Instructions for using the Naomi model
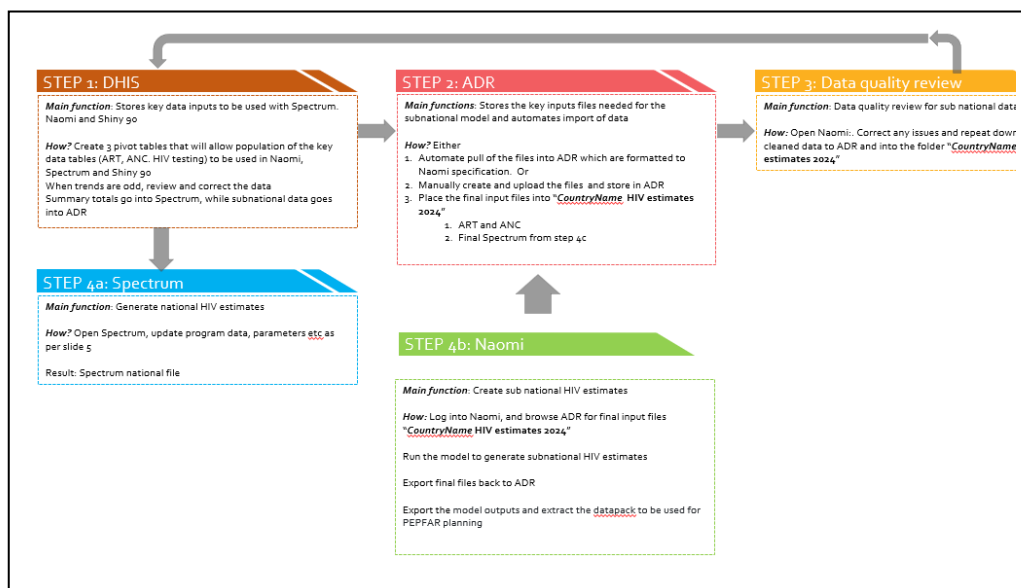
V2.9

29th January 2024

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Data preparation

Prior to using the Naomi Model

The generation of subnational estimates using Naomi is one of the last steps in the process of HIV estimation. Ensure that you have a finalised Spectrum file, as well as validated your subnational program data (numbers on ART and ANC prevalence). If you use DHIS, the generation of the ART and ANC program data can be automated through the AIDS Data Repository (review training presentations). If you do not use DHIS or do not want to automate the process through ADR please compile the data as per the Naomi specifications. The templates with the indicator definitions and required specifications are available here https://adr.unaids.org/en/pages/inputs-unaids .

Populate your Input Data Package in ADR for your 2024 estimates.

- There are 4 required input files used in the Naomi model:
    1. **Geojson:** Defines boundaries of your national and subnational geographical areas.
    2. **Population**: By five-year age groups and sex and district.
    3. **Survey:** Prevalence from your population-based survey and if available, incidence and ART coverage.
    4. **Updated Spectrum AIM file:** Countries with subnational Spectrum files need to use the tool in Spectrum to create a 1 zip file for Naomi. (Tools>More tools>Naomi district estimates tool>Generate district results>add the subnational Spectrum files and click open. It will create a zip file in the same folder as your final Spectrum files. Upload this file into ADR.

- And 3 optional input files:

    5. **ART programme data:** Number receiving treatment Men, women, children.
    6. **ANC programme data:** HIV prevalence, ART coverage among pregnant women.
    7. **DMPPT2 VMMC coverage outputs:** Output from the DMPPT2 tool. Naomi uses this to add VMMC coverage into the datapack output.

- A prepopulated folder called "*Country Name HIV Estimates 2024*" within your ADR country page containing items 1-3 has been created for you. You will need to add in files 4-7 above (your final Spectrum file, your program data and your DMPPT2 outputs).

- We strongly recommend that once this package is created you use the input time series visualisations to review and ensure the quality and consistency of the ANC and ART data (review training presentations). Make any improvements to the ANC or ART data based on your review.

