Tuberculosis module of the Integrated Health Tool for planning and costing:

Exercises

Training on the Tuberculosis module of the Integrated Health Tool for planning and costing

Last update: February 2025

Note:

The data and screen shots in this document are based on the data for 2023 reported by national TB programmes to WHO. Statistics, numbers and calculations in the exercises may therefore differ from what is shown on the online version of the tool once new data have been uploaded following the next cycles of annual TB data collection.

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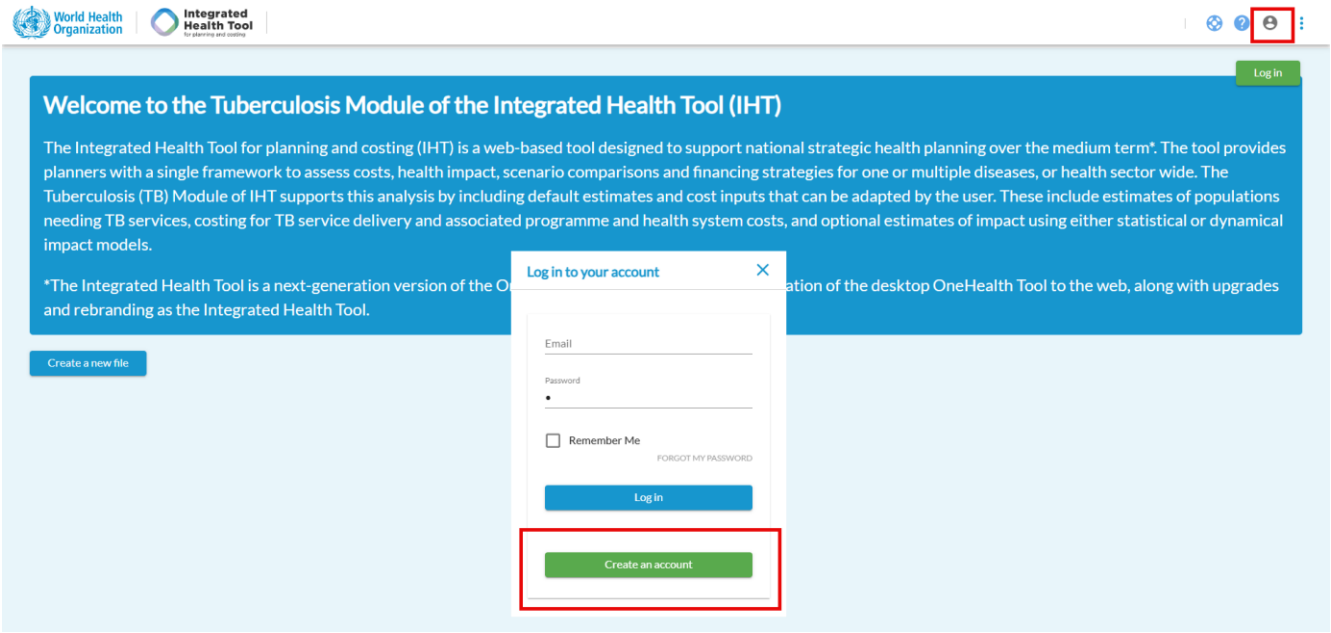
Exercise 0: Setting up an IHT account

To work with the Tuberculosis module of the Integrated Health Tool for planning and costing (TB module of IHT), go to https://tb.integratedhealthtool.org/. This landing page provides the user with the option to set up new files, retrieve existing files, or review files which have been shared with them for review and/or editing.

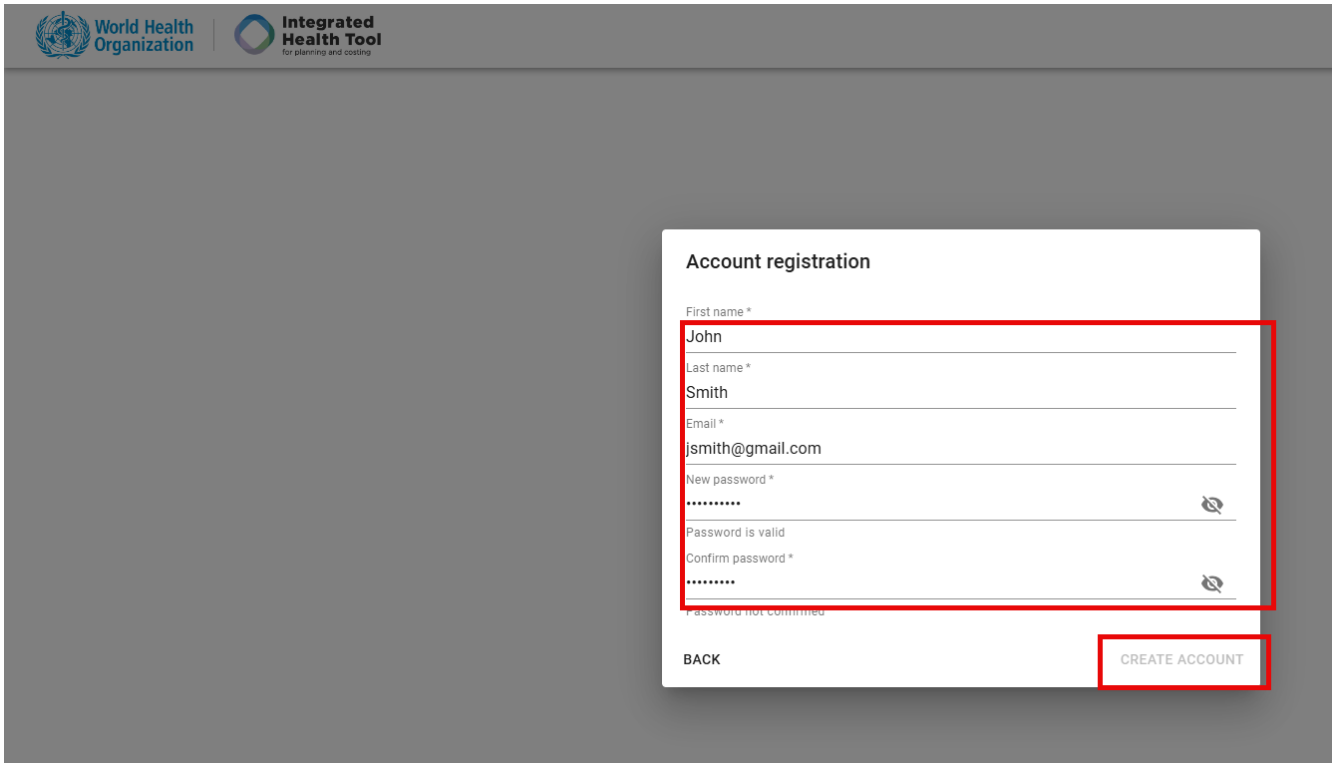
Users can set up a new file or projection as a guest without an account, but if they wish to save files or share with other users, they will need to set up an account. Account credentials will be identical in both IHT and the Tuberculosis module of IHT (meaning that if a user already has an account on one of the sites, they can use that same username and password to access the other).

Steps for account creation:

1. Click on the silhouette icon at the top right to access the account creation (or login) function.

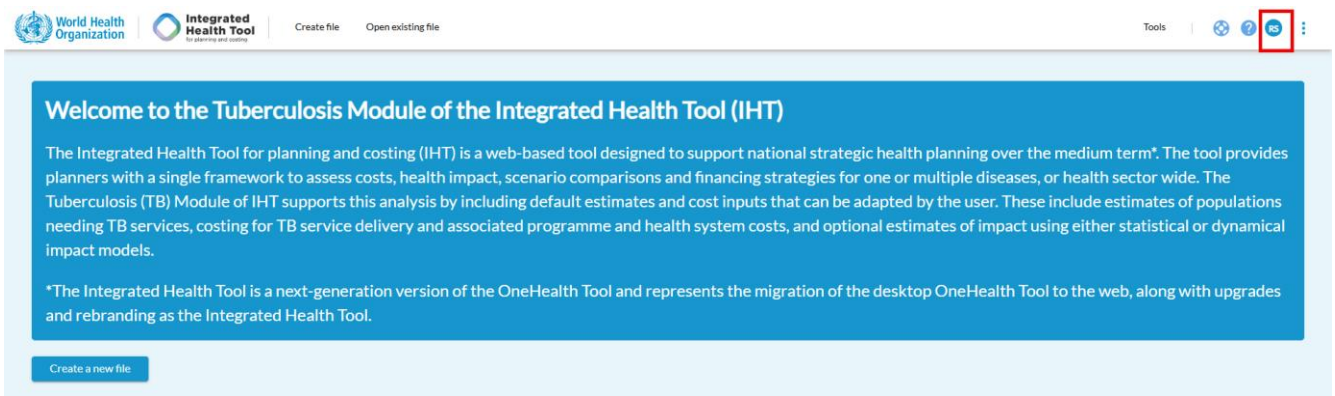


2. To create an account, users are asked to provide their name, email, and a password and click “Create account”.

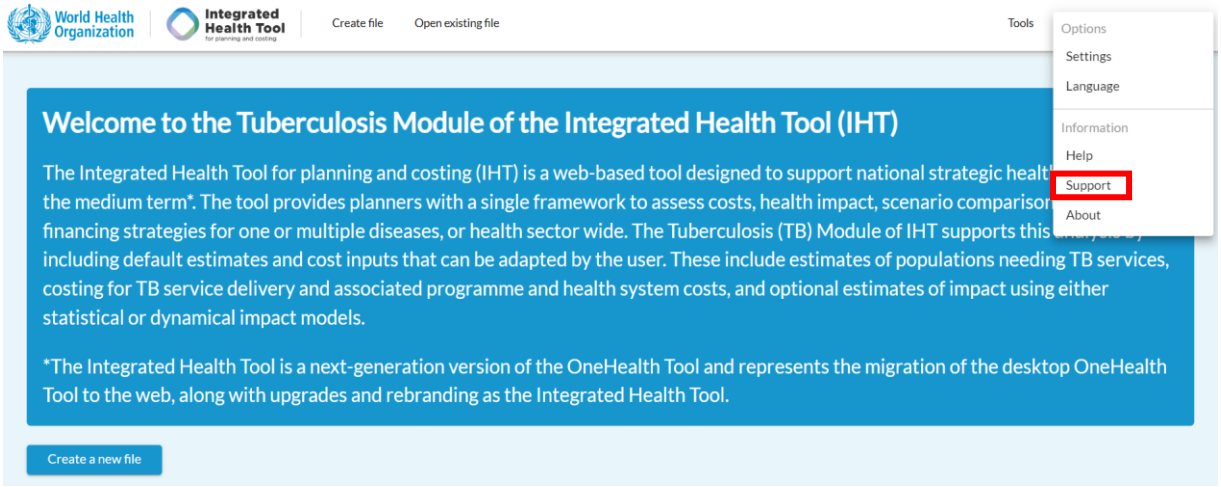


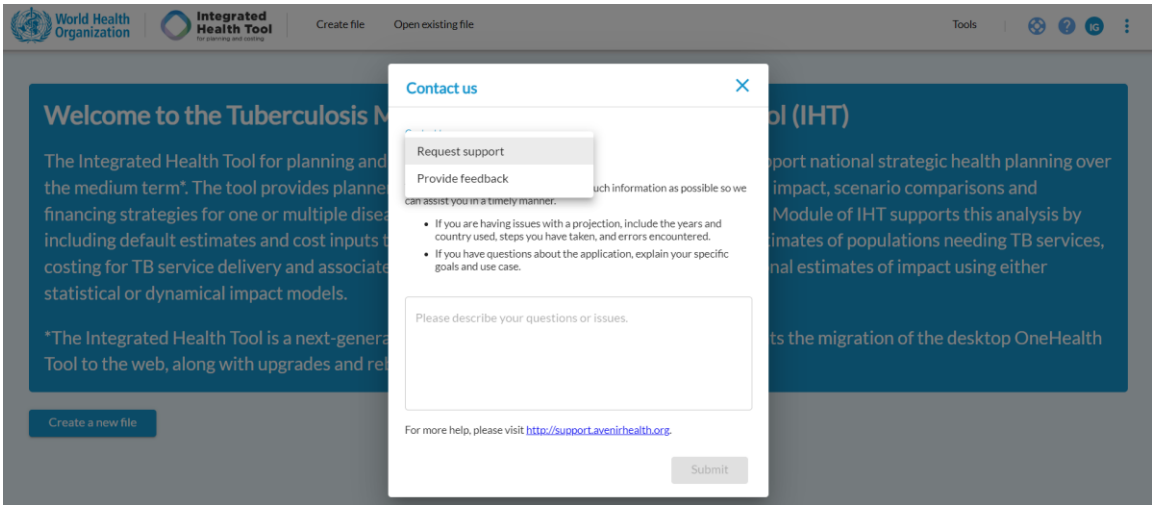
3. Users will receive an email asking for confirmation of the account credentials. This second step is required for account setup and access.

4. Upon confirmation of the account credentials, the user will be able to log into their account using the silhouette icon. Once logged in, their initials will appear in the circle in the top right, indicating successful entry to the account.



5. In case of any problems, click the three dots to the top right, select Support, and enter a support request using the form supplied.



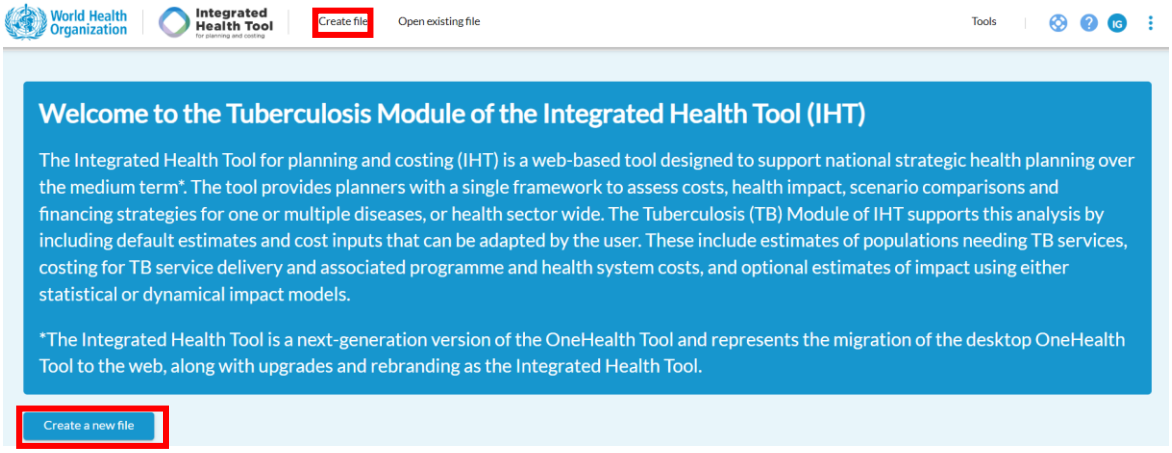


Exercise 1. Starting and configuring a file in the TB module of IHT, and accessing library functions

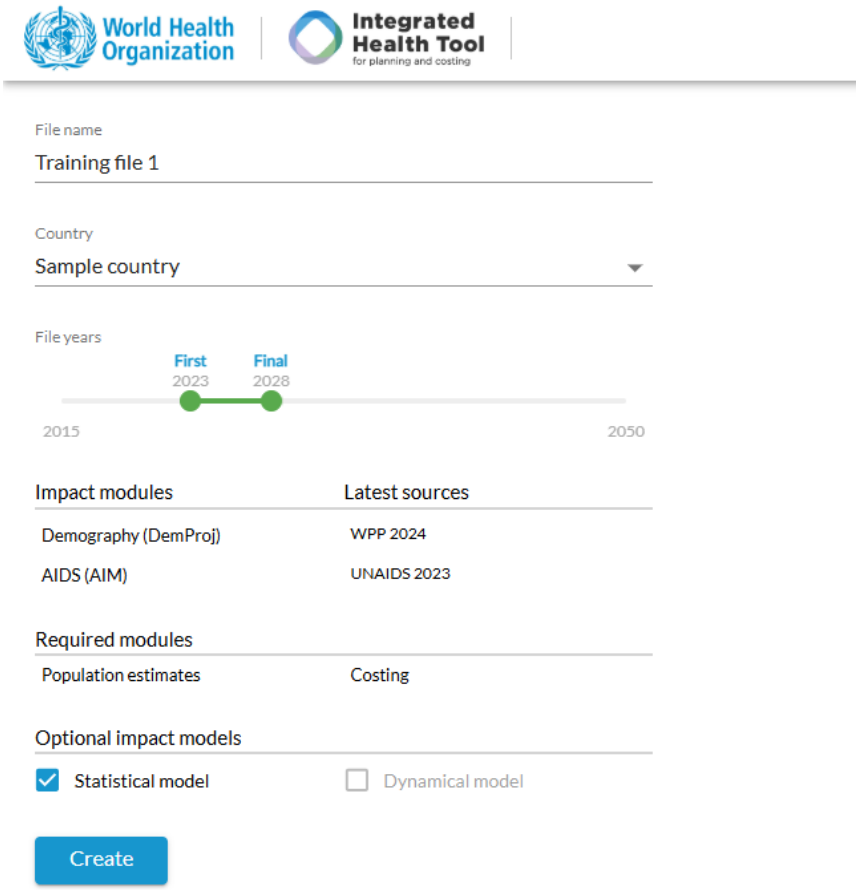
Objectives: This exercise will walk you through the process of starting a new file, configuring interventions, facility and health workforce types, and currency selections. You will also practice sharing and importing files from a colleague.

Task 1: Starting a new file

1. Create a new file using either the "Create a new file" button in the middle of the landing page, or the "Create file" button at the top.



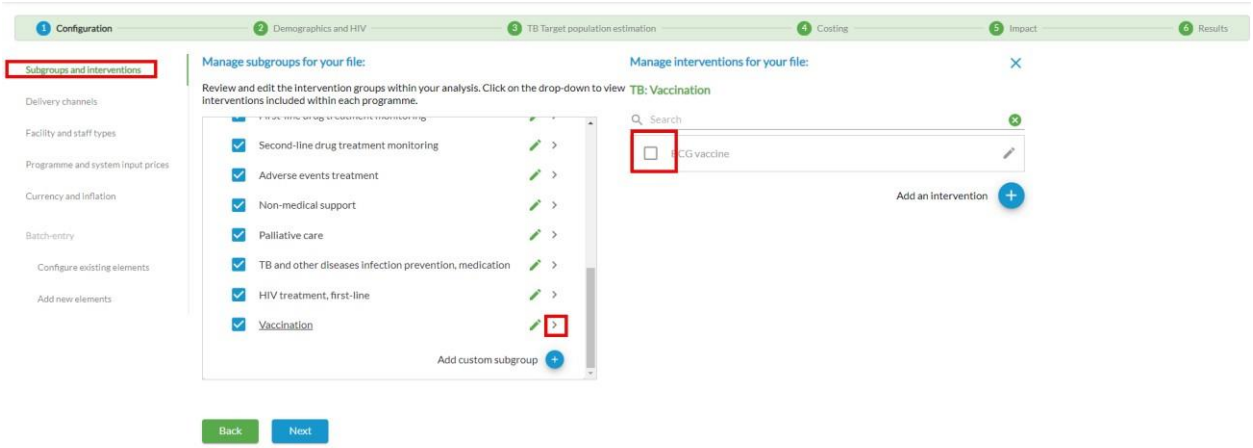
2. Either option will take you to an editor where you can name your file, select your country, designate the years for the file, and select the active modules.
   Call your file "Training File 1," Select "Sample Country" from the dropdown menu, and set it for the years 2023 to 2028. (Hint: the country list is shown in alphabetical order).



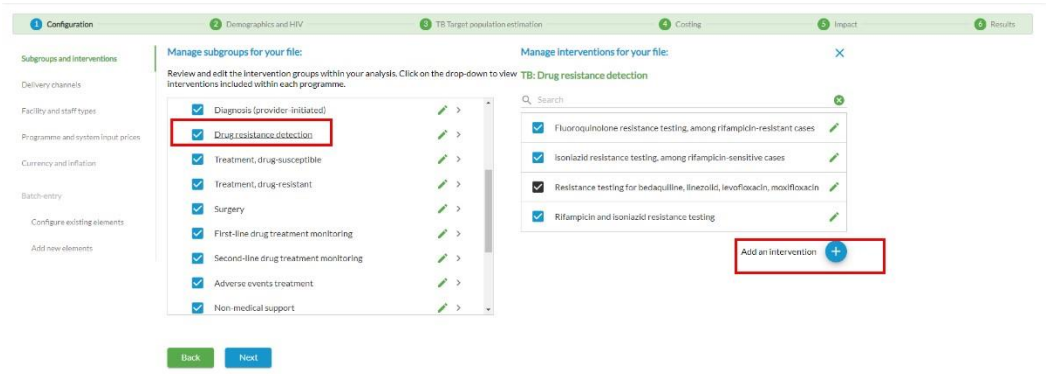
Leave the active modules as per the default selections. Click the blue “Create” button at the bottom of the page.

