UNITED REPUBLIC OF TANZANIA

DEVELOPING SUBNATIONAL ESTIMATES OF HIV PREVALENCE AND THE NUMBER OF PEOPLE LIVING WITH HIV

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METHODOLOGY NOTE

Developing subnational estimates of HIV prevalence and the number of people living with HIV from survey data

Introduction

Significant geographic variation in HIV incidence and prevalence, as well as programme implementation, has been observed between and within countries. Methods to generate subnational estimates of HIV prevalence and the number of people living with HIV are being explored in response to the urgent need for data at smaller administrative units, in order to inform programming that is aligned with local community needs.

This guidance note describes existing methods to generate subnational estimates of HIV prevalence and the number of people living with HIV from survey data, with a particular focus on the development of maps of estimates at second administrative level through the prevR model *(1)* as a data visualization resource. Although HIV estimates at the first administrative level can be generated through various methods and sources for countries with available data, HIV estimates at the second administrative level are not currently available. Estimates at the second administrative level generated through prevR must be interpreted with caution; however, they provide an indication of the status of the epidemic subnationally within a country. A more complex method for estimating HIV prevalence and other variables at the second administrative level is being further developed, which will be integrated with existing Joint United Nations Programme on HIV/AIDS (UNAIDS) estimation processes.

prevR

Applying the prevR method to generate maps of estimates of the number of people living with HIV (aged 15–49 and 15 and older) and of HIV prevalence (aged 15–49) at the second administrative level was recommended by participants at a technical consultation on methods for generating subnational estimates. This consultation, held in Nairobi, Kenya, 24–25 March 2014, was convened by the HIV Modelling Consortium, the UNAIDS Reference Group on Estimates, Modelling and Projections and the UNAIDS Task Force on Hotspots. It served as a follow-up to the July 2013 consultation on identifying populations at greatest risk of infection, which focused on geographic hotspots and key populations.

The countries to which this method was applied were selected based on the availability of data from Demographic and Health Surveys (DHS) or AIDS Indicator Surveys (AIS), which included georeferenced and HIV testing data gathered since 2009. Beginning in 2009, the displacement of DHS cluster data[1] was restricted to the second administrative level *(2)*.

1. In DHS surveys, clusters (groupings of households) are georeferenced, with a random displacement of latitude and longitude. Urban clusters are displaced by a maximum of 2 km and rural clusters by a maximum of 5 km, with 1% displaced 10km. Please see reference 2 for details. Displacement is restricted to within a country and to survey regions, and, since 2009, has also been restricted to the second administrative level, where possible.

Method

The survey data have been spatially distributed using a kernel density approach with adaptive bandwidths based on a minimum number of observations in order to generate estimates of HIV prevalence among people aged 15–49 years. This method was described in detail elsewhere *(1)* and was implemented in the prevR package (in R language).

The basic principle of the prevR method is to calculate an intensity surface of positive cases and an intensity surface of observations. The ratio of positive cases to observations results in the prevalence surface.

The intensity surface of observations is expressed as the number of observations per surface area (per square degree or per square km, depending on the coordinate system). The volume below this surface is equal to the total number of observations in the dataset. This surface indicates how observations are distributed from a scatterplot on a continuous surface.

For each administrative unit, the integral of the intensity surface is calculated (i.e. the corresponding volume below this surface) to obtain the number of distributed observations in that administrative unit.

Results are merged per administrative unit and uncertainty bounds are calculated as 95% confidence intervals based on the distributed number of observations (through kernel density estimations) per unit. This confidence interval is wider in less-surveyed areas and narrower in areas with several survey clusters.

The spatial distribution of the population is based on LandScan, which is used to generate the spatial distribution of the population aged 15 to 49 and the population aged 50 and over, adjusted to estimates of the total population aged 15 to 49 and 15 and older from Spectrum.[2]

The spatial distribution of HIV prevalence and people living with HIV was estimated using prevR and DHS data. Prevalence among the population 50 years and older was computed using a prevalence ratio derived from UNAIDS estimates produced using Spectrum software *(3)*.

Finally, estimates were adjusted to UNAIDS estimates of the number of people living with HIV aged 15–49 and 15 and older *(3)*. National estimates obtained by aggregating subnational estimates of the number of people living with HIV and HIV prevalence generated using this method will, therefore, match UNAIDS estimates.

UNAIDS estimates are midyear estimates. For countries with a DHS conducted during a single year, the estimates are adjusted to the same year. For countries with DHS conducted over two years, estimates are adjusted to UNAIDS estimates for the second year of the survey.

2. Population estimates were obtained through the Spectrum module DemProj. These estimates are based on the United Nations Population Division's World Population Prospects 2012. Some differences may exist between the United Nations Population Division estimates and those obtained through Spectrum. United Nations Population Division estimates are input into Spectrum, and are then adjusted within Spectrum by removing the estimated population of people living with HIV, which is then added back through the estimation process. This process is limited to the 39 high-burden countries.

The main hypotheses of this method are as follows:

- The age structure are uniform across the country.
- Population-based survey data is used only to define the shape of the prevalence surface, while the level of prevalence is defined by UNAIDS estimates.
- The spatial distribution of HIV among people aged 50 and over is equal to the spatial distribution of HIV among people aged 15 to 49.

Quality of the subnational estimates of HIV prevalence and number of people living with HIV generated through prevR

Subnational estimates are accompanied by a quality of estimates indicator and 95% confidence intervals. The estimate quality is categorized based on the following scale:

- Good: estimates are based on observations from the same subnational area.
- Moderately good: estimates are primarily based on observations from the same subnational area.
- Uncertain: estimates are primarily based on observations from a neighbouring subnational area.
- Very uncertain: estimates are based only on observations from a neighbouring subnational area.

