

TECHNICAL REPORT

India HIV Estimates



National Institute of Medical Statistics
Indian Council of Medical Research
(Department of Health Research)
Ministry of Health & Family Welfare
Government of India



National AIDS Control Organization
India's voice against AIDS
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2010



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Abbreviations

AIDS	Acquired Immuno-Deficiency Syndrome
AIIMS	All India Institute of Medical Science
AIM	AIDS Impact Model
ANC	Antenatal clinics
ART	Antiretroviral treatment
ASFR	Age Specific Fertility Rate
BSS	Behavioural Surveillance Survey
CMIS	Computerised Management Information System
EPP	Estimation and Projection Package
FHI	Family Health International
FSW	Female Sex Worker
HIV	Human Immuno-Deficiency Virus
HRG	Higher Risk Group
HSS	HIV Sentinel Surveillance
IBBA	Integrated Biological and Behavioural Assessment
ICMR	Indian Council of Medical Research
IDU	Injecting Drug User
MSM	Men who have Sex with Men
NACO	National AIDS Control Organisation
NACP	National AIDS Control Programme
NFHS	National Family Health Survey
NIHFW	National Institute of Health and Family Welfare
NIMS	National Institute of Medical Statistics
PHR	Population at Higher Risk
PLHIV	People Living with HIV
PLR	Population at Lower Risk
PPTCT	Prevention of Parent to Child Transmission of HIV/AIDS
RGI	Registrar General of India
SACS	State AIDS Control Society
SRS	Sample Registration System
STD	Sexually Transmitted Disease
TFR	Total Fertility Rate
TRG	Technical Resource Group
UNAIDS	Joint United Nations Programme on HIV/AIDS
UT	Union Territory
WHO	World Health Organisation

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Sayan Chatterjee

Secretary & Director General

Department of AIDS Control, NACO, Ministry of Health and Family Welfare, Government of India



31st January, 2012

Foreword

National AIDS Control Programme has adopted an evidence-based approach to channelize programme resources and efforts at regions and risk groups most-at-risk of HIV. Understanding the trends of HIV epidemic and its burden in different states is a critical element of this approach. HIV Sentinel Surveillance and HIV Estimations generate evidence for this purpose. The successful implementation of Programme with its continued focus on HIV prevention has shown positive results with the India's HIV Estimations 2010 clearly indicating a declining trajectory of the HIV epidemic.

Since the first HIV estimation carried out in 1994, the methodology employed for estimation of HIV infected persons in the country has evolved greatly. In the recent (2010) round of HIV estimations, the estimates of HIV prevalence and incidence, the number of people living with HIV (PLHIV) and AIDS related deaths have been generated at national and state levels, using Estimation Projection Package. This has been developed by the 'Global Reference Group on Estimates, Modelling and Projections' and coupled with updated spectrum package customized to India by using Indian population projection figures.

The recent HIV estimations provide an improved understanding of HIV epidemic in India and also offer important insights for impact evaluation of interventions. These have been derived from, not one, but many authoritative data sources and are the result of protracted discussions, consultations and reviews with specialists in the fields of biostatistics, epidemiology and Monitoring and Evaluation from central and state Government institutions, national and international organizations including WHO and UNAIDS. The process was coordinated by a Technical Working Group on HIV Estimates with experts from NACO, NIMS, NIHF, WHO and UNAIDS under the oversight of a larger Technical Resource Group on Surveillance and Estimations, constituted by NACO.

Dr. Arvind Pandey, Director, National Institute of Medical Statistics (ICMR) and his team have done a commendable work for undertaking the detailed analysis and preparing the report, with the technical support from Dr. D.C.S. Reddy, WHO India and Mr. Taoufik Bakkali, UNAIDS. The experts from technical working group and Technical Resource Group on Surveillance and Estimations are specially thanked for their constant support and guidance. I appreciate the contribution of Dr. S. Venkatesh, Deputy Director General (M&E), NACO and Dr. Yujwal Raj, Programme Officer (Surveillance), NACO for coordinating HIV estimation process and dissemination of the results. I am sure this report will be useful to the programme managers, epidemiologists and researchers across the country.

(Sayan Chatterjee)

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अपनी एचआईवी अवस्था जानें, निकटतम सरकारी अस्पताल में मुफ्त सलाह व जाँच पाएँ
Know Your HIV status, go to the nearest Government Hospital for free Voluntary Counselling and Testing

Preface

The National AIDS Control Organization (NACO) in consultation with the national and international epidemiologists, demographers, public health experts and monitoring and evaluation specialists undertakes estimation of HIV epidemic. The National Institute of Medical Statistics, Indian Council of Medical Research is the nodal Institute to coordinate the estimation process. The National Institute of Health and Family Welfare leads in coordinating and conducting the HIV Sentinel Surveillance. The WHO and UNAIDS provides continuous technical support to the process.

Based on data from HIV Sentinel Surveillance among key populations at higher risk, data from vital registration systems, Behaviour Surveillance Surveys etc. and using the Estimation and Projection Package and Spectrum tools as recommended by the UNAIDS Reference Group on Estimates, Modelling and Projections; the India HIV Estimates 2008/2009 thus generated are more precise vis-à-vis previous rounds. The HIV Estimates bring forth a sound reflection on the existing nature and trajectory of the HIV epidemic in the form of prevalence, incidence and related deaths.

The adult (15-49 years) HIV prevalence in India is estimated at 0.32% in 2008 and 0.31% in 2009 with approximately 2.4 million people living with HIV. India has succeeded in reducing the epidemic amongst female sex workers through focused interventions. In select pockets, however, HIV concentration amongst injecting drug users and men who have sex with men is increasing. The details of these and other indicators are provided in this report. The robust estimates so generated for India and the states/Union Territories are a rich resource used by NACO for future planning and strategy of intervention programme.

Although India's progression in the AIDS response is unambiguous, the gains need to be capitalised. India must sustain its efforts and advance forward in achieving national and internationally prescribed targets. Considering the varied nature of the epidemic across its geographical landmass and endeavour to implement a range of essential HIV programmes on a population wide scale based on a sound evidence base, can India meet the commitment of realising zero new infections?

In order to achieve this and make the future generations free from HIV/AIDS, we require leadership, political commitment, civil society participation, knowledge capital generation, financial resources, innovations in developing new and affordable medicines and preventive technologies. We also need to tackle the fundamental drivers of the epidemic particularly gender inequality, poverty and stigma and discrimination in family and health service settings. In doing so, we will achieve our targets.



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Executive Summary

HIV Sentinel Surveillance (HSS) has systematically been scaled up in India, since its initiation, for increased population coverage and improved understanding on the nature of the epidemic. The number of sentinel sites was scaled up from 176 in 1992 to 1251 in 2008/2009 to expand the population coverage. Furthermore, an increasingly robust methodology was deployed for HIV estimates generation that utilised the latest HIV modelling and estimation packages—as recommended by the Global Reference Group on Estimates, Modelling, and Projections—whilst overcoming shortcomings reported of previous HSS rounds. The new and different sources of data generated have facilitated in a refined understanding of the epidemic's trend.

Specialists in the fields of biostatistics, epidemiology and Monitoring and Evaluation from central and state Government institutions; and, national and international organizations—including WHO and UNAIDS—were consulted for generating the 2008/2009 HIV estimates. The process was implemented by a Technical Working Group on Estimates that comprised of experts from NACO, NIMS, NIHF, AIIMS, WHO and UNAIDS under the oversight of a larger Technical Resource Group (TRG) on Surveillance and Estimates.

The focus for the 2008/2009 HIV estimates was the following: firstly, estimating the number of people infected; secondly, estimating HIV prevalence; thirdly, estimating HIV incidence; fourthly, estimating AIDS related deaths; and, finally, estimating the treatment needs for antiretroviral therapy (ART) and prevention of parent to child transmission (PPTCT) services. Data available from 1998 to 2009 from HSS of pregnant women attending antenatal clinics and among populations at higher risk for HIV in each state were utilised. In addition, data on HIV prevalence from population based surveys and size estimates of higher risk group population from mapping exercises were used.

The epidemiological software and tools employed for estimating and projecting adult HIV prevalence and incidence from surveillance data were the 2009 versions of the Estimation and Projection Package (EPP) and Spectrum. These tools were informed by the Global Reference Group on Estimates, Modelling and Projections. The Reference Group includes experts from multiple disciplines such as epidemiologists, demographers, clinicians, modellers and programme implementers representing Intergovernmental Organizations such as UNAIDS and WHO and technical Institutions such as the East West Centre, Hawaii etc.

A broad four step process was adopted by the Technical Working Group on Estimates for generating India's HIV estimates. To briefly elaborate on this, under step one, data on prevalence in higher risk group populations, lower risk group populations and estimates of the size of these populations was inputted to the Estimation and Projection Package (EPP). Under step two, EPP was utilized for fitting a simple epidemic model to the data. Curves were created for each of the identified sub-epidemics. Separate projections were made for each of the 34 States/Union

Territories in India. As the third step, the state level prevalence and incidence projections produced by EPP were imported to Spectrum for generating final trends and calculating the number of people living with HIV, new HIV infections, ART and PPTCT needs. Under step four, data from all states were combined separately in Excel for providing the overall picture for the country. Specific findings from the 2008/2009 HIV estimates are presented ahead whilst the detailed analysis are retained for the fourth chapter of this report.

National and state level HIV prevalence with trends

The India HIV estimates 2008/2009 confirms a slow down in the AIDS epidemic. National adult HIV prevalence, or the number of adults living with HIV as a proportion of the total population, has declined by over 0.10% points from 2000 to reach an estimated 0.31% in 2009. Adult HIV prevalence is either stable or declining in the high prevalence states whereas the trend is varying across the low to moderate prevalence states. Among the high prevalence states, the HIV prevalence has declined in Tamil Nadu between 2006 and 2009 to reach levels of 0.37% in 2008 and 0.33% in 2009. Manipur shows a declining trend over the past four years. Andhra Pradesh, Karnataka, Maharashtra and Nagaland show either a plateau or a slightly declining trend over the time period of 2006 to 2009.

Adult HIV prevalence in the low prevalence states/Union Territories of Orissa, Kerala, Jharkhand, Uttarakhand, Jammu and Kashmir, Arunachal Pradesh and Meghalaya has risen over the last four years. This trend warrants the need for improving the understanding on the epidemic even further in these states/Union Territories to enable more accurate programme response formulation.

In descending order, states/Union Territories with the highest adult HIV prevalence in 2009 included Manipur (1.4%); followed by Andhra Pradesh (0.90%), Mizoram (0.81%), Nagaland (0.78%), Karnataka (0.63%) and Maharashtra (0.55%). Besides these, the states/Union Territories of Goa, Gujarat, Punjab and Tamil Nadu have an estimated adult HIV prevalence greater than national prevalence (0.31%). Delhi, Orissa, West Bengal, Chhattisgarh and Pondicherry have an estimated adult HIV prevalence of 0.28 to 0.30% whilst HIV prevalence in other states is less than 0.28%.

HIV prevalence among males and females aged 15 to 24 years

National HIV prevalence is clearly declined among the young population—male and female—aged 15-24 years at national level. Stable or declining trends in HIV prevalence among this population group is noted in all states/Union Territories excepting Orissa, Assam, Kerala, Jharkhand and Meghalaya.

HIV Incidence

India, for the first time generated estimates for HIV incidence, or the number of new HIV infections per year under the 2008/2009 estimation round. An analysis of epidemic projections over the previous decade reflects a 50% decline in the number of new annual HIV infections at national level. In comparison with the approximately 120,000 new HIV infections estimated in India in 2009, a near double or 270,000 new infections were estimated in 2000.

Similar to the national trend, a decline in HIV incidence is evident in the majority of states with the exception of certain low prevalence states where the number of new infections over the past two years has increased. The six high prevalence states account for 39% of the new HIV infections; whilst Orissa, Bihar, West Bengal, Uttar Pradesh, Rajasthan, Madhya Pradesh and Gujarat together account for 41% of new infections.

The notable decline in the national HIV incidence levels is indicative of the impact of the various interventions under the National AIDS Control Programme and scaled-up prevention strategies. There is a noted requirement, however, to increasingly focus on low prevalence categorized states where although HIV prevalence is less than 5% amongst Higher Risk Groups and 1% amongst antenatal women, high vulnerability prevails.

People Living with HIV

The total number of people living with HIV (PLHIV) in India is estimated at 2.4 million with uncertainty bounds of 1.93 to 3.04 million in 2009. Children under 15 years of age account for 4.4% of all infections, whilst people aged 15 to 49 years account for 82.4% of all infections. Thirty-nine percent of all HIV infections are estimated to be among women. This amounts to 0.93 million women with HIV in India.

