

TECHNICAL REPORT

India
HIV Estimates-2006



National Institute of Medical Statistics
(Indian Council of Medical Research)
New Delhi



National AIDS Control Organisation
Ministry of Health and Family Welfare
Government of India

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Abbreviations

| | |
|---------|--|
| AIDS | Acquired Immuno-Deficiency Syndrome |
| AIIH&PH | All India Institute of Hygiene and Public Health |
| AIIMS | All India Institute of Medical Sciences |
| AIM | AIDS Impact Model |
| ANC | Ante-natal clinics |
| ART | Antiretroviral treatment |
| ARV | Antiretroviral |
| ASFR | Age Specific Fertility Rate |
| BMGF | Bill and Melinda Gates Foundation |
| BSS | Behavioural surveillance survey |
| CDC | Center for Disease Control |
| FHI | Family Health International |
| FSW | Female sex workers |
| HIV | Human Immuno-Deficiency Virus |
| HSS | HIV sentinel surveillance |
| IBBA | Integrated biological and behavioural assessments |
| ICMR | Indian Council of Medical Research |
| IDU | Intravenous drug users |
| IIPS | International Institute for Population Sciences |
| ISI | Indian Statistical Institute |
| MSM | Male sex with males |
| MTCT | Mother to child transmission |
| NACO | National AIDS Control Organisations |
| NACP | National AIDS Control Programme |
| NARI | National AIDS Research Institute |
| NFHS | National Family Health Survey |
| NICED | National Institute of Communicable and Enteric Diseases |
| NIE | National Institute of Epidemiology |
| NIHFW | National Institute of Health and Family Welfare |
| NIMS | National Institute of Medical Statistics |
| PGIMER | Postgraduate Institute of Medical Education and Research |
| PHR | Populations at higher risk |
| PLHIV | People living with HIV/AIDS |
| PLR | Populations at lower risk |
| RCSHA | Resource Centre for Sexual Health and HIV/AIDS |
| RMRC | Regional Medical Research Centre |
| SACS | State AIDS Control Societies |
| SRS | Sample registration system |
| STD | Sexually transmitted diseases |
| TFR | Total fertility rate |
| UNAIDS | Joint United Nations Program on HIV/AIDS |
| USAID | United States Agency for International Development |
| WHO | World Health Organisation |

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Foreword

The HIV sentinel surveillance (HSS) in India was initiated to monitor the spread of HIV infections among specific-risk groups, mainly among patients with sexually transmitted diseases (STD) and women attending antenatal clinics (ANC). STD patients were assumed to be a proxy for people with high risk sexual behaviour and the ANC women were considered a proxy for people at low risk sexual behaviour and likely to catch the infection through bridge populations. In the beginning it also included very few sites for Injecting Drug Users (IDUs) and female sex workers (FSW) in the areas where networks of these groups were visible. Over time, the HSS network has expanded considerably, to increase the geographical coverage as well as to include high-risk behaviour groups such as Men who have Sex with Men (MSM), IDU, FSW and long-distance truckers.

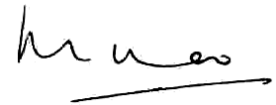
Since 1998, the HSS data was subsequently utilised to estimate the number of people living with HIV (PLHIV). In this endeavour, NACO takes the assistance of a number of institutions of national and international repute. Among them, the National Institute of Health and Family Welfare (NIHFW) takes the lead in coordinating and overseeing the implementation of HIV Sentinel Surveillance, which includes training of the field teams, quality assurance, monitoring of data collection and processing of data analysis. The National Institute of Medical Statistics (NIMS), Indian Council of Medical Research (ICMR) is the nodal agency that carries out the process of HIV estimation. The expert committee on HIV estimation in India formulated in 1998 evolved a methodology involving several assumptions to estimate the number of PLHIV in the country, in consultation with WHO and UNAIDS.

The year 2006 is a landmark in the history of HSS as well as the HIV estimation process. The surveillance network has expanded to 1,122 sentinel sites from 703 that existed the previous year, covering almost all districts of the country. Globally comparable estimates were derived using the WHO/UNAIDS Workbook, specially designed to estimate the HIV burden in low and concentrated epidemics. Further, the availability of multiple data sources this year added valuable inputs towards improving and refining the PLHIV estimates in India and provided ample scope to replace the assumptions with evidence-based values. These data sources are derived from the third round of National Family Health Survey, 2005-06 (NFHS-3), the second round of National Behavioural Surveillance Survey (BSS-2) as well as the Baseline Integrated Biological Behavioural Assessments (IBBA) and NACP-III size estimates for high-risk groups. In addition, consultative meetings with a large group of national and international experts ensured a better understanding of the data and providing reliable estimates.

I would like to acknowledge the efforts put in by National Institute of Medical Statistics, ICMR, New Delhi in bringing out the report. The contributions of Dr. D.C.S. Reddy, WHO India, Dr. Renu Garg, WHO SEARO, Dr. Tobi Saidel, FHI and Dr. Gurumurthy Rangaiyan, UNAIDS are highly appreciated. The contributions of experts from UNAIDS, Geneva and India, CDC Atlanta, Imperial College London, USAID, Macro International, WHO, BMGF, FHI and the World Bank, are gratefully acknowledged. WHO and UNAIDS are specially thanked for their constant support and guidance.

I congratulate Dr. Jotna Sokhey, Additional Project Director, NACO, Dr. Ajay Khera, Joint Director (Basic Services & Surveillance), NACO and Dr. Arvind Pandey, Director, NIMS, for coordinating the HIV estimation process and bringing out of this document.

This technical report is a compendium of the estimation process and the findings. I am confident that this document will be a ready-reckoner for the researchers as well as the programme managers across the country and globe.



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Preface

HIV Sentinel Surveillance has been established to monitor the trends of HIV infection in the country. HSS data is also being used for estimating the number of People Living with HIV/AIDS (PLHIV) in the country. The first HIV estimation in India was done in 1994 based on data from 52 sites. Since then, the process of estimation of HIV infected persons in the country has evolved to a very great extent. An expert committee on HIV estimation was formulated in 1998 that evolved a methodology for HIV estimation using several assumptions. Although the methodology was adopted in consultation of WHO/UNAIDS, time-to-time validations of assumptions were needed. In 2003, NIMS validated these assumptions with the availability of the results from the expanded HSS sites and a community-based survey on prevalence of sexually transmitted infections in India. In 2006, besides data from a greatly expanded sentinel surveillance system, multiple sets of data sources became available, that helped in replacing the assumptions with evidence-based values.

NIMS, in collaboration with NACO, WHO and four identified and specially capacitated regional Institutes, National Institute of Epidemiology, ICMR Chennai, Regional Medical Research Centre, ICMR Dibrugarh, International Institute for Population Sciences Mumbai and PGIMER Chandigarh, organised a number of workshops for State AIDS Control Society (SACS) officials and other researchers in states so as to understand the data needs, gaps and the sub-epidemics in the country. The outcome of these workshops and information from multiple data sources, such as the third round of National Family Health Survey (NFHS-3), the second round of national behavioural surveillance survey (BSS-2), the baseline integrated biological behavioural assessments (IBBA) and NACP-III estimates for sizes of high risk groups, were used to replace the assumptions with evidence-based values. This report describes in detail the process of estimation of PLHIV in 2006. Following a brief introduction in section 1, the process and the overall approach of the estimation is described in section 2. The methodology in detail is explained in section 3 and the results are given in section 4.

A number of national and international organisations were involved in this venture. The contributions of regional Institutes for estimation and surveillance are greatly appreciated. In addition to the four regional Institutes identified for estimation, National Institute of Communicable and Enteric Diseases, ICMR, Kolkata, All India Institute of Medical Sciences, New Delhi and National AIDS Research Institute, Pune cooperated with NIMS in organising the capacity building workshops. Their timely help and cooperation is gratefully acknowledged.

The support and guidance provided by the WHO, India and UNAIDS had been the energizer for the team to complete the challenging task. CDC, Atlanta, Imperial College, London, Macro International, USAID, WHO, India, BMGF, FHI, India and the World Bank were other international organisations providing consultation in finalising the methodology. The contributions of all international organisations are deeply appreciated.

National Institute of Medical Statistics
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Arvind Pandey
Director

1 Introduction

A systematic and consultative HIV estimation process has been ongoing in India since 1998. A national committee with experts from premier national institutions guides the estimation process with assistance from WHO and UNAIDS. The estimations have relied mainly on data generated by NACO's HIV Sentinel Surveillance (HSS) and some epidemiologic assumptions, using an indigenous Excel Worksheet as a tool. The HIV estimation methods and assumptions have been published previously. During the year 2005–2006 a series of activities were initiated to improve the estimation methodology, and the input data base for estimation has been enriched with the availability of multiple data sources. The HSS expanded to over 1,122 sentinel sites covering almost all the districts of the country. The third round of National Family Health Survey (NFHS-3) tested over 102,000 blood specimens from adult men and women through a population-based

household survey. The second round of national behavioural surveillance survey (BSS-2) and the baseline integrated biological behavioural assessments (IBBA) survey were also conducted during the year. More authentic information was available about the size of population at high risk (PHR) from the NACP-III document. Thus the year 2006 is a benchmark in the history of the estimation of PLHIV in India.

The adult HIV prevalence during last five years remained almost stable at 0.4% varying between 0.45% in 2002 and 0.36% in 2006. PLHIV in all ages in 2006 was 2.47 million. Around 4% of them were children, 8% among the above-49 age groups and the remaining 88% in 15–49 age groups. The order of magnitude of prevalence among different risk groups in descending order was 8.7%, 5.7%, 5.4%, 2.4% and 0.3% among IDUs, MSMs, FSWs, long-distance truckers and general population, respectively.

The salient features of the HIV estimation process in 2006 are:

- ◆ It compared the current method with global methods.
- ◆ Having found that the WHO/UNAIDS workbook method is comparable with the current one under the same assumptions and epidemic specifications, it was decided to use the Workbook.
- ◆ A series of workshops were organised in four regions to understand the epidemic sub populations in the country to restructure the Workbook.
- ◆ Multiple sources of data were used to do away with the assumptions involved in the estimation process.
- ◆ A number of consultative meetings were organised with national and international experts to review and modify the estimates.
- ◆ The estimates were re-calculated for the years 2002–2006 to understand the epidemic trend, following the change in methodology.
- ◆ Estimates for PLHIV in all ages were derived from the Spectrum package.

2 Estimation Process, 2006

2.1 Process

As in the previous years, HIV estimation for 2006 was consultative and iterative. A number of meetings of the national and international experts were held to review the HIV estimation methods, data sources, assumptions and results. The group of experts included renowned epidemiologists and biostatisticians from national and international organisations viz., National AIDS Control Organisation (NACO), National Institute of Medical Statistics (NIMS), ICMR, New Delhi, National Institute of Health and Family Welfare (NIHFW), New Delhi, National Institute of Epidemiology (NIE), ICMR, Chennai, National AIDS Research Institute (NARI), Pune, International Institute for Population Sciences (IIPS), Mumbai, Post Graduate Institute of Medical Education and Research (PGIMER), Chandigarh, Indian Statistical Institute (ISI), Kolkata, WHO, UNAIDS, Geneva and India, CDC, Atlanta, FHI, Imperial College, London, USAID, ORC-MACRO and the World Bank.