STEP 1: DHIS	STEP 2: ADR	STEP 3: Data quality review

Main function: Stores key data inputs to be used with Spectrum. Naomi and Shiny 90
 	
How? Create 3 pivot tables that will allow population of the key data tables (ART, ANC. HIV testing) to be used in Naomi, Spectrum and Shiny 90
When trends are odd, review and correct the data
Summary totals go into Spectrum, while subnational data goes into ADR
	Main functions: Stores the key inputs files needed for the subnational model and automates import of data
	
	How? Either
	1. Automate pull of the files into ADR which are formatted to Naomi specification. Or
	2. Manually create and upload the files and store in ADR
	3. Place the final input files into "*CountryName* HIV estimates 2024"
	    1. ART and ANC
	    2. Final Spectrum from step 4c
		Main function: Data quality review for sub national data
		
		How: Open Naomi:. Correct any issues and repeat down cleaned data to ADR and into the folder "*CountryName* estimates 2024"

STEP 4a: Spectrum	STEP 4b: Naomi
Main function: Generate national HIV estimates *How?* Open Spectrum, update program data, parameters etc as per slide 5 Result: Spectrum national file	*Main function*: Create sub national HIV estimates *How:* Log into Naomi, and browse ADR for final input files "*CountryName* HIV estimates 2024" Run the model to generate subnational HIV estimates Export final files back to ADR Export the model outputs and extract the datapack to be used for PEPFAR planning

Running the Naomi Model

Logging in using Single Sign On

Logged in:
- Enables ADR integration
- Project and version saving and sharing

Continue as guest
- Ability to upload datasets, run model, download results.
- No integration with ADR.
- No online management of projects and versions.
- User login recommended to save workflow.
-

To create an account:
- Click 'Sign Up'
- If you cannot log in with your historical details please contact naomi-support@imperial.ac.uk

Creating a project within the Naomi application

Once you are logged into Naomi, you will need to create a **project** or if you had previously created a project then you can load an existing project. Name your **project** and click "Create project" button.

Note you can have **multiple projects.** This is primarily for users that have been granted access to view multiple countries or if a country would like to try different model runs for comparison. On the 'Projects' page, you can see a list of all your projects and manage them.

Step 1: Upload input data

Either upload the 7 country input files manually from your computer or pull your files directly from the ADR in your **HIV estimates 2024 ADR** folder. We strongly recommend the second option as this ensures that everyone on the national HIV estimates team is using the same set of input data. It also allows for a more transparent estimates process and facilitates continuity and a well-documented handover between successive estimation teams. Start by clicking "Select ADR dataset".
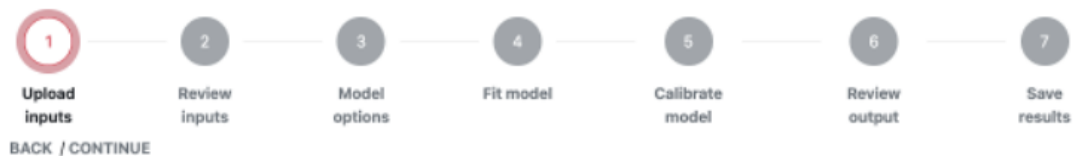
1. Import your dataset using the ADR dataset import function