The quality of HIV estimates at the subnational level depends on the survey sample size. DHS was designed to be representative at the national and first administrative levels, but, in most countries, not at the second administrative level beyond the DHS regions. The number of observations per subnational area varies significantly. If some subnational areas have been sufficiently surveyed, others may be underrepresented. In that case, HIV prevalence has been estimated using observations from neighbouring areas and is categorized as uncertain or very uncertain. Uncertainty estimates correspond to variations between first administrative level areas and may be inaccurate when local variations are not captured by the survey. Sources of administrative area boundaries used to determine if an observation crossed over a second-level administrative border may have errors, therefore observations near border areas need to be considered as uncertain as to their location.

Areas with a higher relative HIV prevalence (expressed as a percentage) are not necessarily those with a higher absolute number of people living with HIV (represented on the people living with HIV density map) since the spatial distribution of the population is highly irregular.

Confidence intervals complement the quality of estimates indicator. Confidence intervals only take into account that estimates of the prevalence and the number of people living with HIV aged 15–49 are based on a limited number of observations. They do not consider the spatial dimension of the estimates.

How are subnational estimates of HIV prevalence and number of people living with HIV produced using prevR related to the UNAIDS estimation process using Spectrum?

UNAIDS estimates trends of HIV prevalence over time at the national level using multiple data sources including population-based surveys. This report estimates spatial subnational variations of HIV prevalence and the number of people living with HIV for a given year based on a unique population-based survey. Furthermore, the spatial distribution of observations is taken into account here. These two approaches should be considered complementary.

Data sources

The following data were used:

- DHS/AIS (http://www.dhsprogram.com/):
  - Burkina Faso, DHS, 2010,
  - Burundi, DHS, 2010,
  - Cameroon, DHS, 2011,
  - Côte d'Ivoire, DHS, 2011–2012,
  - Ethiopia, DHS, 2011,
  - Gabon, DHS, 2012,
  - Guinea, DHS-Multiple Indicator Cluster Survey (MICS), 2012,
  - Haiti, DHS, 2012,
  - Lesotho, DHS, 2009,
  - Malawi, DHS, 2010,
  - Mozambique, DHS, 2009,
  - Rwanda, DHS, 2010–2011,
  - Senegal, DHS-MICS, 2010–2011,
  - Sierra Leone, DHS, 2008,
  - United Republic of Tanzania, Tanzania HIV/AIDS and Malaria Indicator Survey (THMIS), 2011–2012,
  - Uganda, AIS, 2011 and
  - Zimbabwe, DHS, 2010–2011;

- LandScan for the global population distribution (http://web.ornl.gov/sci/landscan/);

- Administrative boundaries:
  - Global Administration Areas (GADM) (http://www.gadm.org/)
  - Rwanda, the National Statistics Institute of Rwanda (http://statistics.gov.rw/geodata);
  - Gabon and Uganda, Global Administrative Unit Layers (GAUL) (http://www.fao.org/geonetwork/srv/en/metadata.show?id=12691)

- Background layers:
  - Google Maps API (https://www.google.com/maps)
  - OpenStreetMap (http://www.openstreetmap.org/); and

- UNAIDS 2013 HIV estimates.

Other methods for generating subnational HIV estimates

From DHS

HIV testing has been conducted by DHS since 2001, on the basis of which nationally representative estimates of HIV prevalence are produced. Estimates of HIV prevalence at the first administrative level are also produced. DHS is typically designed to be representative at the national and first administrative levels, but not at the subnational level more specific than the first administrative level. Prevalence estimates from DHS for countries that have included HIV testing in their surveys are available from the DHS website (https://dhsprogram.com/) through StatCompiler or through country reports or datasets.

Spectrum/Estimation and Projection Package (EPP)

Estimates for countries and first administrative level are generated using Spectrum/Estimation and Projection Package (EPP) based on the data available. Data sources include surveys of pregnant women attending antenatal clinics, population-based surveys, sentinel surveillance among key populations at higher risk, case reporting, programme data on antiretroviral therapy and prevention of mother-to-child transmission programmes and demographic data. The results from these models include a wide array of variables related to HIV including HIV prevalence and number of people living with HIV.

Annually, UNAIDS and its partners support country-level teams in producing national estimates using Spectrum. Every two years, UNAIDS and its partners conduct regional workshops to train national personnel on the tools and methodologies used to produce national estimates. Country-level teams are then responsible for calculating HIV estimates and projections. Regional estimates are produced separately for each region based on data only from that province *(4)*.
In several countries where data are available, including India, South Africa, Nigeria, Mozambique and Kenya, estimates have been produced at the regional level using Spectrum.

In Kenya for example, estimates were first produced at the provincial level[3] applying Spectrum/EPP by including province-level inputs. In the next step, the provincial-level estimates were disaggregated to the county level. Population projections for each province were based on the total fertility rates and mortality indicators from the Kenya DHS and adjusted to match the estimates from the national census. Population estimates for counties were taken from the National Bureau of Statistics. For each county, the prevalence was determined by examining surveillance and survey cluster data from 2003 to 2012. As stated in the report:

The prevalence estimate for 2013 for each county was multiplied by the population aged 15–49 in the county to estimate the number of [HIV-positive] adults. The number of [HIV-positive] adults in each county was adjusted so that the total across all counties in a province would equal the provincial total. Values for other indicators were first distributed by county according to the number of [HIV-positive] adults and then adjusted to match the provincial totals *(5)*.