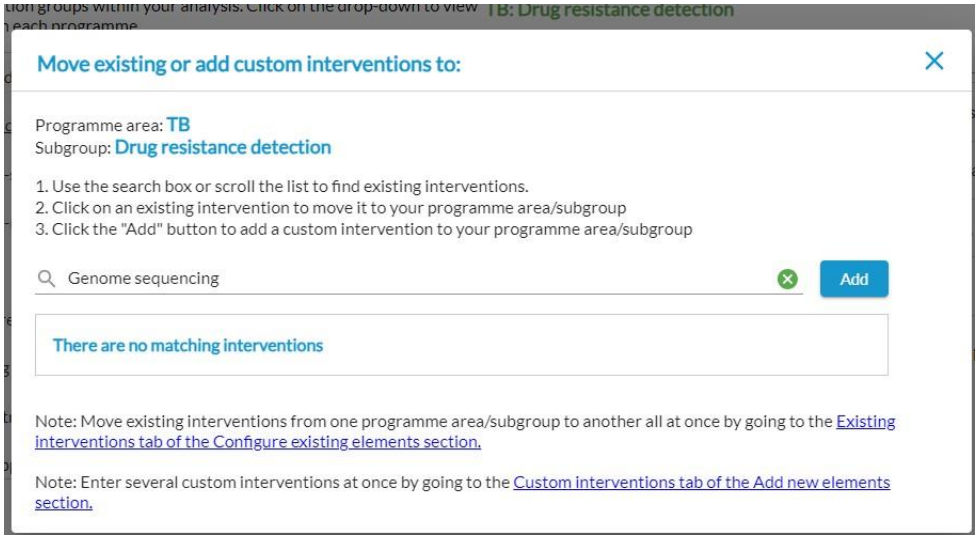
Task 2: Configure your file

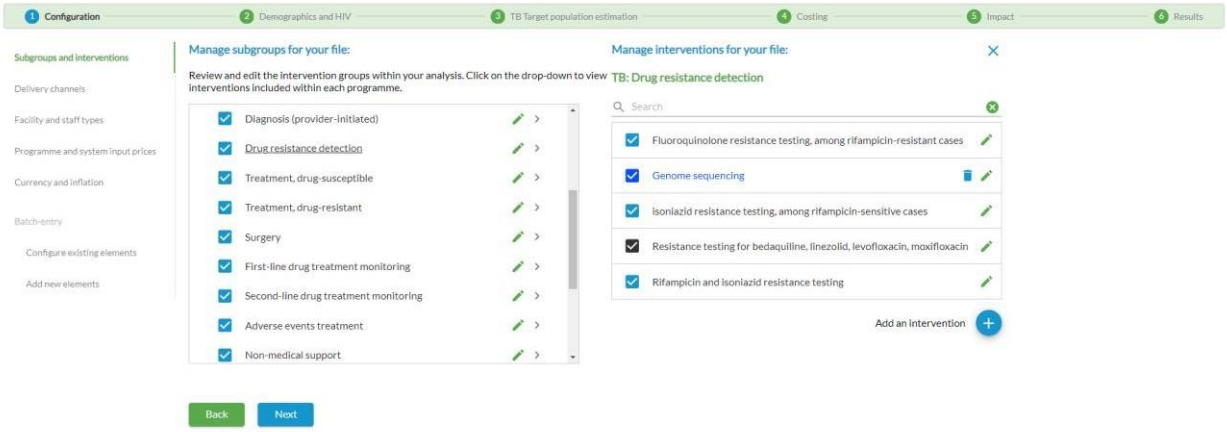
1. **Subgroups and interventions:** Review the existing subgroups and interventions. Identify those which are not relevant for your plan. In this case we will assume that BCG vaccination is not being included in the TB budget, so we can deselect that intervention. To do this, use the arrows in each subgroup to show the interventions, and then uncheck the boxes by those you wish to leave out.



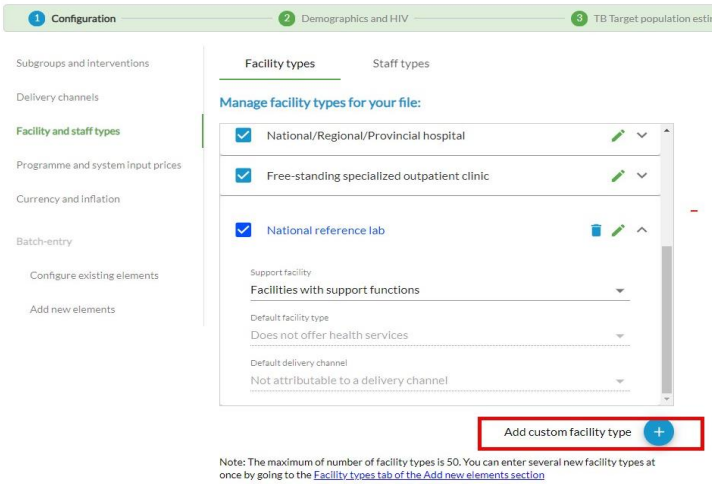
2. We also identify some interventions that are not shown here, which are part of the National Strategic Plan (NSP) for tuberculosis. This includes genome sequencing. In order to capture it, move to the “Drug resistance detection” subgroup and add a new custom intervention called “Genome sequencing.



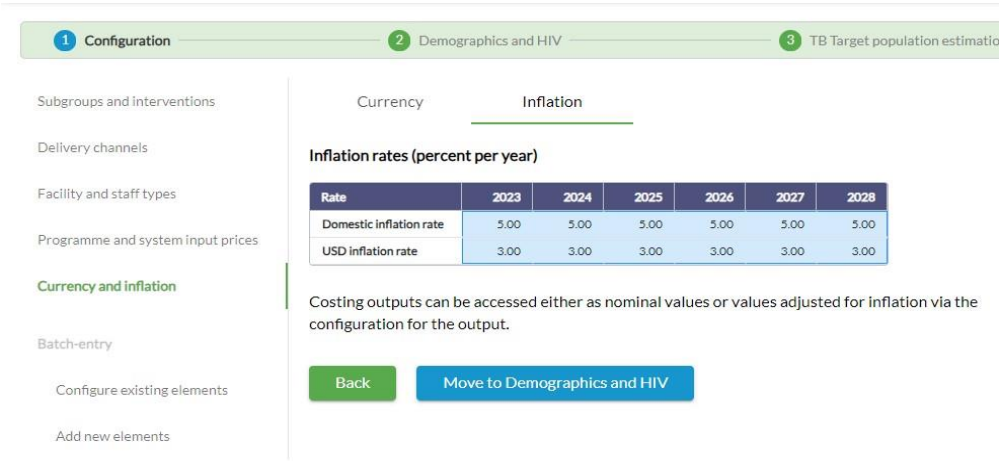




3. **Facility and staff types** show those types of facilities and health workforce that are provided by default in the tool. Add a new facility type (National reference laboratory) and map it as a facility which does not deliver interventions.

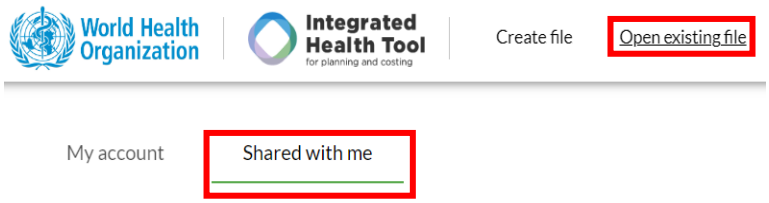


Currency and inflation: Review the exchange rate (leave as is), and set the inflation to 3% for USD and 5% for local currency for all years.

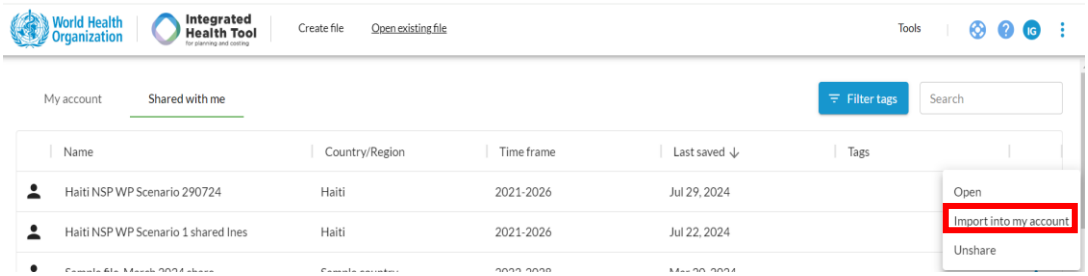


Task 3: Accessing and sharing files

1. Save your work.
2. Navigate to your file library, share your training file with your neighbor as an editable file, and have them share theirs with you.
3. Check to see if the shared files are visible in the Library/Shared with me section.



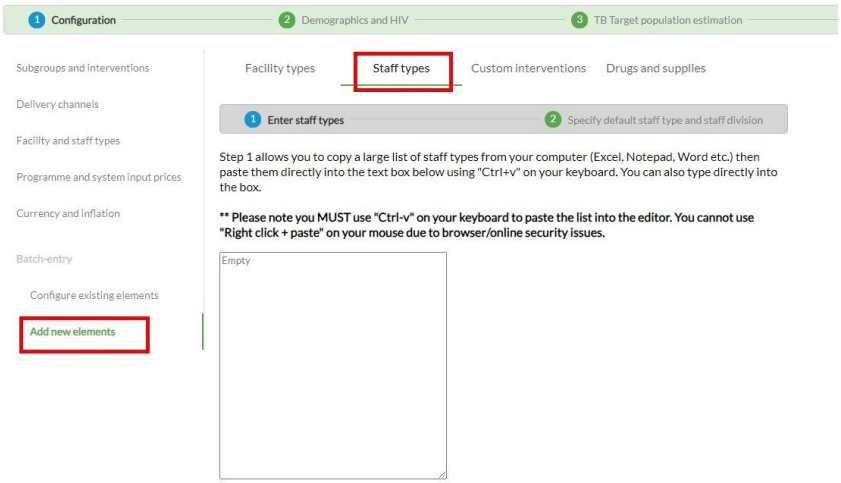
4. Using the three dots to the right of the file name, Import the shared file into your library and give it a new name such as Draft November 18.