The four high prevalence states of South India account for 57% of all HIV infections in the country. Whilst Andhra Pradesh accounts for 500,000 cases; Maharashtra accounts for 420,000 cases, Karnataka accounts for 250,000 cases and Tamil Nadu accounts for 150,000 cases. Over 100,000 PLHIVs are estimated in West Bengal, Gujarat, Bihar and Uttar Pradesh and together these states account for 22% of HIV infections in India. The number of PLHIVs in Punjab, Orissa, Rajasthan and Madhya Pradesh range from 50,000 to 100,000 and these states collectively account for 12% of HIV infections. These states may have low HIV prevalence; however, a large number of PLHIVs are reported due to the states' overall population size.

HIV concentrated amongst Injecting Drug Users and Men who have Sex with Men

India HIV estimates 2008/2009 confirm a clear decline in HIV prevalence among female sex workers at national level and in most states. Contrarily, the estimates bring forth the vulnerability of injecting drug users and men who have sex with men as HIV prevalence is increasing amongst these population groups in many states.

At national level, HIV prevalence is highest amongst the injecting drug users (IDU) at 12.22% followed by men who have sex with men (MSM) at 6.82% and female sex workers (FSW) at 5.92%. HIV prevalence amongst IDU, MSM and FSW is 14.92%, 10.31% and 9.48% respectively. In comparison, HIV prevalence among the general population is estimated at 0.59% in the high prevalence states. HIV prevalence in the low to moderate prevalence states amongst IDU, MSM and FSW is estimated at 0.91%, 5.40% and 3.01% respectively. HIV prevalence among the general population in the low to moderate prevalence states is estimated at 0.19%.

AIDS related deaths

2008/2009 HIV estimates highlight the declining trend of annual AIDS deaths post 2004. Approximately 172,000 people died of AIDS related causes in 2009 in India. The decline is directly attributable to the wider access to ART—made available with roll out of free ART in 2004—and the ability for the National AIDS Control Programme to cover treatment needs for HIV and AIDS, co-infections and provide care services.

Estimates of adult AIDS related deaths are based on several assumptions and additional data sets that include: Estimates of the number of adults and children who are HIV infected, estimation of survival from the time of infection to the time of death for both adults and children infected with HIV with or without treatment. The method used for generating estimates on AIDS deaths is based on the most recent global evidence on survival time, with and without treatment, and uses globally recognized methodology and modelling to calculate this specific indicator.

Conclusion

In conclusion, despite progression by India in advancing towards prescribed national targets—and as reflected from 2008/2009 India HIV estimates—much remains to be done for halting and reversing HIV considering that in absolute terms; a large proportion of India's populous is infected or affected with HIV. A proliferation of the epidemic must be thwarted with zero new infections made as the principle target. The vision for eliminating the impact of the AIDS epidemic can be real through appropriate generation of strategic information and utilisation of knowledge and resources. Planners, programme administrators and implementers must utilise the best scientific knowledge that is generated and made available. Data presented through India HIV estimates 2008/2009 should succeed in acting as a primary step for catalysing continued action in the near future and until more updated data is presented for the advantage of the planners, programme administrators and implementers.

1. Introduction

The National AIDS Control Organization (NACO) provides estimates of HIV prevalence and number of infections in India every year since 1998 for National AIDS Programme Monitoring and Evaluation. The 2008/2009 HIV estimates were generated through a systematic process that included consultation with experts in the field of biostatistics and epidemiology and who represented premier Indian institutions, and the Joint United Nations Programme on HIV/AIDS (UNAIDS) and World Health Organisation (WHO). The process and method adopted was, and as per previous round(s), based on data generated under NACO's HIV Sentinel Surveillance (HSS) in addition to using other data sources and the globally recommended tools and methodologies for finalising the estimates.^{1,2}

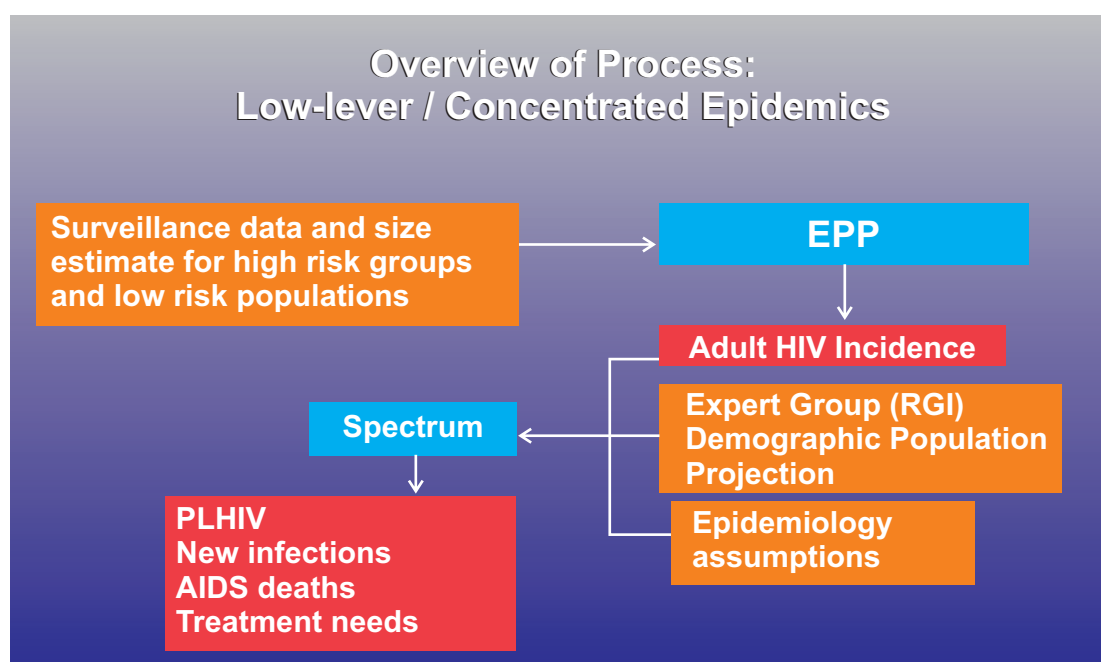
This report highlights the India HIV estimates 2008/2009 and is structured in five chapters. Following this introductory chapter, the second chapter details out the processes and the various steps followed for generating the HIV estimates 2008/2009. The third chapter informs on the methodology used for defining the epidemic and population groups—including higher risk groups and populations at lower risk—and provides explanation on the tools applied, and details out the various inputs in terms of programme coverage, demographic projections and epidemiological assumptions etc. The fourth chapter focuses on results. An analysis is presented on the key indicators including national and state level adult HIV prevalence, the number of HIV infections, and percent distribution of HIV infections by sex and age group. Additionally, estimates of HIV incidence, number of deaths due to AIDS related causes, estimates of women requiring prevention of parent to child transmission (PPTCT) services is detailed. Following the concluding chapter are the annexes. Annex-A includes eleven tables providing national and state-wise break-up of HIV/AIDS estimates for 2008 and 2009. Annex-B provides the lists of the Members of the Technical Resource Group on Surveillance and Estimation and the Working Group on Estimates.

2. Process and data inputs

This chapter outlines the procedure adopted by the Working Group on Estimates to generate India HIV Estimates 2008/2009. The Working Group on Estimates, as stated previously in this report, included noted experts from the National AIDS Control Organisation (NACO), National Institute of Medical Statistics (NIMS), National Institute of Health and Family Welfare (NIHFW), All India Institute of Medical Science (AIIMS), The Joint United Nations Programme on HIV/AIDS (UNAIDS) and World Health Organisation (WHO). The Working Group on Estimates collectively with the Technical Resource Group on Surveillance and Estimates provided technical oversight to the process for generating the India estimates.

Whilst the process for generating India HIV Estimates 2008/2009 is highlighted in pictorial form under figure 1, a brief narrative on the same is included in the paragraphs ahead.

Figure-1: Overview of the Process for generating India HIV Estimates 2008/2009.



2.1 Generation of India HIV Estimates 2008/2009

An overview of the broad six steps pursued for generating India HIV estimates is presented below.

1. The Working Group gathered and reviewed the following data—available from 1998 to 2009—that would be entered to the Estimation and Projection Package (EPP) or spreadsheet models for producing curves:
 - a. Data from HIV Sentinel Surveillance and surveys:
 - Sentinel surveillance among pregnant women attending antenatal clinics.
 - Sentinel surveillance among populations at higher risk for HIV, i.e., female sex workers (FSW), injecting drug users (IDU) and men who have sex with men (MSM).
 - National Behavioural Surveillance Survey (BSS) 2006 etc.

The principle advantage of utilising these data from sentinel surveillance is its ability for providing trends of HIV prevalence by site over time. Findings from sentinel surveillance allows for comparison of trends among number of HIV cases, adult cases, higher risk population groups, bridge population and among age groups.

- b. For determining specific demographic parameters, the Working Group reviewed:
 - The size estimates of higher risk group populations as provided under the National AIDS Control Programme (NACP-III) document. Recommendations for necessary updates were made.
 - Data from vital registration systems for determining number of births, number of deaths, adult population growth rate; population size for people aged over 15 years across India and in the 34 states/Union Territories. National population estimates were obtained from population projection for India and states for the period 2001-2026.³
 - c. Programme data—generated through NACO’s Computerised Management Information System (CMIS)—on adult ART programme coverage was reviewed.
2. Data arising from step one was entered to Estimation and Projection Package (EPP) to produce curves of adult HIV prevalence among different population groups. The curves generated thus also supported description of the evolution of adult HIV prevalence over time.
 3. State-level higher risk group population size estimates were also fed into EPP for determining HIV prevalence. The curve in each risk group within a specific state was estimated based on the time series data.
 4. The curve for antenatal clinic (ANC) attendees was calibrated with data from the National Family Health Survey 2005-06 (NHFS-3) for general population.
 5. The projected adult HIV prevalence/incidence for each state was fed into Spectrum along with programme data on antiretroviral programme coverage, percent of mother and children given nevirapine prophylaxis and certain demographic and epidemiological parameters. This enabled the calculation of:
 - a. The number of people living with HIV (PLHIV) and HIV prevalence—for all ages.
 - b. The number of new infections or HIV incidence.
 - c. The number of deaths due to AIDS related causes.
 - d. Treatment needs for Antiretroviral Therapy (ART) and Prevention of Parent to Child Transmission (PPTCT) services.

Data generated under the India HIV Estimates 2008/2009—and that was arrived at through pursuit of an identified and agreed methodology—was periodically reviewed by the Working Group on Estimates and the Technical Resource Group on Surveillance and Estimation. Results were finalized during the Technical Resource Group meeting held at NACO on August 3-4, 2010.

3. Methodology

The India HIV Estimates 2008/2009 utilises improved methodology to provide a more accurate understanding of India's HIV epidemic. The estimates are generated using 2009 Estimation Projection Package (EPP) and Spectrum Packages—which are informed by the Global Reference Group on Estimates, Modelling and Projections²—and customised using Indian data. Whilst the detailed explanation of the overall methodology for generating HIV estimates is highlighted in sections of this chapter, the process utilized for estimating adult HIV prevalence is first briefly recapitulated below:

- Following data was inputted to EPP:
 - Prevalence in higher risk group populations.
 - Prevalence in low risk group populations.
 - Estimates of the size of these populations.
 - ART data was used to improve the estimate of incidence from the prevalence over time.
 - Demographic parameter used from Sample Registration System⁴, that is, birth rate, survival rate, adult mortality and growth rate of population (15+ years).
- EPP was used to fit a simple epidemic model to the data:
 - Curves were created for each of the identified sub-epidemics.
 - Separate projections were done for each of the 34 States/Union Territories in India.
- The States/Union Territory level prevalence/incidence projections produced by EPP were imported into Spectrum to generate final trends and calculate the number of people living with HIV, new HIV infections, AIDS related deaths and treatment needs.
- Data generated from States/Union Territories was then combined to provide the overall picture for the country.

3.1 Defining the characteristics of the Epidemic

India's HIV epidemic, at national level, is concentrated amongst female sex workers (FSW), men who have sex with men (MSM) and injecting drug users (IDU). Amongst the 34 Indian States/Union Territories the epidemic is defined as a concentrated non-IDU epidemic in all states with the exception of Manipur and Nagaland where the epidemic is defined as a concentrated IDU epidemic.

For estimating and projecting adult HIV prevalence the state/Union Territory population were divided into two subgroups. Firstly, the higher risk groups which included the FSW, MSM and IDU populations. Secondly, the lower risk group which included the general population. The size of higher risk group populations in every state was determined through the NACO size estimates. The lower risk population was determined on the basis of the total estimated population of the state that excludes the higher risk group populations. The population size estimates also took into consideration that MSM and IDU—who after 15 years in this population subgroup—and FSW—who

after 8 years in this population subgroup—were reassigned to the lower risk group, that is, the general population.

Projections generated for the 34 States/Union Territories—on the basis of available data—were inputted to the EPP and Spectrum.

