Methods and assumption for subnational demographic inputs to Spectrum in sub-Saharan Africa

Report and recommendations from a meeting of the UNAIDS Reference Group on Estimates, Modelling and Projections

UN Population Division, USA - 7th May 2019

REPORT & RECOMMENDATIONS

UNAIDS
JOINT UNITED NATIONS PROGRAMME ON HIV/AIDS
UNHCR UNICEF WFP UNDP UNFPA UNODC ILO UNESCO WHO WORLD BANK

The meeting of the UNAIDS Reference Group on Estimates, Modelling and Projections was organised for UNAIDS by the Secretariat of the Reference Group (www.epidem.org), managed at Imperial College London and the University of Cape Town. Participants of the meeting are listed at the end of this document.

Oli Stevens, May 2019

Abbreviations

ANC	Antenatal clinic
ASFR	Age-specific fertility rate
CCMPP	Core component method of population projection
CLHIV	Children living with HIV
EPP	Estimation and Projection Package
DHS	Demographic Health Survey
DemProj	Demographic projection module within Spectrum
GBD	Global Burden of Disease
IHME	Institute for Health Metrics and Evaluation
NSO	National Statistics Office
PES	Post-enumeration survey
PLHIV	People living with HIV
(P)MTCT	(Prevention of) Mother to Child Transmission
TFR	Total fertility rate
UNAIDS	Joint United Nations Programme on HIV/AIDS
UNPD	United Nations Population Division
USCB	US Census Bureau
WPP	United Nations World Population Prospects

Background

UNAIDS Reference Group

The Joint United Nations Programme on HIV/AIDS (UNAIDS) relies on impartial scientific advice from international experts in relevant subject areas to provide guidance on how to best calculate estimates and projections of the prevalence, incidence, and impact of HIV/AIDS globally. The UNAIDS Reference Group on Estimates, Modelling and Projections acts as an 'open cohort' of epidemiologists, demographers, statisticians, and public health experts to provide scientific guidance to UNAIDS and partner organisations on the development and use of the tools used by countries to generate annual HIV estimates, which are the source for UNAIDS Global HIV epidemic estimates. The group is coordinated by a secretariat hosted at Imperial College London and the University of Cape Town.

Work at UNAIDS Reference Group has been organised broadly into tracks:

- 'Technical update' work streams: These work streams are oriented to conducting research and providing technical feedback and guidance on specific updates for the suite of tools used for annual UNAIDS estimates, i.e. Spectrum, which includes the AIDS Impact Module (AIM), the Estimation and Projection Package (EPP), and the Case Surveillance and Vital Registration tool (CSAVR).
- 'Thematic' meetings: These meetings are focused on convening new research to catalyze innovation on specific aspects of HIV estimates that require substantial conceptual or methodological development

Meeting Objectives

Accurate population estimates by age and sex are required for population HIV estimates and trends. Increasingly countries are choosing to develop Spectrum estimates at first administrative level. Population data at the time of the most recent census and projections since the census are often available through national statistics offices, but the consistent population estimates spanning the full projection period (since 1970) are often not available. Subnational population estimates are especially challenging because highly structured migration patterns (e.g. working age adults to urban areas) affect subnational population structures for age groups most affected by HIV more dramatically than at the national level.

Population and demographic inputs form the base of all HIV estimation and there is a further interest in fertility through (P)MTCT and paediatric estimation. At present, demographic inputs at the national level within Spectrum are sourced from World Population Prospects (WPP), and subnational demographic inputs developed on a case-by-case basis supported by US Census Bureau (USCB).

For the purposes of HIV estimation, the most important priority is to ensure accurate estimates of population size by age/sex, which will affect estimates of PLHIV, new infections, and treatment coverage by age group. Secondly, accurate estimates of age-specific fertility are important accurately to estimate need for, and coverage of, PMTCT and MTCT at subnational levels. Non-HIV mortality and net migration are important to the extent that they improve ability to accurately model population by age and sex.