3. Note that while the DHS/AIS were designed to inform at the level of the province, the provincial administrative level is no longer in existence in Kenya.

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References:

1. Larmarange J, Vallo R, Yaro S, Msellati P, Méda N. Methods for mapping regional trends of HIV prevalence from Demographic and Health Surveys (DHS). CyberGeo: European Journal of Geography. 2011;558. doi:10.4000/cybergeo.24606.

2. Burgert, Clara R., Josh Colston, Thea Roy, and Blake Zachary. 2013. Geographic displacement procedure and georeferenced data release policy for the Demographic and Health Surveys. DHS Spatial Analysis Reports No. 7. Calverton, Maryland, USA: ICF International.

3. Methodology – understanding the HIV estimates. Geneva: Joint United Nations Programme on HIV/AIDS; 2013 (http://www.unaids.org/en/media/unaids/contentassets/documents/epidemiology/2013/gr2013/20131118_Methodology.pdf, accessed 7 July 2014).

4. Stover J, Brown T, Marston M. Updates to the Spectrum/Estimation and Projection Package (EPP) model to estimate HIV trends for adults and children. Sexually Transmitted Infections. 2012;88(Suppl 2):i11–.i16. doi:10.1136/sextrans-2012-050640.

5. National HIV indicators for Kenya: 2013. National AIDS and STI Control Programme; 2013.

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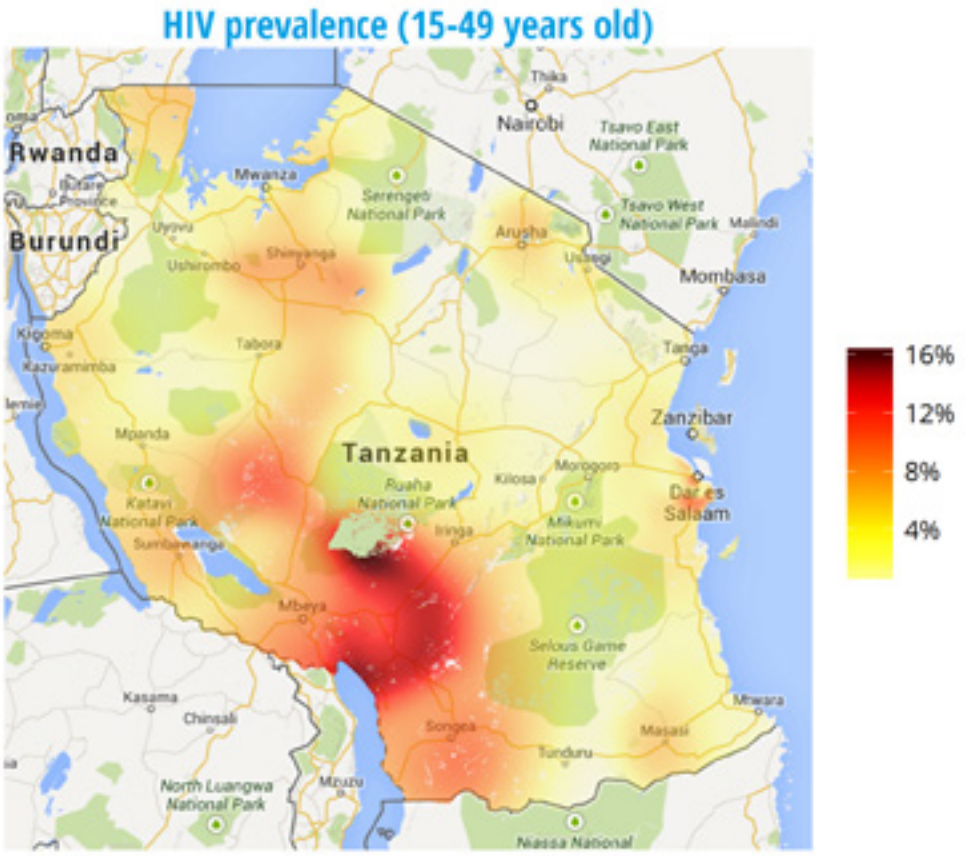
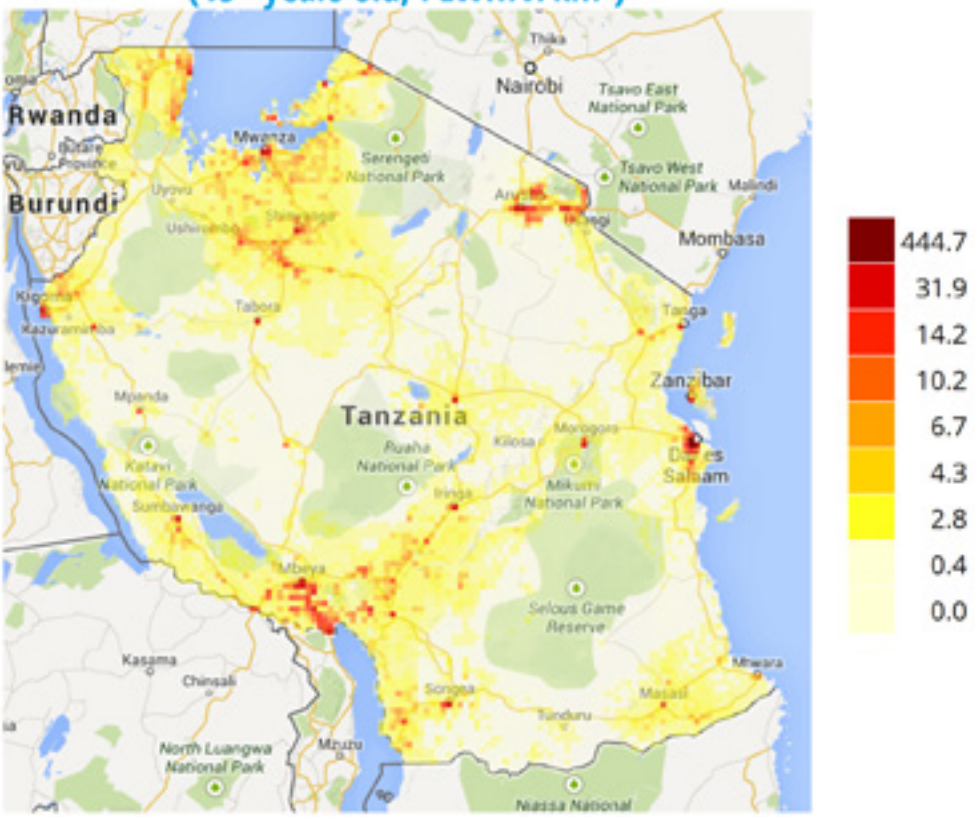
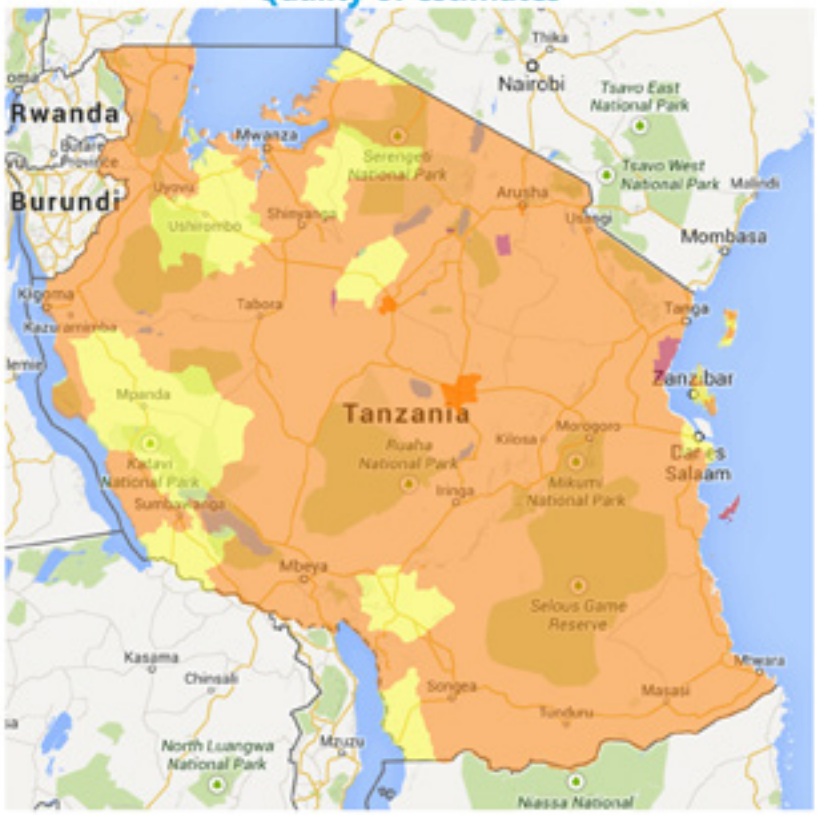
HIV estimates at district level

