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# Methodology – Understanding the HIV estimates

Produced by the Strategic Information and Monitoring Division

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## **Notes on UNAIDS methodology**

Unless otherwise stated, findings in this report are based on modelled HIV estimates. Modelled estimates are required because it is impossible to count the exact number of people living with HIV, who are newly infected or who have died of AIDS in the world. To know this for certain requires testing every person for HIV regularly and investigating all deaths, which is logistically impossible and ethically problematic.

## **Partnerships in creating UNAIDS estimates**

Modelled HIV estimates are created by country teams using UNAIDS-supported software. The country teams are comprised primarily of epidemiologists, demographers, monitoring and evaluation specialists and technical partners. Country-submitted files are reviewed at UNAIDS, and selected HIV service data contained in the files are reviewed and validated in partnership with WHO and UNICEF. UNAIDS review aims to ensure comparability of results across regions, countries and over time.

The software used to create the estimates is Spectrum, developed by the Futures Institute, and the Estimates and Projections Package, developed by East-West Center ([www.futuresinstitute.org](http://www.futuresinstitute.org)). The UNAIDS Reference Group on Estimates, Modeling and Projections provides technical guidance on the development of the HIV component of the software ([www.epidem.org](http://www.epidem.org)).

## **A brief description of UNAIDS methods to create estimates**

Country teams use UNAIDS-supported software to create national HIV prevalence curves that are consistent with all pertinent, available HIV data in the country.

These data typically consist of HIV prevalence results from surveillance among pregnant women attending antenatal care clinics and from nationally-representative population-based surveys in countries with generalized epidemics, where HIV transmission is sufficiently high to sustain an epidemic in the general population.

Because antenatal clinic surveillance is performed on a regular basis, these data can be used to inform national prevalence trends. Data from population surveys, which are conducted less frequently but have broader geographic coverage and also test men, are more useful for informing national HIV prevalence levels. For countries with generalized epidemics that have not conducted population surveys, HIV prevalence levels are adjusted downwards based on comparisons of antenatal clinic surveillance and population survey data from other countries in their region.

In countries with concentrated, or low-level HIV epidemics, where HIV transmission is largely contained within key populations at higher-risk of HIV infection (e.g., people who inject drugs, sex workers, men who have sex with men), repeated HIV prevalence studies in these populations are used to inform national estimates and trends. Estimates of the size of key populations are increasingly derived empirically in each country or, when studies are not available, based on regional values and consensus among experts. Other data sources,

including population surveys, surveillance among pregnant women, and HIV case reporting data are used to estimate HIV prevalence in the general, low-risk population.

The HIV prevalence curves and numbers on antiretroviral therapy are used to derive national HIV incidence trends. For countries with insufficient HIV surveillance or survey data but strong vital registration and disease reporting systems, trends and levels in national HIV prevalence and incidence are matched directly to HIV case reporting and AIDS-related mortality data.

To obtain age and gender-specific incidence, prevalence and death rates, along with other important indicators, including program coverage statistics, assumptions about the effectiveness of HIV program-scale up and patterns of HIV transmission and disease progression, are applied to the national incidence curve. These assumptions are based on systematic literature reviews and analysis of raw study data by scientific experts.

Demographic population data, including fertility estimates, are based on United Nations Population Division, World Population Prospects 2012.

### **Uncertainty bounds around UNAIDS estimates**

The software calculates uncertainty bounds around all estimates, which can be used to measure how precisely we can speak about the magnitude of the epidemic. These bounds define the range within which the true value lies.

There are two factors that determine the width of the ranges around the HIV estimates. The first is the quantity and source of the HIV data available -- countries with more HIV surveillance data have smaller ranges than countries with less surveillance data or smaller sample sizes. Countries in which a national population-based survey has been conducted will generally have smaller ranges around estimates than countries where such surveys have not been conducted.

The second factor that determines the extent of the ranges around estimates is the number of assumptions required to arrive at the estimate – the more assumptions, the wider the uncertainty range since each assumption introduces additional uncertainties. For example, ranges around estimates of adult HIV prevalence are smaller than those around estimates of HIV incidence among children, which requires additional data on the probability of mother-to-child HIV transmission. The latter are based on prevalence among pregnant women, the probability of mother-to-child HIV transmission, and estimated survival times for HIV-positive children.

Although UNAIDS is confident that the actual numbers of people living with HIV, people who have been newly infected or who have died of AIDS lie within the reported ranges, more and better data from countries will steadily reduce this uncertainty.

### **Improvements to the 2013 UNAIDS estimates model**

Country teams create new Spectrum files every year. Files from one year to the next may differ for two reasons. First, new surveillance and program data are entered into the model, which can change HIV prevalence and incidence trends over time, including for past years.

Second, improvements are incorporated into the model based on the latest available science and understanding of the epidemic. Between the previous and current rounds of estimates,

the following changes were applied to the model under the guidance of the UNAIDS Reference Group on Estimates, Modelling and Projections:

- Updated population data from the United Nations Population Division 2012 World Population Prospects
- Revised calibration of HIV prevalence from antenatal clinics to the general population in countries with generalized epidemics without national surveys
- Corrected calculations of incidence trends among people 15-49 to be informed by the number of people receiving antiretroviral therapy among persons ages 15-49 instead of ages 15+
- Revised estimates of non-AIDS mortality among people who inject drugs based on recent literature
- Adjusted AIDS mortality for key populations in concentrated epidemics keeping the sizes of key populations the same as those entered by the user

Because there are improvements to the data and methods used to create the estimates each round, users of the data should not compare results from one round to the next. A full historical set of estimates are created for each round allowing for estimation of trends over time from within the same round.

### **Measuring antiretroviral coverage**

Beginning in 2013, UNAIDS provides estimates of the proportion of adults and children living with HIV who are receiving ART, rather than estimates of the proportion of adults and children eligible according to national or international guidelines who are receiving ART. This change was made because the eligibility criteria for starting ART vary over time and by country.

### **Publication of country-specific estimates**

UNAIDS aims to publish estimates for all countries with populations of 250,000 or more.

Although UNAIDS encourages all countries to submit estimates, for countries that do not submit estimates, draft estimates are created by UNAIDS based on published or otherwise available information. These draft estimates contribute to regional and global totals but are not published.

In countries with concentrated epidemics, the estimated number of pregnant women living with HIV is not easily available. Many women living with HIV in these countries are sex workers or partners of men who have sex with men or drug users and thus are likely to have different fertility levels than the general population. UNAIDS does not present estimates of mother to child transmission or estimates related to children infected through mother to child transmission in some concentrated epidemic countries, unless the country reports that adequate data are available to validate these estimates.

With regard to monitoring incidence trends, if there is not enough historical data to confidently state whether a decline in incidence has occurred, UNAIDS will not publish earlier data to avoid users making inaccurate inferences about trends. Specifically, incidence trends are not published if there are less than four data points for the key population or if there has been no data for the last four years.

Finally, in a few instances UNAIDS will not publish country estimates when further data or analyses are needed to produce valid estimates.

More information on the UNAIDS estimates can be found at our [website](#). The individual Spectrum files are available for most countries from the above website.

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