Introduction

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Improving analysis of the size and dynamics of AIDS epidemics

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Supplement editors Peter D Ghys and Neff Walker and the Chair of the UNAIDS Reference Group on Estimates, Modelling and Projections, Geoff P Garnett, introduce 13 papers describing the data, methods, and tools used to produce the 2005 UNAIDS/ WHO HIV and AIDS estimates

Country HIV and AIDS estimates have been published by the Joint United Nations Programme on HIV/AIDS (UNAIDS) and the World Health Organization (WHO) every two years since 1998,[1] and the 2006 Global Report is the fifth release of country estimates.[2] Since 1998 much has changed in the approaches and methods used to produce national estimates using data from surveillance systems and research studies. In recent years, these estimates have become more accurate, owing much to the availability of results from national population based surveys in countries with generalised epidemics, and to the use of an explicit analytic framework and the greater availability of data on the size of groups with high risk behaviour in countries with low level or concentrated epidemics.[3][4] The focus of these analyses has also been shifting from the global level to the national and increasingly to the subnational level. This is a trend that parallels a shift in the use of these analyses from global advocacy to improved national planning of prevention and treatment as programmes are scaled up towards universal access.[5]

Two years ago, a supplement on the methods underlying the 2003 estimates was published.[6] The current supplement aims to provide information on the approaches, methods, and tools that were used to produce the 2005 estimates featured in the 2006 Global Report,[2] as well as two specific country examples. Following a successful first round in 2003, UNAIDS, WHO, and a large number of partner organisations have conducted a second round of 11 regional training workshops during 2005 to train country participants in the use of the updated methods and tools that are described in this supplement. These training activities have not only resulted in increased analytic capacity among national analysts, but they have also allowed a more satisfactory dialogue between UNAIDS/WHO and country analysts on technical aspects of countries' analyses.

An important part of the current supplement concerns the analysis of national epidemics in countries with low level and concentrated epidemics. In these countries most HIV infections occur in groups of the population with high risk behaviours. In most countries these include female sex workers (FSW) and their clients (CoSW), injecting drug users (IDU), and men who have sex with men (MSM). The papers by Vandepitte et al (FSW),[7] Caraël et al (CoSW),[8] and Cáceres et al (MSM)[9] constitute a first attempt to inventorise and summarise data on the size of these populations groups. The paper by Aceijas et al[10] updates a previous paper[11] on the size of IDU populations while advancing the analysis by including gender and age breakdowns. Degenhart et al attempt to quantify the increased background mortality among IDU due to causes other than AIDS, despite a lack of relevant data in low and middle income countries.[12]

The software tools described in the 2004 supplement—that is, the Workbook,[13] the Estimation and Projection Package (EPP),[14] and Spectrum[15]—have been further developed. Improvements in Workbook include the integration of the point prevalence and projection workbooks[13] into a single tool. To fit an epidemic curve to point prevalence estimates for multiple years, the logistic and double logistic functions have replaced the UNAIDS Reference Group model which didn't always perform well in its spreadsheet application. These functions allow a more robust modeling of epidemic trends.[16] An application of the Workbook method in China has resulted in an improved estimate of people living with HIV/AIDS (PLHIV).[17] Indeed, at the end of 2005 China significantly lowered an earlier estimate of PLHIV, partly as a result of the application of the Workbook method at a lower level than had been previously done. Important improvements in EPP include the calibration to national surveys, the inclusion of a "level fits" procedure to better capture prevalence trends, and allowing for the turnover of groups with high risk behaviour.[18] Improvements in Spectrum include the incorporation of improved age/sex patterns and their adjustment to the pattern from a country's national population based survey, more sophisticated methods for estimating vertically transmitted infections, the estimation of denominator data for prevention and treatment programmes (that is, the number of HIV+ pregnant women, the number of adults and children in need of antiretroviral treatment, and the number of children in need of co-trimoxazole prophylaxis), and inclusion of an updated survival curve for children.[19] A separate paper discusses the quality of the information generated by national population based surveys and how this information can be used to inform HIV and AIDS estimates.[20]

A new tool has been developed to help quantify the number of new HIV infections by mode of exposure,[21] building on earlier approaches.[22] This tool is of particular relevance for helping to develop costed national strategic plans, as these plans need to prioritise programmes according to the importance of the different modes of exposure. The model requires many imputs, and may currently not be easily applied in many countries. However, this lack of data exposes a real gap in country-level information that is essential to plan a cost effective response to the epidemic, and the model can serve to help identify priorities for the expansion of surveillance systems.