Four regional Institutes were identified to understand the micro level epidemiology of HIV/AIDS in India, the global estimation methodologies, and to pinpoint the data needs and data gaps that had to be filled in so as to improve the quality of estimates. They were NIE, ICMR, Chennai in the south,

Regional Medical Research Centre (RMRC), ICMR, Dibrugarh for the east and north-east, PGIMER, Chandigarh for the north and IIPS, Mumbai in the west, under the coordination of NIMS, with support from NACO and WHO, India. In order to understand the data needs and gaps at the micro level, regional workshops were organised in collaboration with the respective regional Institutes, along with All India Institute of Medical Sciences (AIIMS), New Delhi, (NARI), ICMR, Pune, All India Institute of Hygiene and Public Health (AIIHPH), Kolkata and National Institute of Communicable and Enteric Diseases (NICED), ICMR, Kolkata and the State AIDS Control Societies of the respective states.

Proceedings of the workshops and the results of different estimation methodologies were presented and discussed in the expert committee meetings to estimate the HIV burden in India. It also discussed the epidemic structure of the UNAIDS/WHO Workbook with regard to the Indian epidemic and availability of data. Continued consultations with national and international experts were achieved through meetings, workshops, and e-communications. The HIV estimation for 2006 was reviewed and approved by the Technical Resource Group on Surveillance and estimation under the chairpersonship of DG, ICMR and DG, NACO. The key meetings and their outcomes are listed below:

| Time | Meeting | Outcome |
|-----------------------------|--|--|
| February–March 2007 | Four Regional workshops including regional institutes and State AIDS Control Societies | <ul style="list-style-type: none"> Capacity building on HIV estimation methodologies Identification of data gaps Defining state-level/local sub-epidemics |
| 17 th April 2007 | Meeting of the National Expert Committee on HIV Estimation | <ul style="list-style-type: none"> Recommendation on use of WHO/UNAIDS Workbook methods for 2006 estimations |

| Time | Meeting | Outcome |
|-----------------------------|--|--|
| 28 th April 2007 | Round up meeting of the regional workshops on model-based HIV Estimation | <ul style="list-style-type: none"> Finalised the structure of the Workbook for HIV estimation in India |
| April–May 2007 | Weekly meetings of core-technical working group on HIV estimations | <ul style="list-style-type: none"> Refining the workbook structure and decision making on input data for the Workbook |
| 4–6 th June 2007 | Consultation of stakeholders on HIV estimation | <ul style="list-style-type: none"> Review of data sources Review and approval of methodology of HIV estimates for 2006 |
| 27 th June 2007 | Meeting of the experts on HIV estimates | <ul style="list-style-type: none"> Review and approval of methodology and draft estimates |
| 4 th July 2007 | Final consensus meeting on HIV estimates | <ul style="list-style-type: none"> HIV estimates approved |
| 6 th July 2007 | Release of HIV estimates by Honorable Health Minister | <ul style="list-style-type: none"> Public release of HIV estimates |

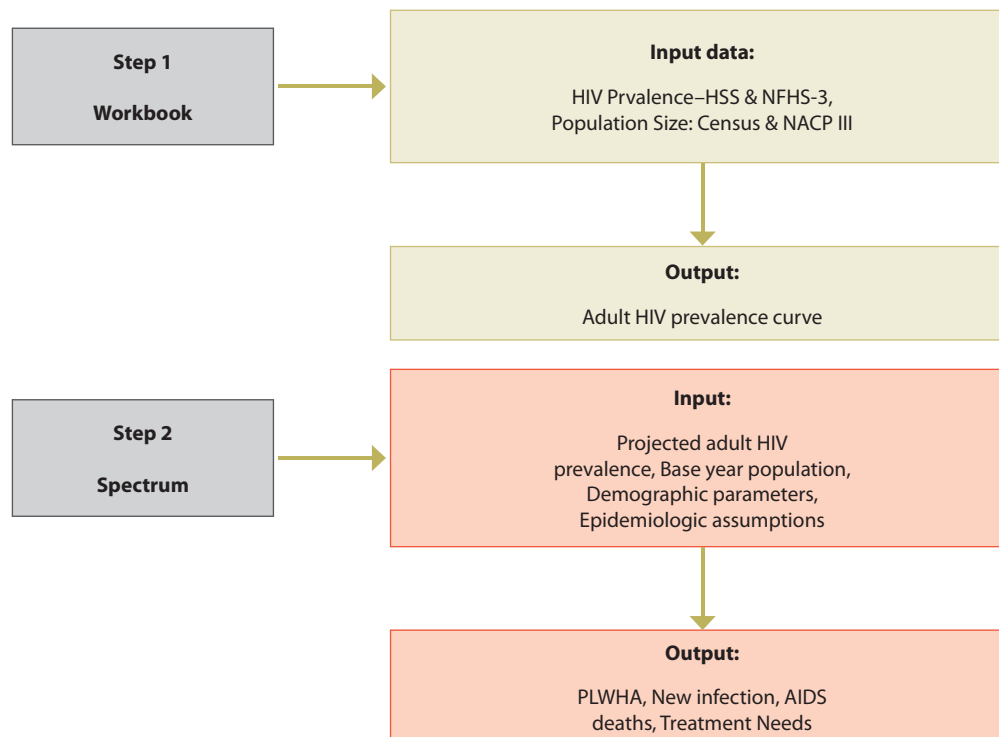
2.2 Overall approach for 2006 estimation

The overall approach to 2006 estimates included five steps as listed below:

1. The sentinel surveillance data was reviewed and used to estimate HIV prevalence for each risk group using the appropriate statistical method, accounting for intra and inter site variation within a specific state. The HIV prevalence among ANC attendees was calibrated with the community-based survey data from NFHS-3.
2. The data on HIV prevalence among each risk group with respective size estimates as given in NACP-III were fed into the UNAIDS/WHO Workbook to estimate the adult HIV prevalence for 2006 for each state.
3. The trend in HIV prevalence in each risk group within a specific state was estimated based on the valid consistent sites using the random effect model. A site was called valid if it had three-fourth coverage of the target and consistent if it had information for five consecutive years, viz. 2002–2006. The HIV prevalence for each risk group for previous years (2002–2005) was then estimated by applying the slope of the trend over the prevalence of 2006.
4. Adult HIV prevalence for these years for each state was estimated by creating separate workbooks. An epidemic curve was fitted for each state using the estimated adult prevalence for five years 2002–2006 to project the HIV prevalence for the epidemic period 1985–2010.
5. The projected HIV prevalence for each state was fed into Spectrum along with programme data on antiretroviral program coverage, percent of mother-baby pairs given NVP etc. and some epidemiologic assumptions, to calculate the number of people living with HIV in all ages.

The diagram below explains the above approach along with the input data sources:

HIV estimates 2006-overall approach



UNAIDS Workbook

The UNAIDS Workbook was developed to estimate and build future scenarios of HIV prevalence in countries with low-level and concentrated epidemics. In concentrated epidemics, HIV has spread rapidly in a defined sub-population, but is not well-established in the general population suggesting active networks of risk within the sub-population. The future course of the epidemic is determined by the frequency and nature of links between highly infected sub-populations and the general population. The UNAIDS Workbook is a series of Excel™ spreadsheets composed of point prevalence worksheets and epidemic curve worksheets. It can be used to make estimates for various regions, generate an epidemic curve and generate estimates of adult prevalence that can be imported into Spectrum.

Spectrum

Spectrum is a policy modelling system consisting of modules for a number of reproductive health areas. Two Spectrum modules, the demographic projection (DemProj) and the AIDS Impact Model (AIM) are used for making a national HIV estimate. National/regional prevalence projections produced by the Workbook are the input in Spectrum to calculate the impact of the epidemic. The AIM is a computer program for projecting the impact of the AIDS epidemic. It projects the consequences of the HIV/AIDS epidemic, including the number of people living with HIV/AIDS, new infections, AIDS deaths by age and sex, number of adults in need of antiretroviral (ARV) treatment and AIDS orphans, given an assumption about adult HIV prevalence. The DemProj projects the population for an entire country or region by age and sex, based on assumptions about fertility, mortality, and migration.

3 Methodology

Key methodological steps included:

- a. Defining the epidemic and population groups using the Workbook;
- b. Estimating adult HIV prevalence for 2006 for each State using Workbook;
- c. Back-calculating previous years' HIV prevalence (2002–2006) for each state using valid consistent sentinel sites and generating an epidemic curve of HIV prevalence within the Workbook;
- d. Calculating estimates of people living with HIV (PLHIV) for all age groups using Spectrum;
- e. Calculating upper and lower bounds for the point estimate.

3.1 Defining the epidemic and population groups using the Workbook

For the purpose of the estimation, the total adult population was divided into populations at higher risk (PHR), i.e., FSW, MSM, IDUS and truckers, and populations at lower risk (PLR).

The general population females included women who are partners of MSM, IDU, truckers, and clients of sex workers. Similarly, the general population male includes husbands of sex workers as well as men who have higher risk behaviour such as clients of sex

Population Groups

- *Populations at higher risk (PHR)*
 - ◆ Female sex workers (FSWs)
 - ◆ Men who have sex with men (MSM)
 - ◆ Male and female injecting drug users (IDUs)
 - ◆ Truckers (includes drivers and cleaners)
- *Populations at lower risk (PLR) includes all individuals not accounted for in the PHR*
 - ◆ General Population Females – Urban
 - ◆ General Population Females – Rural
 - ◆ General Population Males – Urban
 - ◆ General Population Males – Rural

workers, ex-clients of sex workers, ex-IDU, ex-MSM etc.

3.2 Estimating adult HIV prevalence using the Workbook

The Workbook requires the following key sets of data to generate the adult HIV prevalence:

- Size of population at higher risk;
- Size of population at lower risk;
- HIV sero-prevalence among populations at higher risk;
- HIV sero-prevalence among populations at lower risk.

3.2.1 Sizes of Populations at Higher Risk (PHR)

Several sources of data on size estimate were considered including the estimates from the Expert Group on Size Estimation for NACP III planning, coordinated by the Resource Centre for Sexual Health and HIV/AIDS (RCHSA) in 2004 and recent draft estimates from the IBBA. Since IBBA results were available for only selected districts, and that too for more visible subsets of the populations at higher risk (e.g. most visible MSM and FSWs), it was decided to use the estimates provided in NACP III that had state-level estimates.