This meeting looked to:

- Review methods for creating subnational population inputs to Spectrum and plan further development of a tool for systematically creating subnational population inputs.
- Review discrepancies between national census estimates and prevailing population estimates, evidence for systematic biases in national censuses, and assumptions for accounting for biases in census data.
- Review systematic discrepancies between population estimates and household survey respondent population structure and implications for HIV estimates.
- Review analysis of demographic discrepancies arising from the HIV estimates process (e.g. age-specific mortality rates)

Outline

The UNAIDS Reference Group held its thematic meeting on *Methods and assumptions for subnational demographic inputs to Spectrum in sub-Saharan Africa* at the UN Population Division, NYC, USA, 7th May 2019. The meeting featured presentations and group discussion to generate consensus recommendations. The programme was divided into the following sessions:

1. Reviewing approaches and tools to constructing subnational demographic inputs
2. Analytical approaches and interpretation of census data in population estimates
3. Reviewing effects of HIV assumptions on population mortality

This report presents a summary of the meeting presentations and discussions. The presentations are available to meeting participants at www.epidem.org (others, please contact the Secretariat). The final recommendations can be found at the end of this report.

The recommendations drafted at these meetings provide UNAIDS with guidance on generating HIV estimates, provide an opportunity to review current approaches, and help to identify the data needed to further improve the estimates. Previous meeting reports are available at www.epidem.org. This transparent process aims to allow the statistics and reports published by UNAIDS and partners to be informed by impartial, scientific peer-review.

The list of participants and meeting agenda are included in Appendix I and Appendix II, resp ectively.

Session 1: Reviewing approaches and tools to constructing subnational demographic inputs

The objectives for Session 1 of the meeting were to review available existing approaches to generating demographic inputs to the Spectrum model (fertility, mortality, and net migration rates from 1970 through 2025) at subnational levels, including methodological inputs and data inputs required.

Jeff Eaton introduced the objectives for the meeting (see Background) and outlined the agenda (Appendix II) and enumerated specific motivating challenges for Spectrum population inputs that have arisen during the 2019 estimates workshops:

- Population estimates in Spectrum (from WPP) do not match census data or official population estimates produced by National Statistics Offices (NSOs).
- Internal migration and its impact on age/sex structures.
- Discrepancies between estimates of the number of births and programmatic data about antenatal clinic (ANC) attendance.
- Need to update demographic inputs to reflect new data (e.g. new census, fertility from household surveys) or reflect new subnational stratifications or boundaries.

John Stover described the demographic inputs required by Spectrum and their sources, summarised in Table 1. Base population, age-specific fertility rates, and net migration are interpolated directly from WPP 2017 estimates. Non-HIV mortality rates are back-calculated for high HIV burden countries by iteratively adjusting the non-AIDS life expectancy such that the total life expectancy matches WPP estimates.

Table 1. Demographic inputs to Spectrum and their default sources (presented by J Stover)

Input	Definition	Source
Base year population	Population in 1970 by sex and single age	WPP 2017
TFR	Total fertility rate by year from 1970 to 2025	Interpolated to single years from WPP 2017 period rates
Age distribution of fertility	Distribution of births by 5-year age groups and single year	Calculated from WPP 2017 ASFR. Interpolated to single years from 5-year period rates
Sex ratio at birth	Number of male births per 100 female births	Interpolated to single years from WPP 2017 5-year period rates
Life expectancy	Non-AIDS life expectancy at birth by sex and single year	Interpolated to single years from WPP 2017 5-year period rates. For high HIV burden countries we calculate non-AIDS LE to match WPP LE with AIM AIDS mortality
Life table	Survival rates by sex, single age and single year	Interpolated to single years from WPP 2017 period rates.
International migration	Number of net migrants by sex, 5-year age and single year	Interpolated to single years from WPP 2017 period rates

There is often an imperative for the population estimates that underpin HIV estimates to match the most recent national census or official NSO population estimates. A common approach is to iteratively adjust the 1970 base population in DemProj until a population match is achieved. A second recently added option is to upload a file specifying the desired final population by year, age, and sex. DemProj adjusts the net migration such that the modelled population matches the desired population. This, however, can have sizeable impact on migration within specific age groups. This can particularly affect ages 0–4, known to often be undercounted in censuses, which can leads to poor estimates of CLHIV and subsequent programmatic issues.

Several key points were highlighted during discussion of Stover's presentation. First, caution about exactly matching to national census populations by age/sex due to systematic undercounts by particular ages. Second, when reviewing discrepancies between programmatic data and demographic estimates, such as when the number of ANC visits greatly exceeds the number of estimated births, quality of both programmatic data and population estimates should be considered. For example, the reported number of ANC attendees might imply an implausibly large change in total fertility rate (TFR), suggesting likely errors in ANC reporting data. Third, a query was raised whether TFRs estimates from retrospective birth histories in household surveys could be overestimated in high prevalence countries due to survivorship bias of HIV negative women who have higher fertility than HIV positive women. Finally, there are substantial ongoing investments in strengthening civil and vital registration data in sub-Saharan Africa, and birth notification systems should be used to improve demographic estimates as these data become available and reliable.