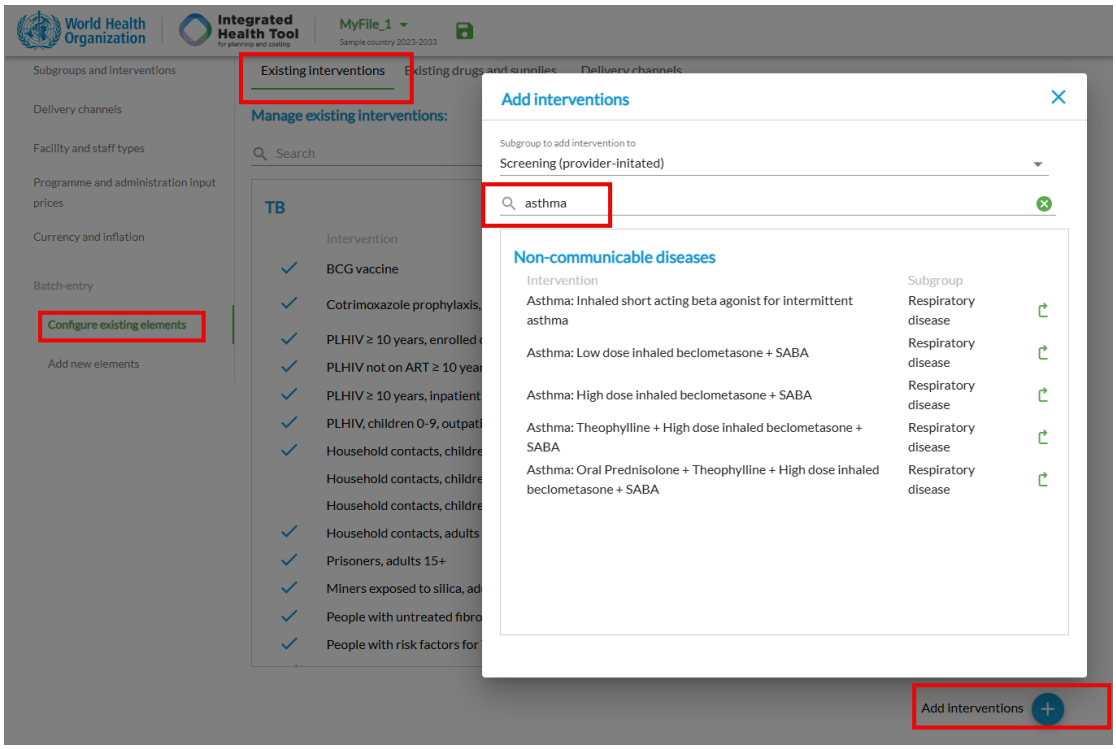
Extra credit:

Use the batch entry function to:

1. Add three new staff types by copy/pasting from Word or Excel (TB CHW, Therapist, Surgical officer).



2. Add an asthma intervention to this file using the option to pull it from the comprehensive IHT interventions.



Quiz

Question 1: How can you add interventions in the TB module of IHT from the comprehensive IHT?

- [ ] Add Custom Intervention
- [ ] Batch Entry/Configure Existing Elements
- [ ] You cannot add interventions from the other health areas of IHT

Question 2: Setting up a country involves registering as an IHT user (select all that apply)

- [ ] Users can explore the tool without setting up an account.
- [ ] It is necessary to first register as an IHT user if you wish to save your work.
- [ ] Users must set up an account in order to access any pieces of the TB module of IHT.

Question 3: True or false: users must use the intervention list as provided by default.

- [ ] True
- [ ] False

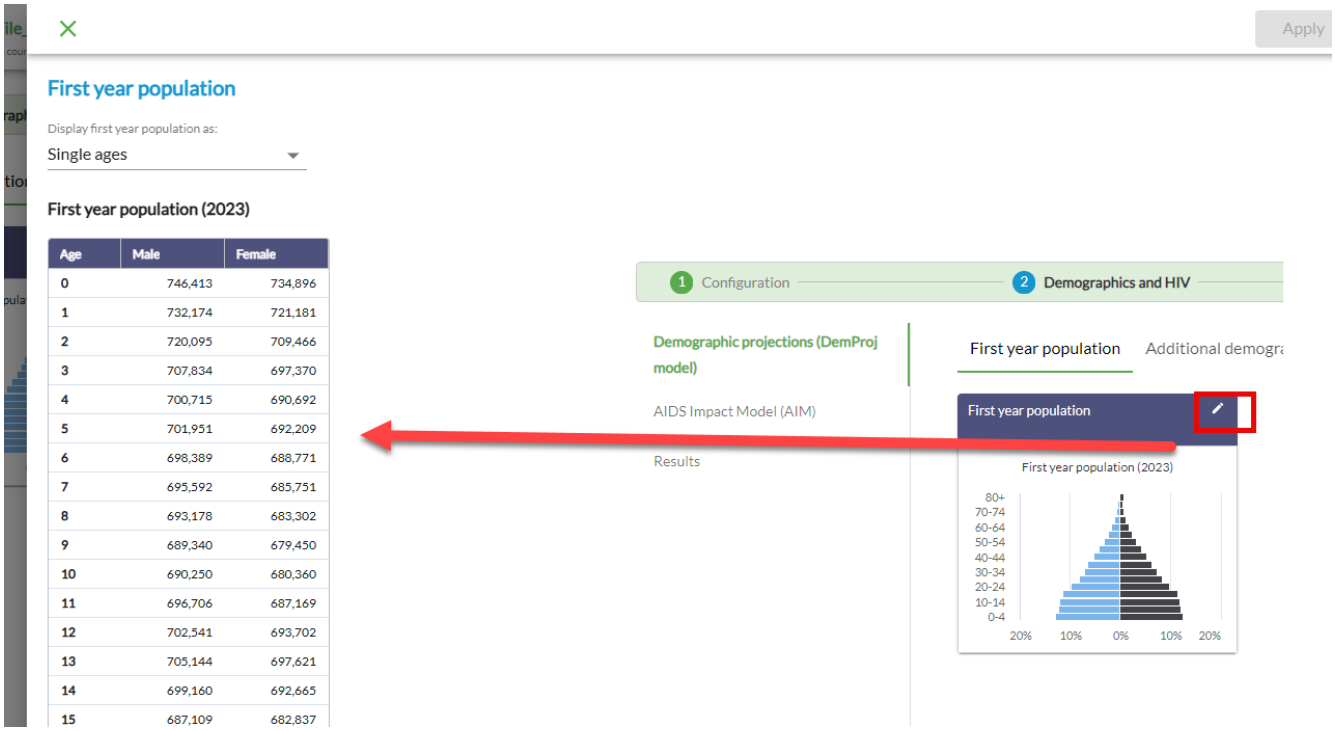
Exercise 2. Demographics and HIV

Objectives: This exercise will guide you on how to review and revise your demographic and HIV projections. After finishing, you should be able to navigate the population and HIV sections, generate results, and revise basic inputs to customize the projections.

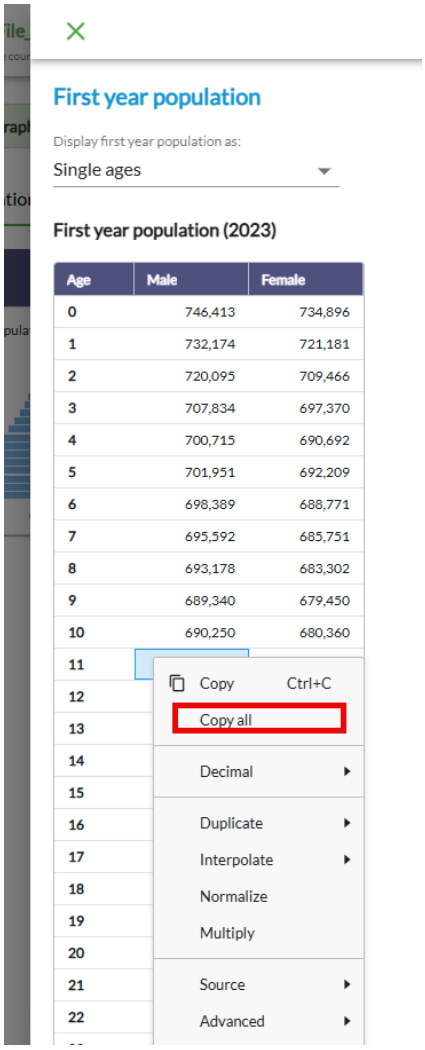
Task 1: Review and revise your demographic projection

1. Move to Step 2. Demographics and HIV.

2. Review the first year population by age and sex, clicking on the pencil to see a table.



3. Imagine that you have consulted with your statistics office, and they inform you that the default population is 3% too low. Copy all (using the five-year age bands) and paste into excel. Multiply the base population by 1.03 for all years and then copy the new figures back into the IHT. This will now form the basis of your demographic projection.

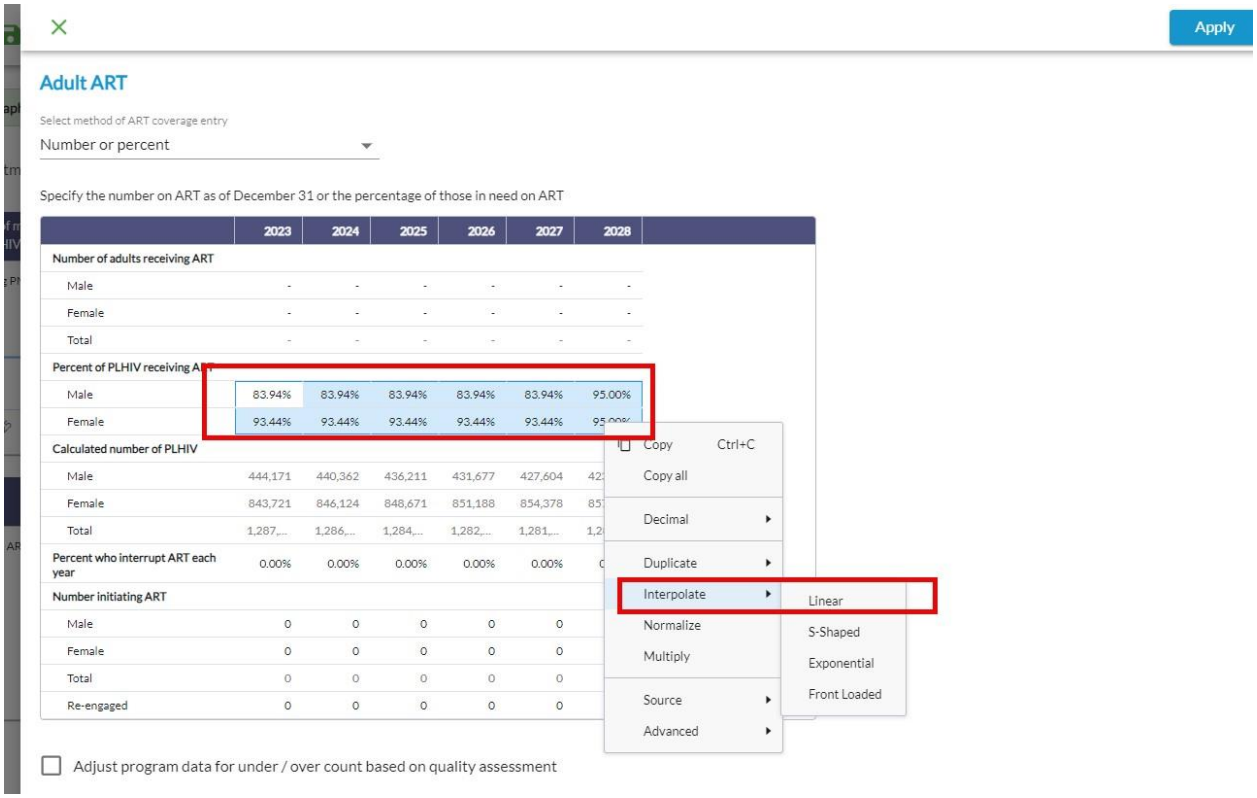


4. Move to Demographics and HIV results, and review your population (navigate to the "Results" option within Demographics and HIV). The population should be around 3% higher than previously shown.