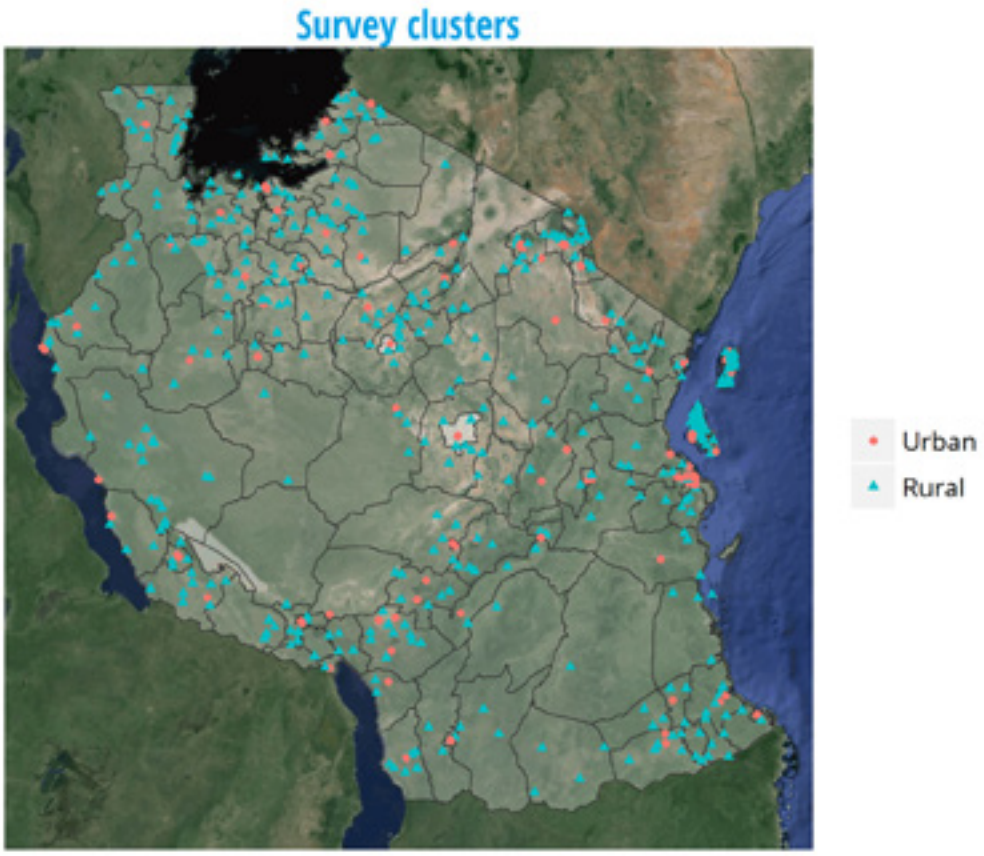


People living with HIV density (15+ years old, PLWHIV/km²)



Quality of estimates





Quality of estimates

- *Good:* estimates are based on observations from the same district.
- *Moderately good:* estimates are mainly based on observations from the same district.
- *Uncertain:* estimates are mainly based on observations from neighboring districts.
- *Very uncertain:* estimates are based only on observations from neighboring districts.

Quality of HIV estimates at district level depends on the sampling size of the 2011/12 United Republic of Tanzania THMIS survey, where a total of 17 988 individuals (15-49 years old) were tested successfully for HIV in 570 survey clusters with geolocation.

Estimates per district

Region / District	HIV prevalence (15-49 years old)	People living with HIV (15-49 years old)	People living with HIV (15+ years old)	Quality of estimates
Arusha				
Arumeru	6,20%	18 000	20 000	uncertain
Arusha	6,30%	11 000	12 000	uncertain
Karatu	0,40%	390	440	uncertain
Monduli	3,40%	3 700	4 200	uncertain
Ngorongoro	0,30%	220	250	uncertain
Simanjiro	3,10%	140	160	very uncertain
Dar-Es-Salaam				
Ilala	7,60%	27 000	30 000	moderately good
Kinondoni	6,80%	42 000	47 000	moderately good
Temeke	8,30%	39 000	44 000	moderately good
Dodoma				
Dodoma Rural	4,00%	10 000	11 000	uncertain
Dodoma Urban	4,40%	8 300	9 300	uncertain
Kondoa	1,50%	3 600	4 100	uncertain
Kongwa	2,60%	3 700	4 200	uncertain
Mpwapwa	3,20%	4 600	5 200	uncertain
Iringa				
Iringa Rural	7,60%	11 000	12 000	uncertain
Iringa Urban	7,30%	4 500	5 100	uncertain
Kilolo	6,40%	8 600	9 800	uncertain
Ludewa	12,00%	8 800	9 900	uncertain
Makete	13,20%	8 100	9 200	uncertain
Mufindi	13,40%	22 000	25 000	uncertain
Njombe	13,30%	32 000	37 000	moderately good
Kagera				
Biharamulo	2,40%	5 700	6 400	uncertain
Bukoba Rural	6,80%	15 000	17 000	uncertain
Bukoba Urban	7,00%	3 300	3 700	very uncertain
Karagwe	5,90%	15 000	17 000	uncertain
Muleba	5,60%	12 000	14 000	uncertain
Ngara	2,50%	4 800	5 400	uncertain
Kaskazini-Pemba				
Micheweni	0,50%	220	240	uncertain
Wete	0,50%	280	310	moderately good
Kaskazini-Unguja				

Region / District	HIV prevalence (15-49 years old)	People living with HIV (15-49 years old)	People living with HIV (15+ years old)	Quality of estimates
Kaskazini 'A'	0,80%	360	400	moderately good
Kaskazini 'B'	2,50%	780	880	uncertain
Kigoma				
Kasulu	4,90%	17 000	20 000	uncertain
Kibondo	1,90%	4 600	5 200	uncertain
Kigoma Rural	4,80%	13 000	15 000	uncertain
Kigoma Urban	5,50%	4 600	5 200	uncertain
Kilimanjaro				
Hai	5,60%	8 400	9 500	uncertain
Moshi Rural	3,50%	7 800	8 800	uncertain
Moshi Urban	3,60%	3 400	3 900	uncertain
Mwanga	4,20%	2 900	3 200	uncertain
Rombo	3,10%	4 500	5 000	uncertain
Same	2,60%	3 200	3 600	uncertain
Kusini-Pemba				
Chakechake	0,70%	340	380	uncertain
Mkoani	0,50%	280	310	moderately good
Lindi				
Kilwa	3,40%	3 400	3 900	uncertain
Lindi Rural	3,50%	4 400	4 900	uncertain
Lindi Urban	3,10%	750	840	uncertain
Liwale	2,90%	1 300	1 400	uncertain
Nachingwea	5,20%	4 900	5 500	uncertain
Ruangwa	4,90%	3 500	4 000	uncertain
Manyara				
Babati	0,50%	950	1 100	uncertain
Hanang	1,20%	1 500	1 600	uncertain
Karatu	0,20%	0	0	very uncertain
Kiteto	1,40%	1 200	1 300	uncertain
Mbulu	0,60%	800	900	uncertain
Simanjiro	2,90%	2 500	2 800	uncertain
Mara				
Bunda	5,10%	7 200	8 200	uncertain

