Modelling Paediatric HIV and the Need for Antiretroviral Therapy: October 2017

Report and Recommendations from a hosted by WHO and UNAIDS in collaboration with the UNAIDS Reference Group on Estimates, Modelling and Projections, London, UK, 19-20 October 2017

REPORT & RECOMMENDATIONS

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

World Health Organization

The meeting hosted by WHO and UNAIDS in collaboration with the UNAIDS Reference Group on Estimates, Modelling and Projections was organised by the Secretariat of the UNAIDS Reference Group (www.epidem.org) based at Imperial College London. Participants of the meeting are listed at the end of this document.

Katherine Wilson & Sabrina Lamour, UNAIDS Reference Group Secretariat
Imperial College London, UK, December 2017

Aim of the meeting

Despite recent successes in the scale up of services for the prevention of mother-to-child transmission (PMTCT), the global burden of paediatric HIV persists as a significant health challenge. As efforts to expand paediatric testing and treatment increase, a larger proportion of children are expected to survive and be in need of antiretroviral therapy (ART). In order to support the continued development and procurement of antiretrovirals, an improved understanding of the trends in paediatric infection at national and global levels remains critical. Unfortunately, limited surveillance data on this population in many countries have hampered efforts to accurately assess the number of children in need of ART, or to predict the uptake of current treatment recommendations in different settings and age groups. As such, forecasting the demand of paediatric drugs and formulations remains a challenge, potentially undermining treatment outcomes.

The World Health Organization (WHO) and the Joint United Nations Programme on HIV/AIDS (UNAIDS), in collaboration with the UNAIDS Reference Group on Estimates, Modelling and Projections, convened its fourth technical consultation to review and update current parameters and method of paediatric HIV estimation. The overall objectives of this meeting were as follows:

- To improve the ability for countries to estimate and project the number of children and adolescents living with HIV
- To estimate the number of children in need for 1st and 2nd line regimens over time by 2020 and explore the size and age of this population

The UNAIDS Reference Group on Estimates, Modelling and Projections

The UNAIDS Reference Group on Estimates, Modelling and Projections exists to provide impartial scientific advice to UNAIDS and other partner organisations on global estimates and projections of the prevalence, incidence and impact of HIV, and to support the further development and refinement of current methods. The Reference Group acts as an 'open cohort' of epidemiologists, demographers, statisticians, and public health experts. It is able to provide timely advice and address ongoing concerns through both *ad hoc* and regular meetings. The group is co-ordinated by a secretariat based in the Department of Infectious Disease Epidemiology at Imperial College London, United Kingdom.

Approach

The meeting featured both presentations and facilitated discussion to generate consensus recommendations. These recommendations give UNAIDS and partners guidance on how best to produce estimates of HIV, and the meetings provide opportunities to review current approaches and help to identify information needs. Thirty-eight experts from nine countries attended the meeting – each contributed data, insights and analysis to produce a set of recommendations on paediatric estimates and forecasting. We thank them for their attendance and contributions.

This report includes summaries of the presentations and discussions for each session. Links to the presentations are available to meeting participants with member logins on the Paediatric HIV October 2017 Meeting page, on the Reference Group website (for non-members, please contact the Reference Group Secretariat). The final recommendations and action items from all the sessions have been summarised towards the end of this report. Earlier reports from the WHO/UNAIDS Paediatric HIV meetings and past UNAIDS Reference Group meetings are published on the Reference Group website (www.epidem.org), which include further information on the different approaches described in this report. Such transparent processes aim 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, respectively.

Day 1 Introduction

Mary Mahy presented a summary of the 2017 UNAIDS estimates for children, including comparisons with recent data from six Population-based HIV Impact Assessment (PHIA's) surveys (in Lesotho, Malawi, Swaziland, Uganda, Zambia, and Zimbabwe), and emphasized the importance of the underlying population dynamics of this age group. UNAIDS additionally requested that the number of children ageing out of the 0-14 age range should be added into Spectrum. John Stover gave an overview of the child model in Spectrum software and introduced the 2017 updates implemented in the model, including a tool to automatically adjust fertility rate ratios (further explained below). For the 2018 round of estimates, the demographic data will be updated to the World Population Prospects 2017 (WPP 2017) data. Numbers of HIV exposed uninfected (HEU) children will also be added as an output in Spectrum (further discussed in Session 5) and the development of the web interface for Spectrum is planned to be completed for the 2019 round of estimates.