Task 2: Review and revise your HIV projection

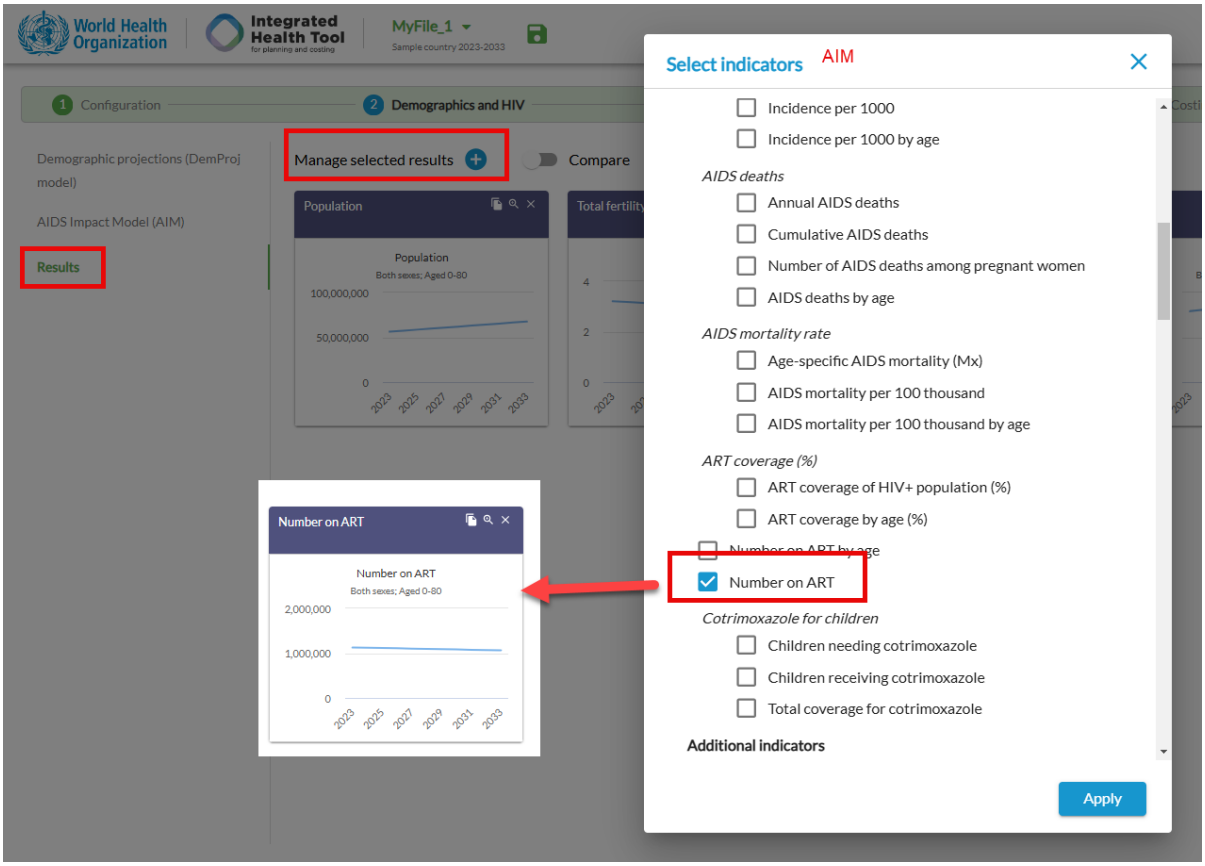
1. Navigate to AIDS Impact Model (AIM) > Program statistics. Note that the coverage rate for Adult ART appears to be flat. Your HIV program colleagues have informed you that they anticipate reaching 95% coverage for ART for men and women by 2028.

2. Click on the pencil to edit coverage in future years for ART. You can enter 95% for both men and women in 2028, and then right click and interpolate between base and final year.



3. Click the blue “Apply” button in the upper right-hand corner.

4. Review demographic and HIV results again. Select the option to manage results and add an AIM result for number on ART.



5. Save your file.

Exercise 3.1 TB Target Population Estimation: provider-initiated screening and diagnosis

Objectives: This exercise will guide you through the process of defining and configuring provider-initiated programs. Once patient populations in provider-initiated programs are defined in terms of their size, the prevalence of TB infection and TB disease within these populations and the types of screening and diagnostic algorithms used to detect TB in these groups, the user will be able to review and evaluate results for the target populations (TPs) associated with costing TB screening & diagnosis, TB treatment and prevention programs in these populations.

The populations in provider-initiated programs, as outlined in (https://screentb.who.int/input), represent populations that are at high-risk of TB disease, and susceptible to benefit from systematic screening and subsequent cascade of care.

Note that the screening algorithms provided for provider-initiated programs are defined for pulmonary TB only and it is assumed that extra-pulmonary TB will be found only (a model approximation to 'predominantly' found) via patient-initiated programs. This approximation is justified by the relatively low proportion of TB patients with extra-pulmonary TB.

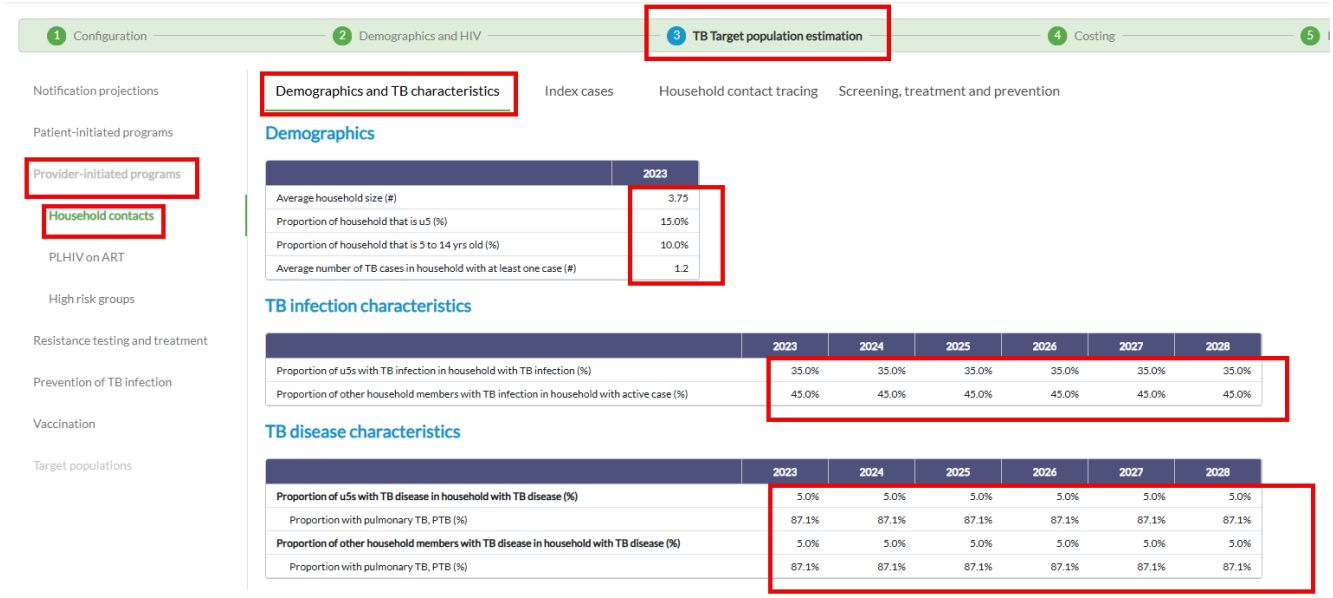
Task 1: Define Households and TB prevalence in the context of Household contacts

1. Move to Step 3. **TB Target populations** > **Household contacts**.
2. Move to tab **Demographics and TB characteristics**.
3. Edit default data that define household demographics in terms of:
    1) household (HH) size (used to estimate the number at risk of TB infection and TB disease),
    2) the proportion of households under the age of 5 years (U5) (used to estimate the number of U5 at risk of TB infection and disease),
    3) the proportion of households aged 5-14 years (O5) (used to estimate the number of 5-14 years olds at risk of TB infection and disease), and
    4) the number TB cases in a household with at least one case of TB.
    5) Default values for 1-3 are obtained from Demographic and Health Surveys (DHS), and an average value is used where DHS is not available. Data for these inputs are readily available from national statistical departments. For the moment, keep these defaults in place.

4. The adjustment factor of 1.2 (for the average number of TB cases in households with at least one case (#) is used to account for the fact that

multiple index cases can originate from one household and the default value of 1.2 comes from systematic review. It can be kept at its default value if countries have no specific data to estimate it.

5. Review the data that define TB infection in U5 and O5 year old populations (used to estimate the number at risk of TB infection). This data come from systematic review (Fox 2017[1]) and should be kept unless country data are available.