2. Select data from the country specific **HIV Estimates 2024** data package

3. If required select specific data release, default selection is latest**.**

4. Click 'Import' to import data

5. If imported data passes file validation, you will see a red check mark next to your files.

6. Continue to (2) Review inputs to review imported data prior to model fitting

Once you have imported data from the ADR you will need to go through the following 7 steps. To advance through the steps, click 'Continue'. If "Continue" is greyed out, it indicates that there is a requirement that has not been fulfilled and you will not be able to advance until that is addressed first.
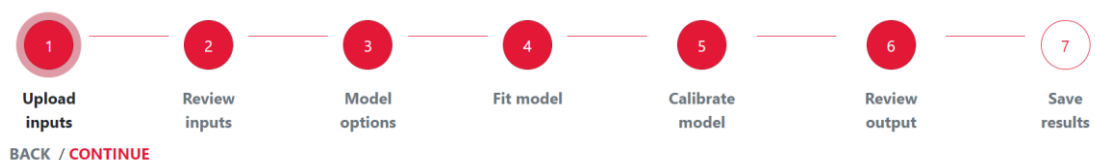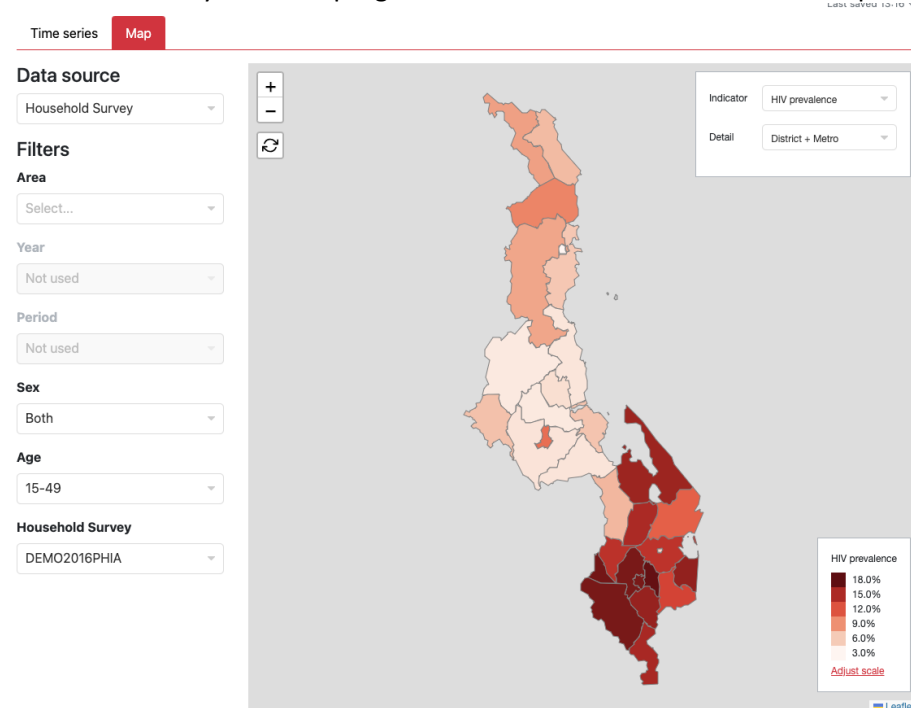
Step 2: Review the input data

You can now review your data. Use the filters on the left-hand side to select the indicator, disaggregates and area of interest.

District level programme data inputs can be reviewed over time:
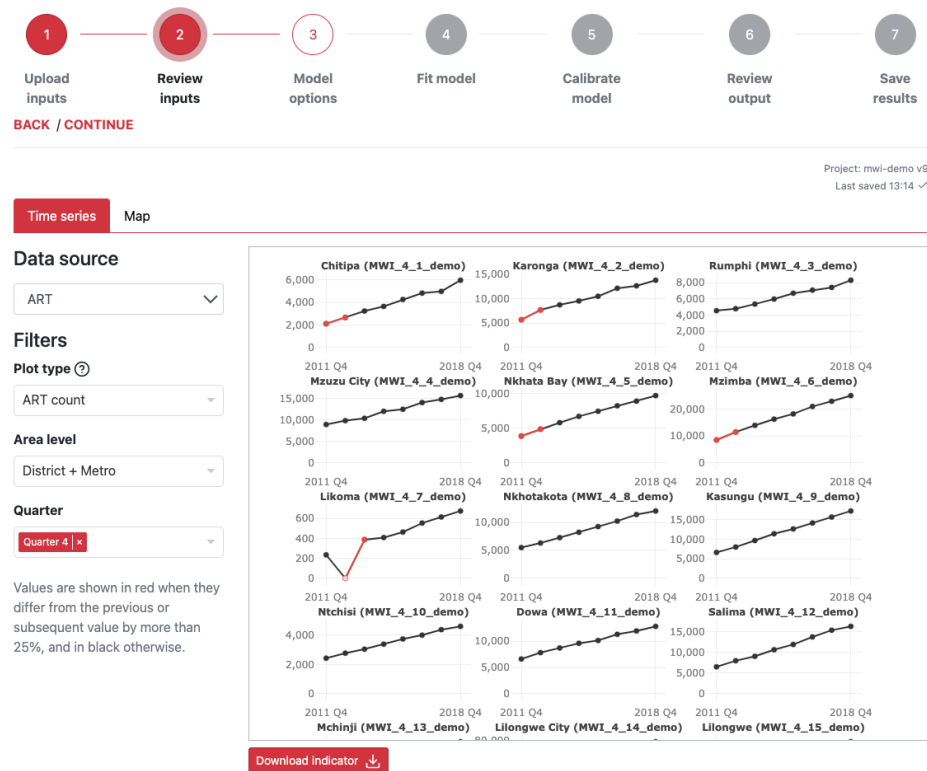
Household survey data and programme data can be reviewed in the Map feature:

Step 3: Model options

Use the following parameters for the Naomi model. These fall into 5 categories.

A. General

- **Area Scope:** Ensure the country is selected.

- **Area level:** Select the lowest level of your geography/area hierarchy for which you have **programme** and **population data.** In this example it is the health district.

- **T2: Calendar quarter to generate estimates:** Select the last quarter of the year for which data are available. As we are generating estimates up to the end of 2021, select "December 2021"

- **T3: Calendar quarter to generate short term projection:** Allows generation of estimates in the future. By default, this is set to September 2023

General	
Select general model options:	
Area scope (required)	Malawi – Demo ×
Area level (required)	Select...
Calendar quarter to generate estimates (required)	December 2023
Calendar quarter to generate short-term projection ⓘ (required)	September 2024

B. Survey

- **Calendar quarter at midpoint of survey:** Use the default which is set to be the midpoint of your most recent population-based survey

- **Prevalence:** Use the default which is your most recent population-based survey

- **ART coverage:** If any population-based survey in your country has measured ART coverage, select the most recent population-based survey.

Survey	
Select which survey to use for each indicator and whether to run the model with survey ART coverage or VLS.	
Calendar quarter at midpoint of survey (required)	June 2020
Prevalence (required)	ZWE2020PHIA ×
ART coverage	ZWE2020PHIA ×

C. ANC

This section allows you to include HIV prevalence from antenatal clinic attendees to inform the subnational estimations. For 'Prevalence Time 1", select the year matching the midpoint of the survey and for "Prevalence Time 2", select the Year you are running your estimate for. Note: If you do not have accurate ANC data at time 1 you can select a more recent year for which you have accurate ANC data. Similarly, incorporate the proportion of ANC clients already on ART. This is used to inform the spatial pattern of ART coverage in the model.

Time 1:   Year of the population-based survey or most recent year for which they have reliable ANC data (in this example it is 2017).

Time 2:   Year of HIV estimates (up to December 2021)).

For each year selected, choose the number of months included in reporting. Ideally this will be a full year reporting (12 months). But for example, if 2020 data are only available for January through September, choose '9' months.

D. ART

Ensure that you include the number of people receiving ART as reported through programmes by indicating yes. The uploaded programme data will be interpolated to align to the quarters selected for the survey midpoint (Time 1) and the quarter to generate estimates (Time 2) selected above.

Note: If you do not have accurate ART data at time 1, we suggest that you leave time 1 blank

Also, in this section we are recommending that you turn on the adjustment for people receiving ART in neighbouring districts (by selecting "Yes").

E. Population calibration options

To ensure that the Spectrum file and the Naomi results are aligned, the Naomi results will be calibrated to match the national results. Ensure you calibrate to the National level. This calibration to Spectrum's population will be completed **before** the model fitting.

F. Advanced: Keep the default advanced options as shown below

- **Awareness of HIV status:** If you uploaded a Spectrum file that did not have a shiny 90 file in it you can run the model but will have to select "No" in order to proceed.