Day 1 Session 1. Estimating births to HIV-positive women

Mary Mahy presented a comparison of estimates for HIV-positive pregnant women in Spectrum with programme data, and outlined the factors which contribute towards an overestimation of coverage for prevention of mother-to-child HIV transmission (PMTCT) programmes in Spectrum. Milly Marston showed analysis of the relationship between HIV and fertility across countries in sub-Saharan Africa from multiple Demographic and Health Surveys (DHS). The results demonstrated strong variances in HIV-associated subfertility by geographical region (e.g. urban vs. rural) and by age (e.g. less HIV subfertility was observed in younger women assumed to have a higher exposure to pregnancy), yet differences between HIV-positive and HIV-negative women were less defined. These results appeared in contrast to findings from Malawi, where a quick return to the fertility rates among the general population for women on antiretroviral treatment (ART) was reported. The group agreed to adjust the fertility rate ratios (FRR's) in Spectrum for women not on ART, to incorporate the subfertility results presented by Milly Marston. Further investigation of fertility in HIV-positive women (on or not on ART) was encouraged, using data from IeDEA and ALPHA network.

Robert Glaubius provided further information on the development of Spectrum tool for the adjustment of FRR's on a country-by-country basis. Preliminary results using the tool were presented for eight countries in sub-Saharan Africa showing a general improvement in estimates of prevalence among pregnant women and PMTCT coverage. Following discussion, it was agreed that the tool should be calibrated to ANC routine data (ANC-RT) and not ANC sentinel surveillance (ANC SS) data. Continued scrutiny of ANC data quality and additional data validation of the fitted fertility rates was encouraged.

Leigh Johnson presented an overview of the methods used to estimate births to HIV-positive women in the Thembisa model, a combined demographic and HIV model for South Africa, and discussed possible reasons for differences between Thembisa and Spectrum estimates. It was agreed that PMTCT coverage should be compared with survey percentage coverage when possible (rather than absolute numbers of women), to reduce the uncertainty in the mother-to-child HIV transmission (MTCT) rate estimates. Survey data was deemed preferable to antenatal clinic routine data, to include pregnant women that may never access antenatal services. It was also advised that UNAIDS would review country's inputs for PMTCT regimes, which affect transmission probabilities.

Day 1 Session 2. Retention on ART among pregnant women

John Stover presented the impact of disengagement from care during pregnancy on Spectrum estimates. Sensitivity analysis comparing 0%, 4% and 8% monthly drop-out from ART during pregnancy for five countries was presented. The results indicated that changes in drop-out rates can result in significant differences in the MTCT rate and in the number of HIV-positive children aged 0 to 4 years old, though has less of an impact on the number of older HIV-positive children. The group recommended a review of the literature to inform a default transmission probability for children born to women who drop-out rate from care during pregnancy and breastfeeding in Spectrum, and that for the immediate term, the transmission rate of never having

started ART will be used for women who disengage from care. Furthermore, it was agreed that Spectrum should be reconfigured from using a monthly drop-out rate during pregnancy, to using an overall value for the proportion of women retained in care at delivery. Further research into the transmission rate among women who have stopped taking ARV's during pregnancy was encouraged.

Constantin Yiannoutsos presented estimates for measuring the effect of ART on pregnancy using programme data from two recent studies in East Africa IeDEA sites (Kenya, Uganda, and Tanzania). The results indicated the rates of mortality and lost to follow up were similar between pregnant and non-pregnant women, and that pregnant women are disproportionately represented among women enrolling in care. No significant impact of ART on fertility was observed in their studies.

Andreas Jahn presented ART retention data from pregnant women in Malawi (from national program data and the NEMAPP study), showing high rates of attrition particularly within the first six months of treatment initiation, which was consistently observed over several years. The potential for double counting in the programme data, due to women initiating ART when pregnant and then reinitiating during breastfeeding, was also discussed.