Methods for the development of bounds of uncertainty around national HIV and AIDS estimates were first developed for the 2003 round.[23] The initial approaches have been further developed by applying bootstrap methods and by including the effect of population based surveys in countries with generalised epidemics, making for narrower uncertainty bounds in countries with dense datasets.[24]

Western countries have not been a focus of efforts to improve and standardise methods for national HIV and AIDS estimates, with many countries relying on case reports. Few western countries have published their methods to produce national HIV and AIDS estimates. There is a perception that western countries can somehow easily derive these estimates from case reports. However, since the advent of HAART back-calculation methods can no longer

be used. In addition the underdiagnosis of prevalent cases in case reports, which was not addressed by back-calculation, needs to be addressed explicitly. Although the US has recently published a new estimate of PLHIV,[25] the methods have not yet been published. Countries including UK and Canada have previously described their estimation methodology.[26 27] An update of the method used in the UK is presented in this supplement.[28]

The above mentioned tools are now widely used in countries as exemplified for the Workbook method by the China paper[17] and for EPP and Spectrum by national reports of many sub-Saharan African countries. They are also proposed by the WHO to estimate the number of people in need of antiretroviral treatment, a key quantity to interpret progress in this area.[29] These tools have also continued to be used to inform global analyses of the impact of prevention and treatment programmes on the course of the AIDS epidemic.[30] Important challenges remain for the future improvement of these tools and their use. These include the application of insights from population based surveys to countries without such surveys; how population based measures of prevalence should be incorporated in the analysis for countries with low level and concentrated epidemics (with DHS results already available for Senegal and expected in Cambodia, Vietnam, and India); the modification of survival due to ART in EPP; and the actual application and use of models of incidence by mode of exposure to improve countries' strategic plans including at lower administrative levels—such as provinces, prefectures, or districts. In the longer term, the existing models will also need to be adapted to allow for the inclusion of empirical incidence and mortality data. Although there currently is no good methodology to derive direct incidence estimates and very few countries have good coverage of vital registration for deaths, efforts are ongoing to develop methods and collect data in these areas. Finally a major challenge is to move the analysis and results outside the narrow circle of technical specialists and take them to politicians and other decision makers.