- **FSW:** State-specific values from the NACP III report were used for high and low size estimates for each state. For states where a range was provided, the lowest and highest values were used for low and high estimates in the workbook. For states where no range was given, the single value was used as the midpoint, and low and high values were calculated as plus or minus 20% of the midpoint. The value of 20% was a consensus of the core technical working group.
- **MSM:** State-specific values from the NACP III report were based on the compilation of information from population-based behavioural survey and review of data from different studies like Avahan data, Avert BSS data, Humsafar trust data etc. Accordingly 65% of adult males were assumed to be sexually active. Among them, 5% are estimated to have homosexual activities and 20% of homosexually active men have had more than 5 partners in the previous month. For the workbook, the estimated number with 5 partners or more was taken as the point estimate and plus or minus 20% of the point estimate was used for low and high values.
- **IDU:** State-specific ranges were available from the NACP III. These ranges were based on a combination of state-wise mapping exercises of IDU, and refined estimates made by the Expert Group after reviewing available evidence and literature. In the few states where there was no refined estimate from the Expert Group, the state mapping figure was used as the midpoint, and low and high values were calculated as plus or minus 20% of the midpoint. Female IDU were estimated to be 10% of all IDU.
- **Truckers:** The NACP III document recorded 5–6 million truckers in the country. Of these 3–3.5 million are long distance truckers. The expert committee recommended the inclusion of 50% of long distance truckers in the workbook for estimation. Assuming that each truck has at least one helper along with the driver, a total of 3 million was included as long distance truckers and helpers. They

were distributed among states following the distribution of the transport related workers in the census report.

3.2.2 Sizes of Populations at Lower Risk (PLR)

The total population in the age group 15–49 in the year 2006 for four classes, urban male, urban female, rural male and rural female were derived using the 'Expert Group Population Estimates and Projections' provided by the National Commission of Population, Ministry of Health & Family Welfare, Government of India. The sizes of PLR in these four classes were calculated by subtracting the sizes of PHR, using the following assumptions.

Assumptions

Urban/Rural

- ◆ FSWs assumed to be 67% urban and 33% rural;
- ◆ MSM assumed to be 60% urban and 40% rural;
- ◆ IDU assumed to be 90% urban and 10% rural in all states except Manipur and Nagaland, where IDU was assumed to be 40% urban and 60% rural;
- ◆ Truckers assumed to be 10% urban and 90% rural;

Male/Female

- ◆ IDU assumed to be 10% female and 90% male.

3.2.3 Estimation of HIV sero-prevalence rates for Populations at Higher Risk (PHR)

The HIV prevalence for each of the populations at higher risk (PHR), i.e., FSW, MSM and IDU was estimated using the random effects logistic regression model, accounting for intra and inter site variation within the specific state.

3.2.4 HIV sero-prevalence among Populations at Lower Risk (PLR)

The HIV prevalence among ANC attendees was estimated similarly as in the case of PHR, by random effects logistic regression models that

account for intra and inter site variation within the specific state. In case of a limited number of ANC sites in a state, standard logistic regression models were used to estimate prevalence.

The HIV prevalence among ANC attendees was then calibrated to the HIV prevalence among women in NFHS-3. The calibration factor was derived for individual states in high prevalence states (Tamil Nadu, Andhra Pradesh, Karnataka, Maharashtra, Manipur and Tamil Nadu). The calibration factor for Manipur was used for Nagaland since NFHS-3 could not be conducted there and the epidemic was similar. For the remainder of the moderate and low prevalence states, a common calibration factor was derived and used. The urban: rural ratio of HIV prevalence as observed in NFHS-3 was applied in each state to derive HIV prevalence among urban and rural women. Subsequently, the female: male ratio of HIV prevalence of NFHS-3 was applied to get the prevalence among men in urban and rural areas.

3.3 Back-calculating the HIV prevalence for previous years and generating an HIV prevalence epidemic curve using the Workbook

3.3.1 Back-calculation of the size of risk groups

Once the workbooks for 2006 were finalised, state-specific year-wise workbooks for 2002 to 2005 were created using the same workbook structure and assumptions that had been used for 2006, with the following modifications:

- *Year-wise population sizes for high-risk groups* were adjusted by calculating the proportion of men and women in each state who were FSWs, IDU and MSM based on the 2004 NACP III data. FSWs were calculated as a proportion of the state-specific female population in 2004, and MSM and IDU as a proportion of the state-specific male population in 2004. These proportions were then applied to gender specific population size estimates projected from the 1991 census for 2001 and 2002, and from the 2001 census, for 2003, 2004 and 2005, to obtain workbook values;

- *Year-wise population sizes for populations at lower risk* were based on year-wise census projections with the appropriate subtractions of populations at higher risk

3.3.2 Back-calculation of the HIV prevalence in risk groups

Year-wise HIV prevalence for high risk groups was calculated following the same set of rules. The trend in HIV prevalence in each risk group within a specific state was estimated, based on the consistent sites that were in place during 2002–06, using the random effect model. The HIV prevalence for each risk group for previous years (2002–2005) was then estimated by applying the trend over the prevalence of 2006.

Year-wise HIV prevalence for populations at lower risk was calculated by applying the same rule as in the case of populations at higher risk. The trend in HIV prevalence among ANC attendees within a specific state was estimated based on the constant sites that were in place during 2002–06 using the random effect model. The HIV prevalence for previous years (2002–2005) was then estimated by applying the trend over the prevalence of 2006. The calibration factor was assumed to be constant over time, i.e. 2002–06.

3.3.4 Generating prevalence curves using the Workbook

Once the year-wise workbooks were finalised for each state, the prevalence estimates for 2002–2006 were entered on the projection sheet of the 2006 workbook for the respective states to fit the logistic curves and project the adult prevalence for the years 1985–2010.

3.4 Calculation of PLHIV estimates for all age groups using Spectrum

The projected prevalence from the Workbook was fed into Spectrum to estimate and project the number of PLHIV in all age groups and other epidemic impact factors for the total epidemic duration i.e., from the initial year 1985 to 2010. The spectrum files were created for each state separately and for the nation.

Curve Fitting

The *single logistic curve* was fitted if the epidemic in the state is still growing or starting to stabilise. Three parameters are used to fit the single logistic curve:

- ◆ The year in which the epidemic reached the half of its peak,
- ◆ α , the rate of increase at the start of the epidemic and
- ◆ The peak prevalence value.

The *double logistic curve* was fitted if the epidemic showed a declining trend. Two additional parameters, the prevalence level at which the epidemic is expected to stabilise and the rate at which the epidemic is declining are used for fitting the double logistic curve.

Spectrum derives these estimates based on the national demographic projections, information on epidemic patterns describing the progression from infection to death, the distribution of infection by age and sex, transmission of HIV from mother-to-child, the effect of HIV infection on fertility, and the effects of anti-retroviral therapy. The information on these parameters, if available for states/the nation was fed into Spectrum along with the workbook projections of HIV prevalence. The default values prepared by the UNAIDS reference group was used wherever specific information was not available. Various input parameters in Spectrum and the source of information is presented in the box below.

3.5 Uncertainty analyses

For each state, the upper uncertainty bound around the adult prevalence rate

was determined by combining the upper confidence intervals of the prevalence estimate in different population groups, pro rata to the population size. Since prevalence among ANC attendees in 2006 was reduced to the level of NFHS-3 by calibration, the NFHS-3 lower confidence interval was used as lower bound for adult prevalence. In order to determine the uncertainty bounds for the previous years (2002–05), separate Workbooks were created for upper bounds in each state using the approach described above. Uncertainty bounds for the national prevalence estimate and the number of people living with HIV were generated by using the Spectrum model. This involved generating up to 1000 logistic curve fits by varying annual estimates. The uncertainty analysis is processed using these curves combined with distributions around key assumptions in Spectrum.

| Input parameters in spectrum and the source of information | |
|--|--|
| Input parameter | Source of information |
| <i>Demographic data</i> | |
| Base year (1985) population by age and sex | Census of India |
| Life expectancy by sex | SRS |
| Migration | Census and expert group population assumption |
| TFR | SRS and expert group population assumption |
| Sex ratio | Census and expert group population assumption |
| Model Life Table | Coale-Damney West |
| ASFR | UN Asia model |
| <i>Epidemiological assumptions</i> | |
| HIV age distribution estimates | Default values for concentrated epidemic pattern |
| MTCT (% MB pair received NVP) | Estimated from MTCT program data |
| Infant feeding pattern | NFHS-2 |
| Adult/children ART | ART program data |
| TB Incidence and prevalence | Default |

4 Results

4.1 National HIV estimate

As mentioned earlier, WHO/UNAIDS Workbook method was used for the estimation of adult HIV infections in all 35 states for five years 2002–06. Independent estimates of adult HIV prevalence and number of PLHIV were derived for each state. The national adult HIV prevalence for each year was derived by aggregating the number of adult PLHIV over states and calculating the percentage over the adult population. The national HIV adult prevalence over time (1985–2012) was projected from the national projection sheet of the UNAIDS Workbook by fitting a double logistic curve over five-point estimates. The projected national prevalence curve is shown in Figure-1 below.

The projected national adult prevalence when input to the national spectrum model provided

the estimate of HIV infections for all ages (2.5 million) with an uncertainty bound 2.0–3.1 million (Table-1). State-specific results on adult HIV prevalence and burden are provided in Appendix Tables A1 and A2 respectively. The spectrum curve for number of PLHIV (all ages) is shown in Figure-2.

4.2 Trend in HIV prevalence

Table-2 presents the time trend of HIV prevalence among adults (age 15–49) by sex during 2002–06 in order to facilitate the comparison of HIV estimate over time by the same methodology. The HIV prevalence for adult males and females together has been showing a declining trend during past five years. It was 0.36% in the year 2006 against 0.45% in 2002. The adult HIV prevalence