Renaud Becquet introduced the INSPIRE project data, for which an individual-based pooled analysis has been underway, to analyse retention on ART among pregnant women across six PMTCT option B+ sites in Nigeria, Malawi and Zimbabwe. He explained the discrepancies in methods for calculating retention between the different sites and highlighted the considerable antepartum loss to follow up rate. Given the large heterogeneity in methods between the sites, it was suggested that this data may not be suitable to fit into Spectrum, yet that the results importantly highlighted the challenge for countries in defining loss to follow up and silent transfers. Further investigation on the data available to countries for metrics for lost to follow up was recommended, to improve current estimates of disengagement from care.

Day 1 Session 3. Transmission rates

Lynne Mofenson presented a literature review on HIV transmission rates among children, published in 2016-2017. Six new publications and four conference abstracts were identified as being relevant and included in this review. Based on these studies, it was agreed that no change was required from the previous rates and that Lynne would inform UNAIDS when another review of the literature would next be useful.

Leigh Johnson and John Stover presented calculations of incident HIV infections during pregnancy and breastfeeding for the Thembisa and Spectrum models, respectively. Maternal seroconversion during late pregnancy and breastfeeding was a large contributing factor towards total mother to child transmission in the Thembisa model. In contrast, incidence during pregnancy in Spectrum was calculated from incidence rates among women by age, that were reweighted to reflect the age distribution of pregnancies. The group encouraged further exploratory studies on women who are incident infections during pregnancy or breastfeeding.

Day 1 Session 4. Age specific ART (and retention and VL suppression) among children and adolescents

Kim Marsh presented estimates of HIV testing and the treatment cascade among children and adolescents from Global AIDS monitoring (GAM) reports, with a higher proportion of older children reported in program data than Spectrum estimates. It was highlighted that as more detailed age group data for ART becomes available, the importance of generating increasingly robust estimates of children living with HIV remains critical. It was agreed that UNAIDS would encourage countries to provide age-specific breakdown of treatment initiators, and that the PHIA data may also inform such information.

George Siberry discussed the data for PEPFAR-lead programmes and how they could contribute to better understanding of paediatric treatment numbers. The age disaggregation used in PEPFAR for children and adolescents are <1, 1-9, 10-14, 15-19 years old, and this age disaggregation is used for all indicators. The limitation of using a 1-9 year age group was highlighted, as this represented a heterogeneous age group with

regards to formulation and regimes of antiretrovirals (ARV's) used, differences in treatment outcomes, etc. Overall estimates of the number of children on treatment so far appear to be decreasing, yet it was reminded that these results were sensitive to programmatic changes, such as changes in the facilities involved in reporting, as well as ageing out of the age groups.

Mary-Ann Davies and Jeannie Collins presented on ART start among children and adolescents. Mary-Ann gave an update about age at ART initiation in IeDEA, followed by a comparison by Jeannie of the IeDEA and CIPHER data. Overall, there was a decline in the numbers of children under 15 years old initiating ART, while the proportion of children starting ART less than 1-2 years old, and over 10 years old, increased. Several differences were shown for the age distribution at the start of ART for Africa in Spectrum, which is based on previous IeDEA data, compared with the (larger) CIPHER dataset. It was recommended that Spectrum should be updated with the latest results from CIPHER or IeDEA on recent distribution of age at ART initiation by region, to be used by countries where age specific data are not available.

The group anticipated that countries would increasingly be able to provide age-disaggregated data and agreed on a priority order of data sources, starting from country specific programme or PEPFAR data, to using cohort data from CIPHER/IeDEA if no other data is available – see Key Recommendations section for further information. Furthermore, it was agreed that an input screen would be added to Spectrum to enter an estimated distribution of percentage on ART by age, for countries who may not have numbers on ART by age, to encourage countries to input their own data.

Additionally, Mary-Ann Davies gave a presentation on the gaps in care and lost to follow up (LTFU) in children and adolescents on antiretroviral therapy. Results were presented for LTFU in CIPHER and IeDEA. The different definitions and metrics of LTFU were also considered. The group was made aware that approaches for incorporation of disengagement from care in adults was currently being investigated as part of the UNAIDS Reference Group (see UNAIDS Reference Group Fall Meeting 2017, 16-18 October, London), and that a similar strategy for disengagement from care for children could subsequently be adopted.

