	7756	7322	7025
Gujarat	0.54	0.46	0.46	0.45	0.43	163763	158190	151772	147114	144474
Puducherry	0.40	0.43	0.48	0.51	0.55	2363	2745	3080	3447	3765
Arunachal Pradesh	0.18	0.13	0.10	0.07	0.05	2095	2050	1980	1880	1760
Assam	0.08	0.06	0.05	0.04	0.03	11143	10898	10530	10041	9442
Bihar	0.10	0.12	0.12	0.13	0.16	38378	47956	57505	66416	74307
Chhatisgarh	0.59	0.42	0.31	0.23	0.17	50488	48229	45357	41929	38067
Delhi	0.35	0.28	0.28	0.31	0.27	33796	33175	32080	31299	30201
Haryana	0.50	0.33	0.22	0.15	0.10	49575	47768	45351	42340	38874
Himachal Pradesh	0.03	0.03	0.04	0.04	0.03	1257	1290	1302	1290	1284
Jammu & Kashmir	0.02	0.02	0.06	0.03	0.04	1290	1595	1885	2144	2361
Jharkhand	0.07	0.07	0.09	0.10	0.11	9464	11785	14100	16277	18204
Kerala	0.59	0.39	0.27	0.18	0.13	80661	77221	72761	67842	62127
Madhya Pradesh	0.17	0.15	0.14	0.12	0.11	59497	57131	54064	50454	46377
Meghalaya	0.19	0.14	0.11	0.08	0.06	2727	2645	2533	2389	2215
Mizoram	1.13	1.06	0.98	0.89	0.74	6025	5860	5615	5290	4908
Orissa	0.06	0.08	0.12	0.16	0.22	9717	16483	25927	37169	48248
Punjab	0.18	0.14	0.13	0.11	0.12	25250	24501	23467	22067	20450
Rajasthan	0.05	0.07	0.10	0.14	0.17	13543	21280	31564	43496	55638
Sikkim	0.24	0.18	0.14	0.10	0.08	758	725	682	631	573
Tripura	0.41	0.30	0.22	0.17	0.12	7728	7406	7010	6524	5989
Uttar Pradesh	0.14	0.13	0.14	0.12	0.11	121952	122198	119830	116640	113384
Uttaranchal	0.09	0.08	0.08	0.08	0.08	4078	4143	4167	4175	4175
West Bengal	0.10	0.10	0.14	0.20	0.30	37944	63072	93951	124597	149382
A & N Islands	0.81	0.66	0.54	0.45	0.37	2012	1978	1917	1829	1714
Chandigarh	0.45	0.35	0.32	0.31	0.34	2934	2921	2830	2950	2882
India	0.45	0.43	0.41	0.39	0.36	2726045	2674270	2611072	2541782	2475751

in Cambodia<sup>20</sup>, it was observed that ANC data suffers from the limitation of overestimating the infection in younger age groups. Also, some community-based studies from Tamil Nadu<sup>21,22</sup> have shown similar levels of prevalence as found in ANC sites but the limitations of such studies have been discussed in the literature<sup>5</sup>. Despite these limitations, the HIV prevalence among ANC attendees had been used for past estimation exercises because of the absence of any other credible nationwide data.

Secondly, in past estimation exercises people with an STD (estimated at about 6% of the adult population in urban and rural areas of high prevalence States and 6% of the adult population in urban area and 5% of the adult population in rural area in moderate and low prevalence States in previous rounds) were retained as a separate group for estimation in both States with high and low prevalence, even after the inclusion of FSW and MSM.

The new analysis for 2006 suggested that the use of non representative ANC sentinel surveillance data without adjustments, and the inclusion of a large section of the population to represent a population at higher risk of HIV, had led to overestimation in the past exercises. This analysis confirmed the findings of HIV overestimation in India suggested earlier by the Guntur study<sup>5-7</sup>.

HIV prevalence among high risk behaviour population, IDU, MSM, FSW and half of trucker population were included in the current estimation, based on two considerations. Firstly, the HIV epidemic in most parts of India is concentrated and in concentrated epidemics household surveys are expected to underestimate the true HIV prevalence as some groups with high risk behaviour may reside in institutions<sup>23</sup> and not in households. Secondly, a proportion of the population that is generally mobile is likely to have been missed in the population-based survey. Indeed, 13.5 per cent of men and 6.4 per cent of women who were eligible to be interviewed did not complete interviews for a variety of reasons (most of them because of absence at the time of the survey) and those individuals were not tested for HIV. An additional 2.1 per cent of men and 1.1 per cent of women who were interviewed were not tested for HIV because they were absent at the time of blood collection. A further 6.3 per cent of men and 7.5 per cent of women were also missed for HIV testing in the survey for other reasons including refusal to provide blood for HIV testing. However, a non response analysis, conducted for NFHS-3, showed that non participation in the blood collection for HIV makes almost no difference to the HIV prevalence estimates for the household-based population. Mishra *et al*<sup>24,25</sup> analyzed the results of demographic surveys conducted in nine countries with HIV testing to assess the value of such data to country HIV surveillance system. They also reported that the overall effects of non response on the observed national estimates of HIV prevalence are small and not significant.

However, the use of pooled estimate of HIV prevalence of NFHS-3 for low and medium prevalence States to derive calibration factors and need to use the same in subsequent years until the next nation wide household survey are the limitations of the current methodology. The current estimate is a revision based on improved data and methodological changes. The difference between the current estimate and previously published estimates does not represent a true decline at

the population level. However, even at this level, India continues to be the third largest contributor<sup>26</sup> to the global HIV burden after South Africa and Nigeria. The prevalence trend at national level appears to be stable after 2002 under both the approaches. Tamil Nadu is the only high prevalence State that has shown significant decline in HIV prevalence. HIV prevalence remained stable at high level in Andhra Pradesh and Karnataka. Increasing epidemic trend in seven low prevalence States, namely, Puducherry, Jammu & Kashmir, Jharkhand, Bihar, Orissa, Rajasthan and West Bengal draws attention to the policy and programme managers.

Given the large size of the country, providing ART to those requiring would be an important challenge for the coming years. In addition, the size of the population at risk of HIV infection remains huge, requiring the concerted preventive efforts.

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