3.2 Estimating adult HIV prevalence using EPP

The Estimation and Projection Package (EPP) was used for estimating and projecting adult HIV prevalence from surveillance data. The data sets inputted to EPP as mentioned previously included firstly, the population size of higher risk groups, that is, FSW, MSM and IDU. Secondly, the population size of lower risk groups which was the general population; thirdly, sentinel surveillance data from 1998 to 2009 on HIV prevalence among higher risk group populations; and fourthly, sentinel surveillance data from 1998 to 2009 on HIV prevalence among antenatal care clinic attendees. The basis for determining the size of these population groups is provided in the following sub-sections.

The Estimation Projection Package (EPP)^{1,7,13,14}

EPP was developed to fit to multiple points with four parameters, t_0 (the start year of the HIV epidemic); r (the force of infection—a large value of “ r ” will cause prevalence to increase rapidly while a small value will cause it to increase slowly), f_0 (the initial fraction of the adult population at risk of infection—it determines the peak level of the epidemic curve) and \emptyset (the behaviour adjustment parameter which determines how the proportion of new entrants in the adult population who are at risk of HIV infections changes over time). If \emptyset is negative, people reduce their risk in response to the epidemic and the curve shows a sharper prevalence decline after the peak. If \emptyset is zero, the proportion at risk remains constant and the prevalence declines after the peak as people die. If \emptyset is positive, risk actually increases over time and prevalence falls less quickly or stabilizes at a high level. Bayesian theory is used for curve fitting.

3.2.1 Size of Populations at Higher Risk

The central data sources utilized for ascertaining the population size of higher risk were two. This included firstly, the size estimates—as detailed out in the NACP-III policy document—for FSW, MSM and IDU. Secondly, 2009 data on the estimated size of higher risk group population generated through the mapping exercise conducted in certain states by NACO and State AIDS Control Societies (SACS). In the remaining states where the mapping exercise was not concluded, the higher risk group population was estimated as a proportion of people with higher risk behaviour as informed under the NACP-III document.

3.2.2 Size of Populations at Lower Risk

The lower risk group category is determined through a simple calculation of the total adult population minus the population size of the higher risk groups. The population size for people aged above 15 years in 2009 was derived through Demproj in the Spectrum Package. The data sources inputted to Demproj for calculating the population size included firstly, the Census population data of 1981, 1991 and 2001 and secondly, the Expert Group Population Estimates and Projections of India⁵.

The breakdown by sex for the higher risk groups was required only for the IDU population, where the assumption made was that 90% of the IDU population are male and 10% are female. This was derived from existing information from BSS and other studies.^{5,6}

3.2.3 HIV prevalence data for people at higher risk and lower risk from 1998 to 2009

The 2009 Estimation and Projection Package (EPP) were utilized for estimating adult HIV prevalence trends over time.

Adult HIV prevalence for lower risk population was calculated from 1998 to 2009 by fitting an epidemiological model to HIV Sentinel Surveillance (HSS) data for antenatal clinic attendees. This is because antenatal clinic attendees are considered as proxy for the general population. It was ensured that data outliers were excluded whilst the appropriate sentinel surveillance data was fitted to an epidemiological model for generating adult HIV prevalence.

Adult HIV prevalence from 1998 to 2009 for FSW, MSM and IDU was calculated by fitting a model to HSS for higher risk groups at each site. Note that only those risk groups which have at least one site with three year data points or two sites with two year data points in HSS were taken for curve fitting. Outliers from HSS data points were excluded.

3.2.4 Programme Coverage

Antiretroviral therapy (ART) programme coverage data influences the fitting of HIV prevalence and incidence curves in EPP. The current ART coverage was extrapolated for the years beyond 2009—which is consistent with the NACP-III planned target of 500,000 by 2015—and distributed among all risk group based on last year proportions in respective risk groups.

3.2.5 Demographic input and epidemiological assumptions

The demographic inputs to EPP include the following indicators specific to the states/Union Territories: The proportion of male population, adult birth rate (15+ years), survival to age 15 (l_{15}), adult mortality in 15+ (μ) and adult population growth rate. The data source for the above mentioned demographic indicators included data from Sample Registration System for the years 2002 to 2008.

The following two primary epidemiological assumptions were considered whilst analyzing data under the 2009 version of EPP:

1. Criteria for reassigning higher risk groups to the general population category: Based on the second round of Behaviour Surveillance Survey conducted in 2006, it was determined that IDU and MSM after a 15 year duration would be reassigned to the general population category whereas for FSW the timeframe for reassignment to the general population was reduced to 8 years.
2. AIDS mortality: AIDS mortality was assumed to be higher by as much as 7% for IDU vis-à-vis non-IDU.

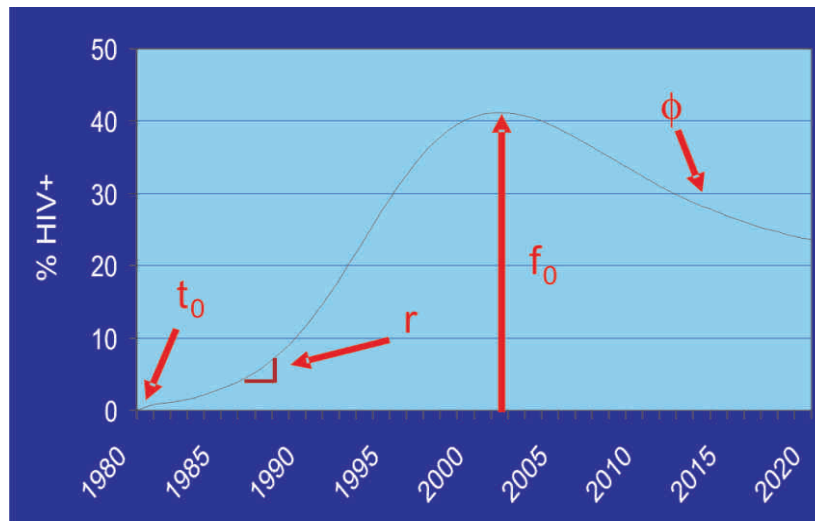
3.2.6 Generating State-specific prevalence curves

This section informs on the process utilized for developing HIV prevalence curves specific to the 34 Indian states/Union Territories for the first time under the 2008/2009 HIV estimates.

State specific HIV prevalence curves were generated by inputting HIV Sentinel Surveillance data to EPP. As a first step, prevalence curves were generated independently for each higher risk group and subsequently, their curves were cumulated to form a prevalence curve for the state. The accumulation is justified by the fact that these populations are separate and are part of the total population of the state.

Initial guesses were made using four parameters, mentioned earlier, for each adult HIV prevalence epidemic curve that was generated for each sub-population group. Briefly, the four parameters were: The rate of growth of the epidemic, the fraction of the population at risk for infection at the start of the epidemic, the start year of the epidemic and a parameter that modulated recruitment to the higher risk population in response to mortality driven declines in their population over time. The multiple sets of values for these four parameters could fit the data with similar likelihoods or similar statistical probability. Thus given the large inherent uncertainties in existing surveillance data, many possible parameter combinations could produce epidemic trends with approximately equally valid fits to a given data set. For eliminating these uncertainties the statistical technique of Bayesian Melding¹⁰ was adopted in the EPP. In brief, by generating a large number of possible combinations of the model parameters and evaluating their statistical fit to the observed surveillance data, it was possible to have estimates of the uncertainty in the best fit curve in the form of 95% confidence bounds.

Figure-2: Generation of HIV prevalence curves in Estimation and Projection Package considering four parameters.

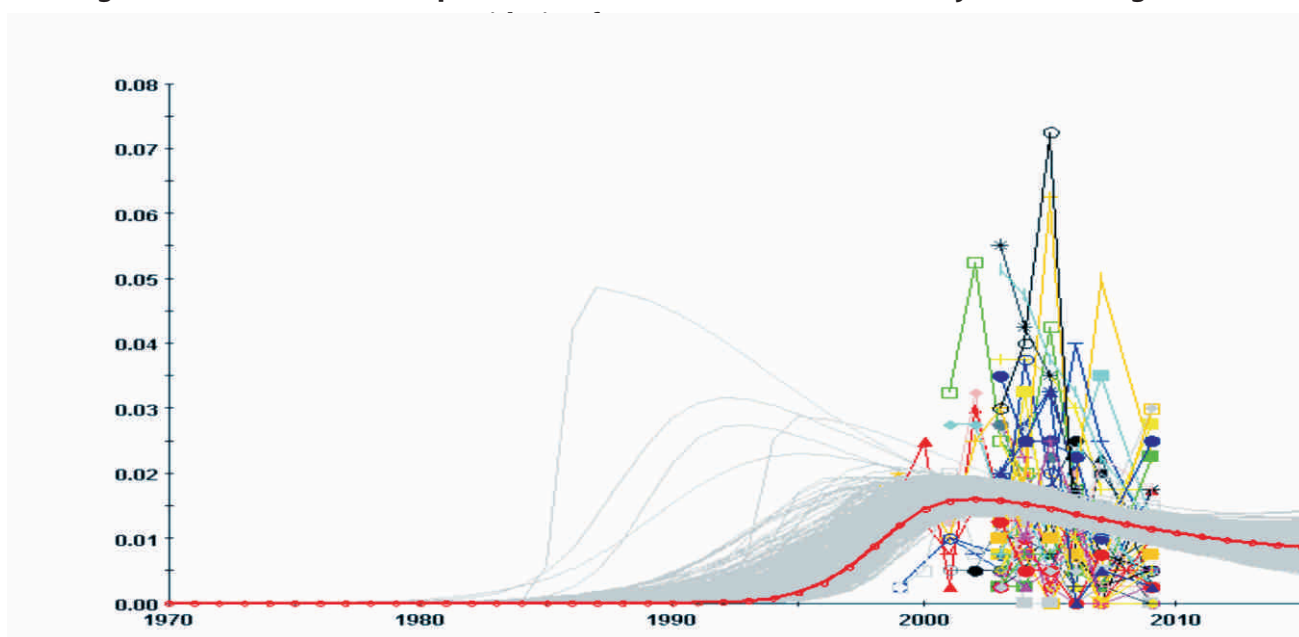


- t_0 – The start year of the epidemic.
- r – Force of infection, determines the initial growth rate.
- f_0 – The initial proportion of the population that is at risk of infection (determines the peak prevalence of the epidemic).
- ϕ – Adjusts the size of the risk group in response to behavioural changes or interventions.

EPP determines the HIV prevalence trend according to four different parameters and tries to fit the plausible epidemiological model to fit the existing data from the surveillance as reflected in figure-2.

Using the Bayesian Melding approach 1000 iterations were used for fitting the initial guesses for ANC sites and 3000 iterations for higher risk group sites. These iterations were reviewed and the best fitting curve—based on the observed experience of HIV Sentinel Surveillance—was considered. The best fitting curves for all sub-population categories were subsequently combined for producing state prevalence curves. Figure 3 is example of a graph with a 1000 curves generated using HIV Sentinel Surveillance ANC prevalence data.

Figure-3: Generation of HIV prevalence curves in Estimation and Projection Package



3.2.7 Calibrating ANC prevalence curves in EPP

Estimates of HIV prevalence are based on ANC data as they are the main source of times series of prevalence data. Due to the difference between ANC prevalence and population prevalence—as measured by population based surveys—calibration of the prevalence curves based on, and thus representing ANC prevalence, was required.

The key source of information used for calibrating HIV prevalence curves is the 2006 National Family Health Survey (NFHS-3)⁷ where state-specific information on HIV prevalence is determined. In EPP, when a calibration factor is used, the overall curve determined on the basis of ANC HSS trend data is scaled according to a calibration constant which is calculated such that the median posterior prevalence in the year of the survey—as given by the Bayesian melding procedure based on ANC data—is rescaled at the population estimate. Differences in the prevalence level will be modelled on the probit scale. This scale is chosen because differences between prevalence levels do not depend on the level themselves. The calibration constant, the difference between community based sample survey prevalence and ANC prevalence, is constant over time on the probit scale such that the influences of the calibration constant decreases for lower prevalence.

The constant calibration factor was derived for individual states in five high prevalence states—that is, Andhra Pradesh, Karnataka, Maharashtra, Manipur and Tamil Nadu—based on calculations from NFHS-3 while for Nagaland; the calibration factor was determined from a specific study undertaken by NACO.^{6,8} For the remainder of the moderate and low prevalence states, the common constant calibration factor was derived from the NFHS-3 (excluding the aforesaid 6 high prevalence states) for national comparison between general population prevalence and ANC prevalence.

3.3 Estimation of PLHIV for all age groups using Spectrum

In Spectrum, the EasyPro component of the DemProj module projects the population of the entire country or region by age and sex and on the basis of assumptions over fertility, mortality, and migration. In order to incorporate India's state specific population projection—as determined by India's Expert Group Projection (RGI)³—to the Spectrum software; experts from The Futures Institute worked closely with Working Group on Estimates. The Futures Institute is the developer of the Spectrum software.