Isaac Taramusi presented the country perspective on reporting ART retention and viral load suppression (VLS) by age group in Zimbabwe and highlighted the low retention particularly in adolescents (a finding that was shared among several group members). The heterogeneity of the definition of ART retention was reiterated, and Isaac also discussed the challenges of ART reporting and data collection, with limited data currently available on viral load testing. Further investigation on the drop-outs in adolescents was recommended, e.g. using IeDEA data.

Day 1 Session 5. Adolescents

Ali Judd showed an analysis of perinatally HIV-infected adolescents (PHA) from the CIPHER global cohort collaboration, to describe the global epidemiology and geographic trends of characteristics and outcomes of vertically infected children surviving beyond 10 years of age. The results indicated substantial regional differences in age and CD4 count, particularly at the first visit and start of ART. By 10 years of age, and at the last visit, the proportion of adolescents on ART and the proportion virologically suppressed were similar across regions. It was noted that height was severely impaired in most regions among vertically infected adolescents, even among those receiving ART, and that mortality during adolescence was substantially elevated for perinatally HIV-infected adolescents in South America and Africa, relative to Europe.

Annette Sohn presented analyses of mortality among vertically infected adolescents. The need for gaining a better understanding on the mortality among those not on ART was highlighted, yet the group acknowledged the challenges in finding the necessary data to inform assumptions. Updated analyses for mortality pre-ART was underway (earlier analyses have previously been shared with WHO). Mary Mahy highlighted the tool available in Spectrum for estimating the number of vertically-infected children. The group recommended that further research is required to measure the differential in mortality between vertically and horizontally infected adolescents, which should be available from IeDEA data, to be included in Spectrum.

Mary showed comparisons of Spectrum 2017 estimates for adolescents (15-19 years) and young people (20-24 years) with recent survey data (39 surveys from DHS and PHIA). The results showed that Spectrum tended

to be higher than survey results. It was suggested that some of the mismatch could be due to differences in the age distribution patterns between surveys. The group agreed that Spectrum model outputs should be compared to data to further investigate for systematic trends of fitting incidence rate ratios (IRR's). Robert Glaubius would also re-analyse temporal patterns in IRR's, including most recent PHIA data, and update those for countries with no recent survey as necessary.

John Stover presented Spectrum methods for estimates of HIV-exposed uninfected (HEU) children and orphans. A new output has been added to Spectrum this year to estimate the number of HEU children and the number of HEU children who have been exposed to ART. Currently, HEU children are assumed to have the same survival rate as any child that is uninfected. Further research is required to investigate HEU-specific survival which could be incorporated into Spectrum. Secondly, John showed the Spectrum estimates of orphans, including AIDS and non-AIDS orphans, where results suggested that Spectrum was overestimating paternal orphans. Following discussion, it was recommended that Avenir Health should consider redoing the comparison of proportions of orphans estimated in Spectrum and DHS with updated demographic WPP 2017 inputs, and try to resolve the discrepancy.

Renaud Becquet presented initial results and plans for further analyses on the contribution of maternal ART exposure and breastfeeding on 24-month survival in HEU children, based on a metanalysis of prevention of mother to child transmission (PMTCT) studies in Africa and South-East Asia. He showed the different risk factors that contribute towards infant death, including maternal death, which was a strong risk factor. The group encouraged continuation of this work, with the aim to potentially incorporate these results into Spectrum.

Day 2 Session 1. Updates on ongoing efforts to improve quantification, forecasting and assessment of demand

Updates were given on the group's work since November 2016 to improve quantification, forecasting and assessment of demand for the different paediatric antiretroviral regimes. John Stover presented a forecast of the numbers of patients on ARV's and demand for individual ARV formulations in low and middle-income countries through 2021. Different methods and scenarios were presented: a linear extrapolation of past data, country targets, and fast track targets. Andrea Ciaranello gave an overview of the IeDEA 'Pediatric Methods and Modeling Consortium' (IPM2), CEPAC (Cost-effectiveness of Preventing AIDS Complications), and of the development of the paediatric ARV forecasting module, which was discussed in more detail in Session 2.