Figure-1: National adult prevalence projection

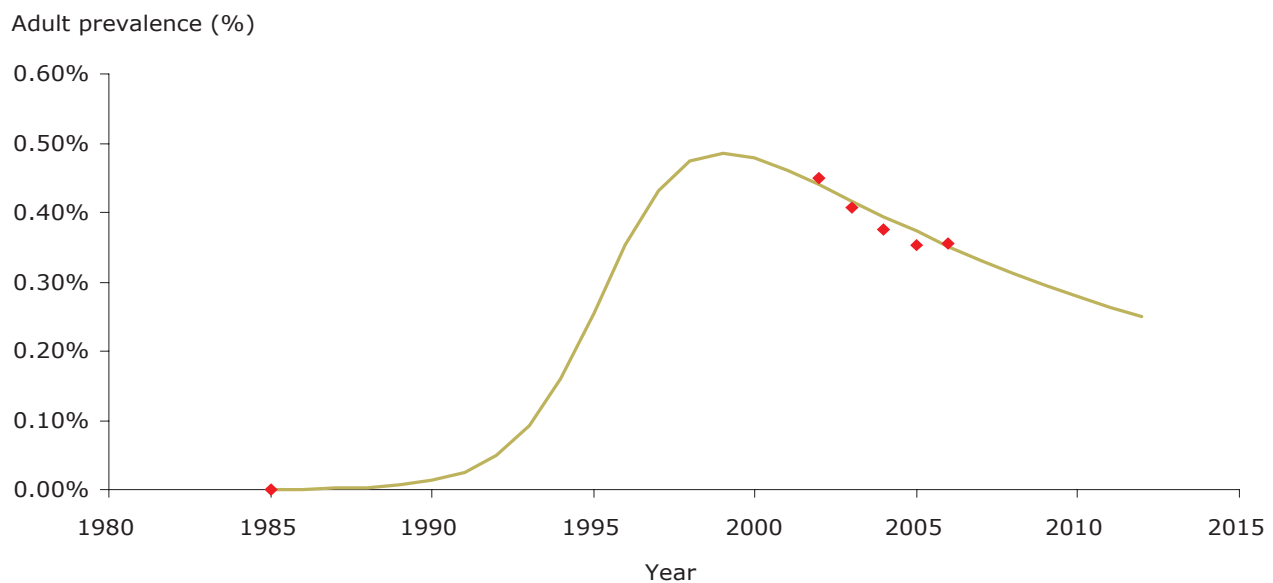
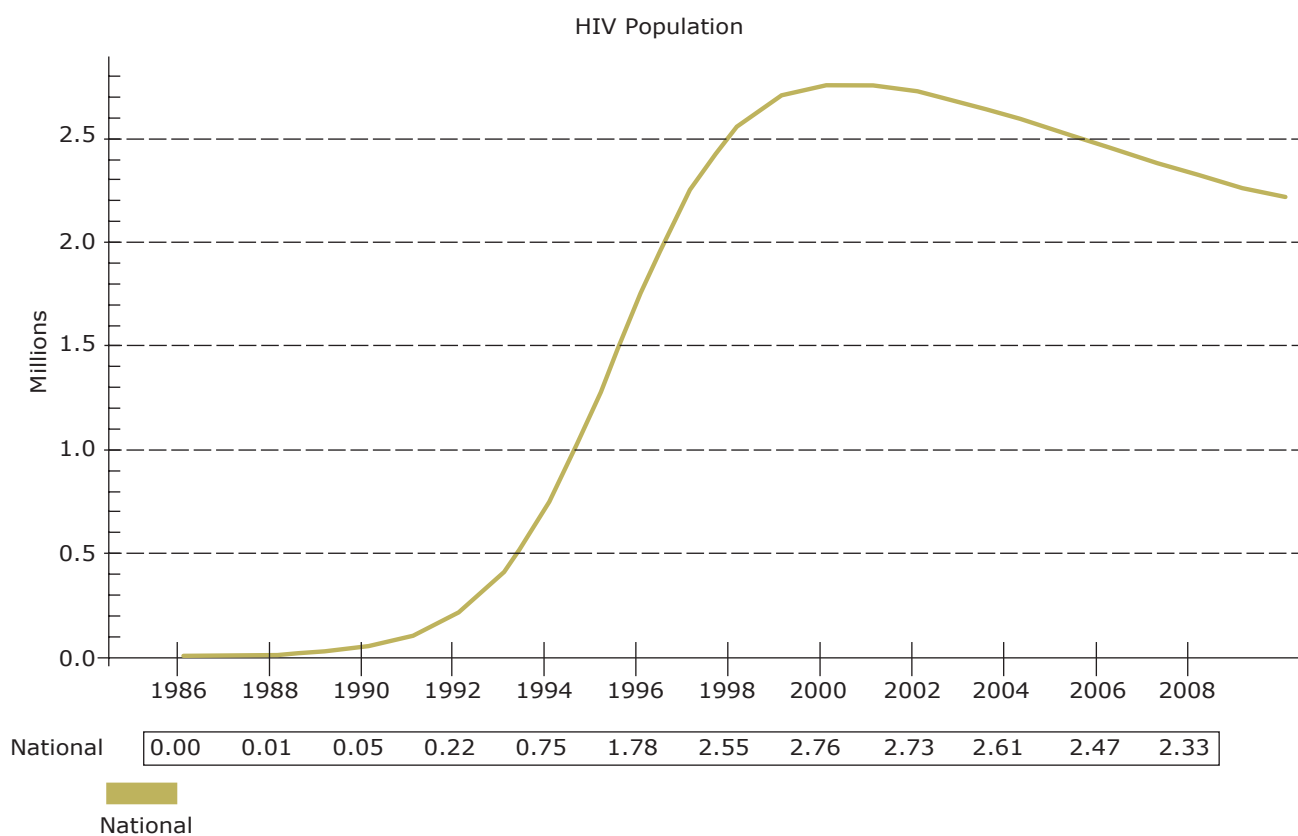


Table-1: Adult HIV prevalence and HIV infections for all age in India

| | |
|-------------------------------------|-----------------------|
| Adult HIV prevalence | 0.36 (0.27–0.47) |
| Number of HIV infections (All ages) | 2.5 (2.0–3.1) million |

Figure-2: Estimated number of PLHIV (all ages)—2006



| Sex | HIV prevalence | | | | |
|--------|----------------|-------|-------|-------|-------|
| | 2002 | 2003 | 2004 | 2005 | 2006 |
| Female | 0.36% | 0.35% | 0.33% | 0.31% | 0.30% |
| Male | 0.53% | 0.50% | 0.48% | 0.46% | 0.43% |
| Total | 0.45% | 0.43% | 0.41% | 0.39% | 0.36% |

among women has declined to 0.30% in 2006 from 0.36% in 2002 while among men it has declined to 0.43% in 2006 from 0.53% in 2002. The percentage of infections among males and females was around 60 and 40 respectively as shown in Table 3.

Table-4 presents the proportion of estimated number of PLHIV by age and time. Accordingly, of the 2.5 million PLHIV in 2006, 88.7% are adults, 7.5% are aged 50 and above, while 3.8% are children. The proportion of infections among children and

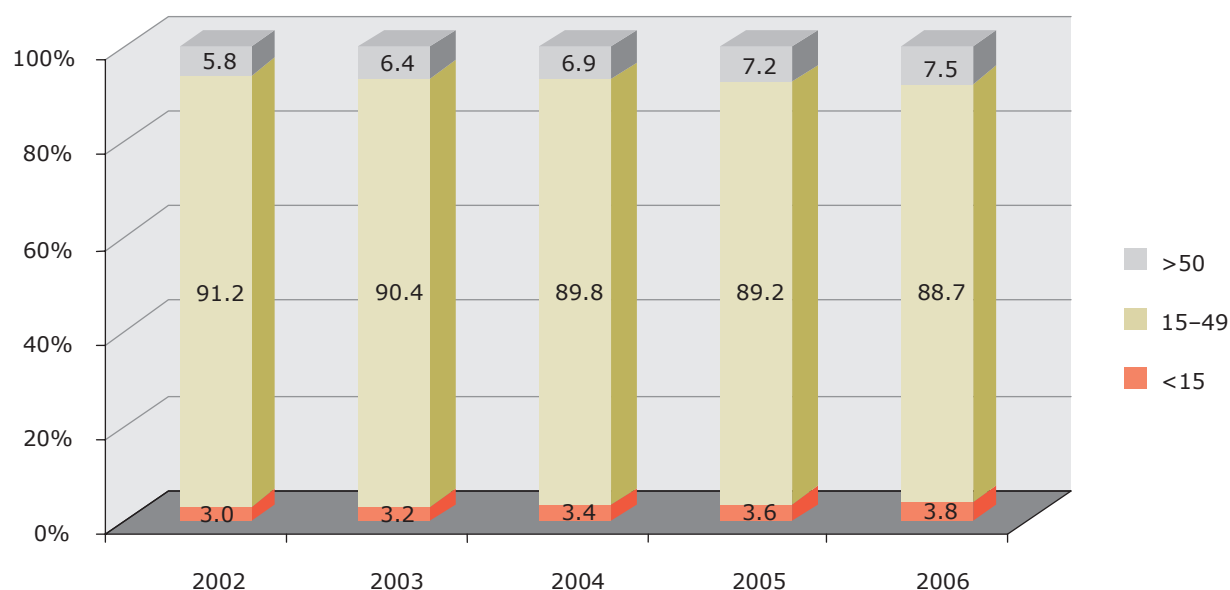
| Sex | 2002 | 2003 | 2004 | 2005 | 2006 |
|-------------------------------|------|------|------|------|-------|
| % Female | 39.1 | 39.1 | 39.1 | 39.1 | 39.1 |
| % Male | 60.9 | 60.9 | 60.9 | 60.9 | 60.9% |
| Total infections (in million) | 2.73 | 2.67 | 2.61 | 2.54 | 2.47 |

adults above 50 years of age has been slightly increasing during the past five years. It was 3% among children and 5.8% among adults beyond the age of 50 in 2002.

in Table-5. The highest HIV prevalence is among IDU for both high prevalence states and low-moderate states. MSM and FSW are at second and third position respectively. The

| Age Group | 2002 | 2003 | 2004 | 2005 | 2006 |
|-------------------------------|-------|-------|-------|-------|-------|
| <15 | 3.0% | 3.2% | 3.4% | 3.6% | 3.8% |
| 15-49 | 91.2% | 90.4% | 89.8% | 89.2% | 88.7% |
| ≥50 | 5.8% | 6.4% | 6.9% | 7.2% | 7.5% |
| Total infections (in million) | 2.73 | 2.67 | 2.61 | 2.54 | 2.47 |

Figure-3: Percentage distribution of HIV infection by age and year



| Epidemic Zone | HIV Prevalence (%) among risk groups (2006) | | | | |
|------------------------|---|------|-----|-----|-------|
| | IDU | MSM | FSW | GP | Total |
| High Prevalence States | 14.5 | 12.7 | 9.1 | 0.7 | 0.8 |
| Low-Moderate States | 4.8 | 3.0 | 2.2 | 0.2 | 0.2 |
| India | 8.7 | 5.7 | 5.4 | 0.3 | 0.4 |

HIV prevalence among different risk groups for the year 2006 by epidemic zone is presented

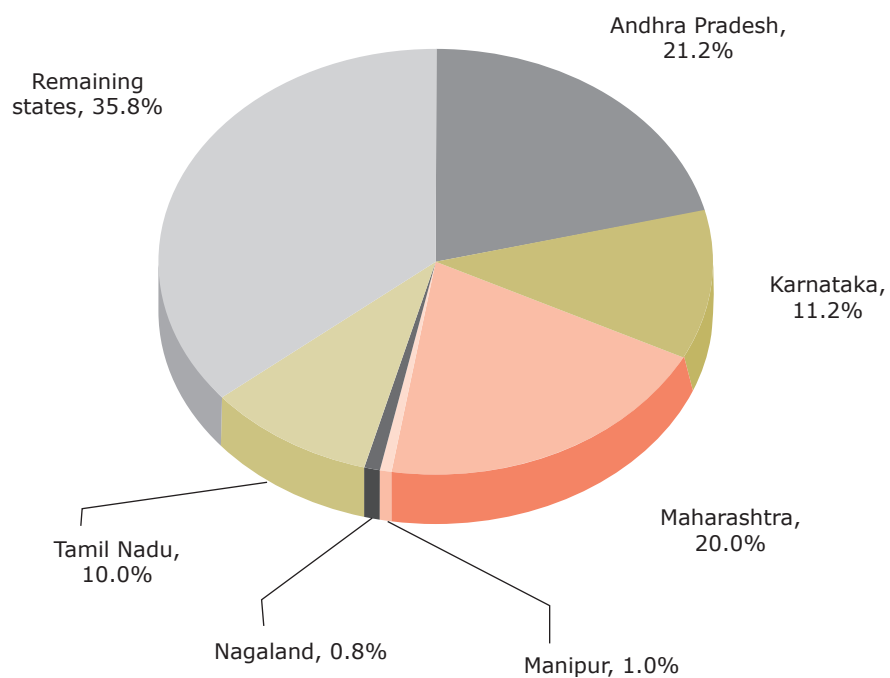
order of HIV prevalence among risk groups is same at the national level too.

| Epidemic Zone | IDU | MSM | FSW | Truckers | GP | Total |
|------------------------|------|------|------|----------|-------|--------|
| High Prevalence States | 0.7% | 6.5% | 3.4% | 2.0% | 87.4% | 100.0% |
| Low-Moderate States | 0.6% | 7.2% | 1.8% | 6.5% | 84.0% | 100.0% |
| India | 0.7% | 6.7% | 2.8% | 3.6% | 86.2% | 100.0% |

The percentage distribution of adult HIV infections among different risk groups is presented in Table 6. Among the high risk groups MSM has the maximum share and FSW stands at second position.