- **Use aggregate survey dataset**: Set to yes if your survey dataset only has prevalence values for the broad 15-49 age group category. This includes Benin, Central African Republic, Equatorial Guinea, Guinea Bissau and Niger.

- **Proportion recently infected:** For this round of estimates please do not use this option. Keep this blank.

- Naomi will not output two additional years of short term-projections for target setting. For the 2024 Estimates process these have been defaulted to September 2025 and September 2026. The admin level at which datapack targets is set is country specific. Please contact Naomi support if the PEPFAR PSNU level is not correct.
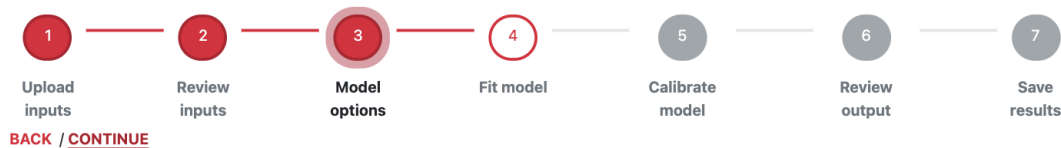

At the end of the page, click "Validate" to validate all the selected options. When everything is validated, you will see a red check mark before proceeding. Click 'Continue' to fit the Naomi model.

Step 4: Fit the model

Click 'Fit the model'. This will take a few minutes up to 30 minutes/1 hour depending on the number of subnational areas and consistency of data.

Step 5: Calibration

Calibrate your Naomi results to your Spectrum file. This is to ensure that the mean aggregate subnational estimates from Naomi are consistent with the national estimates from Spectrum. This should be done for the following four indicators: PLHIV, ART, aware of HIV status and new infections. All of these these indicators should be adjusted to match your Spectrum file at either the national or sub-national Spectrum level with the following age sex stratification: sex and age <15 /15+ years.
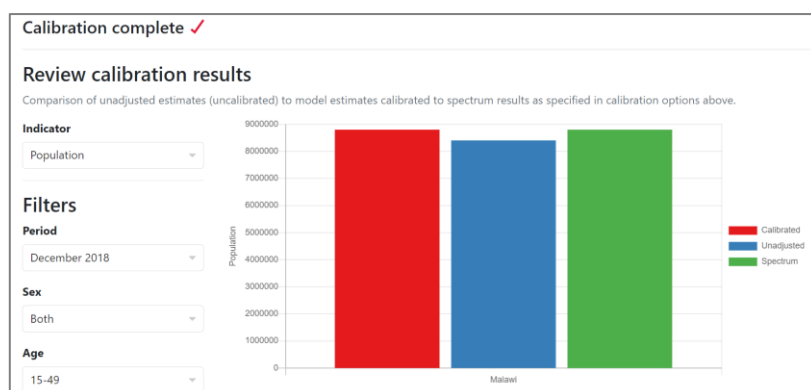

Calibration method: Select logistic as the default calibration method. This will scale estimates of prevalence, ART coverage, proportion unaware, and incidence on the logit scale within each district / sex / age stratum in order to match to Spectrum. This ensures that ART coverage does not go above 100% in any district / sex / age stratification.

Once calibration completed you can review your calibrated estimates alongside your uncalibrated estimates to compare scale of the adjustment to Spectrum totals. This can be viewed for a number of indicators by age and sex disaggregates:

Step 6: Review model outputs

BACK / **CONTINUE**

> ⚠ **Model fit raised the following warning(s)** ✕
>
> - Naomi ART current not equal to Spectrum: 2021 Y000_999 Malawi naomi: 898132 spectrum: 897619; 2020 Y000_999 Malawi naomi: 861810.45724115 spectrum: 862212; 2019 Y000_999 Malawi naomi: 830196.809839962 spectrum: 830098 and 13 more
> - Naomi ANC testing not equal to Spectrum: 2022 Malawi naomi: 615237 spectrum: 584475; 2021 Malawi naomi: 585102 spectrum: 555847; 2020 Malawi naomi: 607319 spectrum: 576953 and 7 more
> - Naomi ANC tested positive not equal to Spectrum: 2022 Malawi naomi: 8044 spectrum: 7641; 2021 Malawi naomi: 9303 spectrum: 8838; 2020 Malawi naomi: 10422 spectrum: 9901 and 7 more
>
> **Show less**
>
> ⚠ **Model calibration raised the following warning(s)**
>
> - HIV prevalence is higher than 50% for: December 2022, Zomba City, Female, 45-49; December 2023, Zomba City, Female, 45-49

You may receive a warning for implausible estimates and should review your data inputs and/or calibration options before proceeding to download final outputs. These might include:

- ART coverage values that are implausibly high or over 100%

- HIV prevalence values that are implausibly high

- Outlying estimates compared to most other districts or to other quarters/years

- Aggregated district level data not summing to totals in Spectrum file
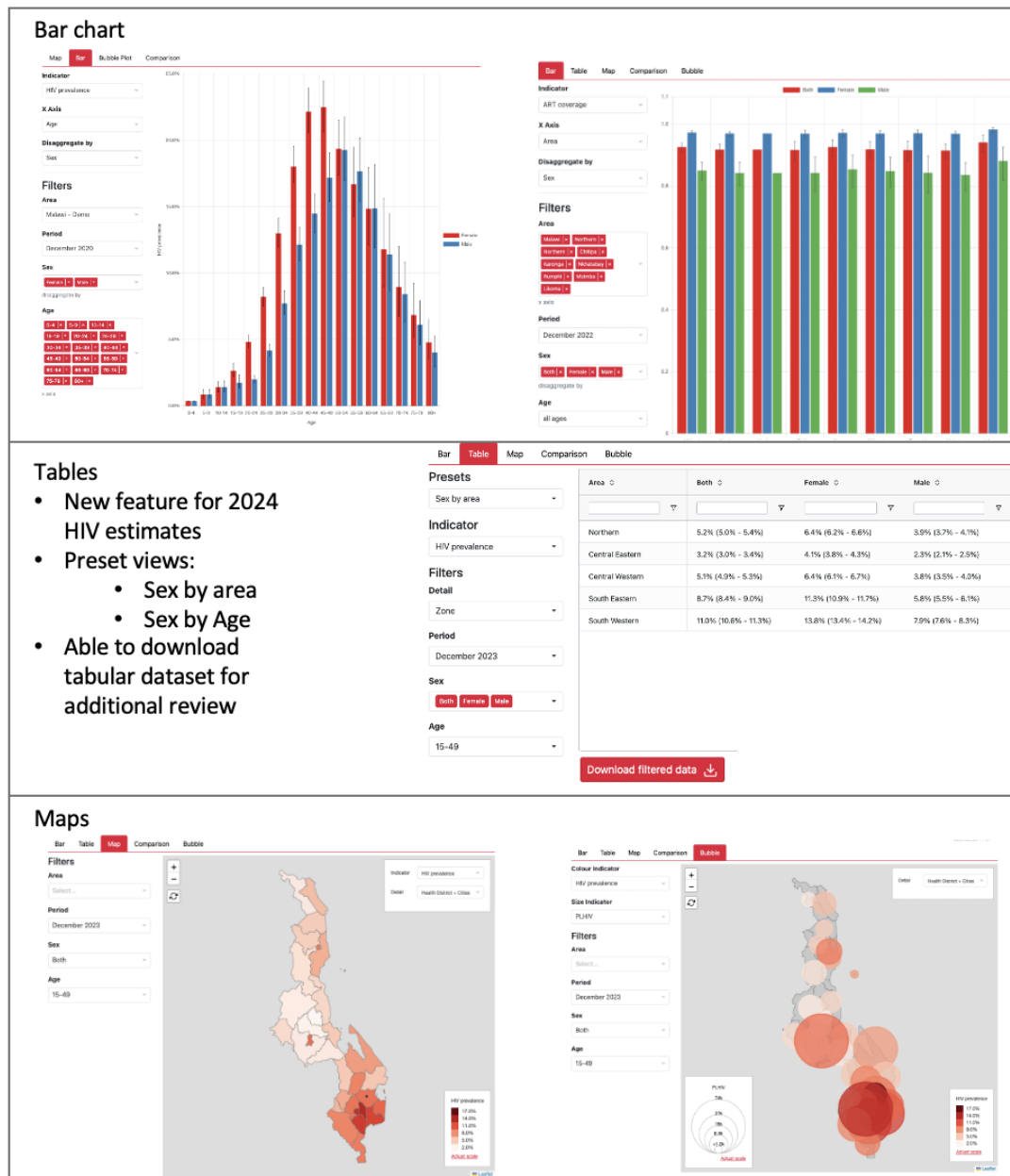
Estimates and data inputs should be reviewed across fine age and sex disaggregates to identify outliers and implausible estimates. It useful to review:

- If there is agreement between the national programme data entered into Spectrum and the subnational programme data entered into Naomi.

- District level population inputs by age and sex. Naomi will apply HIV prevalence and ART coverage estimates to direct district level population inputs. Data quality in issues in the denominator in that calculation may result in inaccurate age and sex estimates of PLHIV.

Naomi estimates can be reviewed as:

- Visualizations: Maps, bar charts and bubble charts
- Tabular results: Estimates and Cis - sortable and searchable

These are available for all indicators, area levels, time points and age/sex stratifications.

Naomi estimates can additionally be reviewed alongside model inputs including household survey and programme data inputs:
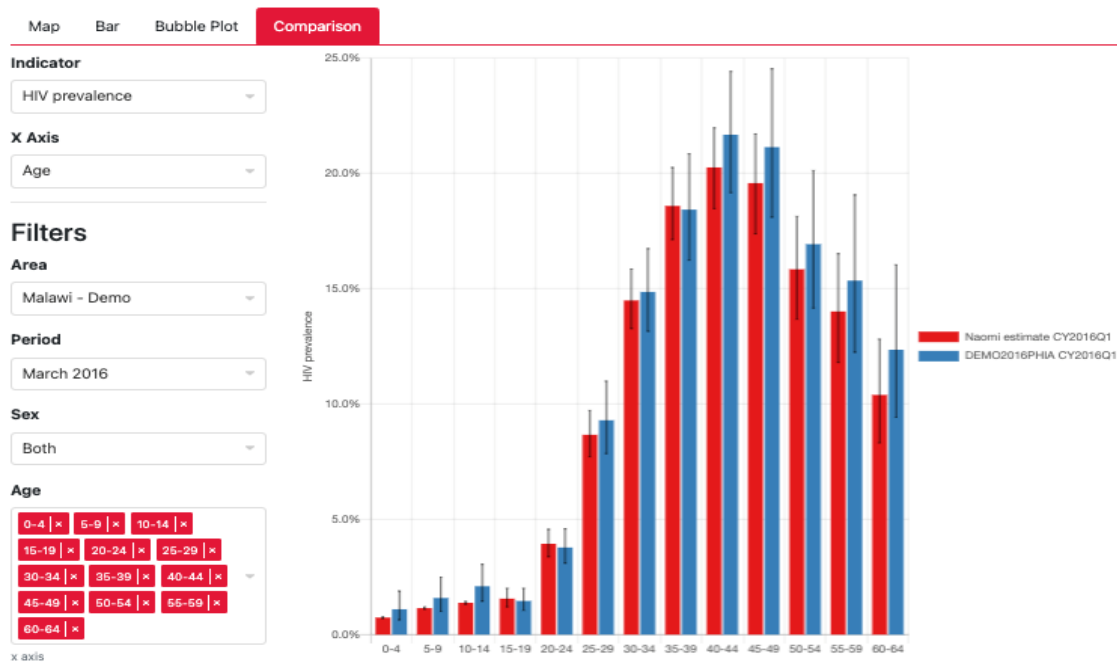
HIV prevalence and ART coverage: compares household survey estimates to model estimates