Jeannie Collins presented the switching rates to second-line therapy from perinatally infected children in Sub-Saharan Africa, Asia, South America and Caribbean, USA, and Europe. The results indicated low switching rates to second line ART overall, yet the presence of substantial regional variations (with a higher incidence of switch among children initiating NNRTI-based regimens, who were older at ART start, and in settings where there was routine viral load and CD4 monitoring). Characteristics of individuals at ART start for age, initial regimen, NRTI backbones, WHO weight bands and WAZ (Weight for age Z-score) were also presented. The group recommended that further analyses should be focused on the most recent years only, and that results for the highest burden areas should be prioritised.

Vineet Prabhu discussed CHAI (Clinton Health Access Initiative) forecasting of ARV's for suppliers and updates to the 'CHAI Simple Tool', an alternative approach to analysing market sustainability. Discussions on the optimal forecasting age bands followed and the group suggested that paediatric forecasting for the under 10-year age group may be most informative, instead of under 15 years, as those towards the age of 15 years would quickly transition into the adult ART regimens.

Fernando Pascual presented the MPP (Medicines Patent Pool) forecasting methods which are used to encourage manufacturers to sign licenses and estimate the potential market of these products, e.g. predicting the pace of introduction of new drugs to the market. Janice Lee presented the DNDi (Drugs for Neglected Diseases initiative) demand forecasting for the 4-in-1 HIV drug (a proposed improved first line treatment for children under the age of three) between 2018 and 2022, and provided an overview of the different formulations across regions. The group agreed that a 10-year demand forecast would be most informative, yet acknowledged the challenges for this, given the limited available data. Further collaboration

between MPP and DNDi was recommended, to ensure that consistent messages are presented to drug manufacturers.

Day 2 Session 2. Facilitated discussion to input development of the paediatric CEPAC Model

The presentation by Andrea Ciaranello reviewed the methods and preliminary characteristics of the paediatric CEPAC forecasting model, which included discussions of desirable model outputs, the potential structure of the model, available data input, scale up scenarios and planned work. The primary objective of this model is to develop forecasts to inform manufacturing and supply of paediatric antiretroviral formulations. A secondary use of the model as proposed as an aid for countries to forecast need for different ARV's at the national level. Potential approaches to incorporate part of the estimates of the CEPAC model in Spectrum as a matrix composed of the different ages of ART start with their corresponding switching rates between drug regimens were also suggested.

The group proposed that suitable data to inform model validation may be available from electronic medical records (EMR's), e.g. in Malawi and Tanzania. It was suggested that the assumptions of the model could be tested using programmatic data from a small number of countries, which could be selected from those with the highest coverage of EMR. UNAIDS also informed that they will be compiling data on availability of EMRs in countries and that these data are intended to be available on UNAIDS' AIDSInfo website in coming years.

The group agreed that this model will be a useful addition in global forecasting and for working with pharmaceutical companies to predict and prepare for future demand for drugs, including new drug formulations which have not yet been launched. The difficulties in forecasting need for ARVs and ART coverage at the global level over a three to five year time scale were also discussed. The group recognises the importance of timely results, and recommended further collaboration and piloting with selected countries, to help calibrate and validate the CEPAC model estimates.