Population projection is an important prerequisite for estimating HIV prevalence, the number of people living with HIV per year, and other indicators. The demographic projection in Spectrum depends on life tables to describe age-specific patterns of mortality corresponding to assumed levels of life expectancy at birth. It is assumed that regardless of the progress of the infection, PLHIV are also subject to non-HIV mortality at the same rates as those who are not infected. Additionally, they are also subject to the AIDS mortality depending on whether they are on treatment or not.

Spectrum^{1,9}

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 EPP are fed as 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 epidemic, including the number of people living with HIV, new infections, AIDS related deaths by age and sex, number of adults in need of antiretroviral treatment (ART) 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.

In order to process estimates and projections of HIV related parameters, Spectrum requires a number of inputs and parameters that allows fitting of the projection according to the trend of the epidemic as initially determined in EPP.

The first input into Spectrum is the projection of the HIV incidence determined in EPP for the specific state. This allows importing the trend of the epidemic for each of the sub-populations into Spectrum. It is combined with the population projection and the other programme coverage

indicators and other parameters to determine the indicators related to the impact of the epidemic. The parameters included to Spectrum include the ART, PPTCT programme coverage data, age and sex distribution of prevalence as initially determined in NACP-III and the sex ratio of new infections are also included.

The modelling in Spectrum includes the most recent information on HIV progression, treatment needs, AIDS death, survival on treatment for adult and children, probability of mother to child transmission—which is itself dependent on infant feeding practices and coverage of antiretroviral prophylaxis for prevention of mother to child transmission—to assess the effect of HIV infection on fertility and the peri-natal transmission rate amongst many other indicators. In absence of India specific data, the default values initially set in the software was retained. This was considering that the default values were determined from the most recent and globally accepted data and approved by the Global Reference Group on HIV Estimates and Projections.² Following were the inputs applied to Spectrum. The same coverage of ART for adults, as set in EPP, was applied to Spectrum. For each of the 34 States/Union Territories, adult and children ART treatment coverage—from 2004 to 2009 and the projected coverage till 2015—along with duration of breastfeeding were used in AIM. An estimated 300,000 adults and 17,000 children utilized ART as on December 2009. Approximately 13,000 mothers had utilized PPTCT in India as of December 2009. Tables A-8 to A-10 in Annex A highlights States and UT estimates of these indicators.

Assumptions over other state-specific HIV characteristics included age and sex distribution of new infections, proportion of those newly infected, progressing need for treatment by time since infection, proportion of adults in need of treatment, proportion of adults dying due to AIDS related causes without treatment by time in need, annual mortality among children in need of treatment but not receiving treatment by age, annual survival of adults and children on ART, probability of transmission of HIV from mother to child etc. After finalizing the input of all these parameters, Spectrum re-processed the estimation and projection of the HIV epidemic. Additionally, it calculated all related parameters such as the HIV population, AIDS deaths, ART, PPTCT treatment needs etc.

3.4 Uncertainty Analysis

Spectrum produces a point estimate for each indicator for each year owing to which there may be a considerable amount of uncertainty associated with each point estimate. This is firstly, because of the uncertainty around the prevalence/incidence curve produced by EPP.¹¹ Secondly, it is due to the input assumptions that are based on studies from population samples in selected countries.

For addressing this associated uncertainty, a special programme in Spectrum was used for producing uncertainty bounds around the usual point estimates for each indicator and for each year. The Spectrum uncertainty analysis consists of a large number of “Monte Carlo” runs. Each run randomly selects a prevalence curve from the EPP and fits input values for other parameters from a range that can be set by the user depending on the quality of the data or the projection.

The prevalence points are randomly varied—for the 1000 iterations for general population—within some range. A logistic curve is fitted to the resulting points. In other words, the 1000 different logistic curves generated are fitted for the prevalence data by varying the data before

each fit with the ranges indicated next to the quality categories. These ranges represent two standard deviations around the central estimate. Once the calculations are completed, 1000 incidence curves are generated and used in the next step of the uncertainty analysis. Once the analysis is complete it is possible to view the results as graphs.

While incidence curves are initially generated in EPP and imported to Spectrum, the latter recalculates the prevalence and incidence projection on the basis of the more valid population projection. Uncertainty analysis for each of the 34 States/Union Territories is run on that basis, and the parameters of data quality to run the uncertainty analysis are determined according to the number of HSS sites used for the initial projection in EPP. Estimates for states that had at least three sites for subpopulations were assessed by the Working Group as of good quality. Estimates generated for states with less than three sites were considered of average-to-unsatisfactory quality as the data was insufficient for providing a long term trend.

4. Result

This chapter highlights key findings of the India HIV Estimates 2008/2009. Albeit data on national and state level indicators may be referred to under appropriate tables in Annex A; the estimates of these indicators are analysed herein to reflect on emerging trends for the vantage of policy makers and programmers.

This chapter is sub-divided to include six sections. Section one informs on national level estimates of adult HIV prevalence and the number of people living with HIV (PLHIV) whilst state level estimates on the same indicators are presented under section two. Section three includes an analysis of estimates of HIV incidence particularly with regard to its trajectory over the previous decade. Analysis on the percent distribution of HIV infections amongst higher risk groups out of the total estimated adult HIV infections is presented under section four whilst the estimated treatment needs of mothers requiring access to prevention of parent to child transmission (PPTCT) services is analysed under section five. The final section of this chapter brings forth estimates of the number of people who died due to AIDS related illnesses and analyses this in comparison with the antiretroviral therapy programme scale up in India. The methodology for generating India HIV Estimates 2008/2009 is briefly recapitulated below.

State level projections are based on HIV Sentinel Surveillance prevalence trends for antenatal clinic attendees, female sex workers (FSW), men who have sex with men (MSM) and injecting drug users (IDU). State/Union Territory specific prevalence and incidence curves are generated for both the lower risk population and key population at higher risk by entering site specific data from 1998 to 2009 to the Estimation and Projection Package (EPP) and by calibrating ANC prevalence against National Family Health Survey (NFHS-3), 2005-06 prevalence.

State/Union Territory specific relevant indicators were determined through Demproj and AIM Modules of the Spectrum package. The data inputs included firstly, the state level trend of estimates of HIV incidence determined by EPP and secondly, additional programme data related to Prevention of Parent to Child Treatment (PPTCT) coverage, adult Anti-retroviral (ART) coverage, and child treatment coverage amongst others. As detailed earlier in the report, a sound process was adopted whilst establishing the parameters for estimates and projections. The included importantly and for example, editing of the sex ratio of new HIV infection. The Working Group on Estimates aimed on ensuring that the sex ratio of all HIV infections by age matched with information determined under NFHS-3. During the analysis process, and as part of ensuring validity and quality of the results, uncertainty bounds for HIV prevalence and the number of PLHIV were generated for national level and for each state/Union Territory.

4.1 National estimates of Adult HIV Prevalence and total number of PLHIV

While the adult HIV prevalence for each state and Union Territory was directly projected through EPP and Spectrum, the national adult HIV prevalence is determined through application of the simple aggregation of number of people living with HIV (PLHIV) from all states divided by the total adult population and calculated as a multiple of hundred to determined a percentage. A similar simple mathematical formula was applied for determining the uncertainty bounds. National and States/Union Territory level values of HIV adult prevalence may be referred to from Annex A Table A-1.

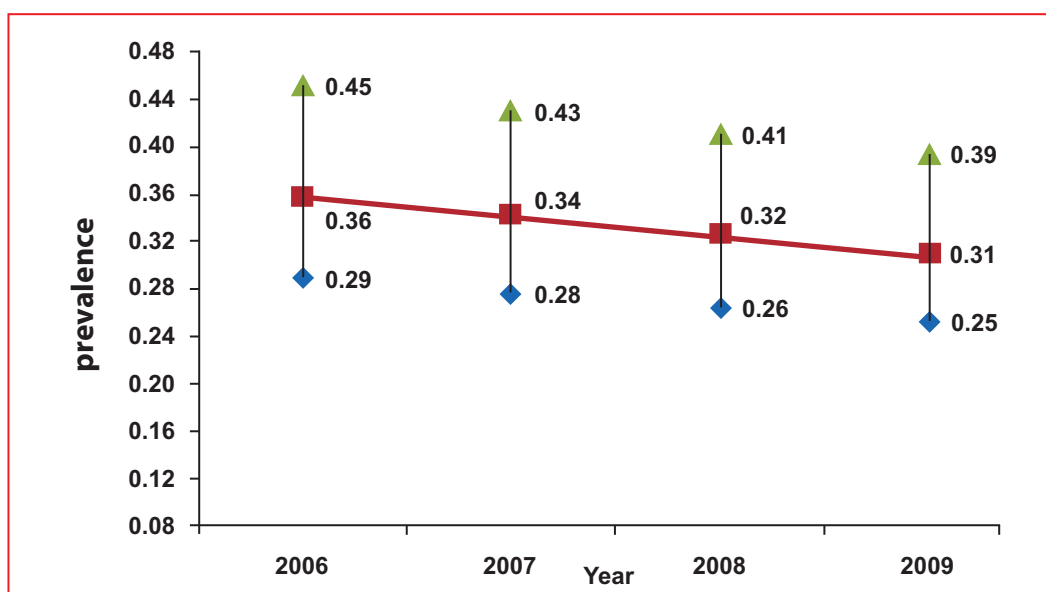
Table 1 below summarises the key results of the estimation process for 2008 and 2009. A descriptive analysis of the 2008/2009 HIV estimates is as follows:

- The adult HIV prevalence (males and females together) in India in 2009 is estimated at 0.31% with uncertainty bounds of 0.25% to 0.39% and 0.32% in 2008 with uncertainty bounds of 0.26% to 0.41%. The decline in HIV prevalence hence is by 0.02 percentage point during the previous two years.
- The adult HIV prevalence was estimated at 0.25% for women and 0.36% for men in 2009. It was estimated at 0.26% for women and 0.38% for men in 2008.
- In 2009, approximately 2.39 million people were estimated to be living with HIV with uncertainty bounds of 1.93 to 3.04 millions; while in 2008, 2.44 million people were living with HIV within the uncertainty bounds of 1.97 to 3.09 millions.
- Sex disaggregated data for number of people living with HIV is estimated at approximately 61% male and 39% female. The percent distribution of HIV infection by age is estimated at 4.4% among children below the age of 15 years, 82.4% among adults aged 15 to 49 years and the remaining 13.2% among people over 50 years of age.

Table 1: Adult HIV prevalence by Sex and Number of HIV infections for all ages with uncertainty bounds for the years 2008 and 2009, India.		
	2008	2009
Adult 15-49 HIV prevalence		
Persons	0.32% (0.26 – 0.41)	0.31% (0.25 - 0.39)
Female	0.26%	0.25%
Male	0.38%	0.36%
Number of HIV infections (All ages)		
Persons (in Lakh)	24.42 (19.74 – 30.89)	23.95 (19.34 – 30.42)
Percent distribution of HIV infections by age group		
< 15	4.2%	4.4%
15-49	83.3%	82.4%
50+	12.5%	13.2%

Figure-4 highlights the year-wise estimated adult HIV prevalence with uncertainty bounds for the period 2006-2009. The results of 2008/2009 round of HIV estimates in terms of trend and levels are derived from a methodology that allows for readjustment of the prevalence curves on the basis of additional HSS data. Accordingly, HIV prevalence was estimated at 0.36% for the year 2006 and 0.34% for the year 2007. As these are exactly the same values derived under the 2006 and 2007 round of HIV estimates, the consistency in results are indicative that the process adopted by the Working Group on Estimates and the results derived therein are valid and a sound base for analysis.

Figure-4: Adult HIV prevalence trends from 2006 to 2009 in India.



The adult HIV prevalence in India maintains a stable to slightly declining trend. Over the period of 2006 through to 2009, adult HIV prevalence has not significantly varied; nevertheless a slight decrease is observable from 0.36%—with uncertainty bounds of 0.29 to 0.45%—in 2006 to 0.31%—with uncertainty bounds of 0.25 to 0.39% in 2009.

The value for the total number of people living with HIV (PLHIV) by state is determined on the basis of the estimated HIV prevalence for all population per state in a specific year multiplied by the projected population for that year. Although noted in earlier sections of the report, the population projection was adjusted and recalculated under the 2008/2009 HIV estimation round for each state on the basis of parameters determined by India's expert group on population projection.³ The total population for India and its breakdown by age categories was determined through a simple mathematical calculation of the total population from all states.

The total number of PLHIV for India was determined as the sum of PLHIV from all states. Through this method, the compensation factor between states with regard to, for example, the difference in HIV prevalence and incidence levels, ART coverage, migration, AIDS related deaths and so on was eliminated. This process allowed for a more representative estimate of the total number of PLHIV for India when cumulated from state specific estimates.