Region / District	HIV prevalence (15-49 years old)	People living with HIV (15-49 years old)	People living with HIV (15+ years old)	Quality of estimates
Musoma Rural	4,60%	8 500	9 600	uncertain
Musoma Urban	4,00%	2 400	2 700	uncertain
Serengeti	2,70%	2 800	3 100	uncertain
Tarime	3,60%	10 000	12 000	moderately good
Mbeya				
Chunya	8,20%	9 800	11 000	uncertain
Ileje	10,20%	6 800	7 600	uncertain
Kyela	12,80%	13 000	14 000	uncertain
Mbarali	12,00%	16 000	18 000	uncertain
Mbeya Rural	9,50%	14 000	15 000	uncertain
Mbeya Urban	9,40%	14 000	16 000	uncertain
Mbozi	7,10%	21 000	23 000	uncertain
Rungwe	10,90%	19 000	22 000	uncertain
Morogoro				
Kilombero	8,10%	15 000	17 000	uncertain
Kilosa	2,70%	7 200	8 100	uncertain
Morogoro Rural	3,60%	5 600	6 300	uncertain
Morogoro Urban	3,00%	4 000	4 500	uncertain
Mvomero	2,70%	4 100	4 600	uncertain
Ulanga	6,80%	7 600	8 600	uncertain
Mtwara				
Masasi	5,80%	14 000	16 000	uncertain
Mtwara Rural	2,30%	2 800	3 100	uncertain
Mtwara Urban	2,10%	1 100	1 300	uncertain
Newala	4,80%	5 600	6 300	uncertain
Tandahimba	3,50%	4 100	4 700	uncertain
Mwanza				
Geita	4,30%	18 000	20 000	moderately good
Ilemela	4,00%	6 000	6 800	uncertain
Kwimba	6,10%	11 000	13 000	uncertain
Magu	4,70%	11 000	13 000	uncertain
Misungwi	5,60%	8 200	9 200	uncertain
Nyamagana	3,90%	4 700	5 300	uncertain
Sengerema	4,10%	11 000	13 000	uncertain
Ukerewe	4,30%	4 900	5 600	uncertain
Pwani				
Bagamoyo	4,40%	5 900	6 600	uncertain

Region / District	HIV prevalence (15-49 years old)	People living with HIV (15-49 years old)	People living with HIV (15+ years old)	Quality of estimates
Kibaha	3,80%	2 900	3 200	uncertain
Kisarawe	4,90%	2 700	3 100	uncertain
Mafia	4,00%	930	1 100	very uncertain
Mkuranga	7,30%	7 900	8 900	uncertain
Rufiji	4,90%	5 800	6 500	uncertain
Rukwa				
Mpanda	5,50%	13 000	15 000	moderately good
Nkasi	6,50%	7 300	8 300	uncertain
Sumbawanga Rural	5,80%	13 000	14 000	moderately good
Sumbawanga Urban	7,50%	6 400	7 200	uncertain
Ruvuma				
Mbinga	8,80%	21 000	23 000	moderately good
Namtumbo	9,00%	9 100	10 000	uncertain
Songea Rural	9,90%	9 000	10 000	uncertain
Songea Urban	10,00%	7 600	8 600	uncertain
Tunduru	3,20%	4 600	5 200	uncertain
Shinyanga				
Bariadi	3,30%	12 000	13 000	moderately good
Bukombe	3,80%	8 800	9 900	moderately good
Kahama	6,50%	22 000	25 000	moderately good
Kishapu	8,20%	11 000	13 000	uncertain
Maswa	5,60%	9 800	11 000	moderately good
Meatu	5,50%	8 000	9 000	uncertain
Shinyanga Rural	8,00%	13 000	14 000	uncertain
Shinyanga Urban	8,50%	6 600	7 400	uncertain
Singida				
Iramba	4,60%	9 700	11 000	moderately good
Manyoni	3,90%	4 700	5 300	uncertain
Singida Rural	2,60%	5 900	6 700	uncertain
Singida Urban	2,00%	1 300	1 500	uncertain
Tabora				
Igunga	7,60%	14 000	16 000	uncertain

Region / District	HIV prevalence (15-49 years old)	People living with HIV (15-49 years old)	People living with HIV (15+ years old)	Quality of estimates
n.a. (1081)	6,40%	100	110	very uncertain
Nzega	6,70%	16 000	18 000	uncertain
Sikonge	7,00%	5 400	6 100	uncertain
Tabora Urban	4,40%	4 800	5 400	uncertain
Urambo	2,90%	6 300	7 100	uncertain
Uyui	5,40%	8 800	9 900	uncertain
Tanga				
Handeni	3,90%	5 600	6 300	uncertain
Kilindi	2,20%	1 800	2 000	uncertain
Korogwe	2,40%	3 600	4 100	uncertain
Lushoto	1,50%	3 700	4 100	uncertain
Muheza	2,70%	4 400	4 900	uncertain
Pangani	4,00%	1 000	1 200	very uncertain
Tanga	2,80%	4 000	4 500	uncertain
Zanzibar South and Central				
Kusini	0,90%	160	180	uncertain
Zansibar Central	1,50%	540	610	moderately good
Zanzibar West				
Magharibi	1,20%	1 300	1 500	moderately good
Mjini	0,70%	830	940	moderately good
ALL	**5,10%**	**1 000 000**	**1 200 000**	