Key Recommendations

Recommendation/Action Item	Lead Person(s)	Proposed timeline
Day 1 **Session 1: Estimating births to HIV+ women**		
Incorporation of children ageing out in Spectrum: Children aging out to be added as a visualisation output in Spectrum	Avenir Health	Immediate
Fertility among HIV+ women in Spectrum: • Fertility rate ratios (FRR's) to be adjusted in women not on antiretroviral therapy (ART), to incorporate subfertility results presented by ALPHA Network (Milly Marston) and Jeff Eaton • Implement parameter in Spectrum to allow changes to the FRR of women on ART. Default value for parameter will remain at 1.0 pending further analysis and investigation • Further exploratory studies to determine potential differences are encouraged	Milly Marston, Jeff Eaton, Avenir Health Avenir Health IeDEA, ALPHA Network	Immediate Immediate 2018
Reviewing PMTCT coverage and FRR's in country files: Coverage of programmes for prevention of mother to child HIV transmission (PMTCT) and adjustments to FRR's to be reviewed by UNAIDS, following updated demographic WPP 2017 inputs, to identify potential outliers with unusually high PMTCT coverage	UNAIDS	Immediate
Estimating births to HIV+ women: PMTCT coverage to be compared to survey percentage coverage when possible, rather than absolute numbers of women, to reduce the uncertainty in the MTCT rate estimates (survey data is preferable to antenatal clinic routine data, to include pregnant women that may never access antenatal services)	UNAIDS	Immediate
Quality of programme data: Use Elimination and "Pathways to Elimination" efforts to evaluate quality of programme data. UNAIDS to encourage country teams to investigate quality of programme data • UNAIDS to contact GVAC by November 2017	UNAIDS, Annette Sohn	Ongoing (next call Nov 2017)
Fertility rate ratio (FRR) in Spectrum: ANC routine data is recommended for fitting FRR's in Spectrum if data meet completeness and reporting standards. ANC sentinel surveillance data are not recommended for fitting FRR.s	Avenir Health	Immediate
Session 2: Retention on ART among pregnant women		
Disengagement from care during pregnancy in Spectrum: • Further consultation between Avenir Health, Andrea Ciaranello and partners to review literature and agree on a default parameter for drop-out rate from care during pregnancy in Spectrum. Drop-out rate during breastfeeding should also be considered	Avenir Health, Andrea Ciaranello, Caitlin Dugdale	Immediate

• Spectrum to be reconfigured from using a monthly to drop out rate during pregnancy, to using an overall value for proportion of women retained in care at the time of delivery • Spectrum to use the transmission rate of never having started ARV's for the immediate term, for women who disengage from care (assuming that most of these women do not actually initiate taking the medicines)	Avenir Health Avenir Health	Immediate Immediate
Transmission rate among drop-outs: Further research into transmission rates among women who have dropped out to be considered	Caitlin Dugdale, Andrea Ciaranello	TBC
Disengagement from care in countries: Further investigation into what data is currently available to countries as metrics for loss to follow up (LTFU)/disengagement, to improve estimates of drop outs. Liaison with UNAIDS country SI advisors is recommended	UNAIDS, IeDEA	Oct 2018 (next Paediatric meeting)
Session 3: Transmission rates		
Transmission probabilities by ART regimen: Transmission probabilities to remain unchanged. Continued literary research to monitor for new results is encouraged • UNAIDS to organise teleconference with Lynne Mofenson after AIDS conference 2018	UNAIDS, Lynne Mofenson	Ongoing (next call July 2018)
Incident infections during pregnancy and breastfeeding: Exploratory studies on women who seroconvert during pregnancy or breastfeeding are encouraged and welcomed (e.g. potential Lesotho and Swaziland) • UNAIDS to organise teleconference with Fatima Oliveira Tsiouris February 2018	UNAIDS, Fatima Oliveira Tsiouris	Ongoing (next call Feb 2018)
Session 4: Age specific ART (and retention and VL suppression) among children and adolescents		
Age-specific ART initiation: UNAIDS to further encourage countries to have age-specific breakdown of treatment initiators. • UNAIDS to arrange webinar in December 2017	UNAIDS, SI advisors	Ongoing (next webinar Dec 2017)
Priority of data sources for age-specific ART: The next version of Spectrum for 2018 estimates will use country entered data by age group for children on ART. If countries do not have age specific data, they should use the following prioritised data sets to inform distribution (Spectrum to incorporate these options): 1. Country programme data 2. PEPFAR programme data 3. Representative site data 4. Neighbouring country programme data 5. Cohort study (IeDEA) default values	Avenir Health	Sept 2018 (by next Spectrum version; webinar in Dec 2017)