The next series of presentations reviewed three methodologies for constructing subnational demographic estimates (see Table 2):

- Excel workbook based population projection tools developed by US Census Bureau (presented by Festus Ukwani).
- The Bayesian 'popReconstruct' model as implemented for the Institute for Health Metrics and Evaluation (IHME) Global Burden of Disease (GBD) Study (presented by Charlton Callender.
- Piecewise cubic interpolation as implemented in the 'custom population adjustment' in Spectrum developed by Avenir Health (presented by Rob Glaubius)

	US Census Bureau tool	GBD implementation of popReconstruct model	Population interpolation of age-stratified population inputs (Avenir Health)
Population data	2 censuses at subnational level, one close to 1970, one recent, disaggregated by age and sex	All censuses, disaggregated by age and sex	All censuses [or NSO estimates], disaggregated by age and sex
Demographic rates	At the subnational level: • Fixed fertility schedule • Fixed non-HIV mortality	At the subnational level: • Fixed fertility schedule • Fixed total mortality	At the subnational level: • All fixed rates
Model	Cohort component population projection (CCMPP) model	Cohort component population projection (CCMPP) model	Smooth interpolation of population by age/sex
Fitting procedure	Manual iterative adjustment of total migration at subnational level	Bayesian estimation of age-specific net migration and age-specific start population	Nonlinear optimisation of population size

Table 2. Summary of key characteristics of modelling tools reviewed for creating Spectrum demographic inputs.

The USCB Excel-based tools (presented by Ukwani) disaggregates national population estimates to subnational level. The 1970 base population by subnational area is established by disaggregating the national 1970 base population proportionally using the closest census to 1970 with the required disaggregation. Subnational ASFRs are fixed at national values. Subnational non-AIDS adult mortality is estimated by extrapolating subnational child mortality estimates using one-parameter model life tables. Where possible, subnational child mortality estimates are taken from a census or survey before substantially HIV mortality affected the population. If international migration is deemed to be significant (>5% of population), it is divided proportionally amongst sub-areas. Little data are available on internal migration and it is not used by USCB. These inputs are fed into a cohort component population projection model (CCMPP). Resulting subnational estimates are compared to results of the most recently available census, and internal migration is iteratively adjusted until there is good correspondence between the subnational population projection and the total population from the most recent census (internal migration adjustments are not disaggregated by age and sex). Specific points arising during discussion were: (1) that ASFRs could be calculated by subnational areas from DHS and other surveys rather than applying national ASFRs to subnational areas, (2) 1970 base populations could be improved by back-projecting from the earliest available census (which is sometimes many years later) to more precisely capture expected changes in age/sex structure over time, and (3) changes over time to subnational boundaries changes are a major challenge.

The IHME implementation of the PopReconstruct model, presented by Charlton Callender, embeds a core component population projection (CCMPP) within a Bayesian hierarchical model. For GBD population estimation, the model reconstructs the national population from 1950 to 2017. A single trajectory for age-specific fertility, sex ratios at birth, and mortality are fixed inputs. Age-specific net migration and 1950 base populations are varied to fit population data by age and sex from all available household censuses. Due to systematic under

enumeration of ages 0-4 in censuses, population counts for this age group are not used in model estimation. Final estimates for this age group will reflect fertility and child mortality inputs resulting from separate estimation processes. As a consequence of fixing fertility, sex ratio at birth, and mortality inputs, any misspecification of these model components will be absorbed in the estimated migration during fitting to population totals. Subnational populations are raked to national totals by age and sex, though migration is not raked to the national or international level. Variance inflation, reweighting, and processing of model inputs resolved several data quality issues including uncertain 1950 base population, census quality, age misreporting at older ages, and data reported by varying age groups.

Rob Glaubius described using piecewise-cubic interpolation of national census data and population estimates from the Kenya National Bureau of Statistics (KNBS) to create a 'custom population adjustment' input file into DemProj. A population file by year, single year age groups, and sex is produced. At each annual projection step in Spectrum, the population is rescaled to match the uploaded custom population, with the residual acting as net migration. No changes are made to other demographic inputs implying that misspecification of fertility, survival, and previous year population will propagate error into the net migration total. This is exemplified in Nyanza province, where there is an estimated influx of 0-4 year olds of ~50,000/year between 2015-2020.

