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New Estimates of the Global Burden of HIV: UNAIDS and the Health Metrics Institute

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The fault, dear colleagues, is not in our models, but in our data.

Estimates of the scale and time trends of the burden of HIV in the world are made each year by UNAIDS(1) and the prognosis is encouraging. The global prevalence of HIV positive people not on ART, the incidence of HIV, and AIDS related mortality are all in decline. What matters now is the number of people in each region who are not on ART as they continue to drive the epidemic. If present trends continue the proportion of all children and adults who are infected with HIV but not on ART, will have fallen by 2030 to 0.7% and 3.3% in Eastern and Southern Africa (ESA), 0.3% and 1.3% in West and Central Africa (WCA), 0.01% and 0.1% in Asia and the Pacific (A&P), 0.1% and 0.4% in the Caribbean, 0.01% and 0.4% in Eastern Europe and Central Asia (EE&CA), 0.1% and 0.2% in Latin America (LA), 0.01 and 0.09% in the Middle East and North Africa (ME&NA). The overall prevalence of HIV appears to be increasing only in West and Central Europe and North America (WCE&NA) where the prevalence in adults is low at 0.3% but increasing at a rate of about 7% p.a. Because UNAIDS does not receive data on the coverage of ART in WCE&NA it is not possible to assess trends among those not on ART. If we define 'the end of AIDS' as having fewer than 1% of people living with HIV but not on ART so that the corresponding incidence and mortality would both be about 0.1% p.a., then the world is on track to reach this target in most of the world. However, the target will be missed in ESA and in WCA unless efforts to control the epidemic are further expanded and it will be important to ensure that the increase in the relatively low prevalence of HIV in WCE&NA is halted and reversed.

UNAIDS and HMI estimates

UNAIDS uses their Epidemiological Projection Package (EPP) to estimate time trends in the overall HIV incidence and mortality from data on time trends in HIV prevalence, and uses Spectrum to make age and gender specific estimates (2). In concentrated epidemics they rely on measurements of the prevalence of infection and estimates of the size of key or sentinel populations and uses Spectrum and the Asian Epidemic Model (3) to fit the data.

In 2014 a reassessment of the UNAIDS estimates was published by the Health Metrics Institute (HMI) (4) using their own version of Spectrum while attempting to reconcile the number of deaths from HIV with the total number of deaths and the number of deaths from other causes.

Encouragingly, UNAIDS and HMI reach similar conclusions. Their current estimates of global incidence and mortality do not differ significantly while the UNAIDS estimate of the current prevalence is 25% ± 10% higher than the HMI estimate. Trends over the last ten years differ to some degree: UNAIDS has the incidence and mortality falling faster than does HMI, but both have prevalence rising at about the same rate. The broad agreement is unsurprising since they start from the same EPP output and the differences arise mainly because the HMI model constrains the number of AIDS deaths to match the estimates of all deaths minus the deaths from causes other than AIDS assuming that these two estimates are reliable. HMI also makes other, somewhat different, assumptions about mortality in those on and not on ART.

The difficulty is that routinely collected data, usually from sentinel sites which are often ante-natal clinics, are sparse and not measured in a consistent and reliable way in different places and at different times. Furthermore, the data are adjusted to allow for expected differences between sentinel populations and the general population and may give biased estimates of the overall number of people infected with HIV. For key populations, even the denominator is difficult to establish with confidence and, because they are often hidden and marginalized, the prevalence among them is hard to measure, adding further uncertainty to estimates of total numbers. Demographic and health surveys (5) are done intermittently in many countries and may be used to calibrate trend data from other sources, but these too may be unreliable with unrepresentative samples and high refusal rates. The HMI study explains, in detail, some of the many biases and corrections that have to be made but even then does not take into account many other factors that are known to be important. For example, the HMI study (4) goes to some length to quantify the life expectancy of those with HIV as a

function of their CD4+ cell count, but does not allow for the known inter- and intra-population variation in the CD4+ cell count in HIV-negative people (6) or for the well-established dependence of mortality as a function of the age at infection for those not on ART (7). While HMI estimates the number of people living with HIV they do not provide estimates of the number on ART.

Need for better monitoring, routine surveillance and data on key populations

As ART becomes more widely available what is urgently needed is: better patient monitoring following the lead set by Malawi (8); better routine surveillance following the lead set by the annual ante-natal clinic surveys in South Africa (9); and better estimates of the size and prevalence of HIV in key populations following the lead set, for example, by Vietnam in Can Tho Province (10). The Malawi Quarterly Reports serve not only to monitor the performance of the national HIV control programme but also provide important feedback to clinic staff on the quality of the data and on the quality of the service provision; the cost of doing this in Malawi only amounts to about 1% of the cost of their HIV programme. The South African sentinel surveillance at ANC clinics, started by Horst Küstner (11), has provided excellent estimates of the trend in the prevalence of HIV, at a district level, for the last 24 years (9). If the raw data, suitably anonymized, were made available it would be possible to make a much better assessment of the patterns of spread in space and time helping to focus and plan control interventions much more effectively. If, in these annual surveys, they not only tested the blood for HIV and syphilis but also for other sexually transmitted infections, measured CD4+ cell counts and viral load, tested for drug-resistance and estimated HIV incidence using the increasingly accurate early infection assays (12), it would greatly improve our understanding of the epidemiology of HIV and provide considerably better estimates and projections at very little marginal cost. Vancouver had a relatively small but highly concentrated epidemic which they have successfully managed to control (13). Their programme of patient monitoring, linked to extensive virological tests, especially for drug resistance, and very extensive needle exchange, provides a model for what can be done in concentrated epidemics (14).

In conclusion, the current estimates of incidence, prevalence, mortality and ART coverage are encouraging and suggest that if control efforts are further expanded it will be possible to meet the target of ending AIDS as a significant public health threat by 2030. However, if a suitably expanded programme of treatment and prevention is to be implemented it will be essential to make a considerable investment, even though small in relation to the overall cost, in the collection, compilation, analysis and interpretation of data.

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