Major proportion (64%) of the HIV burden in India is in the six high prevalence States. Figure-4 depicts the percentage of total HIV burden in six high prevalence states and in remaining states.

Figure-4 Percentage distribution of HIV burden in states



5 Conclusions and Next Steps

The WHO/UNAIDS Workbook and India's old worksheet approach are based on the same principles and produce the same results for a given set of inputs. Hence, the method of estimation of PLHIV in 2006 is unlikely to produce vastly different results from those generated by the earlier approach. The application of Spectrum to estimate PLHIV for all ages might have used smoothed data. Evolution of the random effects model, on the other hand, ensures that inter and intra-site variations are accounted for, which in turn brings the estimates closer to reality.

The estimates were derived for the past five years, i.e. 2002–2006 and found that the epidemic is stable at the national level, although at the state-level some high prevalence states showed a decline and some in the low prevalence areas showed an increase in the epidemic. The decline was significant only in Tamil Nadu. The lowered estimate does not connote any decline in the epidemic but a correction for some incongruities in data and the previous method of estimation.

Appendix

Table -A1: State-wise Adult HIV Prevalence

| State/Uts | Adult prevalence (15–49) | | | | |
|---------------------------|--|-------------|-------------|-------------|-------------|
| | 2002 | 2003 | 2004 | 2005 | 2006 |
| Andhra Pradesh | 1.16 | 1.13 | 1.10 | 1.08 | 1.05 |
| Karnataka | 0.85 | 0.84 | 0.82 | 0.81 | 0.81 |
| Maharashtra | 1.08 | 0.98 | 0.89 | 0.80 | 0.74 |
| Manipur | 2.42 | 2.20 | 2.01 | 1.83 | 1.67 |
| Nagaland | 2.00 | 1.83 | 1.62 | 1.45 | 1.26 |
| Tamil Nadu | 0.93 | 0.73 | 0.59 | 0.47 | 0.39 |
| Goa | 1.01 | 0.92 | 0.84 | 0.77 | 0.73 |
| Gujarat | 0.54 | 0.51 | 0.48 | 0.45 | 0.43 |
| Pondicherry | 0.40 | 0.43 | 0.47 | 0.50 | 0.55 |
| Arunachal Pradesh | 0.18 | 0.13 | 0.09 | 0.07 | 0.05 |
| Assam | 0.08 | 0.06 | 0.04 | 0.03 | 0.03 |
| Bihar | 0.10 | 0.11 | 0.12 | 0.13 | 0.16 |
| Chhatisgarh | 0.59 | 0.43 | 0.31 | 0.22 | 0.17 |
| Delhi | 0.35 | 0.32 | 0.30 | 0.27 | 0.27 |
| Haryana | 0.50 | 0.32 | 0.21 | 0.14 | 0.10 |
| Himachal Pradesh | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 |
| Jammu & Kashmir | 0.02 | 0.02 | 0.02 | 0.03 | 0.04 |
| Jharkhand | 0.07 | 0.07 | 0.08 | 0.09 | 0.11 |
| Kerala | 0.59 | 0.39 | 0.25 | 0.17 | 0.13 |
| Madhya Pradesh | 0.17 | 0.15 | 0.13 | 0.12 | 0.11 |
| Meghalaya | 0.19 | 0.14 | 0.10 | 0.07 | 0.06 |
| Mizoram | 1.13 | 0.99 | 0.91 | 0.82 | 0.74 |
| Orissa | 0.06 | 0.08 | 0.11 | 0.15 | 0.22 |
| Punjab | 0.18 | 0.16 | 0.14 | 0.12 | 0.12 |
| Rajasthan | 0.05 | 0.07 | 0.09 | 0.12 | 0.17 |
| Sikkim | 0.24 | 0.17 | 0.13 | 0.09 | 0.08 |
| Tripura | 0.41 | 0.29 | 0.21 | 0.15 | 0.12 |
| Uttar Pradesh | 0.14 | 0.13 | 0.12 | 0.11 | 0.11 |
| Uttaranchal | 0.09 | 0.08 | 0.08 | 0.07 | 0.08 |
| West Bengal | 0.10 | 0.13 | 0.16 | 0.21 | 0.30 |
| Andaman & Nicobar Islands | 0.81 | 0.66 | 0.54 | 0.44 | 0.37 |
| Chandigarh | 0.45 | 0.42 | 0.38 | 0.35 | 0.34 |
| Dadra & Nagar Haveli | < 100 Cases | | | | |
| Daman & Diu | | | | | |
| Lakshadweep | | | | | |
| | No results as there are no valid sites | | | | |
| India | 0.45 | 0.43 | 0.41 | 0.39 | 0.36 |



Table -A2: Percent Distribution of HIV Infections in 2006 by Age Group

| State/Uts | Percent Distribution | | | Number in lakh |
|---------------------------|--|-------------|------------|----------------|
| | <15 | 15-49 | >49 | |
| Andhra Pradesh | 2.07 | 90.58 | 7.36 | 5.26 |
| Karnataka | 2.25 | 91.28 | 6.48 | 2.76 |
| Maharashtra | 3.44 | 87.27 | 9.29 | 4.95 |
| Manipur | 3.23 | 88.23 | 8.53 | 0.25 |
| Nagaland | 2.99 | 87.60 | 9.41 | 0.19 |
| Tamil Nadu | 3.34 | 86.33 | 10.33 | 2.46 |
| Goa | 2.75 | 87.54 | 9.71 | 0.07 |
| Gujarat | 2.13 | 89.78 | 8.10 | 1.44 |
| Pondicherry | 2.47 | 91.55 | 5.98 | 0.04 |
| Arunachal Pradesh | 2.63 | 86.85 | 10.52 | 0.02 |
| Assam | 2.39 | 90.15 | 7.46 | 0.09 |
| Bihar | 1.78 | 93.23 | 4.99 | 0.74 |
| Chhatisgarh | 3.60 | 87.25 | 9.15 | 0.38 |
| Delhi | 3.73 | 86.64 | 9.63 | 0.30 |
| Haryana | 2.83 | 89.08 | 8.09 | 0.39 |
| Himachal Pradesh | 2.49 | 91.05 | 6.46 | 0.01 |
| Jammu & Kashmir | 1.61 | 93.10 | 5.29 | 0.02 |
| Jharkhand | 1.83 | 93.19 | 4.98 | 0.18 |
| Kerala | 2.00 | 87.99 | 10.01 | 0.62 |
| Madhya Pradesh | 3.29 | 87.88 | 8.83 | 0.46 |
| Meghalaya | 2.62 | 89.11 | 8.27 | 0.02 |
| Mizoram | 2.65 | 88.24 | 9.11 | 0.05 |
| Orissa | 0.89 | 95.29 | 3.82 | 0.48 |
| Punjab | 2.29 | 89.04 | 8.67 | 0.20 |
| Rajasthan | 1.36 | 94.78 | 3.86 | 0.56 |
| Sikkim | 2.79 | 87.96 | 9.25 | 0.01 |
| Tripura | 2.30 | 88.38 | 9.32 | 0.05 |
| Uttar Pradesh | 3.30 | 89.51 | 7.19 | 1.13 |
| Uttaranchal | 3.02 | 90.92 | 6.06 | 0.04 |
| West Bengal | 0.84 | 95.24 | 3.92 | 1.49 |
| Andaman & Nicobar Islands | 1.87 | 88.21 | 9.92 | 0.02 |
| Chandigarh | 5.07 | 85.05 | 9.89 | 0.03 |
| Dadra & Nagar Haveli | < 100 Cases | | | |
| Daman & Diu | | | | |
| Lakshadweep | No results as there are no valid sites | | | |
| India | 3.8 | 88.7 | 7.5 | 24.7 |