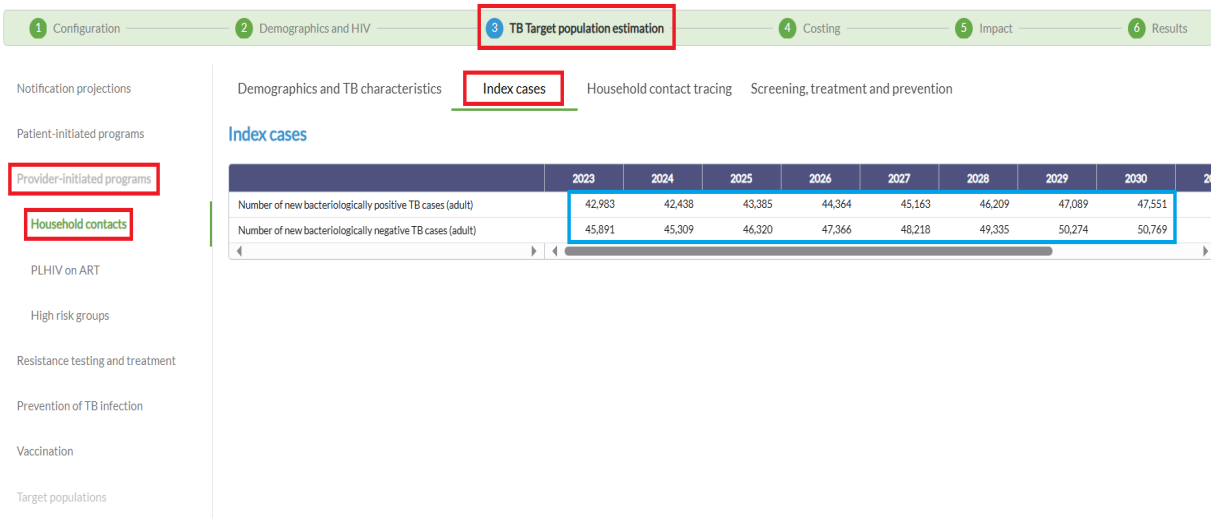
[1] G.J. Fox et al, Preventive therapy for latent tuberculosis infection—the promise and the challenge, International Journal of Infectious Diseases 56 (2017) 68–76

Task 2: Define the number index cases that pose risk to household members

1. Move to tab **Index cases.**
2. Review the **number of new bacteriologically positive TB cases (adults).** The projected/estimated number provided as default comes from the section **Notification projections > Projection** of total TB notifications and the split according to type of patient in the tab **Notification projections > Projection of total TB notification/Define TB case split/distribution**. A further adjustment is made that only adult patients are index cases, as children-to-adult transmission in households is not a common transmission route. Note that contact tracing is recommended (WHO) for 100% of bacteriologically positive index cases.

3. Review the **number of new bacteriologically negative TB cases (adults).** Note that a proportion of adult bacteriologically negative cases are also infectious to others and are treated as index cases in the context of HH contact tracing in some TB programs.

4. Note that these values for Index cases, which are framed in blue, cannot be edited and are calculated from the notification projection inputs to the model.



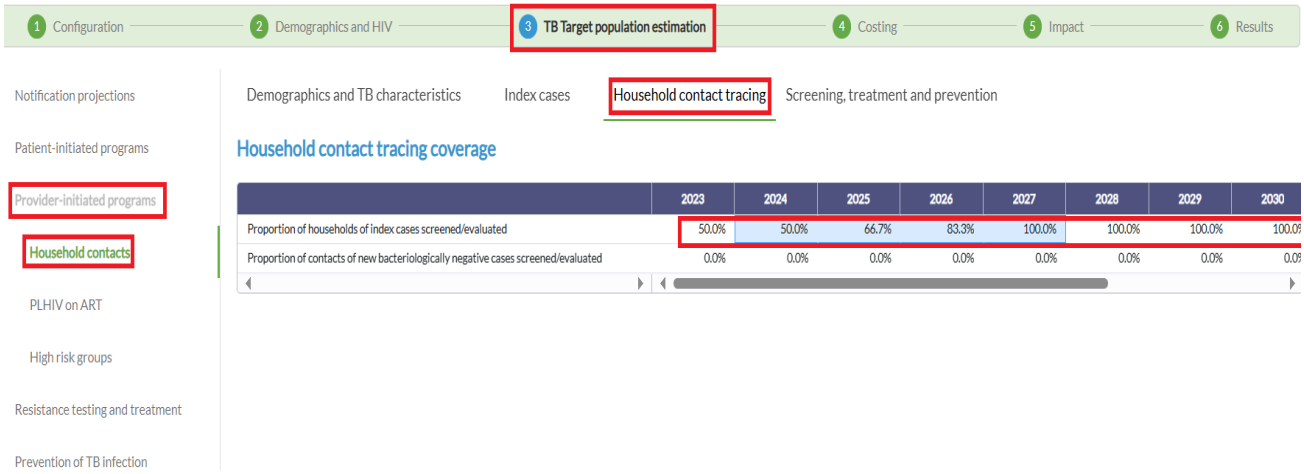
Task 3: Define the household contact program in terms of the proportion of households of index cases are evaluated

1. Move to tab **Household contact tracing**.
2. Edit the **Proportion of households of index cases screened/evaluated**. The user can enter the coverage of households that are screened by year, according to country policy. Typically, HH contact tracing is low at present (baseline) and is expected to increase to universal screening of contacts under current recommendations.

As in the example below, set the **Proportion of households of index cases screened/evaluated** to be increased from 50% in 2024 to 100% in 2027, using a linear scale-up pattern.

3. If contacts of bac-negative cases are also screened according to a country's prevention policy or strategy, then the **Proportion of contacts of new bacteriologically negative cases screened/evaluated** can be edited accordingly.

   As in the example below, set the **Proportion of contacts of new bacteriologically negative cases screened/evaluated** at 0%.



Task 4: For each age group defined for household contacts (0 4, 5-14 and 15+ years), define the care cascade beginning with the screening algorithm.

1. Move to tab **Screening, treatment and prevention**.
2. Step 1 is to provide TB screening inputs to define the screening program. Here the user can enter the proportion of contacts within household reached/screened by the program and screened for active TB disease.

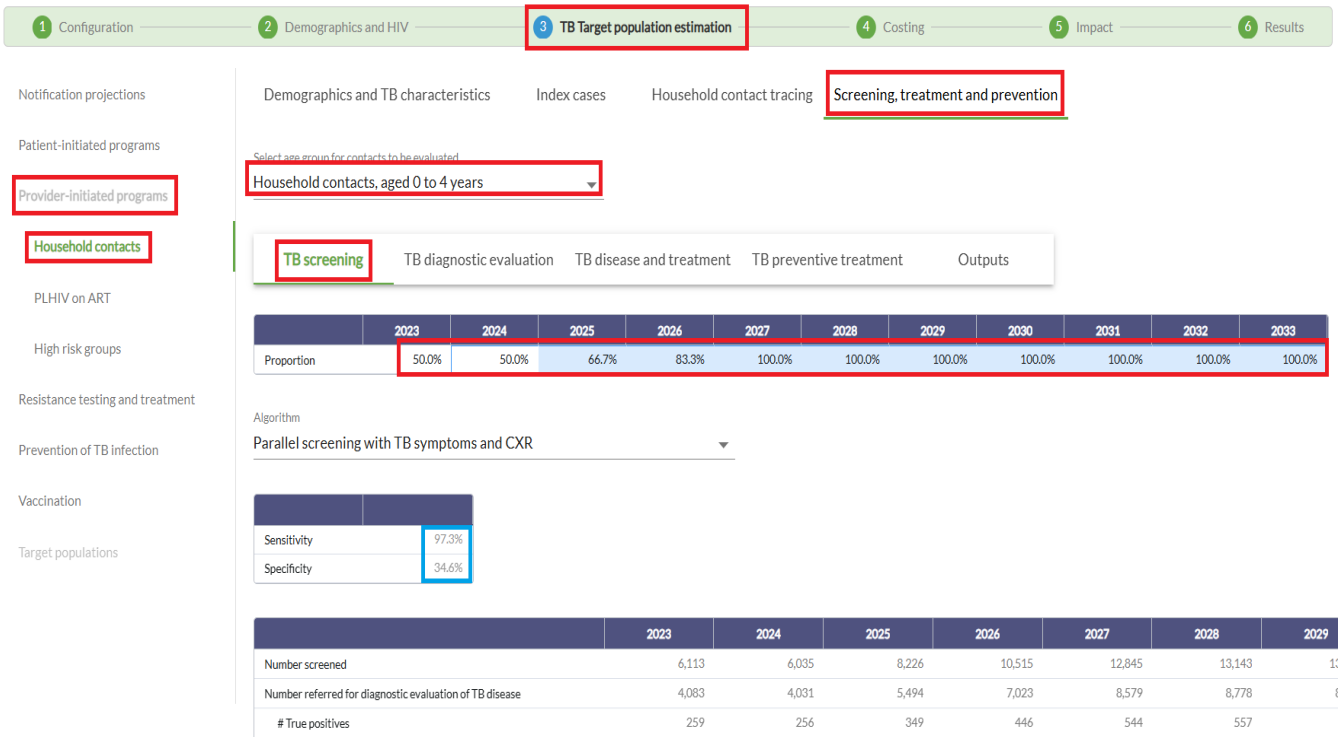
   A list of WHO-recommended screening algorithms is provided by default in "Algorithm" menu. In addition to the screening algorithms listed, the tool also provides flexibility for the user to define custom screening algorithm (by defining step 1 and step 2 where applicable for a chosen algorithm). Each algorithm has an associated and displayed sensitivity and specificity. These values are calculated and grayed out from user editing.