Annex A Table A-2 provides detailed national and States/Union Territory level estimates of the total number of PLHIV and may be referred to from there.

4.2 State-wise HIV Adult Prevalence and PLHIV

NACO categorised the states and Union Territories of India to high, moderate, and low epidemic zones according to HIV prevalence estimates generated under each HIV Sentinel Surveillance Round for various population groups. The criteria for the categorisation of India's states and Union Territories are highlighted ahead.

High Prevalence States: The six states of Andhra Pradesh, Karnataka, Maharashtra, Manipur, Nagaland and Tamil Nadu were classified as high prevalence states in 1998. The criterion for categorising states on this basis was in consideration of whether HIV prevalence exceeded 1% among antenatal clinic attendees.

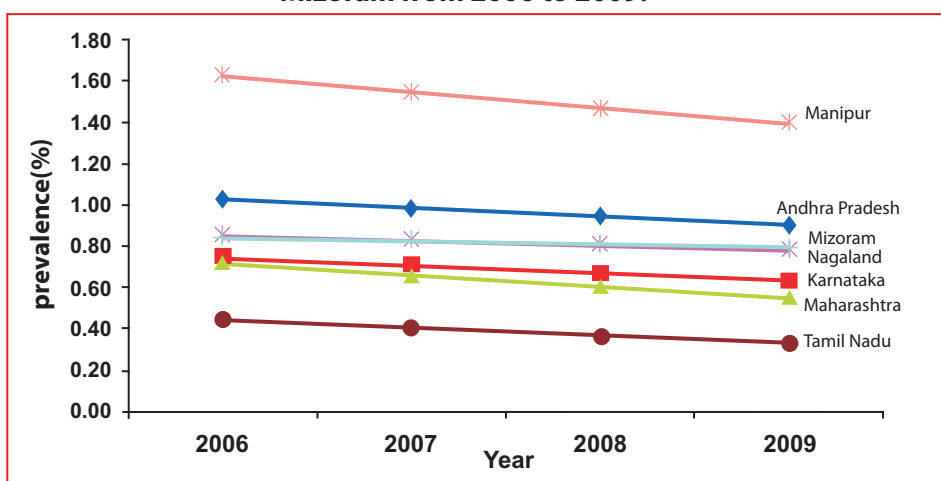
Moderate Prevalence States: The states/Union Territories of Gujarat, Goa and Pondicherry were classified as moderate prevalence states. These states that share borders with the high prevalence states report an HIV prevalence of over 5% among higher risk groups though less than 1% among antenatal clinic attendees.

Low Prevalence States: Excluding the six high prevalence and three moderate prevalence states/ Union Territories, the remainder of India's states and Union Territories are of low prevalence. The criteria for categorising states with low prevalence are if HIV prevalence is under 5% among higher risk groups and under 1% among antenatal clinic attendees.

States/Union Territory wise estimates of adult HIV prevalence and PLHIV were the basis for estimating national adult HIV prevalence and PLHIV as detailed in earlier sections of the report. Over and above this process, an uncertainty analysis was conducted independently for each state in Spectrum. The state level data on adult HIV prevalence is provided under Table A-1 in Annex A and an analysis of central emerging trends is recapitulated below.

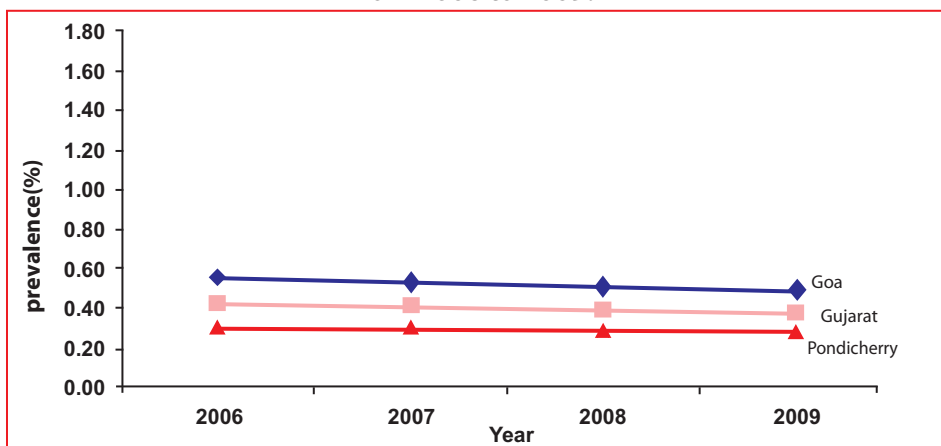
Figure-5 provides a graphical representation of the adult HIV prevalence trend line in the six high epidemic states, i.e., Andhra Pradesh, Karnataka, Maharashtra, Manipur, Nagaland and Tamil Nadu, and Mizoram. Mizoram is added to this group on the basis of the actual estimation derived from the Spectrum. As reflective from the graph, HIV prevalence is on the decline in all states over the four year period of 2006 to 2009; although the degree in decline varies slightly. For instance, the HIV prevalence trend in Karnataka, Mizoram and Nagaland appears more stable. Such a trajectory in HIV prevalence in these states is reflective of the results gained through national efforts and investments for AIDS roll-back.

Figure-5: Adult HIV prevalence trend in High Prevalence states/Union Territories and Mizoram from 2006 to 2009.



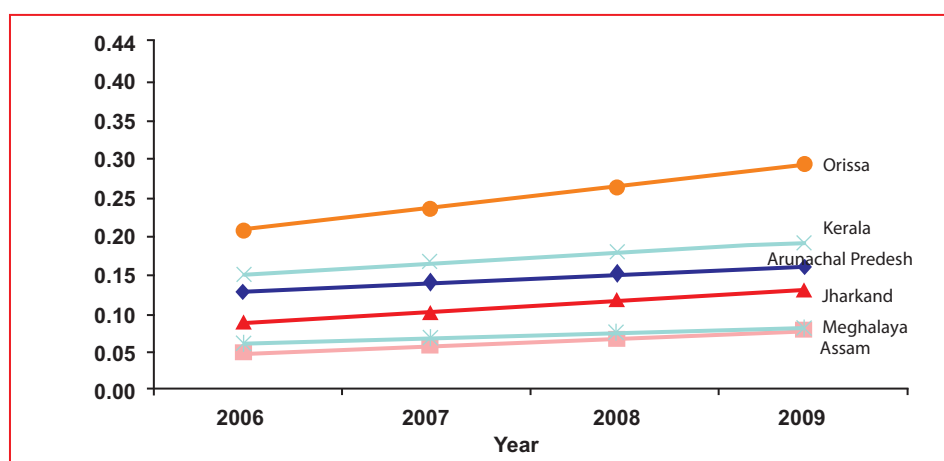
Adult HIV prevalence trends from 2006 to 2009 in Goa, Gujarat and Pondicherry—the moderate prevalence states—are depicted in figure 6. As evident, the HIV prevalence trend in all three moderate prevalence states/Union Territories is declining.

Figure-6: Adult HIV prevalence trend in Moderate Prevalence states/Union Territories from 2006 to 2009.



Regarding the low prevalence states/Union Territories, figure 7A highlights those where the trend for HIV prevalence is stable to increasing between 2006 and 2009. These include the six states/Union Territories of Arunachal Pradesh, Assam, Jharkhand, Kerala, Meghalaya and Orissa. The relatively greater increase in HIV prevalence is noted in Assam, Jharkhand and Orissa vis-à-vis Arunachal Pradesh, Kerala and Meghalaya. The case of Chandigarh is special. Although an increasing trend is observed in this Union Territory, a separate analysis is recommended for a more accurate reflection of the state of the epidemic.

Figure-7A: Adult HIV prevalence trend in Low Prevalence states/Union Territories from 2006 to 2009.



HIV Estimates for Chandigarh

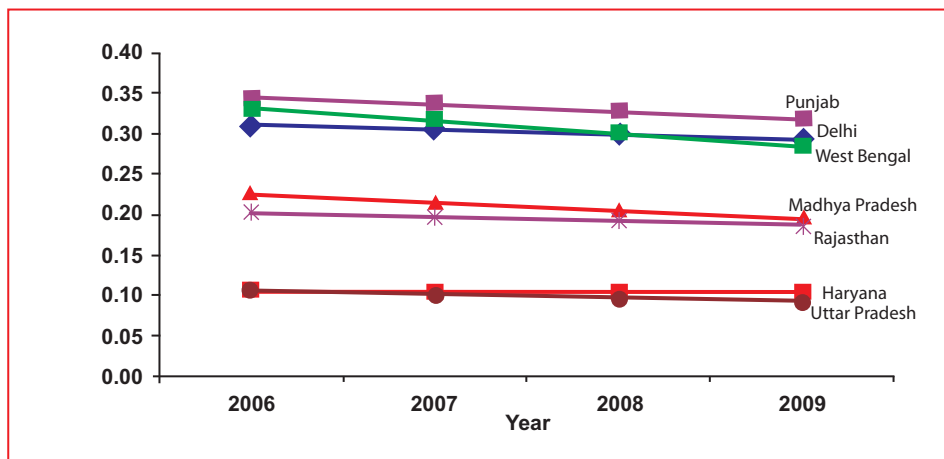
Estimates of HIV prevalence and number of people living with HIV (PLHIV) in the low prevalence Union Territory of Chandigarh find an increasing trend over previous four years. This trajectory though is not considered a true reflection of the nature of the epidemic.

Whilst recognising the increase in the estimated HIV prevalence and number of PLHIV, the trend is considered attributable to the services Chandigarh provides to PLHIV from the neighbouring states. Chandigarh is a known medical centre for treatment providing first line ART treatment free of cost to people from Punjab, Haryana and Himachal Pradesh coming for treatment. Given that the antiretroviral therapy (ART) programme coverage data is an input to epidemiological tools used for generating estimates—or one of the parameters for the projection—the resulted trend is showing an increase independent of the trend observed in HSS because of the known number of PLHIVs registered in Chandigarh which are not necessary the state specific infections.

A separate analysis of the HIV epidemic in Chandigarh is thus required to take into consideration the evidence and the trends of neighbouring states, and isolate union territory specific estimates.

Figure-7B highlights the low prevalence categorised states of Delhi, Haryana, Punjab, Rajasthan, Uttar Pradesh, and West Bengal where HIV prevalence is either stable or declining. Evidently, the degree for decline in HIV prevalence is not uniform between these states which may be on account of the programmatic impact of ART coverage and the strength of the prevention interventions etc. The decline in HIV prevalence is lower in Haryana and Punjab vis-à-vis Delhi, Rajasthan, Uttar Pradesh, and West Bengal.

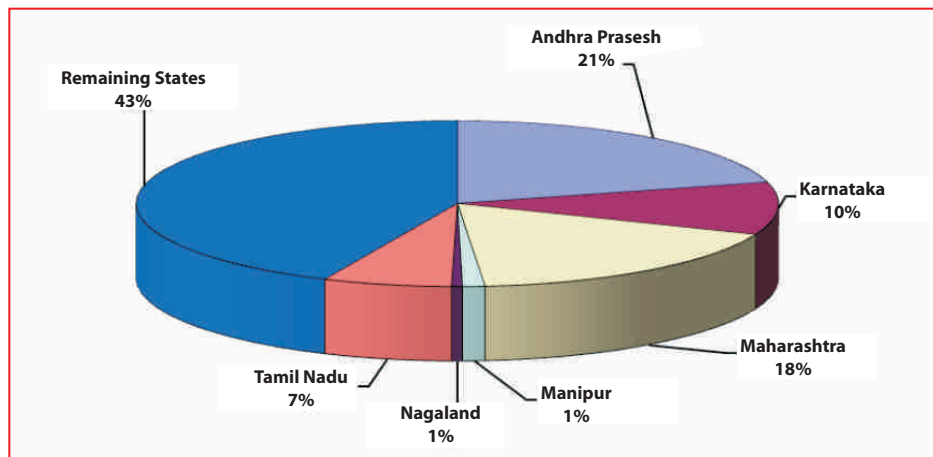
Figure-7B: Adult HIV prevalence trend in Low Prevalence states/Union Territories from 2006 to 2009.



Annex A Table A-3 presents the percent distribution of HIV infections according to three broad age groups of people below the age of 15 years, age 15-49 years and over 50 years of age for the state and national level in 2008 and 2009.

The percent distribution of HIV burden amongst high prevalence states vis-à-vis the remaining states in India is 57% and 43% respectively. Amongst the high prevalence states, Andhra Pradesh accounts for the greatest proportion of cases at 21% vis-à-vis the other states. Following Andhra Pradesh, Maharashtra accounts for approximately 18% of HIV infection, Karnataka and Tamil Nadu respectively account for 10% and 7% of all cases whereas Manipur and Nagaland account for 1% of the estimated total.