Table –A3: Projected Population (15–49) 2002–2006

| Table –A3-a: Projected Population (15–49) 2002–2003 | | | | | | | | |
|---|---|----------|----------|----------|---|----------|----------|----------|
| State/Uts | Projected population (15–49) as on 1st October, 2002 | | | | Projected population (15–49) as on 1st October, 2003 | | | |
| | Urban | | Rural | | Urban | | Rural | |
| | Male | Female | Male | Female | Male | Female | Male | Female |
| Andhra Pradesh | 5861724 | 5636862 | 15413662 | 15099007 | 5981441 | 5757429 | 15695340 | 15389163 |
| Karnataka | 5202796 | 4879792 | 9716306 | 9437863 | 5348333 | 5026126 | 9853978 | 9581494 |
| Maharashtra | 12349102 | 10493784 | 15642845 | 14588650 | 12755815 | 10847960 | 15916954 | 14840106 |
| Manipur | 155394 | 156702 | 441618 | 426400 | 158513 | 160677 | 453899 | 438751 |
| Nagaland | 101460 | 85280 | 468852 | 427999 | 103872 | 88183 | 480949 | 439833 |
| Tamil Nadu | 8064952 | 8061890 | 9549204 | 9629870 | 8330498 | 8337467 | 9463982 | 9544539 |
| Goa | 195914 | 173580 | 182926 | 172002 | 206161 | 182133 | 185981 | 173637 |
| Gujarat | 5709431 | 4964001 | 9054745 | 8487815 | 5886397 | 5103153 | 9208386 | 8628968 |
| Pondicherry | 178066 | 184898 | 89033 | 90482 | 183928 | 190857 | 90856 | 92895 |
| Arunachal Pradesh | 154210 | 60252 | 739570 | 221811 | 160195 | 65509 | 757680 | 224681 |
| Assam | 1004437 | 878927 | 6365268 | 6006088 | 1041220 | 916292 | 6497213 | 6142628 |
| Bihar | 2225375 | 1974210 | 18454735 | 17468322 | 2291611 | 2029110 | 18991924 | 17946032 |
| Chhatisgarh | 1147915 | 1060800 | 4282723 | 4257677 | 1191141 | 1101763 | 4368874 | 4339731 |
| Delhi | 4353440 | 3447910 | 298771 | 234291 | 4538404 | 3600365 | 298602 | 234434 |
| Haryana | 1832562 | 1549856 | 4297023 | 3733268 | 1922047 | 1622942 | 4403350 | 3829635 |
| Himachal Pradesh | 182965 | 147092 | 1485399 | 1495709 | 189962 | 151385 | 1514890 | 1521993 |
| Jammu & Kashmir | 759931 | 609590 | 2142731 | 1937199 | 786102 | 631771 | 2187834 | 1990973 |
| Jharkhand | 1638273 | 1432600 | 5423351 | 5210712 | 1688471 | 1481032 | 5567311 | 5343791 |
| Kerala | 2218410 | 2381952 | 6348056 | 6818877 | 2237781 | 2399443 | 6417850 | 6883430 |
| Madhya Pradesh | 4377499 | 3867708 | 11872991 | 10818064 | 4521998 | 3995027 | 12191930 | 11101490 |
| Meghalaya | 125490 | 124189 | 515310 | 497822 | 128758 | 128758 | 528557 | 510704 |
| Mizoram | 124956 | 118326 | 124956 | 115661 | 128758 | 122266 | 127676 | 117938 |
| Orissa | 1581825 | 1428155 | 8397375 | 8315011 | 1626675 | 1476253 | 8538060 | 8467856 |
| Punjab | 2494178 | 2146676 | 4596308 | 4162345 | 2587356 | 2219662 | 4667028 | 4223881 |
| Rajasthan | 3530750 | 3123566 | 11270641 | 10429502 | 3647196 | 3223037 | 11608248 | 10733011 |
| Sikkim | 18156 | 14924 | 138840 | 122057 | 18935 | 16230 | 142283 | 124971 |
| Tripura | 125396 | 148230 | 514924 | 699558 | 128806 | 153758 | 528752 | 718438 |
| Uttar Pradesh | 9068304 | 7989684 | 33666670 | 30652042 | 9399646 | 8261439 | 34632686 | 31496946 |
| Uttaranchal | 610579 | 529753 | 1591867 | 1644166 | 633517 | 549722 | 1630905 | 1679933 |
| West Bengal | 6567126 | 5815985 | 16383657 | 15369480 | 6700503 | 5963220 | 16699077 | 15696180 |
| A & N Islands | 37352 | 28793 | 72570 | 59185 | 40049 | 30860 | 75768 | 61720 |
| Chandigarh | 275475 | 206621 | 34362 | 20268 | 290961 | 217740 | 36444 | 21660 |
| D & N Haveli | 19743 | 10664 | 50692 | 37857 | 22730 | 12452 | 52496 | 38439 |
| Daman & Diu | 16008 | 17062 | 39486 | 22928 | 16777 | 17866 | 43837 | 24363 |
| Lakshadweep | 7470 | 7465 | 10138 | 10131 | 7577 | 7580 | 10824 | 10828 |

Source: 'Expert Group Population Estimates and Projections': National Commission of Population, Ministry of Health & Family Welfare, Government of India.

Table –A3-b: Projected Population (15–49) 2004–2005

| State/Uts | Projected population (15–49) as on 1st October, 2004 | | | | Projected population (15–49) as on 1st October, 2005 | | | |
|-------------------|---|----------|----------|----------|---|----------|----------|----------|
| | Urban | | Rural | | Urban | | Rural | |
| | Male | Female | Male | Female | Male | Female | Male | Female |
| Andhra Pradesh | 6100648 | 5877515 | 15976210 | 15677567 | 6220418 | 5997635 | 16255640 | 15963572 |
| Karnataka | 5495882 | 5174572 | 9988758 | 9722371 | 5645455 | 5324592 | 10122235 | 9861519 |
| Maharashtra | 13171164 | 11209764 | 16191216 | 15089964 | 13595236 | 11578197 | 16463920 | 15338130 |
| Manipur | 161955 | 165000 | 466650 | 452650 | 165688 | 169074 | 478716 | 465372 |
| Nagaland | 105957 | 91300 | 495198 | 452100 | 108420 | 94302 | 507628 | 464256 |
| Tamil Nadu | 8598060 | 8615100 | 9372840 | 9453204 | 8867644 | 8894230 | 9275748 | 9355835 |
| Goa | 218191 | 192065 | 189062 | 176015 | 230935 | 203040 | 193276 | 179280 |
| Gujarat | 6065338 | 5243476 | 9359784 | 8768396 | 6246811 | 5385517 | 9508342 | 8905509 |
| Pondicherry | 192585 | 198528 | 93795 | 95316 | 202384 | 206790 | 97856 | 97745 |
| Arunachal Pradesh | 166286 | 70349 | 776003 | 228084 | 172484 | 75861 | 794539 | 230929 |
| Assam | 1079022 | 954207 | 6628355 | 6278544 | 1117858 | 993208 | 6759176 | 6414848 |
| Bihar | 2358287 | 2084650 | 19527892 | 18423486 | 2424429 | 2139858 | 20063797 | 18900054 |
| Chhatisgarh | 1235396 | 1143162 | 4454806 | 4421472 | 1280692 | 1185504 | 4539979 | 4502371 |
| Delhi | 4728990 | 3757288 | 298380 | 234506 | 4926478 | 3919330 | 298103 | 235090 |
| Haryana | 2014652 | 1697898 | 4509364 | 3926155 | 2110429 | 1775288 | 4613934 | 4022247 |
| Himachal Pradesh | 196516 | 155724 | 1545208 | 1548498 | 203157 | 160108 | 1575280 | 1574672 |
| Jammu & Kashmir | 812638 | 654320 | 2233404 | 2046013 | 839537 | 677235 | 2279443 | 2101262 |
| Jharkhand | 1739356 | 1529640 | 5710054 | 5476464 | 1790418 | 1579427 | 5854033 | 5608162 |
| Kerala | 2256644 | 2416947 | 6487782 | 6946920 | 2275542 | 2433353 | 6556210 | 7009343 |
| Madhya Pradesh | 4667836 | 4123442 | 12512062 | 11385146 | 4816541 | 4254454 | 12833323 | 11669462 |
| Meghalaya | 132309 | 133650 | 542961 | 525250 | 136220 | 138384 | 555444 | 538470 |
| Mizoram | 133407 | 127050 | 130113 | 120450 | 137332 | 131130 | 132884 | 123318 |
| Orissa | 1672554 | 1525522 | 8676707 | 8618875 | 1718937 | 1575433 | 8813244 | 8769605 |
| Punjab | 2682806 | 2294673 | 4737201 | 4284200 | 2780554 | 2370622 | 4805707 | 4343818 |
| Rajasthan | 3765272 | 3324346 | 11948874 | 11038963 | 3884476 | 3427008 | 12291972 | 11346317 |
| Sikkim | 19764 | 17050 | 146034 | 128150 | 20572 | 17856 | 149008 | 131688 |
| Tripura | 132261 | 159934 | 542763 | 737014 | 136318 | 166224 | 555844 | 755819 |
| Uttar Pradesh | 9739174 | 8539621 | 35614627 | 32355288 | 10086502 | 8824306 | 36608695 | 33224714 |
| Uttaranchal | 657826 | 569437 | 1670413 | 1716587 | 682004 | 589930 | 1710391 | 1752576 |
| West Bengal | 6832395 | 6109995 | 17009135 | 16017550 | 6963850 | 6257350 | 17316418 | 16335550 |
| A & N Islands | 42806 | 33526 | 78478 | 64303 | 45625 | 36257 | 81234 | 66936 |
| Chandigarh | 309057 | 231778 | 38558 | 22542 | 328631 | 246285 | 41303 | 23985 |
| D & N Haveli | 26891 | 14839 | 53782 | 39571 | 30602 | 18407 | 55084 | 40719 |
| Daman & Diu | 17562 | 18686 | 48294 | 25831 | 18361 | 19523 | 52858 | 27332 |
| Lakshadweep | 7683 | 7694 | 11525 | 11542 | 7790 | 7809 | 12241 | 12272 |

Source: 'Expert Group Population Estimates and Projections': National Commission of Population, Ministry of Health & Family Welfare, Government of India.

Table –A3-c: Projected Population (15–49) 2006

| State/Uts | Projected Population (15–49) as on 1st October, 2006 | | | |
|-------------------|--|----------|----------|----------|
| | Urban | | Rural | |
| | Male | Female | Male | Female |
| Andhra Pradesh | 6339619 | 6117210 | 16534102 | 16249290 |
| Karnataka | 5796504 | 5477295 | 10253808 | 9997770 |
| Maharashtra | 14025888 | 11952768 | 16732746 | 15582880 |
| Manipur | 169200 | 173196 | 492372 | 478270 |
| Nagaland | 111108 | 97352 | 521136 | 476006 |
| Tamil Nadu | 9137028 | 9174294 | 9174904 | 9254100 |
| Goa | 243846 | 213792 | 196974 | 181696 |
| Gujarat | 6429724 | 5528183 | 9655112 | 9040808 |
| Pondicherry | 213331 | 215080 | 101374 | 100748 |
| Arunachal Pradesh | 178788 | 82070 | 813288 | 233192 |
| Assam | 1157740 | 1033310 | 6890717 | 6551510 |
| Bihar | 2490960 | 2195200 | 20598435 | 19376070 |
| Chhatisgarh | 1327040 | 1228800 | 4624880 | 4582912 |
| Delhi | 5132188 | 4088352 | 297168 | 235024 |
| Haryana | 2208885 | 1855150 | 4718065 | 4117300 |
| Himachal Pradesh | 210432 | 164538 | 1604544 | 1600506 |
| Jammu & Kashmir | 867350 | 701064 | 2324300 | 2155608 |
| Jharkhand | 1842155 | 1629894 | 5998720 | 5741894 |
| Kerala | 2293380 | 2449770 | 6624224 | 7070145 |
| Madhya Pradesh | 4966584 | 4387071 | 13156682 | 11954883 |
| Meghalaya | 139872 | 143198 | 570204 | 551850 |
| Mizoram | 142128 | 135840 | 135360 | 125652 |
| Orissa | 1765824 | 1627080 | 8949763 | 8918364 |
| Punjab | 2880168 | 2448072 | 4872097 | 4401584 |
| Rajasthan | 4004793 | 3530016 | 12635961 | 11655000 |
| Sikkim | 21432 | 19244 | 152844 | 134142 |
| Tripura | 139872 | 172630 | 570204 | 774288 |
| Uttar Pradesh | 10441716 | 9114091 | 37611432 | 34102289 |
| Uttaranchal | 707070 | 610686 | 1749804 | 1788926 |
| West Bengal | 7094828 | 6405255 | 17623593 | 16654995 |
| A & N Islands | 48504 | 39054 | 84036 | 69618 |
| Chandigarh | 349716 | 261072 | 43488 | 25456 |
| D & N Haveli | 34968 | 21508 | 55836 | 42450 |
| Daman & Diu | 18612 | 19810 | 58092 | 29432 |
| Lakshadweep | 7896 | 7924 | 12408 | 12452 |

Source: Interpolated using 'Expert Group Population Estimates and Projections': National Commission of Population, Ministry of Health & Family Welfare, Government of India.