Session 2: Analytical approaches and interpretation of census data in population estimates

The second session focused on reviewing the interpretation and assumptions about the national census data that form the foundation of demographic estimates at national and subnational levels. Specific objectives of this session were to:

- Understand the methods, assumptions, and analyses underpinning interpretation of census data in estimates;
- Discuss interpretation of the large imbalance in female-to-male sex ratio amongst young adults in SSA censuses (see figure 1 below); and
- Discuss how to provide guidance to countries regarding rationale for adjustments to raw census populations.

Jeff Eaton presented a comparison of population estimates between Spectrum files developed for 2018 UNAIDS estimates, WPP 2017, GBD 2017, and census values. Adult population size estimates from 2018 Spectrum files and WPP 2017 populations in Spectrum are larger than census values (around 3 and 5% respectively), with GBD 2017 estimates historically similar to WPP estimates though have converged with census values in recent years. There was a systematic discrepancy in the female-to-male sex ratio among adults 15-49 between Spectrum and WPP estimates versus raw national census results. Spectrum and WPP estimates for female-to-male ratios are close to parity for most countries, and few exceed 1.05. Sex ratios in censuses are consistently above parity (more women than men) and can

approach 1.2. The GBD population estimates correspond more closely to national census results, consistent with the assumption that age-specific census data are unbiased for adult ages. The differences between Spectrum and census populations are largely explained by men enumerated in the 20-39 age group in censuses than estimated in Spectrum populations. Age-standardising survey HIV prevalence estimates to the Spectrum population structure reduced the overall age 15-49 prevalence by 3-5% (relative) compared to direct survey results in 10 sub-Saharan African countries.