Age at ART initiation CIPHER/IeDEA: It is recommended that updated results from CIPHER or IeDEA on recent distribution of age at ART initiation by region should be added to Spectrum and used by countries where age specific data are not available • UNAIDS to arrange teleconference with CIPHER and IeDEA in April 2018	CIPHER, IeDEA, UNAIDS	April 2018
ART by age in Spectrum: Spectrum to include an input screen to enter an estimated distribution of percentage on ART by age, for countries who do not have numbers on ART by age	Avenir Health	Immediate
Children newly on ART in Spectrum: Spectrum to consider displaying the back-calculations of new initiations of children on ART	Avenir Health	May 2018
Disengagement from care among children: • Disengagement from care in adults is currently being reconsidered (see UNAIDS Reference Group Meeting October 2017 meeting report) and shall be discussed at the next Paediatric meeting, to consider using the similar strategy for disengagement from care for children • UNAIDS to arrange teleconference with IeDEA in February 2018 to address the following: o To develop an improved definition of disengagement from care o To follow up on country specific data from cohorts for validation process	IeDEA, Avenir Health, UNAIDS IeDEA, UNAIDS, WHO	Oct 2017 Feb 2018
Session 5: Adolescents		
Adolescent specific drop out: Further research is encouraged to collect data to inform drop-out rates from care amongst adolescents	IeDEA	Oct 2018 (next Paediatric meeting)
Incorporation of vertically infected specific survival into Spectrum: Regular teleconference meetings (every 2 months) to aid research into the incorporation of vertically infected specific survival into Spectrum. Avenir Health and UNAIDS to define needs for the model, and IeDEA to provide data • UNAIDS to share short guidance summarising the assumptions in Spectrum in preparation for the meeting	Avenir Health, UNAIDS, WHO, IeDEA, Annette Sohn, Andrea Ciaranello	Ongoing (UNAIDS to arrange call in February with IeDEA)
Incidence rate ratios (IRR's) in Spectrum: 1. Model outputs to be compared with data, where available, to further investigate whether there is a systematic trend of non-fitting and ensure the current Spectrum IRR fitting tool gives a suitably good fit to the recent survey data 2. Rob Glaubius to re-analyse temporal patterns in IRR's, including most recent PHIA data and update IRR's for countries with no recent survey, as necessary (to consider if there are consistent patterns that should be default assumptions for countries	Avenir Health Avenir Health	Immediate Immediate

without recent survey). Analysis to be shared with interested parties once complete		
HIV Exposed Uninfected (HEU): Current investigations on HEU survival to be continued and to be incorporated into Spectrum once completed • UNAIDS to arrange call in April 2018 to follow-up	Nigel Rollins, Renaud Becquet	Oct 2018 (call in April 2018)
Comparison of number of orphans from Spectrum and DHS: Avenir Health to consider redoing comparison of proportions of orphans estimated in Spectrum and DHS with updated demographic WPP 2017 inputs	Avenir Health	Sept 2018 (by next Spectrum version)
Day 2 **Session 1: Updates on ongoing efforts to improve quantification, forecasting and assessment of demand**		
Facilitating collaboration: Regular teleconference meetings (every 2 months) to be organised to facilitate collaborative work between modellers, programme planners, cohorts and policy makers	WHO	Ongoing (brief face to face meeting at next AMDS April 2018)
Session 2: Facilitated discussion to input development of the paediatric CEPAC Model		
CEPAC method development: Further collaboration with countries is recommended to inform model assumptions, validate/calibrate outputs and improve method development. Refined results to be presented at next Paediatric Meeting	Andrea Ciaranello, CEPAC, WHO, PEPFAR	Oct 2018
Additional Recommendations		
EMR Coverage: UNAIDS to consider adding coverage of electronic medical records (EMR) for each country as an additional output on AIDSInfo website, including a measure of the coverage of HIV relevant indicators	UNAIDS	2018

Appendix I: List of Participants

In collaboration with the UNAIDS Reference Group on Estimates, Modeling and Projections

Modelling Paediatric HIV and the Need for ART

19-20 October 2017

Park room, Rydges Kensington Hotel, London, UK

LIST OF PARTICIPANTS	
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Appendix II: Agenda

In collaboration with the UNAIDS Reference Group on Estimates, Modeling and Projections