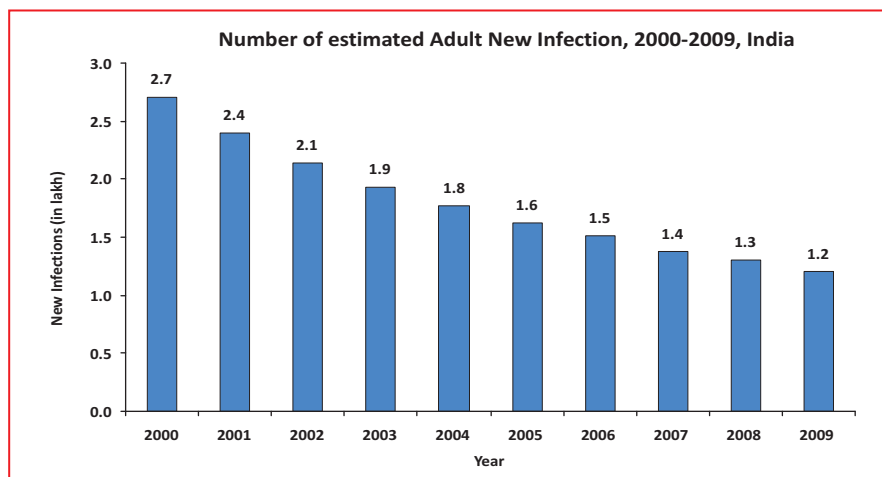
Figure-8: Percent distribution of HIV among states/Union Territories in India.



4.3 Estimates of HIV Incidence

Spectrum projection models estimate HIV incidence or the number of new HIV infections over a period of time. Estimating new infections is a critical input not only for evaluating the performance of prevention interventions—including the provision of antiretroviral treatment—but also for determining the course of the epidemic in the coming years. This would allow for the quantification of the need for future services which is important for planning and budgeting. Under the 2008/2009 HIV estimation round, India for the first time generated estimates of the number of new HIV infections per year. The estimated new adult HIV infections for the year in states/Union Territories and at national level are provided in Annex A Table A-4.

Figure-9: Number of Estimated Adult New Infections from 2000 to 2009 in India.



The estimated total number of new adult infections for India was 130,592 in 2008 with uncertainty bounds of 89,755 to 188,261 and 120,668 in 2009 with uncertainty bounds of 77,956 to 177,004. The decline in number of new infections is thus estimated by 10,000 at national level from the year 2008 to 2009. Whilst a stable to declining trend is noted in most states, certain low prevalence states report a marginal increase in the number of new infections over the past two years. This underscores the need for sustained programme focus on these states that are with low prevalence but high vulnerability. Of the total number of new infections estimated in 2009, the six high prevalence states account for 39% of the total cases, while the states of Orissa, Bihar, West Bengal, Uttar Pradesh, Rajasthan, Madhya Pradesh and Gujarat account for 41% of new infections.

Analysis of the epidemic's projections over the previous decade (2000-2009) points to the decline in the estimated number of new annual HIV infections by over 50%. This trend validates the impact of the various interventions under the National AIDS Control Programme (NACP); particularly as the focus under NACP-III has been on scaling-up prevention strategies. It also highlights the need for sustaining and increasing efforts in future if continued progress in AIDS response is to be achieved.

4.4 Distribution of HIV infections amongst Higher Risk Groups and General Population

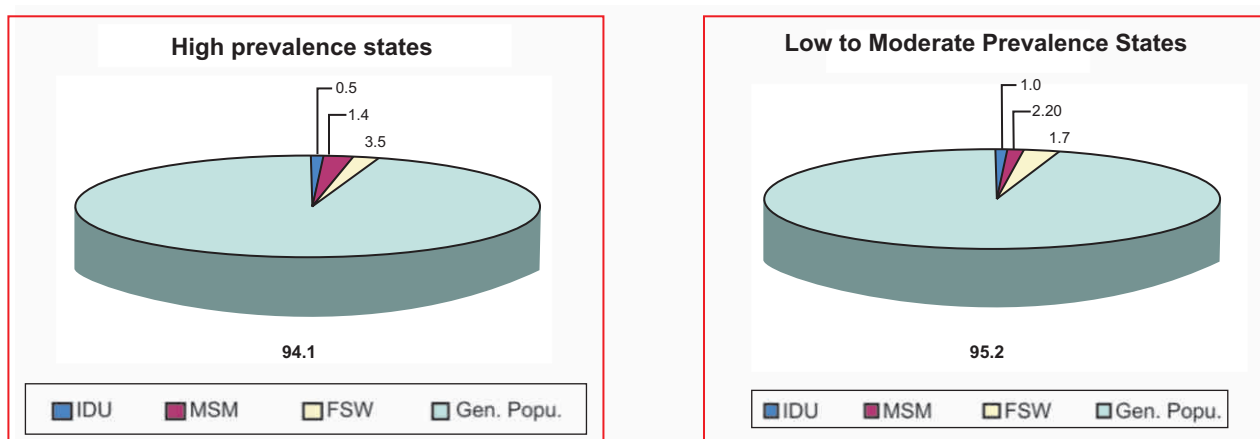
The percent distribution of adult HIV infections among the higher risk group and general population—generated from EPP/Spectrum—in high prevalence states/ Union Territories and low-moderate prevalence states/Union Territories is reflected in Table 2 and Figure-10. The general population accounts for approximately 95% of total HIV infections at the national level in 2009 whereas the higher risk groups of female sex workers (FSW), men having sex with men (MSM) and injecting drug users (IDU) account for 2.68%, 1.72% and 0.75% of HIV infections respectively in 2009.

A similar trend is notable in the high prevalence categorised states/Union Territories where the general population account for approximately 95% of the total infections whilst the FSW, MSM and IDU account for 3.5%, 1.4% and 0.5% of total HIV infections respectively. In the low to moderate prevalence categorised states/Union Territories, the general population account for a little over 95% of total infections. The percent distribution of HIV infections amongst the higher risk groups in ascending order is approximately 2.2% amongst MSM, 1.7% amongst FSW and 1% amongst IDU in these states/Union Territories.

Table 2: Percent distribution of adult HIV infections by sub-population in epidemic zones (2009).					
Epidemic zone	Percent distribution of adult HIV infections amongst higher risk groups and general population (2009)				
	IDU	MSM	FSW	Gen. Pop.	Total
High Prevalence States/Union Territories	0.5	1.4	3.5	94.1	100.0
Low-Moderate Prevalence States/Union Territories	1.0	2.20	1.7	95.2	100.0
India	0.75	1.72	2.68	94.85	100.0

Note that the percent share of adult HIV infections is dependent upon the estimated population size for each of the higher risk groups. The basis for determining HIV prevalence among higher risk groups was the data generated through previous mapping and size estimation exercises. The dynamic size and geographical location of most of the key population at higher risk warrants the need for the mapping and size estimation exercises to regularly be updated. This would enable an improved understanding of their contribution to the HIV epidemic and thereby support accurate planning and implementation of the HIV prevention programmes. The estimated adult higher risk and low risk populations in states/Union Territories and at national level are provided in Annex A Table A-6.

Figure-10: Percent distribution of adult HIV infections by sub-population in epidemic zones (2009).



4.5 Estimates of Women Needing PPTCT Services

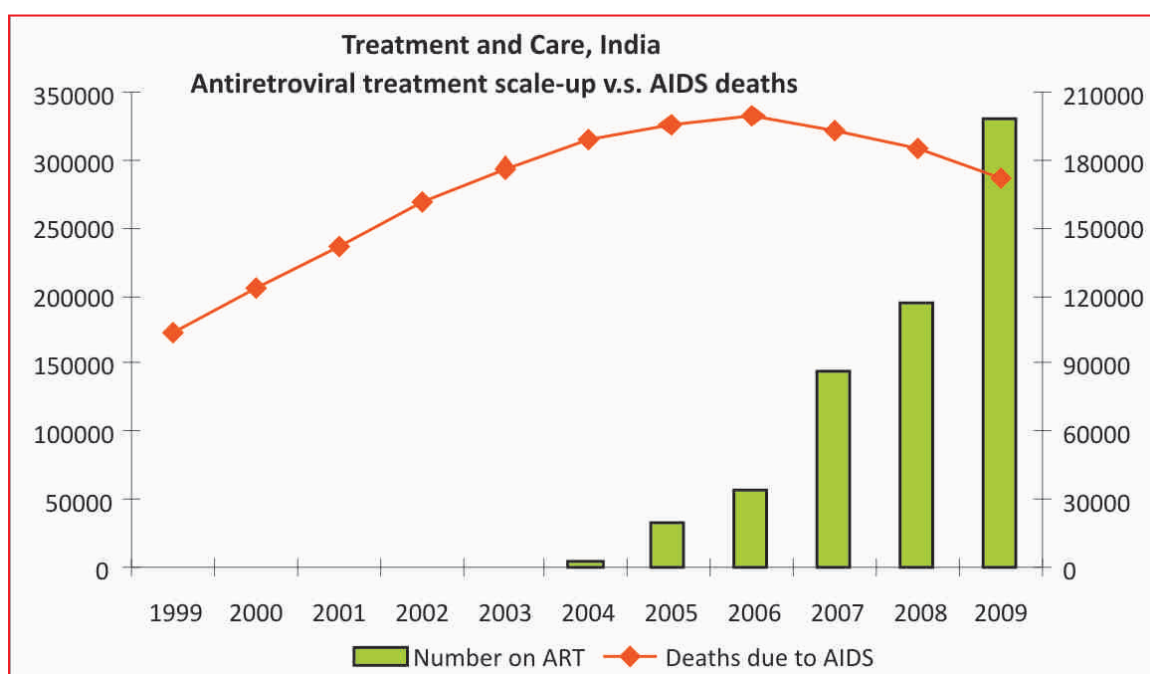
NACO is focused on strengthening and saturating the coverage of prevention of mother to child treatment (PPTCT) services for reduced new infections among children. Recognising that the complex and multi-sectoral nature of the PPTCT programme demands a sound evidence base and good coordination for its successful implementation, HIV estimates and projections of the number of HIV positive pregnant women requiring PPTCT services per year is an essential base for policy makers and programmers to allocate resources, evaluate service coverage, cost-saving procurements and to better understand the mother-to-child transmission dimension of the epidemic.

PPTCT requirement for 2008 is estimated at 45,800 with uncertainty bounds of 23,784 to 73,503 whilst it is estimated at 43,257 in 2009 with uncertainty bounds of 22,494 to 69,572. Additional details on PPTCT requirements national level and States/Union Territory level may be referred to from Annex A Table A-11.

4.6 Deaths Due to AIDS related causes

Spectrum model estimates and projects annual number of deaths due to AIDS related causes for adults and children. In India, in 2008, an estimated 185,870 number of people—with uncertainty bounds of 144,095 to 244,122—died due to AIDS related causes. This estimate reduced to 172,041 in 2009 with uncertainty bounds approximated in the range of 128,821 to 229,373. Greater details on States/Union Territory level estimates for 2008 and 2009 are provided in Annex A Table A-5.

Figure-11: Treatment and Care in India: Antiretroviral treatment scale up VS AIDS related deaths.



The decline in the number of AIDS related deaths is essentially due to the scale up of the ART programme in India. Figure 11 clearly reflects the trend in number of AIDS related deaths which started fleshing from 2004 to 2006—at the time when the ART treatment was first introduced—and subsequently after when it started declining with the roll-out and expansion of the ART programme. It is expected that an increased coverage of ART treatment will lead to a further decline in the number of annual AIDS related deaths.

5. Conclusion

The HIV estimates for India and its states are generated for 2008/2009 through sound modelling and utilization of the improved version of the Estimation Projection Package (EPP) and Spectrum tools. Updated epidemiological data—made available through the latest HIV Sentinel Surveillance rounds and information on higher risk groups—was utilized for advancing the HIV estimates.

India's response to the HIV epidemic and the broad social mobilisation of stakeholders has achieved significant results in controlling the HIV epidemic. The achievements warrant the need for further commitment and coordinated joint action that is guided by the best available scientific evidences and technical knowledge.

Evident from the 2008/2009 HIV estimates, NACP-III has yielded significant results in addressing previously existing gaps in the AIDS response, as well as the social and structural constraints. There is need, however, to build on the gains and focus on the emerging areas of concern. Spread of HIV in the low prevalence and vulnerable states must be thwarted through sustainable effort and investment on prevention, coupled with innovative strategies.

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ANNEX-A

Table A-1: Estimated Adult (15-49) HIV prevalence with uncertainty bounds by State/UTs, 2008-09.