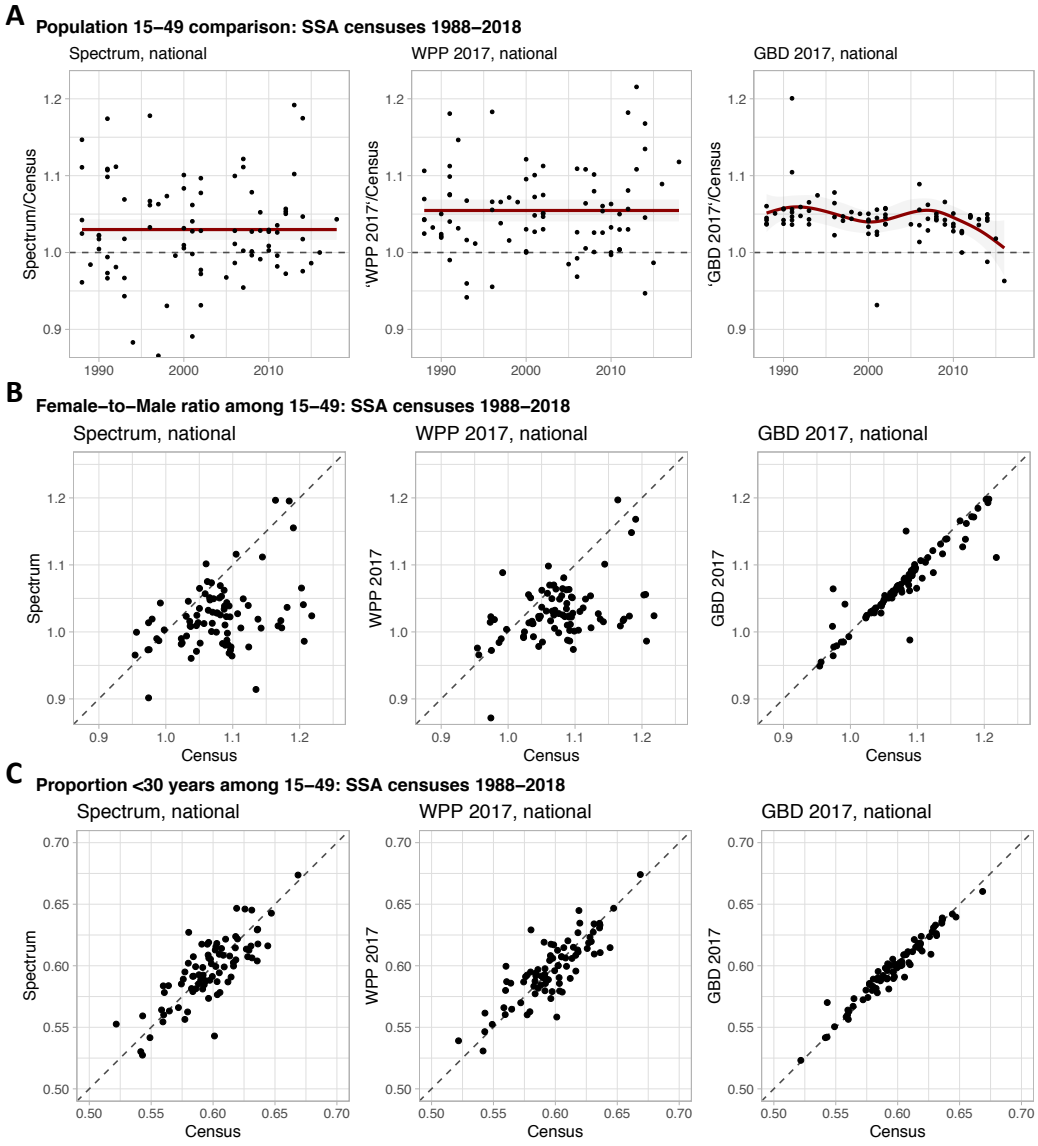

Figure 1. Comparison of population, female-to-male sex ratio, and proportion under 30 in ages 15-49. Presented by J Eaton

Thomas Spoorenberg and Patrick Gerland summarised common sources of errors in national censuses and methodological approaches to diagnosing and correcting errors. Broadly, census errors may be classified as *coverage errors* and *contents errors*, with examples given:

- Coverage errors: under/over enumeration of parts of the country or specific subpopulations, under-reporting of specific household members (e.g., infant/children, girls, students, young adult migrants);

- Contents errors: age heaping, age exaggeration at older ages, proxy reporting, non response, coding or data processing errors. In many cases, it is impossible to distinguish between age misstatement, differential coverage by age, and digit preference.

Undercounting of children aged 0-4 and men aged 15-29 is common, including in high income countries. Analysis for WPP aims to identify and correct such errors through a number of strategies:

- Review of post-enumeration surveys (PES; where available).
- Validation with external data and theoretical distributions;
- Intercensal analysis of equivalent cohorts from multiple censuses (Figure 2).

Spoorenberg demonstrated the tool used internally at UNPD to visualise, compare, and validate estimates against available data sources. This supports many of the comparisons and adjustments described above that feature in final WPP results. Further development and public access to this tool and the underlying data sources is an objective for the UNPD over the coming 3-5 years.