Table-A4: Size Estimates for High Risk Groups, 2004

| Table-A4-a: Size Estimates for IDU, 2004 | |
|--|----------------------|
| State/UTs | IDU Range |
| Andhra Pradesh | 298–2640 |
| Karnataka | 4819–5056 |
| Maharashtra | 220–9900 |
| Manipur | 26800–24002 |
| Nagaland | 16827–15500 |
| Tamil Nadu | 7539–12620 |
| Goa | 1050 |
| Gujarat | 24–11300 |
| Pondicherry | 15–1040 |
| Arunachal Pradesh | 757 |
| Assam | 100–1500 |
| Bihar | 338–5890 |
| Chhattisgarh | Not Applicable |
| Delhi | 6070–9605 |
| Haryana | 13510 |
| Himachal Pradesh | 210–1000 |
| Jammu & Kashmir | 48–380 |
| Jharkhand | Not Applicable |
| Kerala | 1722–12000 |
| Madhya Pradesh | 219–3530 |
| Meghalaya | 72–1450 |
| Mizoram | 10380–8850 |
| Orissa | 696–15504 |
| Punjab | 864–8500 |
| Rajasthan | 387–3780 |
| Sikkim | 271 |
| Tripura | 528–7000 |
| Uttar Pradesh | 1466–17200 |
| Uttaranchal | 125–240 |
| West Bengal | 5080–13418 |
| A & N Islands | Not Applicable |
| Chandigarh | 1671–3000 |
| Daman and Diu | Not Applicable |
| D & N Haveli | Not Applicable |
| Lakshwadeep | Not Applicable |
| Total | 100173–189729 |

Source: Extracted from Report of the Expert Group on Size Estimation of Population with High Risk Behaviour for NACP-III Planning

| Table-A4-b: Size Estimates for MSM, 2004 | |
|--|------------------|
| State/UTs | MSM |
| Andhra Pradesh | 170,291 |
| Karnataka | 118,893 |
| Maharashtra | 222,771 |
| Manipur | 4,843 |
| Nagaland | 4,628 |
| Tamil Nadu | 138,792 |
| Goa | 3,038 |
| Gujarat | 116,624 |
| Pondicherry | 2,152 |
| Arunachal Pradesh | 2,563 |
| Assam | 60,895 |
| Bihar | 191,138 |
| Chhattisgarh | 46,296 |
| Delhi | 33,624 |
| Haryana | 50,229 |
| Himachal Pradesh | 13,649 |
| Jammu & Kashmir | 23,695 |
| Jharkhand | 61,372 |
| Kerala | 68,371 |
| Madhya Pradesh | 138,981 |
| Meghalaya | 5,198 |
| Mizoram | 2,029 |
| Orissa | 82,480 |
| Punjab | 57,394 |
| Rajasthan | 130,036 |
| Sikkim | 1,275 |
| Tripura | 7,259 |
| Uttar Pradesh | 387,039 |
| Uttaranchal | 19,121 |
| West Bengal | 183,280 |
| A & N Islands | 853 |
| Chandigarh | 2,241 |
| Daman & Diu | 409 |
| D & N Haveli | 538 |
| Lakshadweep | 138 |
| Total | 2,352,133 |

Source: Extracted from Report of the Expert Group on Size Estimation of Population with High Risk Behaviour for NACP-III Planning

Table-A4-c: Size Estimates for FSW, 2004

| State/UTs | Corrections after district-wise and rural correction and for estimate based on HIV prevalence | Corrections after district-wise and rural corrections and for estimate based on Best regional data |
|-------------------|---|--|
| Andhra Pradesh | 109,385 | 109,385 |
| Karnataka | 77,504 | 77,504 |
| Maharashtra | 170,377 | 172,910 |
| Manipur | 9,044 | 9,044 |
| Nagaland | 4,956 | 4,956 |
| Tamil Nadu | 108,153 | 108,153 |
| Goa | 2129.33 | 2,129 |
| Gujarat | 26166.42 | 26,166 |
| Pondicherry | 1935.15 | 1,935 |
| Arunachal Pradesh | 695.59 | 1,270 |
| Assam | 4,168 | 29,464 |
| Bihar | 31,845 | 82,796 |
| Chhatisgarh | 4,576 | 21,556 |
| Delhi | 46632.46 | 46,632 |
| Haryana | 12243.98 | 24,997 |
| Himachal Pradesh | 7296.38 | 7,296 |
| Jammu & Kashmir | 3,076 | 11,977 |
| Jharkhand | 6,466 | 28,186 |
| Kerala | 7800.45 | 7,800 |
| Madhya Pradesh | 16,914 | 64,949 |
| Meghalaya | 598.50 | 2,434 |
| Mizoram | 1562.75 | 1,563 |
| Orissa | 6,294 | 39,838 |
| Punjab | 12882.38 | 28,616 |
| Rajasthan | 23461.20 | 59,576 |
| Tripura | 1396.50 | 3,618 |
| Sikkim | 175.56 | 686 |
| Uttar Pradesh | 35,746 | 170,179 |
| Uttaranchal | 2,470 | 8,773 |
| West Bengal | 92,009 | 92,009 |
| A & N Islands | 210.14 | 210 |
| Chandigarh | 3,394 | 3,394 |
| Daman & Diu | 113.05 | 113 |
| Total | 831,677 | 1,250,114 |

Source: Extracted from Report of the Expert Group on Size Estimation of Population with High Risk Behaviour for NACP-III Planning

Table-A5: HIV Prevalence 2002–2006

| TableA5-a: Adjusted* HIV Prevalence among ANC Women 2002–2006 | | | | | |
|---|------|------|------|------|------|
| State/UTs | 2002 | 2003 | 2004 | 2005 | 2006 |
| Andhra Pradesh | 1.46 | 1.43 | 1.40 | 1.38 | 1.35 |
| Karnataka | 1.05 | 1.04 | 1.04 | 1.03 | 1.02 |
| Maharashtra | 1.20 | 1.09 | 0.98 | 0.89 | 0.80 |
| Manipur | 1.71 | 1.57 | 1.43 | 1.30 | 1.19 |
| Nagaland | 1.62 | 1.45 | 1.29 | 1.15 | 1.03 |
| Tamil Nadu | 1.07 | 0.86 | 0.69 | 0.56 | 0.45 |
| Goa | 1.37 | 1.23 | 1.12 | 1.01 | 0.91 |
| Gujarat | 0.78 | 0.72 | 0.67 | 0.63 | 0.58 |
| Pondicherry | 0.46 | 0.50 | 0.55 | 0.59 | 0.63 |
| Arunachal Pradesh | | | | | 0.08 |
| Assam | 0.31 | 0.22 | 0.16 | 0.11 | 0.04 |
| Bihar | 0.16 | 0.11 | 0.08 | 0.06 | 0.35 |
| Chhatisgarh | 0.22 | 0.24 | 0.28 | 0.31 | 0.30 |
| Delhi | 1.18 | 0.84 | 0.60 | 0.42 | 0.18 |
| Haryana | 0.27 | 0.24 | 0.22 | 0.20 | 0.14 |
| Himachal Pradesh | 0.86 | 0.54 | 0.35 | 0.22 | 0.05 |
| Jammu & Kashmir | 0.06 | 0.06 | 0.06 | 0.05 | 0.04 |
| Jharkhand | 0.01 | 0.02 | 0.02 | 0.03 | 0.18 |
| Kerala | 0.11 | 0.12 | 0.14 | 0.16 | 0.21 |
| Madhya Pradesh | 1.12 | 0.74 | 0.48 | 0.32 | 0.17 |
| Meghalaya | 0.29 | 0.26 | 0.22 | 0.19 | 0.09 |
| Mizoram | 0.37 | 0.26 | 0.18 | 0.13 | 0.96 |
| Orissa | 1.51 | 1.35 | 1.20 | 1.08 | 0.43 |
| Punjab | 0.10 | 0.14 | 0.21 | 0.30 | 0.12 |
| Rajasthan | 0.26 | 0.21 | 0.18 | 0.15 | 0.30 |
| Sikkim | 0.09 | 0.12 | 0.16 | 0.22 | 0.13 |
| Tripura | 0.53 | 0.37 | 0.26 | 0.18 | 0.21 |
| Uttar Pradesh | 0.85 | 0.60 | 0.42 | 0.30 | 0.19 |
| Uttaranchal | 0.25 | 0.24 | 0.22 | 0.21 | 0.11 |
| West Bengal | 0.14 | 0.13 | 0.12 | 0.12 | 0.44 |
| Andaman & Nicobar Islands | 0.10 | 0.15 | 0.21 | 0.31 | 0.56 |
| Chandigarh | 1.33 | 1.07 | 0.86 | 0.70 | 0.23 |
| Dadra & Nagar Haveli | 0.34 | 0.31 | 0.28 | 0.25 | 0.00 |
| Daman & Diu | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Lakshadweep | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

*for inter and intra site variations and trends.

| Table-A5-b: NFHS-3 Results of HIV Prevalence | | | | |
|--|-----------|---------|--------------------|--------------|
| State | Women (%) | Men (%) | Total (%) with C I | Male: Female |
| Andhra Pradesh | 0.76 | 1.22 | 0.97 (0.70–1.25) | 1.6 : 1 |
| Karnataka | 0.54 | 0.86 | 0.69 (0.44–0.93) | 1.6 : 1 |
| Maharashtra | 0.48 | 0.78 | 0.62 (0.43–0.81) | 1.6 : 1 |
| Manipur | 0.76 | 1.59 | 1.13 (0.82–1.44) | 2.1 : 1 |
| Tamil Nadu | 0.40 | 0.27 | 0.34 (0.18–0.50) | 0.7 : 1 |
| Uttar Pradesh | 0.05 | 0.10 | 0.07 (0.03–0.11) | 2.1 : 1 |
| Non-High Prevalence State | 0.08 | 0.16 | 0.12 (0.07–0.19) | 2.1 : 1 |
| India | 0.22 | 0.36 | 0.28 (0.23–0.33) | 1.6 : 1 |
| Urban | 0.29 | 0.41 | 0.35 | |
| Rural | 0.18 | 0.32 | 0.25 | |