State/UT/India	2008			2009		
	Estimate	Uncertainty bounds		Estimate	Uncertainty bounds	
		Lower	Upper		Lower	Upper
Andhra Pradesh	0.94	0.81	1.11	0.90	0.77	1.07
Karnataka	0.67	0.48	0.92	0.63	0.46	0.88
Maharashtra	0.60	0.48	0.78	0.55	0.44	0.71
Manipur	1.47	1.24	1.74	1.40	1.17	1.66
Nagaland	0.81	0.69	0.95	0.78	0.66	0.93
Tamil Nadu	0.37	0.29	0.46	0.33	0.26	0.41
Goa	0.51	0.32	0.76	0.49	0.31	0.73
Gujarat	0.39	0.32	0.58	0.37	0.30	0.55
Pondicherry	0.29	0.23	0.37	0.28	0.22	0.36
Arunachal Pradesh	0.15	0.11	0.21	0.16	0.12	0.22
Assam	0.07	0.05	0.10	0.08	0.06	0.12
Bihar	0.22	0.18	0.27	0.22	0.18	0.27
Chattisgarh	0.28	0.21	0.38	0.28	0.20	0.38
Delhi	0.30	0.25	0.36	0.30	0.25	0.36
Haryana	0.10	0.09	0.13	0.10	0.09	0.13
Himachal Pradesh	0.21	0.17	0.25	0.19	0.16	0.24
Jammu & Kashmir	0.07	0.05	0.09	0.08	0.06	0.11
Jharkhand	0.12	0.10	0.14	0.13	0.11	0.17
Kerala	0.18	0.15	0.22	0.19	0.15	0.24
Madhya Pradesh	0.20	0.17	0.25	0.19	0.16	0.24
Meghalaya	0.08	0.06	0.11	0.08	0.06	0.12
Mizoram	0.82	0.60	1.14	0.81	0.60	1.12
Orissa	0.26	0.22	0.33	0.29	0.24	0.37
Punjab	0.33	0.27	0.39	0.32	0.26	0.39
Rajasthan	0.19	0.16	0.23	0.19	0.16	0.23
Sikkim	0.06	0.04	0.07	0.06	0.05	0.08
Tripura	0.15	0.10	0.21	0.15	0.10	0.21
Uttar Pradesh	0.10	0.08	0.12	0.09	0.08	0.11
Uttaranchal	0.08	0.06	0.12	0.10	0.07	0.15
West Bengal	0.30	0.25	0.37	0.29	0.24	0.35
Andaman & Nicobar	0.27	0.20	0.37	0.26	0.19	0.36
Chandigarh*	0.38	0.32	0.45	0.39	0.32	0.47
Dadra & Nagar Haveli	0.15	0.12	0.20	0.15	0.11	0.20
Daman & Diu	0.16	0.13	0.21	0.16	0.12	0.21
India	0.32	0.26	0.41	0.31	0.25	0.39

HIV Estimates for Chandigarh needs to be analysed as a separate exercise. This is because the increasing trend in HIV prevalence is can be attributable to neighbouring states, and are accounted here because of services Chandigarh provides to PLHIV from neighbouring states. These numbers are considered here for the need of national estimates.

Table A-2: Estimated Number of HIV Infection with uncertainty bounds by States/UTs, 2008-2009.

	2008			2009		
	Estimate	Uncertainty bounds		Estimate	Uncertainty bounds	
State/UT/India		Lower	Upper		Lower	Upper
Andhra Pradesh	510956	436425	603124	499620	424214	596011
Karnataka	252236	180505	345287	245522	179205	335119
Maharashtra	444971	352968	584590	419789	331891	548366
Manipur	27387	22713	32985	26773	22113	32374
Nagaland	13243	11196	15628	13120	11065	15483
Tamil Nadu	166499	130269	207948	154742	121000	194611
Goa	5540	3610	8156	5440	3584	8027
Gujarat	141475	112429	206544	136875	109952	200826
Pondicherry	2290	1804	2915	2254	1768	2860
Arunachal Pradesh	991	741	1347	1082	808	1481
Assam	12113	8828	17587	14244	10400	21599
Bihar	116563	98408	141854	120470	100493	147676
Chattisgarh	38592	28692	51487	39774	29188	53885
Delhi	33954	28583	40992	34216	28735	41076
Haryana	15544	12924	18664	15852	13189	19122
Himachal Pradesh	9247	7428	11427	8878	7105	11069
Jammu & Kashmir	4791	3602	6418	5403	3971	7444
Jharkhand	20472	16957	24787	23574	19133	29301
Kerala	37561	31060	45815	40060	32654	49352
Madhya Pradesh	86460	71485	105275	84803	69916	103540
Meghalaya	1213	908	1753	1332	1002	1921
Mizoram	5998	366	8325	6025	4448	8361
Orissa	63513	52099	79861	71813	58879	90117
Punjab	57157	47409	68524	56928	47077	67967
Rajasthan	76098	64109	91704	76316	63998	92466
Sikkim	216	163	279	231	173	296
Tripura	3378	2337	4760	3425	2381	4845
Uttar Pradesh	110544	90564	137906	109352	90199	137193
Uttaranchal	4413	3131	6633	5539	3893	8597
West Bengal	174340	145067	212575	167994	138348	206930
Andaman & Nicobar	416	312	566	395	292	536
Chandigarh	2929	2471	3526	3067	2571	3716
Dadra & Nagar Haveli	290	221	389	285	217	383
Daman & Diu	255	198	340	251	192	336
India	2441645	1973982	3089971	2395444	1926625	3032363

HIV Estimates for Chandigarh needs to be analysed as a separate exercise. This is because the increasing trend in HIV prevalence can be attributable to neighbouring states, and are accounted here because of services Chandigarh provides to PLHIV from neighbouring states. These numbers are considered here for the need of national estimates.

Table A-3: Percent distribution of HIV infections by broad age groups for States/UTs in 2008-09.

State/UT/India	2008				2009			
	<15	15- 49	50+	Number in Lakh	<15	15- 49	50+	Number in Lakh
Andhra Pradesh	3.92	83.55	12.53	5.11	4.04	82.66	13.29	5.00
Karnataka	3.59	84.99	11.42	2.52	3.86	83.67	12.47	2.46
Maharashtra	5.52	78.43	16.05	4.45	5.68	77.22	17.10	4.20
Manipur	2.40	71.41	26.19	0.27	2.49	70.13	27.38	0.27
Nagaland	1.94	75.67	22.39	0.13	2.04	74.51	23.45	0.13
Tamil Nadu	4.10	79.53	16.37	1.66	4.36	77.69	17.95	1.55
Goa	4.71	79.57	15.72	0.06	4.60	79.26	16.14	0.05
Gujarat	3.64	86.09	10.27	1.41	3.96	84.76	11.28	1.37
Pondicherry	3.28	84.02	12.71	0.02	3.46	82.87	13.66	0.02
Arunachal Pradesh	3.63	89.51	6.86	0.01	3.88	88.82	7.30	0.01
Assam	2.27	91.33	6.40	0.12	2.32	91.10	6.59	0.14
Bihar	3.82	88.16	8.03	1.17	4.06	87.33	8.60	1.20
Chattisgarh	3.37	89.02	7.61	0.39	3.66	88.13	8.22	0.40
Delhi	3.27	84.83	11.90	0.34	3.33	83.99	12.67	0.34
Haryana	4.00	86.07	9.94	0.16	4.20	85.33	10.47	0.16
Himachal Pradesh	4.19	82.75	13.06	0.09	4.37	81.85	13.78	0.09
Jammu & Kashmir	2.13	90.46	7.41	0.05	2.18	90.14	7.68	0.05
Jharkhand	2.52	90.92	6.56	0.20	2.57	90.63	6.80	0.24
Kerala	2.02	90.18	7.81	0.38	2.17	89.47	8.35	0.40
Madhya Pradesh	5.02	84.54	10.44	0.86	5.36	83.50	11.14	0.85
Meghalaya	1.81	91.18	7.01	0.01	1.88	90.69	7.43	0.01
Mizoram	2.15	75.01	22.84	0.06	2.17	74.21	23.62	0.06
Orissa	2.44	90.46	7.11	0.64	2.45	90.29	7.26	0.72
Punjab	3.36	85.42	11.21	0.57	3.50	84.66	11.84	0.57
Rajasthan	4.94	84.51	10.54	0.76	5.12	83.76	11.11	0.76
Sikkim	2.31	89.35	8.33	0.00	2.16	88.74	9.09	0.00
Tripura	3.17	87.03	9.80	0.03	3.33	86.36	10.31	0.03
Uttar Pradesh	6.51	81.77	11.72	1.11	6.73	80.96	12.32	1.09
Uttaranchal	1.86	92.57	5.57	0.04	1.90	92.31	5.80	0.06
West Bengal	3.90	84.88	11.22	1.74	4.14	83.86	11.99	1.68
Andaman & Nicobar	0.96	85.58	13.46	0.00	1.01	84.81	14.18	0.00
Chandigarh	2.22	88.29	9.49	0.03	2.31	87.48	10.21	0.03
India	4.20	83.32	12.48	24.42	4.36	82.41	13.23	23.95

**Table A-4: Estimated number of new Adult HIV Infection with uncertainty bounds
by States/UTs, 2008-2009.**

	2008			2009		
	Estimate	Uncertainty bounds		Estimate	Uncertainty bounds	
State/UT/India		Lower	Upper		Lower	Upper
Andhra Pradesh	25749	14935	36950	23905	11736	34806
Karnataka	10762	8159	16394	9184	6963	14069
Maharashtra	12829	11144	15528	11287	9812	13557
Manipur	1289	718	1795	1219	641	1693
Nagaland	806	505	1162	704	374	1086
Tamil Nadu	1926	692	3211	850	294	1416
Goa	315	134	495	299	116	471
Gujarat	5973	4961	9562	4283	3558	6856
Pondicherry	129	66	221	94	42	161
Arunachal Pradesh	134	100	187	134	99	188
Assam	2272	1626	3764	2540	1841	4270
Bihar	10654	7475	15143	10056	6458	14761
Chattisgarh	3577	2161	5705	3221	1801	5501
Delhi	2173	1452	3181	1970	1135	2934
Haryana	1186	830	1648	1196	739	1680
Himachal Pradesh	419	265	676	400	234	649
Jammu & Kashmir	721	445	1217	778	460	1400
Jharkhand	3553	2645	5074	3814	2748	5701
Kerala	4269	3194	5982	3968	2900	5896
Madhya Pradesh	4885	2604	7279	4806	2112	7289
Meghalaya	174	129	255	168	124	248
Mizoram	444	337	672	409	310	635
Orissa	10337	8477	13131	11268	9263	14325
Punjab	3687	2347	5376	3611	2054	5436
Rajasthan	5280	3368	7802	5018	2864	7655
Sikkim	24	17	31	23	16	30
Tripura	280	202	415	280	204	417
Uttar Pradesh	6680	4590	9596	6397	4331	9151
Uttaranchal	1014	676	1701	1196	800	1996
West Bengal	8687	5248	13584	7316	3752	12319
Andaman & Nicobar	21	11	39	21	9	39
Chandigarh	307	218	430	217	144	315
Dadra & Nagar	19	15	26	19	14	26
Daman & Diu	17	9	29	17	8	28
India	130592	89755	188261	120668	77956	177004

**Table A-5: Estimated number of AIDS related deaths with uncertainty bounds
by States/UTs, 2008-2009.**

	2008			2009		
	Estimate	Uncertainty bounds		Estimate	Uncertainty bounds	
State/UT/India		Lower	Upper		Lower	Upper
Andhra Pradesh	38780	31528	46532	35694	28195	43011
Karnataka	18660	10708	26992	16355	8806	24847
Maharashtra	42695	36174	59783	36771	29380	52163
Manipur	1755	1224	2318	1700	1137	2323
Nagaland	836	648	1056	783	586	998
Tamil Nadu	14330	10205	18162	12459	8000	16642
Goa	467	282	732	401	213	661
Gujarat	9831	6983	14761	9356	6612	14633
Pondicherry	162	95	235	131	73	196
Arunachal Pradesh	45	30	64	54	36	76
Assam	415	282	618	471	304	732
Bihar	6555	5184	8319	6944	5448	8856
Chattisgarh	2032	1453	2863	2234	1569	3102
Delhi	2037	1529	2644	1772	1244	2375
Haryana	981	766	1265	973	749	1252
Himachal Pradesh	793	654	976	789	654	959
Jammu & Kashmir	159	92	239	183	100	271
Jharkhand	744	538	975	836	603	1129
Kerala	1503	1106	2002	1649	1205	2219
Madhya Pradesh	6764	5363	8488	6824	5471	8487
Meghalaya	51	35	73	53	34	79
Mizoram	403	264	562	362	222	529
Orissa	2932	2295	3704	3219	2466	4121
Punjab	4145	3350	5099	3989	3199	4942
Rajasthan	5322	4275	6515	5183	4156	6411
Sikkim	9	6	13	9	6	14
Tripura	243	154	343	244	156	350
Uttar Pradesh	8795	6993	10987	8180	6283	10201
Uttaranchal	87	40	158	97	42	185
West Bengal	14181	11759	17392	14154	11784	17348
Andaman & Nicobar	41	31	55	41	31	53
Chandigarh	71	15	137	85	22	148
Dadra & Nagar	24	17	32	24	18	32
Daman & Diu	22	17	28	22	17	28
India	185870	144095	244122	172041	128821	229373

Table A-6: Estimated Adult (15+) HRG and low risk Population by State/UTs, 2009.