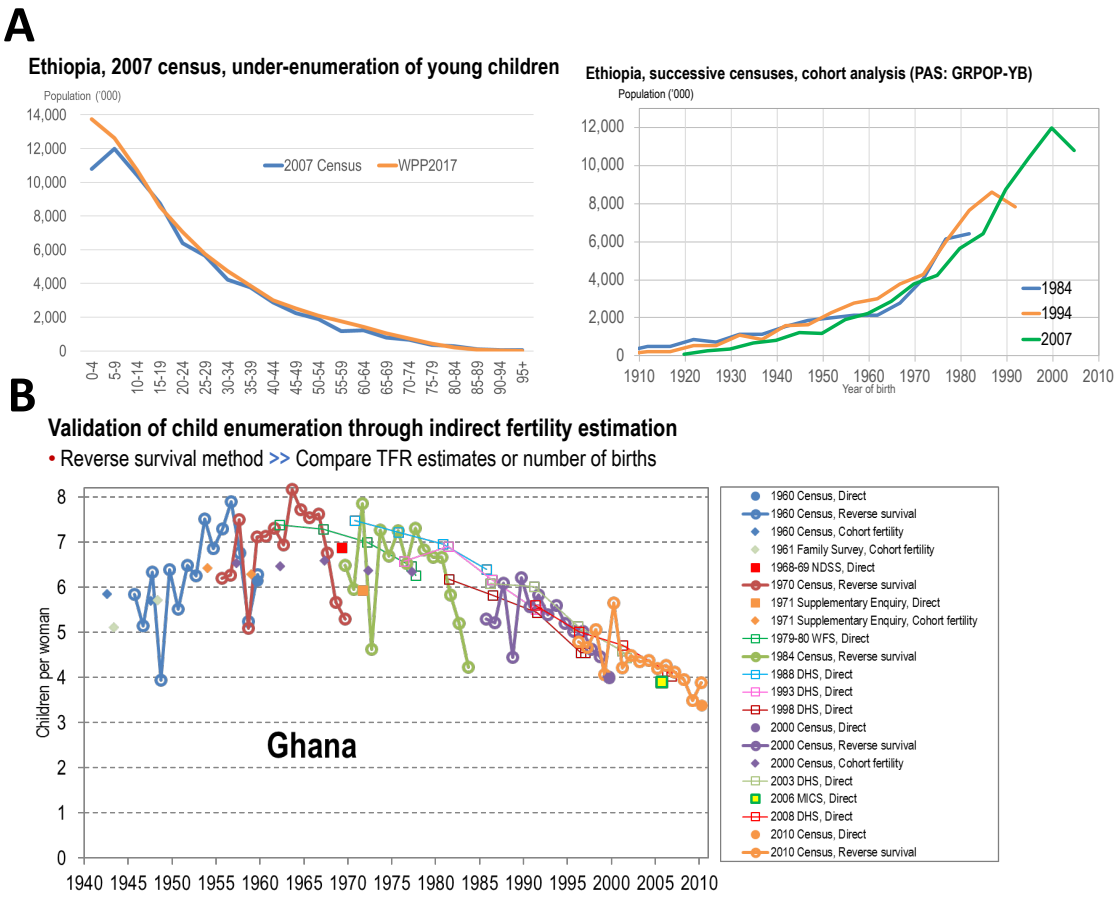

Figure 2. Intercensal analysis highlighting underenumeration of ages 0-4 in censuses, and validation through fertility estimation. Presented by T Spoorenberg

Census data inputs to the popReconstruct undergo systematic processing steps to prepare final model inputs (presented by C Callender):

1. **Distribute counts of unknown age and/or sex proportionally.**
2. **Adjust for subnational boundary changes**
3. **Adjust for national location differences between data sources and GBD locations:** (Serbia/Kosovo, Germany, Cyprus, Malaysia, Moldova/Transnistria, Yugoslavia, Singapore, India)
4. **Correct for age-heaping:** Age heaping is corrected by applying the Feeney, Arriaga, or Arriaga Strong correction depending on the UN Joint Score, which summarises the accuracy of a census based on the observed age ratios and sex ratios.
5. **Correct for under enumeration:** Census counts were adjusted for under enumeration based on the country socio-demographic index. The adjustment factor was estimated by fitting a regression model to 165 post-enumeration surveys (PES) identified in the public domain with socio-demographic index (SDI) as a covariate.
6. **Generate 1950 baseline population:** In order of preference, this is derived from a 1950 census; backprojecting a census close to 1950 assuming zero migration; or using the 1950 population from GBD 2016 where zero migration is an inappropriate assumption.

A key topic of discussion of the overall session was that very limited PES data were available for sub-Saharan Africa overall or by age and sex, which was noted as a limitation of the under-enumeration adjustments applied in this region. Collective work by the stakeholders present to identify and ascertain and consolidate PES data from NSOs would enhance the robustness of estimation by all exercises.

Given the sparsity of PES data in SSA, there was little evidence to adjudicate the imbalanced adult M/F sex ratio observed in censuses. Interpretation of the imbalanced sex ratio was a key point of difference between the WPP and GBD population estimates. WPP estimates tended to estimate more balanced sex ratios than estimated by censuses (implicitly assuming that they likely resulted from under-enumeration of men). GBD estimates tended to reflect the imbalanced census sex ratio in final estimates, likely reconciling them through out-migration of working age men, though this requires further investigation to confirm. Differences in mortality sex ratios could also contribute to differences.

While results of population estimation suggested different interpretations, discussion consensus was that it is difficult to discriminate between undercounting and out migration of working aged men and little confidence in either interpretation. Further steps to investigate include: (1) estimating the required rates of migration to resolve discrepancies, (2) regionally reconciling populations and associated international migration, and (3) ascertaining and reviewing PES.

Regarding communication of population estimation results and reasons for enumeration adjustments, the UNPD tool use to visualise data and demographic estimates was widely agreed to be an informative and effective way of explaining WPP adjustments to census data. Sharing outputs of this tool with UNAIDS to aid communication with national HIV estimates teams could help support adoption of adjusted population estimates. It was agreed to convene webinars with HIV estimates teams, NSOs, UNPD, UNAIDS, and the Reference Group from 8-10 priority countries that have disagreements over Spectrum population sources.

August/September 2019 was identified as the ideal timing because it is after the release of WPP 2019 in June, but early enough before the 2020 HIV estimates process to address concerns through consensus discussion of the HIV estimates teams and NSOs.