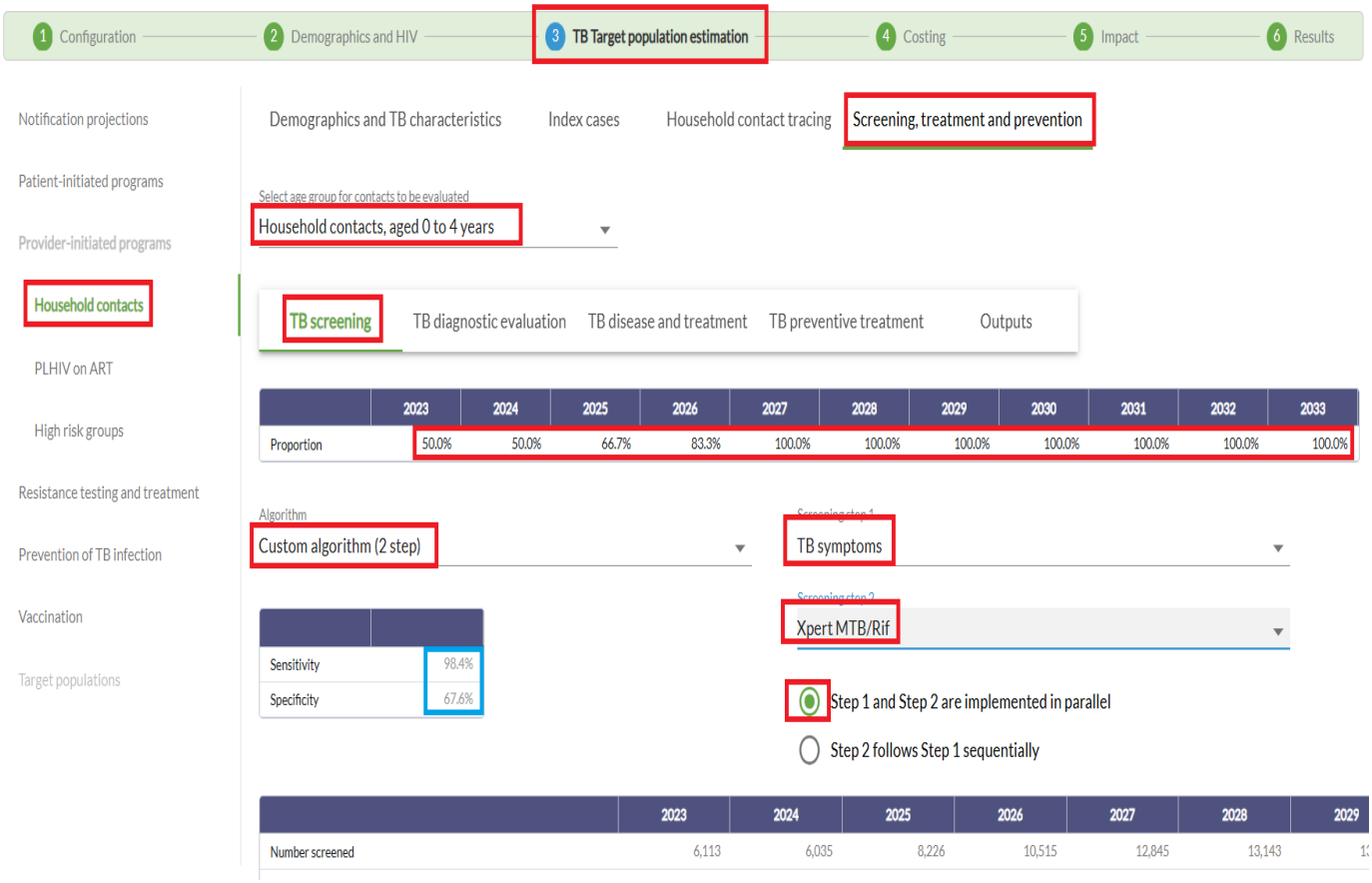
   As in the example below, which shows the configuration of a screening algorithm for 0-4-year-old household contacts, increase screening coverage from 50% in 2024 linearly to 100% by 2027. Do this for all age groups.

The default screening algorithm is used which has a sensitivity of 97.3% and a specificity of 34.6%. These values are framed in blue in the image below and cannot be edited.

Also shown below is the option of creating a custom screening algorithm, allowing the user to select the number screening steps (1 or 2 steps), the tool used in each step from a list of recommended options for each population. If a two-step screening custom algorithm is being configured, the user specifies whether the tools are applied sequentially or in parallel. In the example below, step 1 is symptom-based screening and step 2 screening with Xpert.

3. Review TB screening outputs. Based on the inputs of this editor and on preceding inputs, an estimation is presented (framed in blue below and blocked from editing) of:
    a. Number eligible for screening and diagnosis of TB disease.
    b. The number screened.
    c. The number referred for diagnostic evaluation of TB disease following screening, which comprise those with true and false positive (TP and FP) outcomes following the screening step.
    d. The number of TP cases/patients missed, which can be used to highlight the impact of the lack of perfect sensitivity.
    e. The number needed to be screened refer to one true case of TB disease for diagnostic evaluation (Number needed to screen-NNTS) which is used to summarize the yield of screening for TB disease in this population.
    f. In d and e, note the role of (1-specificity) which determines the number of FPs that go forward to the diagnostic step. Often there is a tradeoff between high sensitivity and high specificity and many algorithms are designed to achieve one but then cannot achieve the other. For example, parallel screening algorithms lead to high sensitivity (to minimize false negativity) and low specific (which has the tradeoff of leading to high numbers of FPs).


1 Configuration
2 Demographics and HIV
3 TB Target population estimation
4 Costing
5 Impact
6 Results
Notification projections
Patient-initiated programs
Provider-initiated programs
Household contacts
PLHIV on ART
High risk groups
Resistance testing and treatment
Prevention of TB infection
Vaccination
Target populations
Demographics and TB characteristics
Index cases
Household contact tracing
Screening, treatment and prevention
Household contacts, aged 0 to 4 years
TB screening
TB diagnostic evaluation
TB disease and treatment
TB preventive treatment
Outputs
2023 2024 2025 2026 2027 2028 2029 2030 2031 2032 2033
Proportion 50.0% 50.0% 66.7% 83.3% 100.0% 100.0% 100.0% 100.0% 100.0% 100.0% 100.0%
Algorithm
Parallel screening with TB symptoms and CXR
Sensitivity 97.3%
Specificity 34.6%
2023 2024 2025 2026 2027 2028 2029
Number screened 6,113 6,035 8,226 10,515 12,845 13,143
Number referred for diagnostic evaluation of TB disease 4,083 4,031 5,494 7,023 8,579 8,778
True positives 259 256 349 446 544 557



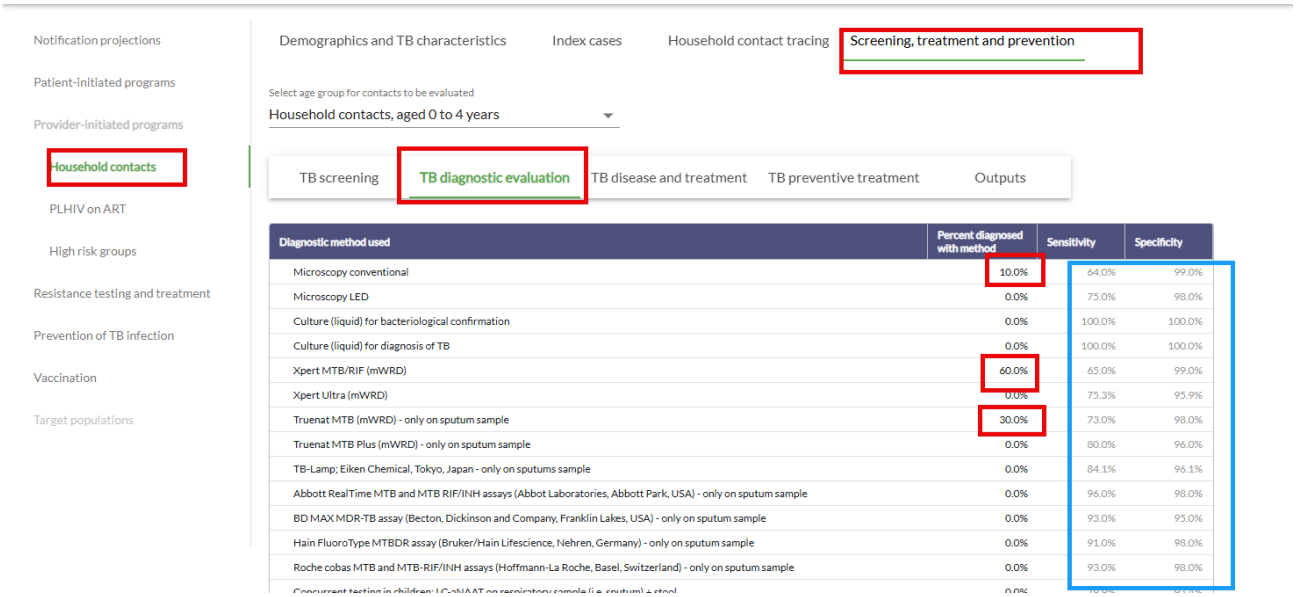
Task 5: For each age group defined for household contacts (0 4 years, 5-14 years and 15+ years), define diagnostic algorithm.

1. Define program for TB diagnostic evaluation. For each population the user can edit the distribution of diagnostic tools that are applied to the screened population that are referred for diagnosis (i.e. the true and false positive outcomes of the screening step). The default data documented shows “Xpert MTB/RIF (Molecular WHO-recommended rapid diagnosis or mWRD)” used for 100% cases, which has a sensitivity and specificity for diagnosing TB disease of 84% and 97% respectively.

   A typical country setup may include a combination of mWRD (e.g. Xpert, Truenat) technologies with a small proportion of patients diagnosed with smear microscopy, to cover situations of operational challenges with mWRD methods.

   As in the example, set diagnostic coverage with Xpert at 60%, Truenat at 30% and smear microscopy at 10% coverage resulting in an overall sensitivity of 79.3% and specificity of 97.1% for the diagnostic algorithm. Do this for all age groups.

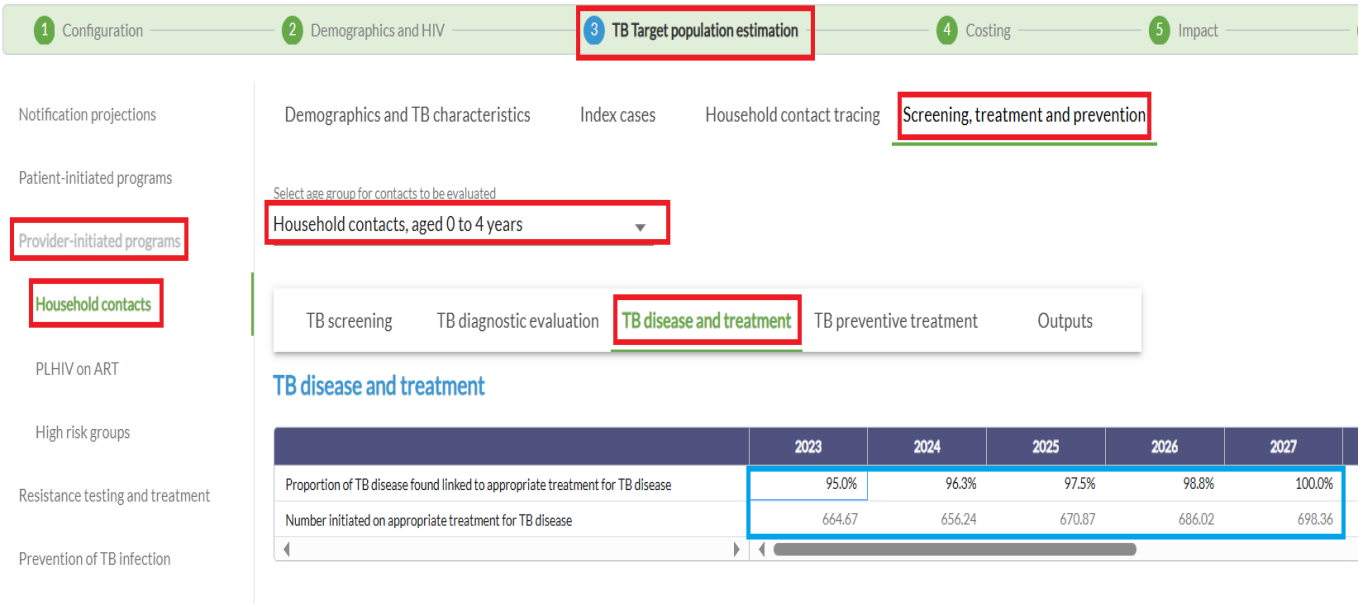
2. Review TB diagnostic outputs. Based on these and on preceding inputs, a projection is presented of:
    a. The number who received a diagnostic evaluation.
    b. The number diagnosed with TB disease, which comprise those with TP and FP outcomes following the diagnostic step.
    c. The number of true positive cases/patients missed, which can be used to highlight the impact of the lack of perfect sensitivity.
    d. The number evaluated (among all screened) to confirm one TB case (also called the number needed to test or NNTT) which is used to summarize the yield of screening and diagnosis for TB in this population.



