

HEALTH INFORMATICS, DATA MANAGEMENT AND STATISTICS: SUB-NATIONAL ESTIMATION OF HIV INDICATORS

OVERVIEW

The U.S. President's Emergency Plan for AIDS Relief (PEPFAR) adopted UNAIDS' ambitious "90-90-90" global targets for ending the HIV epidemic by 2020 as a framework for program planning. The stated goal of the 90-90-90 targets is that, by 2020, (1) 90 percent of all people living with HIV (PLHIV) will know their HIV status; (2) 90 percent of all people with diagnosed HIV will receive sustained antiretroviral therapy (ART); and (3) 90 percent of people receiving ART will have viral suppression.

PEPFAR field teams apply the 90-90-90 framework at the district level to ensure that programs are optimizing their resources by scaling up testing and treatment first in areas with the highest unmet need and serving populations most likely to contribute to new HIV infections. However, planning at the district level is difficult, as existing data systems and modeled estimates typically do not provide reliable data on HIV prevalence, PLHIV, and viral suppression at the district level.

CDC'S ROLE

As an innovative way to overcome this gap in the data, CDC identified and extended two highly sophisticated quantitative techniques to generate robust estimates of PLHIV and other HIV-related indicators at the district level:

- **Small-area estimation**, a statistically principled tool that utilizes population-based survey data and auxiliary data to produce robust estimates of PLHIV at the district level, and
- **Spectrum spreadsheet disaggregation**, a quantitative technique that exploits existing population-based survey data, census data, and programmatic HIV data to estimate district-level disease burden, which is then used to proportionally allocate national HIV-related indicators, such as PLHIV, down to the district-level.

While many PEPFAR-supported countries routinely conduct population-based surveys with HIV testing, with a growing number including viral load testing as well, these surveys are not designed to produce robust estimates of HIV prevalence, PLHIV, or viral suppression at the district level.

To overcome this design limitation, CDC introduced the use of small-area estimation to improve the precision of these unreliable district-level estimates of HIV prevalence, PLHIV, and viral suppression using an advanced mixed-effects regression technique (i.e., Fay-Herriot model) that incorporated auxiliary data, such as existing census and programmatic HIV data, into the model.

CDC was able to use small-area estimation to produce statistically reliable (i.e., robust) estimates of HIV prevalence and PLHIV for most districts and then developed a new framework for estimating viral suppression at the district level. In addition, the team used small-area estimation and Spectrum spreadsheet disaggregation to produce age and sex disaggregated district-level estimates, further enhancing PEPFAR's ability to target resources to maximize public health impact.

ACCOMPLISHMENTS / RESULTS

CDC produced robust estimates of PLHIV and other HIV-related indicators, disaggregated by age and sex, for 1,465 districts across 18 countries. These estimates helped PEPFAR field teams and ministries of health improve their response to the HIV epidemic by providing them with actionable data to help prioritize and target their resources to maximize public health impact. CDC saved the U.S. Government additional costs by utilizing routine program data and existing U.S. Government-funded, population-based survey data to produce district-level estimates avoiding the need to conduct additional costly surveillance activities. To ensure sustainability, CDC conducted six in-country trainings, trained over 150 country staff, and developed user-friendly Excel- and R-based tools and dashboards.

FUTURE EFFORTS

In the future, CDC plans to:

- **Extend the use of small-area estimation to aid in the identification of hot spots of HIV transmission**

CDC recently developed a novel statistical method to estimate HIV incidence using cross-sectional, self-reported HIV testing history data and routinely collected HIV biomarker data. CDC is actively working to assist countries with the estimation of incidence using data from population-based HIV impact assessments and other surveys. CDC is also working on an approach to extend the use of small-area estimation to improve the estimation of HIV incidence at granular, sub-national levels by age and sex. These new tools and techniques will further PEPFAR's ability to do the right things, in the right places.

- **Continue to assist PEPFAR-supported countries with sub-national estimation of HIV-related indicators for planning**
- **Publish its technical approach for sub-national estimation in a peer-reviewed journal**

BENEFITS OF OUR WORK

CDC provides countries with robust estimates of HIV prevalence, PLHIV, and viral suppression at the district-level. CDC developed a novel approach for estimating viral suppression at the district-level, and played an important global leadership role by introducing small-area estimation to the UNAIDS Reference Group on Estimates, Modelling and Projections, the international body responsible for developing the methods used to produce global statistics. Based on CDC's work, UNAIDS is now exploring the use of small-area estimation to generate sub-national estimates of treatment coverage and key population size.