Session 3: Reviewing effects of HIV assumptions on population mortality

François Pelletier described research about the impact of changing the sex ratio of infection in high burden epidemics on the sex ratios of life expectancy and mortality. This presentation and ensuing discussion identified several recommendations:

- The sex ratio of infection for Gabon was implausibly large at around 2.4 times higher for women than men. This likely arises from fitting the incidence rate ratio to the single household prevalence survey. But given the difference from neighboring countries and epidemiologic implausibility, this should be revisited, possibly using ratios from neighbouring countries.
- Sex-specific mortality data are an unutilised data source that can be used to improve age/sex ratios of HIV incidence. UN Population Division have an extensive mortality database which should be considered for incorporation into Spectrum and the improvement of age/sex ratios of HIV incidence in several countries.
- Spectrum should output mortality (35q15, 45q15) disaggregated by sex.
- Specification of AIDS mortality changes in 10-year age intervals in Spectrum results in disjoint age patterns of total mortality in high HIV prevalence countries. Spectrum should consider smoothing these.

Session 4: Discussion and recommendations

Discussion at the end of the day returned to comparing features of the modelling approaches presented in Session 1 (summarised in Table 2) and the desirable features for a tool used to prepare demographic inputs to Spectrum.

- The popReconstruct and cubic spline interpolation approaches leverage census data stratified by age and sex from all available censuses. The USCB Excel tools use only the earliest and most recent census, and does not reconcile the population age structure to recent census data. Utilising age/sex stratified data from all available censuses was viewed as desirable.
- All three models require exogenously estimated fixed inputs for age-specific fertility and age-specific mortality over the entire projection period (1970 to 2025), and consider net migration to be the residual of the population estimation process. More systematic estimation of demographic inputs at subnational levels, in particular ASFRs, was identified as an opportunity for improvement.
- The USCB tool and popReconstruct are based on a cohort component model of population projection (CCMPP), while the cubic-spline interpolation did not have an underlying demographic model. The underlying CCMPP model was viewed as

desirable because it enforces demographic constraints amongst the input parameters which should result in improved consistency for all demographic inputs.

- The popReconstruct and cubic-spline interpolation models used an automated approach to optimise the model parameters to match input census data by age and sex, while the USCB tool required manual iterative adjustments to match the projected population to the most recent census data. An automated optimisation approach was viewed as desirable.

Based on these considerations, the group recommended two approaches for further exploration:

1. **Development of the popReconstruct model into a user-friendly tool.** The feasibility of this was viewed to depend on (1) how robust model results are to sparser and imperfect data inputs, and (2) computational considerations. Reducing the model time period to 1970 to present (instead of starting at 1950), modelling 5-year age groups followed by post-hoc interpolation (rather than single year age groups), and stronger constraints on model parameters through priors are potential approaches to address these concerns.
2. **Comparison of results of the simpler cubic spline population interpolation with results of the popReconstruct model.** If results of the population interpolation are suitably similar to the results of the full CCMPP-based popReconstruct model, then the simpler spline-based interpolation approach to create 'custom population input' files to DemProj could be sufficient. Concerns with this approach were: (1) implausibly large or sharp changes to implied net migration rates, and (2) inability to adjust for under-enumeration of 0–4 year olds in censuses. Post-hoc smoothing of net migration may address the first concern.

Reviewing estimates of demographic inputs, especially age-specific fertility and TFR at subnational levels, was recommended.

A second major challenge for demographic and population inputs to HIV estimates identified throughout the day was the separate remits of the HIV estimates teams and National Statistical Offices. While HIV estimates rely crucially on population inputs, official population estimates are typically the remit of NSOs and members of the HIV estimates teams typically do not have specific demographic training or authority to make judgements about underlying population inputs. Several strategies were outlined:

- Convening webinars with priority countries in August / September before the HIV estimates round to reach stakeholder consensus about population inputs before the
- Improving interoperability of software between Spectrum (used for HIV estimates) and the Demographic Analysis & Population Projection System (DAPPS) software used by NSO. Specifically, exploring whether DAPPS output files could be inputted into DemProj.
- Increased coordination and maximising opportunities afforded through ongoing technical assistance provided by US Census Bureau to NSOs in many high HIV burden countries.

Recommendations

UNAIDS Reference Group on Estimates, Modelling and Projections

Methods and assumptions for subnational demographic inputs to Spectrum in sub-Saharan Africa

7th May 2019, UN Population Division, USA

Recommendation/Action Item	Lead Person(s)	Proposed timeline

User friendly tools for creating full set of demographic inputs required by Spectrum
• Desirable criteria for demographic inputs tool:
  ○ Utilize age/sex stratified census data from all available census / population estimates.
  ○ Fixed age-specific fertility and mortality rate inputs (feature of all models reviewed).
  ○ Cohort component population projection model for internally consistent population structure over time.
  ○ Automated fitting approach to calibrate population by age/sex/year to available census or population estimates.
  ○ Accessible as a tool within Spectrum or an interface accompanying Spectrum (e.g. Shiny interface) to produce outputs that can be directly input to Spectrum as target population input.		