Uncertainty bounds

Region / District	HIV prevalence (15-49 years old)		People living with HIV (15-49 years old)		Quality of estimates
	Low	High	Low	High	
Arusha					
Arumeru	3,20%	11,50%	9 000	33 000	uncertain
Arusha	0,00%	51,90%	0	88 000	uncertain
Karatu	0,00%	8,50%	0	8 700	uncertain
Monduli	1,50%	7,10%	1 600	7 900	uncertain
Ngorongoro	0,00%	7,70%	0	5 800	uncertain
Simanjiro	0,00%	39,60%	0	1 800	very uncertain
Dar-Es-Salaam					
Ilala	5,10%	11,10%	18 000	39 000	moderately good
Kinondoni	4,60%	9,80%	29 000	61 000	moderately good
Temeke	5,40%	12,40%	26 000	58 000	moderately good
Dodoma					
Dodoma Rural	1,70%	8,60%	4 400	22 000	uncertain
Dodoma Urban	0,50%	18,80%	1 000	35 000	uncertain
Kondoa	0,30%	5,60%	640	14 000	uncertain
Kongwa	0,20%	14,10%	250	20 000	uncertain
Mpwapwa	0,70%	10,20%	1 100	15 000	uncertain
Iringa					
Iringa Rural	4,40%	12,60%	6 200	18 000	uncertain
Iringa Urban	0,00%	77,00%	0	48 000	uncertain
Kilolo	3,20%	12,10%	4 300	16 000	uncertain
Ludewa	5,60%	22,80%	4 200	17 000	uncertain
Makete	7,40%	22,10%	4 600	14 000	uncertain
Mufindi	9,00%	19,50%	15 000	32 000	uncertain
Njombe	9,70%	17,90%	24 000	44 000	moderately good
Kagera					
Biharamulo	0,90%	5,80%	2 200	13 000	uncertain
Bukoba Rural	2,10%	17,90%	4 700	41 000	uncertain
Bukoba Urban	0,00%	95,00%	0	45 000	very uncertain
Karagwe	2,60%	12,40%	6 500	31 000	uncertain
Muleba	1,70%	14,80%	3 800	32 000	uncertain
Ngara	0,10%	17,50%	100	34 000	uncertain
Kaskazini-Pemba					
Micheweni	0,00%	5,80%	0	2 700	uncertain
Wete	0,00%	3,20%	10	1 900	moderately good

Region / District	HIV prevalence (15-49 years old)		People living with HIV (15-49 years old)		Quality of estimates
	Low	High	Low	High	
Kaskazini-Unguja					
Kaskazini 'A'	0,00%	4,60%	20	2 200	moderately good
Kaskazini 'B'	0,90%	6,00%	300	1 900	uncertain
Kigoma					
Kasulu	1,60%	12,70%	5 600	46 000	uncertain
Kibondo	0,40%	6,60%	1 000	16 000	uncertain
Kigoma Rural	1,60%	12,40%	4 400	35 000	uncertain
Kigoma Urban	0,00%	84,40%	0	71 000	uncertain
Kilimanjaro					
Hai	2,30%	12,20%	3 500	18 000	uncertain
Moshi Rural	0,80%	11,70%	1 700	26 000	uncertain
Moshi Urban	0,00%	65,20%	0	62 000	uncertain
Mwanga	0,60%	16,70%	430	11 000	uncertain
Rombo	0,30%	14,30%	480	21 000	uncertain
Same	0,30%	12,50%	320	15 000	uncertain
Kusini-Pemba					
Chakechake	0,00%	4,50%	20	2 100	uncertain
Mkoani	0,00%	5,60%	0	3 000	moderately good
Lindi					
Kilwa	0,70%	12,40%	650	12 000	uncertain
Lindi Rural	1,50%	7,70%	1 900	9 500	uncertain
Lindi Urban	0,00%	47,20%	0	11 000	uncertain
Liwale	0,70%	9,50%	290	4 100	uncertain
Nachingwea	1,80%	13,00%	1 700	12 000	uncertain
Ruangwa	1,30%	14,20%	950	10 000	uncertain
Manyara					
Babati	0,00%	5,50%	0	9 600	uncertain
Hanang	0,20%	5,20%	220	6 100	uncertain
Karatu	0,00%	86,80%	0	50	very uncertain
Kiteto	0,10%	7,60%	90	6 700	uncertain
Mbulu	0,00%	5,00%	10	6 900	uncertain
Simanjiro	1,20%	6,20%	1 100	5 400	uncertain

Region / District	HIV prevalence (15-49 years old)		People living with HIV (15-49 years old)		Quality of estimates
	Low	High	Low	High	
Mara					
Bunda	1,70%	13,40%	2 300	19 000	uncertain
Musoma Rural	1,90%	10,10%	3 500	19 000	uncertain
Musoma Urban	0,00%	72,80%	0	44 000	uncertain
Serengeti	0,90%	7,30%	900	7 400	uncertain
Tarime	1,30%	8,80%	3 800	26 000	moderately good
Mbeya					
Chunya	4,40%	14,60%	5 200	17 000	uncertain
Ileje	3,50%	24,10%	2 300	16 000	uncertain
Kyela	1,80%	43,00%	1 800	43 000	uncertain
Mbarali	7,20%	18,90%	9 800	26 000	uncertain
Mbeya Rural	4,60%	18,20%	6 600	26 000	uncertain
Mbeya Urban	0,30%	47,40%	460	73 000	uncertain
Mbozi	3,50%	13,50%	10 000	39 000	uncertain
Rungwe	4,80%	22,00%	8 600	39 000	uncertain
Morogoro					
Kilombero	4,20%	14,70%	7 900	27 000	uncertain
Kilosa	0,80%	7,70%	2 100	21 000	uncertain
Morogoro Rural	1,20%	9,20%	1 900	14 000	uncertain
Morogoro Urban	0,00%	48,40%	0	64 000	uncertain
Mvomero	0,40%	10,90%	640	16 000	uncertain
Ulanga	2,90%	14,30%	3 300	16 000	uncertain
Mtwara					
Masasi	2,70%	11,30%	6 700	28 000	uncertain
Mtwara Rural	0,30%	10,90%	320	13 000	uncertain
Mtwara Urban	0,00%	74,70%	0	39 000	uncertain
Newala	1,20%	14,30%	1 400	17 000	uncertain
Tandahimba	0,60%	13,60%	650	16 000	uncertain
Mwanza					
Geita	2,50%	7,10%	10 000	29 000	moderately good
Ilemela	0,10%	24,30%	220	36 000	uncertain
Kwimba	2,80%	12,20%	5 100	22 000	uncertain
Magu	1,60%	11,40%	3 900	27 000	uncertain
Misungwi	2,30%	12,20%	3 400	18 000	uncertain
Nyamagana	0,00%	79,20%	0	96 000	uncertain
Sengerema	1,60%	9,10%	4 600	25 000	uncertain
Ukerewe	0,00%	35,20%	0	41 000	uncertain