Available at:

- 5-year age and sex stratifications (unless aggregate survey is used)
- Year at which survey is conducted

ART current: compares programme data input to model estimates

- If ART data is collected at a calendar quarter not in line with model projections, this plot will display the interpolated ART data aligned with model time points
- Available at time periods and age and sex stratifications present in programme data

ANC ART coverage and ANC HIV prevalence age matched: compares ANC programme data to age matched general population Naomi estimates

- Available at time periods and age and sex stratifications present in programme data

Step 7: Download the results

Local download of Naomi outputs:

There are 4 options available for output downloads:

1. **Export model outputs for Spectrum**: Use this option to download a zip file which can then be uploaded into Spectrum and used to create a Data pack. You can also use this file to view the results on a Naomi-Spectrum viewer available at Naomi-Spectrum.unaids.org. This provides some additional viewing options and a table format of the data both at district and province level.
   To obtain the PEPFAR datapack unzip the file and you will find a csv named " ***pepfar_datapack_indicators_2024***"
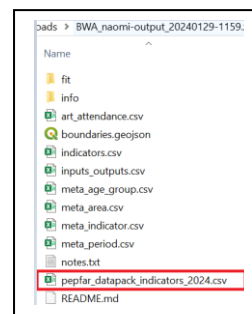
2. **Download coarse age group outputs**: This will produce a similar output zip folder as described above with outputs filtered to include only coarse age group estimates.
3. **Download summary report**. This option provides a summary of your results which you can share with key stakeholders.
4. **Download comparison report**. This option provides a report comparing model estimates with model inputs including household surveys and programme data.

Automatically transfer outputs to the Aids Data Repository:

If you have reviewed your estimates and would like to transfer them to your country specific estimates package on the Aids Data Repository, you may can do so by selecting "**Upload to ADR**":
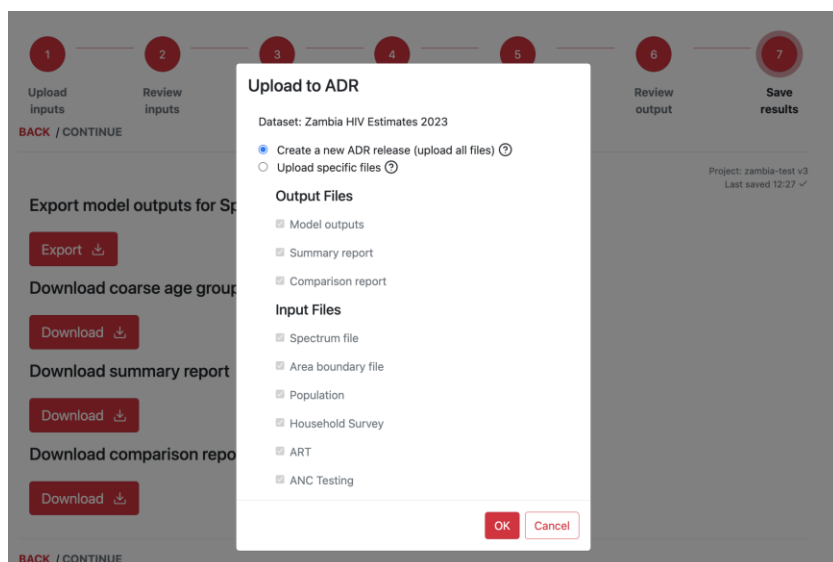
Here you will be given the options to update specific Naomi output files in addition to the data inputs used to generate your estimates

Note: If you encounter any issues using these options, kindly let us know what the issue is and share your project with your facilitator so we can review your model inputs and model run.

Share project

This will create a copy of test for the given users.

Please enter the email addresses you would like to share this project with. Press Enter to add a new address. These email addresses must be already registered with Naomi.

OK Cancel

UNAIDS
20 Avenue Appia
CH-1211 Geneva 27
Switzerland

+41 22 791 3666

unaids.org