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REFERENCES

1 **UNAIDS**. *Report on the global HIV/AIDS epidemic*, June 1998.UNAIDS, Geneva, 1998.
2 **UNAIDS**. *Report on the global AIDS epidemic*, May 2006.UNAIDS, Geneva, 2006.
3 **Boerma JT**, Ghys PD, Walker N. Estimates of HIV-1 prevalence from national population-based surveys as a new gold standard. *Lancet* 2003;**362**:1929–31.
4 **Walker N**, Grassly NC, Garnett GP, et al. Estimating the global burden of HIV/AIDS: what do we really know about the HIV pandemic? *Lancet* 2004;**363**:2180–5.
5 **UNAIDS**. Towards Universal Access. Available at http://data.unaids.org/Topics/UniversalAccess/UniversalAccess_Concept_Jan2006_en.pdf (accessed March 2006).
6 **Ward H**, Walker N, Ghys PD, eds. Methods and tools for HIV/AIDS estimates and projections. *Sex Transm Inf* 2004;**80**(Suppl 1).
7 **Vandepitte J**, Lyerla R, Dallabetta G, et al. Estimates of the number of female sex workers in different regions of the world. *Sex Transm Inf* 2006;**82**(Suppl 3):iii18–25.
8 **Caraël M**, Slaymaker E, Lyerla R, et al. Clients of sex workers in different regions of the world: hard to count. *Sex Transm Inf* 2006;**82**(Suppl 3):iii26–33.
9 **Cáceres C**, Konda K, Pecheny M, et al. Estimating the number of men who have sex with men in low and middle income countries. *Sex Transm Inf* 2006;**82**(Suppl 3):iii3–9.
10 **Aceijas CR**, Friedman SR, Cooper HLF, et al. Estimates of injecting drug users at the national and local level in developing and transitional countries, and gender and age distribution. *Sex Transm Inf* 2006;**82**(Suppl 3):iii10–7.
11 **Aceijas C**, Stimson GV, Hickman M, et al. Global overview of injecting drug use and HIV infection among injecting drug users. *AIDS* 2004;**18**:2295–303.
12 **Degenhart L**, Hall W, Warner-Smith M. Using cohort studies to estimate mortality among injecting drug users that is not attributable to AIDS. *Sex Transm Inf* 2006;**82**(Suppl 3):iii56–63.
13 **Walker N**, Stover J, Stanecki K, et al. The workbook approach to making estimates and projecting future scenarios of HIV/AIDS in countries with low-level and concentrated epidemics. *Sex Transm Inf* 2004;**80**(Suppl 1):i10–i13.
14 **Ghys PD**, Brown T, Grassly NC, et al. The UNAIDS Estimation and Projection Package: a software package to estimate and project national HIV epidemics. *Sex Transm Inf* 2004;**80**(Suppl 1):i5–i9.
15 **Stover J**. Projecting the demographic consequences of adult HIV prevalence trends: the Spectrum Projection Package. *Sex Transm Infect* 2004;**80**(Suppl 1):i14–i18.
16 **Lyerla R**, Gouws E, García-Calleja JM, et al. The 2005 Workbook: an improved tool for estimating HIV prevalence in countries with low level and concentrated epidemics. *Sex Transm Infect* 2006;**82**(Suppl 3):iii41–4.
17 **Lu F**, Wang N, Wu Z, et al. Estimating the number of people at risk for and living with HIV in China in 2005: methods and results. *Sex Transm Inf* 2006;**82**(Suppl 3):iii87–91.
18 **Brown T**, Grassly NC, Garnett G, et al. Improving projections at the country level: the UNAIDS Estimation and Projection Package. *Sex Transm Inf* 2006;**82**(Suppl 3):iii34–40.
19 **Stover J**, Walker N, Grassly NC. Projecting the demographic impact of AIDS and the number of people in need of treatment: updates to the Spectrum projection package. *Sex Transm Inf* 2006;**82**(Suppl 3):iii45–50.
20 **García-Calleja JM**, Gouws E, Ghys PD. National population based HIV prevalence surveys in sub-Saharan Africa: results and implications for HIV and AIDS estimates. *Sex Transm Inf* 2006;**82**(Suppl 3):iii64–70.
21 **Gouws E**, White PJ, Stover J, et al. Short term estimates of adult HIV incidence by mode of transmission: Kenya and Thailand as examples. *Sex Transm Inf* 2006;**82**(Suppl 3):iii51–5.
22 **Pisani E**, Garnett GP, Brown T, et al. Back to basics in HIV prevention: focus on exposure. *BMJ* 2003;**326**:1384–7.
23 **Grassly NC**, Morgan M, Walker N, et al. Uncertainty in estimates of HIV/AIDS: the estimation and application of plausibility bounds. *Sex Transm Inf* 2004;**80**(Suppl 1):i31–i38.
24 **Morgan M**, Walker N, Gouws E, et al. Improved plausibility bounds about the 2005 HIV and AIDS estimates. *Sex Transm Inf* 2006;**82**(Suppl 3):iii71–7.
25 **Glynn M**, Rhodes P. Estimated HIV prevalence in the United States at the end of 2003. National HIV Prevention Conference; June 2005, Atlanta. Abstract 595.
26 **Petrukevitch A**, Nicoll A, Johnson AM, et al. Direct estimates of prevalent HIV infection in adults in England and Wales for 1991 and 1993: an improved method. *Genitourin Med* 1997;**73**:348–54.
27 **Geduld J**, Gatali M, Remis RS, et al. Estimates of HIV prevalence and incidence in Canada, 2002. *Canada Communicable Disease Report* 2003;**29**:197–206.
28 **McGarrigle CA**, Cliffe S, Copas AJ, et al. Estimating adult HIV prevalence in the UK in 2003: the direct method of estimation. *Sex Transm Inf* 2006;**82**(Suppl 3):iii78–86.
29 **Boerma JT**, Stanecki KA, Newell M-L, et al. Monitoring progress towards 3 by 5. Methods and mid 2005 update. *Bull WHO* 2006;**84**:145–50.
30 **Stover J**, Bertozzi S, Gutierrez J-P, et al. The global impact and net costs of scaling-up prevention programmes for HIV/AIDS in low- and middle-income countries through 2015. *Science* 2006;**311**:1474–6.