Region / District	HIV prevalence (15-49 years old)		People living with HIV (15-49 years old)		Quality of estimates
	Low	High	Low	High	
Pwani					
Bagamoyo	1,60%	10,60%	2 200	14 000	uncertain
Kibaha	0,80%	13,00%	590	9 800	uncertain
Kisarawe	1,60%	12,80%	870	7 200	uncertain
Mafia	0,00%	95,00%	0	22 000	very uncertain
Mkuranga	2,80%	16,70%	3 000	18 000	uncertain
Rufiji	1,10%	16,10%	1 300	19 000	uncertain
Rukwa					
Mpanda	3,60%	8,20%	8 600	20 000	moderately good
Nkasi	3,40%	11,80%	3 800	13 000	uncertain
Sumbawanga Rural	2,80%	11,30%	6 100	25 000	moderately good
Sumbawanga Urban	1,60%	23,90%	1 400	20 000	uncertain
Ruvuma					
Mbinga	4,20%	16,90%	9 900	40 000	moderately good
Namtumbo	4,90%	15,50%	5 000	16 000	uncertain
Songea Rural	5,90%	15,80%	5 400	14 000	uncertain
Songea Urban	0,00%	59,00%	20	45 000	uncertain
Tunduru	0,50%	12,70%	720	18 000	uncertain
Shinyanga					
Bariadi	1,60%	6,40%	5 700	23 000	moderately good
Bukombe	2,00%	7,10%	4 500	16 000	moderately good
Kahama	4,10%	10,10%	14 000	35 000	moderately good
Kishapu	4,30%	14,60%	6 000	20 000	uncertain
Maswa	2,80%	10,40%	5 000	18 000	moderately good
Meatu	2,80%	10,30%	4 000	15 000	uncertain
Shinyanga Rural	4,30%	13,90%	6 900	22 000	uncertain
Shinyanga Urban	1,30%	29,90%	1 000	23 000	uncertain
Singida					
Iramba	2,50%	8,20%	5 200	17 000	moderately good
Manyoni	1,40%	9,60%	1 700	11 000	uncertain
Singida Rural	1,10%	5,60%	2 500	13 000	uncertain
Singida Urban	0,00%	19,60%	0	13 000	uncertain

Region / District	HIV prevalence (15-49 years old)		People living with HIV (15-49 years old)		Quality of estimates
	Low	High	Low	High	
Tabora					
Igunga	4,00%	13,40%	7 700	25 000	uncertain
n.a. (1081)	0,00%	75,00%	0	1 200	very uncertain
Nzega	4,10%	10,70%	9 900	26 000	uncertain
Sikonge	3,00%	14,70%	2 300	11 000	uncertain
Tabora Urban	0,40%	19,80%	490	22 000	uncertain
Urambo	1,30%	6,20%	2 800	13 000	uncertain
Uyui	2,50%	10,90%	4 100	18 000	uncertain
Tanga					
Handeni	1,20%	10,70%	1 700	15 000	uncertain
Kilindi	0,10%	12,50%	100	10 000	uncertain
Korogwe	0,20%	11,50%	380	17 000	uncertain
Lushoto	0,10%	10,10%	130	25 000	uncertain
Muheza	0,50%	9,50%	880	16 000	uncertain
Pangani	0,20%	23,40%	40	6 000	very uncertain
Tanga	0,00%	28,10%	0	40 000	uncertain
Zanzibar South and Central					
Kusini	0,00%	11,90%	0	2 100	uncertain
Zansibar Central	0,50%	3,90%	180	1 400	moderately good
Zanzibar West					
Magharibi	0,50%	2,90%	510	3 200	moderately good
Mjini	0,00%	5,60%	20	6 400	moderately good
ALL	**4,80%**	**5,50%**	**960 000**	**1 100 000**	

Guidance

Please refer to the methodology note on Developing subnational estimates of HIV prevalence and the number of people living with HIV available on http://www.unaids.org.

Data sources

- THMIS Tanzania 2011/12 (http://www.dhsprogram.com/)
- 2013 UNAIDS estimates computed with Spectrum/EPP (http://www.unaids.org/en/dataanalysis/datatools/spectrumepp2013/)
- LandScan 2012 for global population distribution (http://web.ornl.gov/sci/landscan/)
- GADM for administrative boundaries (http://www.gadm.org/)
- Google Maps API for background layers (https://www.google.com/maps)

Disclaimer

This report has been written for UNAIDS by Joseph Larmarange (IRD / Ceped) in July 2014.

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