State/UTs	Estimated Population	IDU	MSM	FSW	Low risk Population
Andhra Pradesh	61966835	1094	18682	85962	61861097
Karnataka	42803683	800	24926	118610	42659347
Maharashtra	80106438	3999	101031	245831	79755577
Manipur	1787132	12592	1466	6417	1766656
Nagaland	1656296	19959	1419	6597	1628321
Tamil Nadu	51389357	4031	49235	79712	51256379
Goa	1169660	935	2270	2983	1163472
Gujarat	41122828	2407	48496	71487	41000439
Pondicherry	918590	847	3468	3010	911265
Arunachal Pradesh	770816	385	1099	1208	768124
Assam	20680201	1017	923	13096	20665165
Bihar	60988440	6243	4920	25543	60951734
Chattisgarh	15748082	2285	1965	22546	15721287
Delhi	12735572	10872	46398	67735	12610567
Haryana	16542660	13556	45441	35228	16448434
Himachal Pradesh	4958562	875	19756	10435	4927496
Jammu & Kashmir	8419234	2933	737	3961	8411603
Jharkhand	20521135	1805	3295	40476	20475558
Kerala	26570425	10198	101942	11272	26447013
Madhya Pradesh	46193712	8856	20317	59686	46104853
Meghalaya	1913901	494	0	3183	1910224
Mizoram	735968	13748	2896	2273	717052
Orissa	28771089	3127	6033	23225	28738705
Punjab	20200888	18065	5441	49585	20127797
Rajasthan	43041765	2535	18016	53603	42967610
Sikkim	452069	391	1835	633	449209
Tripura	2642317	1146	1195	17675	2622302
Uttar Pradesh	121754725	14359	18041	35566	121686760
Uttaranchal	6488948	2010	1540	7400	6477998
West Bengal	65287100	17300	20800	57800	65191200
Andaman & Nicobar	305023	0	606	470	303947
Chandigarh	931057	3519	3349	5492	918696
Dadra & Nagar	219,135	0	739	0	218,396
Daman & Diu	177,372	0	577	214	176,581

Source: Projected populations derived by EasyProj in the Spectrum Package developed by John Stover using India Census figures and Expert group population projections.

Table A-7: State-wise demographic parameters viz., Adult birth rate- ratio of annual birth to adult population (15+), Survival to age 15 (l_{15}), Adult mortality-ratio of annual deaths to adult population in 15+ (μ 15+) and Adult population growth rate (15+) by state/UTs, 2009.

State/UTs	Adult birth rate (15+)*	Survival to age 15 (l_{15})	Adult mortality in 15+ (μ)	Adult population growth rate
Andhra Pradesh	0.0248	0.9067	0.0087	0.0144
Karnataka	0.0270	0.9113	0.0085	0.0163
Maharashtra	0.0245	0.9310	0.0078	0.0153
Manipur	0.0213	0.8862	0.0050	0.0171
Nagaland	0.0233	0.8862	0.0046	0.0158
Tamil Nadu	0.0208	0.9303	0.0086	0.0099
Goa	0.0189	0.9310	0.0079	0.0163
Gujarat	0.0317	0.8986	0.0075	0.0174
Puducherry	0.0218	0.9303	0.0089	0.0117
Arunachal Pradesh	0.0347	0.8862	0.0062	0.0245
Assam	0.0346	0.8663	0.0091	0.0180
Bihar	0.0455	0.8556	0.0072	0.0241
Chhattisgarh	0.0393	0.8359	0.0089	0.0238
Delhi	0.0250	0.8862	0.0053	0.0210
Haryana	0.0343	0.8953	0.0076	0.0220
Himachal Pradesh	0.0240	0.9124	0.0087	0.0180
Jammu & Kashmir	0.0255	0.9124	0.0061	0.0145
Jharkhand	0.0388	0.8556	0.0077	0.0227
Kerala	0.0188	0.9785	0.0082	0.0103
Madhya Pradesh	0.0426	0.8359	0.0085	0.0222
Meghalaya	0.0339	0.8862	0.0080	0.0169
Mizoram	0.0238	0.8862	0.0051	0.0165
Orissa	0.0300	0.8590	0.0096	0.0159
Punjab	0.0232	0.9264	0.0082	0.0164
Rajasthan	0.0422	0.8582	0.0067	0.0246
Sikkim	0.0244	0.8862	0.0052	0.0155
Tripura	0.0207	0.8862	0.0059	0.0168
Uttar Pradesh	0.0466	0.8633	0.0089	0.0245
Uttarakhand	0.0302	0.8633	0.0063	0.0242
West Bengal	0.0237	0.8959	0.0071	0.0178
Andaman & Nicobar	0.0256	0.9303	0.0065	0.0285
Chandigarh	0.0219	0.9264	0.0050	0.0144
Dadra & Nagar Haveli	0.0374	0.8986	0.0058	0.0166
Daman & Diu	0.0239	0.8986	0.0056	0.0166

Table A-8: State-wise number of Adults Receiving ART, 2004-2009.

State/UT	2004	2005	2006	2007	2008	2009
Andhra Pradesh	671	2214	7154	28745	40903	69165
Karnataka	549	2736	4933	13145	19448	40320
Maharashtra	1533	7277	12574	31711	43924	74935
Manipur	393	1321	2354	3804	4294	5605
Nagaland	50	131	308	695	921	1736
Tamil Nadu	1020	9249	12523	23581	26930	41322
Goa	0	183	337	498	646	1016
Gujarat	0	1047	1389	5127	6798	14906
Pondicherry	0	48	362	334	267	595
Arunachal Pradesh	0	3	0	17	25	28
Assam	0	33	147	344	537	915
Bihar	0	0	403	1709	2998	5665
Chattisgarh	0	0	0	556	893	1504
Delhi	702	1902	2915	3735	4743	7492
Haryana	0	0	175	701	965	1594
Himachal Pradesh	0	22	102	368	434	862
Jammu & Kashmir	0	60	103	286	417	563
Jharkhand	0	81	136	570	828	1535
Kerala	0	1394	1550	2525	2920	4500
Madhya Pradesh	0	309	738	1825	2156	3692
Meghalaya	0	0	0	14	33	86
Mizoram	0	0	37	172	327	705
Orissa	0	0	62	714	779	2385
Punjab	104	0	301	1756	2982	5054
Rajasthan	11	760	1211	2997	3966	6963
Sikkim	0	0	2	13	18	30
Tripura	0	0	0	22	44	120
Uttar Pradesh	0	961	2058	4219	6710	11422
Uttaranchal	0	0	46	221	318	631
West Bengal	0	709	1355	2638	3315	6096
Chandigarh	0	569	896	1403	1174	1688
India	5,033	31,009	54,171	134,445	180,713	313,130

Table A-9: State-wise number of children receiving ART, 2004-2009.

State/UT	2004	2005	2006	2007	2008	2009
Andhra Pradesh	2	22	307	1,880	2,646	3,384
Karnataka	21	81	324	1,198	1,928	2,466
Maharashtra	1	264	821	2,383	3,357	4,293
Manipur	37	99	180	355	406	519
Nagaland	3	9	15	45	65	83
Tamil Nadu	82	389	920	1,655	1,950	2,494
Goa	0	6	20	26	37	47
Gujarat	0	45	59	267	416	532
Pondicherry	0	12	26	36	43	55
Arunachal Pradesh	0	0	0	0	0	0
Assam	0	0	4	14	18	35
Bihar	0	0	10	66	124	159
Chattisgarh	0	0	0	43	96	123
Delhi	56	157	277	329	417	533
Haryana	0	0	3	29	51	65
Himachal Pradesh	0	1	9	47	63	81
Jammu & Kashmir	0	0	0	19	29	37
Jharkhand	0	4	5	26	38	49
Kerala	0	30	114	148	171	219
Madhya Pradesh	0	28	60	140	161	206
Meghalaya	0	0	0	1	1	1
Mizoram	0	0	0	13	24	31
Orissa	0	0	0	19	39	50
Punjab	16	0	17	102	193	247
Rajasthan	4	25	76	205	283	362
Sikkim	0	0	0	0	1	1
Tripura	0	0	0	0	1	1
Uttar Pradesh	0	30	81	192	353	451
Uttaranchal	0	0	3	21	29	37
West Bengal	0	21	48	98	136	174
Chandigarh	13	11	31	38	30	35
India	235	1,234	3,410	9,395	13,106	16,770

Table A-10: State-wise number of Women Receiving PPTCT, 2003-2009.

State/UTs/India	2003	2004	2005	2006	2007	2008	2009
Andhra Pradesh	0	0	1,337	2,964	3,605	3,925	3,936
Karnataka	0	0	242	602	957	2,163	2,200
Maharashtra	0	97	486	1,035	1,711	2,673	2,844
Manipur	0	16	43	166	187	204	201
Nagaland	0	0	21	37	41	121	119
Tamil Nadu	0	0	1,237	553	1,674	2,832	1,537
Goa	0	4	16	48	64	46	56
Gujarat	0	10	92	199	270	377	506
Pondicherry	0	0	1	11	32	0	21
Arunachal Pradesh	0	0	0	0	2	2	2
Assam	0	0	5	17	22	33	37
Bihar	0	2	3	40	71	65	117
Chattisgarh	0	0	0	0	29	17	61
Delhi	12	32	53	67	81	141	220
Haryana	0	0	0	21	19	28	43
Himachal Pradesh	0	0	0	1	3	15	15
Jammu & Kashmir	0	0	0	0	5	1	13
Jharkhand	0	0	0	0	10	55	38
Kerala	0	16	40	65	80	113	81
Madhya Pradesh	0	0	3	4	19	29	109
Meghalaya	0	0	0	0	0	3	11
Mizoram	0	0	1	16	26	57	98
Orissa	0	0	5	34	10	100	96
Punjab	0	0	2	5	19	77	92
Rajasthan	0	6	21	17	72	99	191
Sikkim	0	0	0	1	0	6	1
Tripura	0	0	0	0	0	1	2
Uttar Pradesh	0	0	5	19	107	107	198
Uttaranchal	0	0	3	1	4	19	17
West Bengal	2	26	44	83	139	135	189
Andaman & Nicobar							
Chandigarh	0	13	11	31	38	30	35
Dadra & Nagar Haveli	0	0	0	0	2	0	6
Daman & Diu	0	0	0	0	1	0	2
India	14	222	3,671	6,037	9,300	13,474	13,094

**Table A-11: Estimated Number of Mothers needing PMTCT with Uncertainty bounds
by States/UTs, 2008-2009**

State/UT/India	2008			2009		
	Estimate	Uncertainty bounds		Estimate	Uncertainty bounds	
		Lower	Upper		Lower	Upper
Andhra Pradesh	8429	4443	12871	7919	4183	12111
Karnataka	4728	2434	7847	4369	2249	7264
Maharashtra	7225	3663	12049	6362	3239	10559
Manipur	202	104	323	186	95	296
Nagaland	138	73	212	129	69	199
Tamil Nadu	2378	1178	3821	2063	1018	3304
Goa	90	41	164	85	38	157
Gujarat	2963	1584	5164	2771	1479	4841
Pondicherry	36	19	58	34	18	54
Arunachal Pradesh	33	17	53	36	18	59
Assam	263	124	453	306	144	535
Bihar	3170	1686	4905	3174	1679	4996
Chattisgarh	975	496	1611	992	506	1650
Delhi	473	250	746	466	246	736
Haryana	391	205	618	393	207	631
Himachal Pradesh	148	75	235	137	68	218
Jammu & Kashmir	85	41	141	95	46	159
Jharkhand	463	241	727	527	273	844
Kerala	638	340	1022	681	361	1081
Madhya Pradesh	2321	1201	3624	2189	1144	3444
Meghalaya	21	11	36	23	12	40
Mizoram	63	31	107	61	30	104
Orissa	1230	637	1942	1370	711	2167
Punjab	1001	526	1582	957	506	1511
Rajasthan	1916	1035	3020	1846	982	2924
Sikkim	3	2	6	4	2	6
Tripura	59	29	101	58	28	99
Uttar Pradesh	3252	1690	5259	3082	1618	4985
Uttaranchal	94	46	162	116	57	204
West Bengal	2952	1531	4550	2766	1436	4299
Andaman & Nicobar	2	1	3	2	1	3
Chandigarh	47	25	73	48	26	75
Dadra & Nagar	6	3	10	5	3	9
Daman & Diu	5	2	8	5	2	8
India	45800	23784	73503	43257	22494	69572

ANNEX-B

B-1: Members of the Technical Resource Group on Surveillance and Estimation, NACO.	
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