Modelling Paediatric HIV and the Need for ART

19-20 October 2017

Park room, Rydges Kensington Hotel, London, UK

Day 1, Thursday 19th October 2017

TIME	AGENDA ITEM	Presenter/Moderator
	Chair: Tim Hallett (UNAIDS Reference Group)/Peter Ghys (UNAIDS)	
8:30 – 8:45	Opening remarks	Peter Ghys, UNAIDS / Tim Hallett, UNAIDS Reference Group
8:45 – 9:00	Summary of previous meeting and objectives	Martina Penazzato, WHO
9:00 – 9:15	Results from 2017 and outstanding challenges	Mary Mahy, UNAIDS
9:15 – 9:30	Overview of calculations and 2017 changes to the child model in Spectrum	John Stover, Avenir Health
9:30 – 10:30	**Session 1: Estimating births to HIV+ women** • Estimates of HIV+ pregnant women compared to programme data • Fertility among HIV+ women • Adjustments to fertility rate ratios • Estimates from alternative models Discussion – Decision on adjustments to the calculations	Mary Mahy, UNAIDS / Jeff Eaton, Imperial Milly Marston, LSHTM Robert Glaubius, Avenir Health Leigh Johnson,UCT
10:30 – 10:45	**Coffee Break**	
10:45 – 12:00	**Session 2**: **Retention on ART among women** • Impact of dissengagement from care during pregnancy on estimates • Dissengagement from care in pregnancy and breastfeeding • INSPIRE Retention in Care • Ability of countries to report retention among pregnant women Discussion – Decision on default values to include in Spectrum	John Stover, Avenir Health Constantin Yiannoutsos, IeDEA Renaud Becquet, INSPIRE Andreas Jahn, Malawi Isaac Taramusi, Zimbabwe
12:00 – 13:00	**Session 3**: **Transmission rates** • Any recent updates to transmission probabilities by regimen • Calculation of incident infections during pregnancy and breastfeeding Discussion – Improvements to calculations of transmission due to incident infections	Lynne Mofenson, EGPAF Leigh Johnson, UCT John Stover, Avenir Health
13:00- 14:00	**Lunch**	

14:00 - 15:30	**Session 4: Age specific ART (and retention and VL suppression) among children and adolescents** • Availability of age specific data for ages 0-19 years from countries • Comparison to USG data • Updated data on age at ART initiation • Gaps in care and outcomes • Country perspective on reporting ART retention and VLS by age group Discussion - Decision on changes to input options for Spectrum	Kim Marsh, UNAIDS George Siberry, OGAC Mary-Ann Davies/ Constantin Yiannoutsos Mary-Ann Davies, UCT (2) Isaac Taramusi, Zimbabwe Matthias Alagi, Nigeria Andreas Jahn, Malawi
15:30 – 16:00	**Coffee Break**	
16:00 - 17:30	**Session 5: Adolescents** • The global epidemiology of perinatally HIV-infected adolescents • Survival among vertically infected versus horizontally infected adolescents • Comparison to empirical data Faciliated Discussion	Ali Judd, MRC UCL Annette Sohn, TreaAsia / Constantin Yiannoutsos, IeDEA Mary Mahy, UNAIDS
	HIV exposed uninfected / Orphans estimates • Calculations for HEU and Orphan estimates • Faciliated Discussion	John Stover, Avenir Health Renaud Becquet, INSPIRE
17:30 –18:00	Discussion and next steps • Adjustments for Spectrum • Research required	Tim Hallett, UNAIDS Reference Group

Day 2, Friday 20th October 2017

TIME	AGENDA ITEM	Presenter/Moderator
	Chair: George Siberry (OGAC)	
8:30 – 9:00	Summary of the outcomes of the previous meeting	Martina Penazzato, WHO
9:00 – 10:30	**Session 1: Updates on ongoing efforts to improve quantification, forecasting and assessment of demand** • UNAIDS/WHO • CEPAC/IeDEA • CIPHER • CHAI • MPP • DNDi Facilitated discussion	John Stover, Avenir Health Andrea Ciaranello, CEPAC Jeannie Collins, MRC UCL Vineet Prabhu, CHAI Fernando Pascual, MPP Janice Lee, DNDi Boniface Dongmo Nguimfack, WHO
10:30 – 11:00	**Coffee Break**	
11:00 – 12:45	**Session 2: Facilitated discussion to input development of the paedaitric** • Model structure • Data inputs • Clinical and programmatic scenarios • In country validation and implementation Facilitated discussion	Andrea Ciaranello Martina Penazzato, WHO
12:45- 13:00	**Wrap up and next steps** • Adjustments to Spectrum • Research required	Mary Mahy, UNAIDS Martina Penazzato, WHO