Table –A5-c: Adjusted* HIV Prevalence among IDUs, 2002–2006

| State/UTs | 2002 | 2003 | 2004 | 2005 | 2006 |
|---------------------------|-------|-------|-------|-------|-------|
| Andhra Pradesh | 23.70 | 22.32 | 20.93 | 19.55 | 18.16 |
| Karnataka | 9.17 | 7.78 | 6.39 | 4.99 | 3.60 |
| Maharashtra | 25.94 | 24.55 | 23.17 | 21.78 | 20.40 |
| Manipur | 28.79 | 26.59 | 24.39 | 22.20 | 20.00 |
| Nagaland | 2.43 | 2.13 | 1.84 | 1.54 | 1.25 |
| Tamil Nadu | 29.73 | 28.35 | 26.97 | 25.58 | 24.20 |
| Goa | 4.45 | 4.14 | 3.82 | 3.51 | 3.20 |
| Gujarat | 4.45 | 4.14 | 3.82 | 3.51 | 3.20 |
| Pondicherry | 4.45 | 4.14 | 3.82 | 3.51 | 3.20 |
| Arunachal Pradesh | 4.45 | 4.14 | 3.82 | 3.51 | 3.20 |
| Assam | 5.25 | 4.94 | 4.62 | 4.31 | 4.00 |
| Bihar | 1.45 | 1.14 | 0.83 | 0.51 | 0.20 |
| Chattisgarh | 4.45 | 4.14 | 3.82 | 3.51 | 3.20 |
| Delhi | 11.24 | 10.93 | 10.62 | 10.31 | 10.00 |
| Haryana | 1.26 | 0.94 | 0.63 | 0.31 | 0.00 |
| Himachal Pradesh | 4.45 | 4.14 | 3.82 | 3.51 | 3.20 |
| Jammu & Kashmir | 4.45 | 4.14 | 3.82 | 3.51 | 3.20 |
| Jharkhand | 1.65 | 1.34 | 1.03 | 0.71 | 0.40 |
| Kerala | 4.27 | 3.96 | 3.64 | 3.33 | 3.02 |
| Madhya Pradesh | 4.45 | 4.14 | 3.82 | 3.51 | 3.20 |
| Meghalaya | 4.45 | 4.14 | 3.82 | 3.51 | 3.20 |
| Mizoram | 3.07 | 2.70 | 2.34 | 1.97 | 1.60 |
| Orissa | 11.63 | 11.33 | 11.02 | 10.71 | 10.40 |
| Punjab | 15.03 | 14.72 | 14.41 | 14.11 | 13.80 |
| Rajasthan | 4.45 | 4.14 | 3.82 | 3.51 | 3.20 |
| Sikkim | 1.45 | 1.14 | 0.83 | 0.51 | 0.20 |
| Tripura | 4.45 | 4.14 | 3.82 | 3.51 | 3.20 |
| Uttar Pradesh | 5.88 | 5.56 | 5.25 | 4.94 | 4.63 |
| Uttaranchal | 4.45 | 4.14 | 3.82 | 3.51 | 3.20 |
| West Bengal | 5.25 | 4.94 | 4.62 | 4.31 | 4.00 |
| Andaman & Nicobar Islands | 4.45 | 4.14 | 3.82 | 3.51 | 3.20 |
| Chandigarh | 18.82 | 18.52 | 18.21 | 17.91 | 17.60 |
| Dadra & Nagar Haveli | 4.45 | 4.14 | 3.82 | 3.51 | 3.20 |
| Daman & Diu | 4.45 | 4.14 | 3.82 | 3.51 | 3.20 |

*for inter and intra site variations and trends.

Table –A5-d: Adjusted* HIV Prevalence among MSM 2002–2006

| State/UTs | 2002 | 2003 | 2004 | 2005 | 2006 |
|---------------------------|-------|-------|-------|-------|-------|
| Andhra Pradesh | 13.12 | 12.40 | 11.68 | 10.96 | 10.25 |
| Karnataka | 22.05 | 21.34 | 20.63 | 19.91 | 19.20 |
| Maharashtra | 18.46 | 17.75 | 17.03 | 16.32 | 15.60 |
| Manipur | 13.27 | 12.55 | 11.84 | 11.12 | 10.40 |
| Nagaland | 13.12 | 12.40 | 11.69 | 10.97 | 10.25 |
| Tamil Nadu | 8.48 | 7.76 | 7.04 | 6.32 | 5.60 |
| Goa | 5.27 | 5.15 | 5.03 | 4.92 | 4.80 |
| Gujarat | 12.61 | 12.26 | 11.90 | 11.55 | 11.20 |
| Pondicherry | 2.87 | 2.75 | 2.64 | 2.52 | 2.40 |
| Arunachal Pradesh | 2.47 | 2.35 | 2.24 | 2.12 | 2.00 |
| Assam | 1.26 | 1.14 | 1.02 | 0.90 | 0.78 |
| Bihar | 0.88 | 0.76 | 0.64 | 0.52 | 0.40 |
| Chattisgarh | 2.47 | 2.35 | 2.24 | 2.12 | 2.00 |
| Delhi | 12.72 | 12.61 | 12.49 | 12.38 | 12.27 |
| Haryana | 2.47 | 2.35 | 2.24 | 2.12 | 2.00 |
| Himachal Pradesh | 0.92 | 0.80 | 0.68 | 0.56 | 0.44 |
| Jammu & Kashmir | 2.47 | 2.35 | 2.24 | 2.12 | 2.00 |
| Jharkhand | 2.47 | 2.35 | 2.24 | 2.12 | 2.00 |
| Kerala | 0.88 | 0.76 | 0.64 | 0.52 | 0.40 |
| Madhya Pradesh | 2.47 | 2.35 | 2.24 | 2.12 | 2.00 |
| Meghalaya | 2.47 | 2.35 | 2.24 | 2.12 | 2.00 |
| Mizoram | 2.47 | 2.35 | 2.24 | 2.12 | 2.00 |
| Orissa | 2.47 | 2.35 | 2.24 | 2.12 | 2.00 |
| Punjab | 5.27 | 5.15 | 5.03 | 4.92 | 4.80 |
| Rajasthan | 0.48 | 0.36 | 0.24 | 0.12 | 0.00 |
| Sikkim | 2.47 | 2.35 | 2.24 | 2.12 | 2.00 |
| Tripura | 2.47 | 2.35 | 2.24 | 2.12 | 2.00 |
| Uttar Pradesh | 2.47 | 2.35 | 2.24 | 2.12 | 2.00 |
| Uttaranchal | 2.47 | 2.35 | 2.24 | 2.12 | 2.00 |
| West Bengal | 7.06 | 6.95 | 6.83 | 6.72 | 6.60 |
| Andaman & Nicobar Islands | 2.47 | 2.35 | 2.24 | 2.12 | 2.00 |
| Chandigarh | 5.27 | 5.15 | 5.03 | 4.92 | 4.80 |
| Dadra & Nagar Haveli | 2.47 | 2.35 | 2.24 | 2.12 | 2.00 |
| Daman & Diu | 2.47 | 2.35 | 2.24 | 2.12 | 2.00 |

*for inter and intra site variations and trends.

Table –A5-e: Adjusted* HIV Prevalence among FSW, 2002–2006

| State/UTs | 2002 | 2003 | 2004 | 2005 | 2006 |
|---------------------------|-------|-------|-------|-------|-------|
| Andhra Pradesh | 15.60 | 13.91 | 12.22 | 10.53 | 8.84 |
| Karnataka | 14.88 | 13.19 | 11.50 | 9.81 | 8.12 |
| Maharashtra | 19.55 | 17.86 | 16.18 | 14.49 | 12.80 |
| Manipur | 17.85 | 16.29 | 14.73 | 13.16 | 11.60 |
| Nagaland | 22.64 | 21.08 | 19.52 | 17.96 | 16.40 |
| Tamil Nadu | 10.37 | 8.68 | 6.99 | 5.29 | 3.60 |
| Goa | 1.95 | 1.70 | 1.45 | 1.20 | 0.95 |
| Gujarat | 7.39 | 7.14 | 6.90 | 6.65 | 6.40 |
| Pondicherry | 2.44 | 2.19 | 1.94 | 1.69 | 1.44 |
| Arunachal Pradesh | 1.00 | 0.75 | 0.50 | 0.25 | 0.00 |
| Assam | 1.40 | 1.15 | 0.90 | 0.65 | 0.40 |
| Bihar | 1.61 | 1.35 | 1.10 | 0.85 | 0.60 |
| Chattisgarh | 3.09 | 2.84 | 2.59 | 2.34 | 2.09 |
| Delhi | 2.00 | 1.75 | 1.50 | 1.25 | 1.00 |
| Haryana | 1.41 | 1.16 | 0.91 | 0.66 | 0.41 |
| Himachal Pradesh | 1.67 | 1.42 | 1.17 | 0.92 | 0.67 |
| Jammu & Kashmir | 1.95 | 1.70 | 1.45 | 1.20 | 0.95 |
| Jharkhand | 1.87 | 1.62 | 1.37 | 1.12 | 0.87 |
| Kerala | 1.00 | 0.75 | 0.50 | 0.25 | 0.00 |
| Madhya Pradesh | 2.07 | 1.82 | 1.57 | 1.32 | 1.07 |
| Meghalaya | 1.95 | 1.70 | 1.45 | 1.20 | 0.95 |
| Mizoram | 11.38 | 11.14 | 10.89 | 10.65 | 10.40 |
| Orissa | 2.00 | 1.75 | 1.50 | 1.25 | 1.00 |
| Punjab | 2.60 | 2.35 | 2.10 | 1.85 | 1.60 |
| Rajasthan | 2.40 | 2.15 | 1.90 | 1.65 | 1.40 |
| Sikkim | 1.95 | 1.70 | 1.45 | 1.20 | 0.95 |
| Tripura | 1.95 | 1.70 | 1.45 | 1.20 | 0.95 |
| Uttar Pradesh | 1.41 | 1.15 | 0.90 | 0.65 | 0.40 |
| Uttaranchal | 1.95 | 1.70 | 1.45 | 1.20 | 0.95 |
| West Bengal | 8.57 | 8.32 | 8.08 | 7.83 | 7.58 |
| Andaman & Nicobar Islands | 1.95 | 1.70 | 1.45 | 1.20 | 0.95 |
| Chandigarh | 1.67 | 1.42 | 1.17 | 0.92 | 0.67 |
| Dadra & Nagar Haveli | 1.95 | 1.70 | 1.45 | 1.20 | 0.95 |
| Daman & Diu | 1.95 | 1.70 | 1.45 | 1.20 | 0.95 |

*for inter and intra site variations and trends.

| Table-A6-a: Members of the Technical Resource Group Surveillance and Estimation – NACP III | | |
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Table-A6-c: Members of Consensus and Consultative Meeting on HIV Estimation India 2007

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| 38. | Dr. Fred Arnold | Macro International, USA |
| 39. | Dr. Peter Ghys | UNAIDS, Geneva |
| 40. | Dr. Geoffe Garnett | Imperial College, London |
| 41. | Dr. Meade Morgan | CDC, GAP |
| 42. | Dr. David Wilson | World Bank |
| 43. | Dr. Prabhat Jha | CGHR, Canada |
| 44. | Dr. Swarup Sarkar | UNAIDS, Bangkok |

HIV Population