• Review feasibility of implementation of popReconstruct model in user friendly tool.
  ○ Potential opportunities to reduce fitting time: starting 1970 (instead of 1950), 5-year age groups then interpolating to disaggregate to single year.
  ○ Robustness to sparser census data inputs.
  ○ Robustness to blunter demographic rate inputs (fertility, mortality)
  ○ Test on more subnational datasets.
	IHME, Imperial, Avenir Health	

• Compare popReconstruct results with simpler age/sex population interpolation approach. ○ Assess whether results sufficiently similar to accept simpler interpolation approach.	Avenir Health	
• Construct improved admin 1 ASFR inputs from small-area analysis of DHS and other surveys.	TBC	
Ensure accurate Spectrum demographic inputs and enhance transparency and communication about population inputs with HIV estimates teams		
• Spectrum interface to accept DAPPS population files as inputs to DemProj	Avenir Health, USCB	
• Consolidate information about birth registration data availability and usability from partners supporting CRVS implementation (UNICEF, UNFPA, World Bank).	UNAIDS	
• Organise webinars to review WPP 2019 estimates with 8-10 priority countries with population estimates discrepancies.	UNAIDS, UNPD	

○ Including HIV estimates teams, NSOs, UNAIDS, UNPD, USCB • Encourage further development and public dissemination of UNPD tools for visualising data and demographic estimates. **Understand and improve guidance to countries about interpretation of census data in population estimates** • Equivocation on whether systematic imbalance in census sex ratios among young adults are mostly due to under-enumeration or sex differences in mortality and migration. ○ Prevailing WPP estimates tend to imply under-enumeration. ○ Prevailing GBD estimates tend to imply sex differences in net migration and mortality ○ Limited empirical evidence. • IHME to share post-enumeration survey data set with UNPD, USCB. • Source missing post-enumeration surveys from NSOs and ascertain whether DYB submissions are include or exclude PES results. **Spectrum and mortality in SSA** • Stratify DemProj mortality outputs (35q15, 45q15) in Spectrum by sex • Review sex-specific mortality patterns to inform sex ratio of HIV incidence pre-2003 • Use sex ratio of infection from neighbouring countries to alter existing ratio in Gabon • Compare mortality dataset for research on incorporating mortality data into EPP/Spectrum with UNPD database	IHME UNPD, USCB Avenir Health Avenir Health? UNAIDS Jeff Eaton/UNPD	

Agenda

Time	Duration (mins)	Topic	Presenter(s)/ Lead Discussant
Session 1: Tools for subnational demographic inputs (chaired by Leigh Johnson)			
9.30	10	Welcome and introductions	Mary Mahy & Patrick Gerland
9:40	10	Meeting objectives	Jeff Eaton
9:50	10	Demographic inputs required by Spectrum and definitions	John Stover
10:00	30	USCB subnational disaggregation tools	Tim Fowler
10:30	30	GBD 'PopReconstruct' implementation	Charlton Callender
11:00	30	Subnational demographics in Kenya	Rob Glaubius
11:30	45	Discussion and example case studies • Addis Ababa, Ethiopia • Nyanza (former province), Kenya • Nairobi, Kenya • Southern Province, Zambia • Kampala, Uganda • Bulawayo, Zimbabwe	
12.15	45	Lunch (to be catered on site – details to follow)	
Session 2: Interpretation of census data (chaired by Mary Mahy)			
13:00	20	Discrepancies between Spectrum populations, census data & population estimates and implications for HIV prevalence	Jeff Eaton
13:20	20	Assessment of bias & adjustment of census data in UN WPP analysis	Patrick Gerland Thomas Spoorenberg
13:40	20	Assessment of bias & adjustment of census data in GBD population estimation	Charlton Callender
14:00	30	Review challenging cases from 2019 estimates round • Lesotho • Malawi • Zimbabwe • Cameroon • Eritrea • Nigeria • South Sudan	
14:30	30	Discussion	
15.00	30	Coffee break	
Session 3: Other demographic challenges (chaired by Jeff Eaton)			
15:30	30	Other demographic discrepancies arising from Spectrum	François Pelletier
16:00	30	Discussion & planning next steps for development of tools for Spectrum demographic inputs	Jeff Eaton
16.30	–	Meeting close	