Task 6: For each age group defined for household contacts (0-4, 5-14 and 15+ years), define treatment initiation.

1. Define linkage to care for TB disease and treatment. For each population the user can edit the proportion of TB patients with a positive diagnostic evaluation outcome that are initiated on treatment. Typically, this proportion is 100% or it is set to become 100% to meet End TB targets.

   As in the example below, set linkage to care to increase linearly from 95% in 2023 to 100% by 2027. Do this for all age groups.



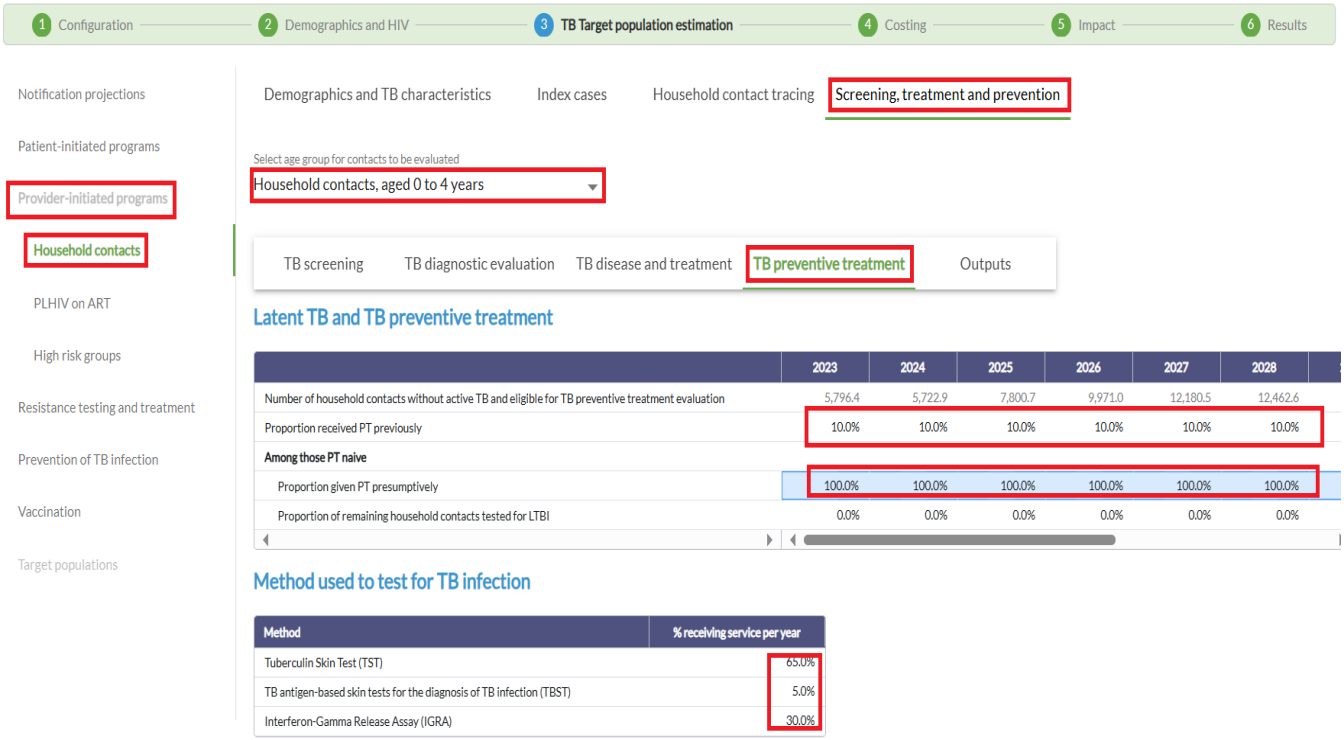
Task 7: For each age group defined for household contacts (0-4, 5-14, 15+ years), define treatment TB prevention.

1. Configure the prevention program by editing the proportion of TPT eligible patients given TB preventive treatment (TPT) presumptively. Typically, those at highest risk of TB disease, like children in households of index cases, are given TPT without testing for TB infection.

    a. Note that TPT eligibility is defined to be those screened and found not to have active TB disease (as per WHO guidelines) and who are naive with respect to preventive treatment. Also, note that to increase the calculated number of people eligible for TPT, screening programs must be increased also.

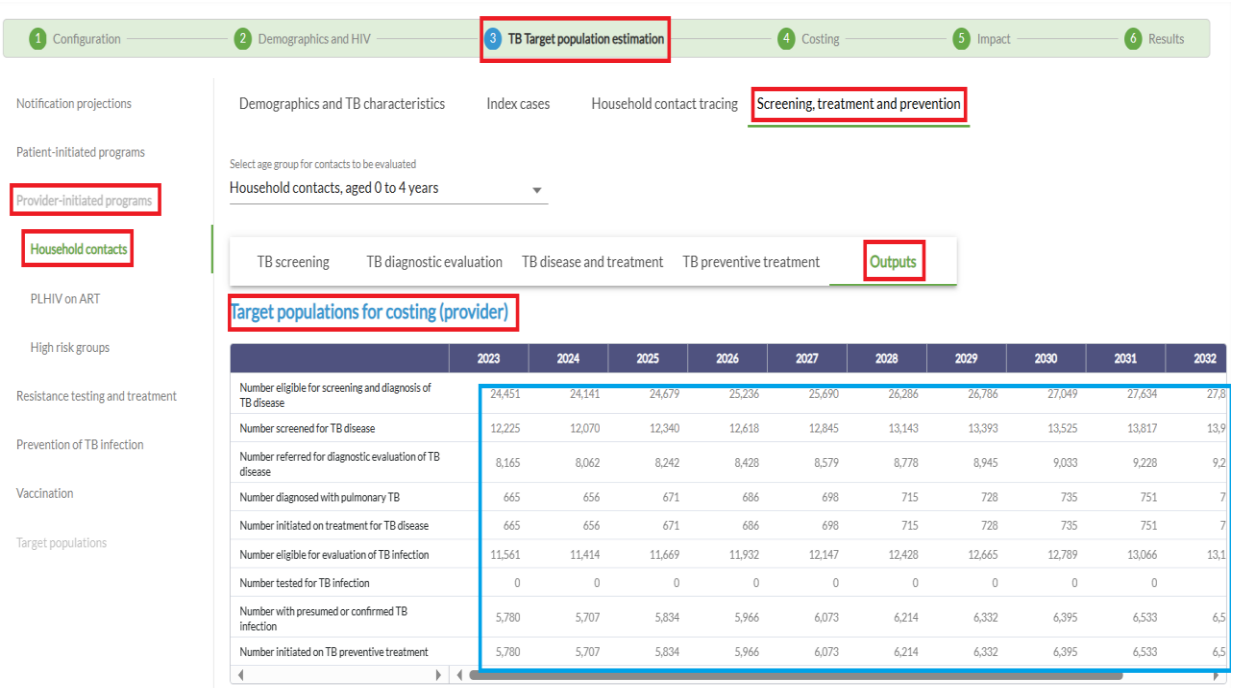
    b. The input defining a proportion of those eligible for TPT but who received TPT previously is used to reduce the TPT eligible population. Note that while those who previously received TPT are excluded from the number eligible for TPT, they are still counted in the number who receive protection against TB disease, and they contribute to impact from TPT.

    c. As in the example below, set the proportion of child contacts who received TPT previously to 10% and set all child contacts under the age of 5 years to be given TPT presumptively. With 100% receiving TPT presumptively, 0% can receive TPT following an LTBI test. Do not replicate this assumption of presumptive TPT for the 5-14 and 15+ age groups as the general recommendation is to test for latent TB in these age groups.
2. Among those not given TPT presumptively, define the proportion of patients given TPT following a test for TB infection.
    a. Note that in a future version of the software, the user will be able to configure a distribution of latent TB infection (LTBI) tests used, so that the total sensitivity and specificity can be applied in cost and impact calculations. For the moment, this is handled via costing and a default mix of latent TB testing tools are provided.
3. Among those eligible for preventive treatment, presumptively or following LTBI testing, state the proportion of patients linked to TPT.
    a. As in the example below, link all eligible for TPT to receive/initiate TPT. Do not replicate this for the 5-14 and 15+ age groups.



Task 8: For each age group defined for household contacts (0-4, 5-14, 15+ years) review and interpret care cascade outputs.

1. Outputs (framed in blue below and not for editing) outlining the cascade comprising screening and diagnosis of active TB disease, to treatment of TB disease, treatment of TB infection (presumptively or following LTBI testing) include:
    a. Number eligible for screening and diagnosis of TB disease
    b. Number screened for TB disease
    c. Number referred for diagnostic evaluation of TB disease
    d. Number diagnosed with pulmonary TB
    e. Number initiated on treatment for TB disease
    f. Number eligible for evaluation of TB infection
    g. Number tested for TB infection
    h. Number with presumed or confirmed TB infection
    i. Number initiated on TB preventive treatment



Task 9: Review remaining patient populations for provider-initiated programs

1. Review population sizes, TB characteristics and screening programs for People living with HIV (PLHIV) on Anti-retroviral treatment (ART). The volumes of patients that are reachable by this program come from the HIV component (2. Demographics and HIV) and the volumes can be changed within the HIV component of IHT. For the purposes of the Tuberculosis module of IHT, these populations are defined by age group and each age group by severity of HIV disease.
    a. Children living with HIV (CLHIV), 0 to 9 years
    b. CLHIV, 10 to 14 years
    c. PLHIV, 15 years and older

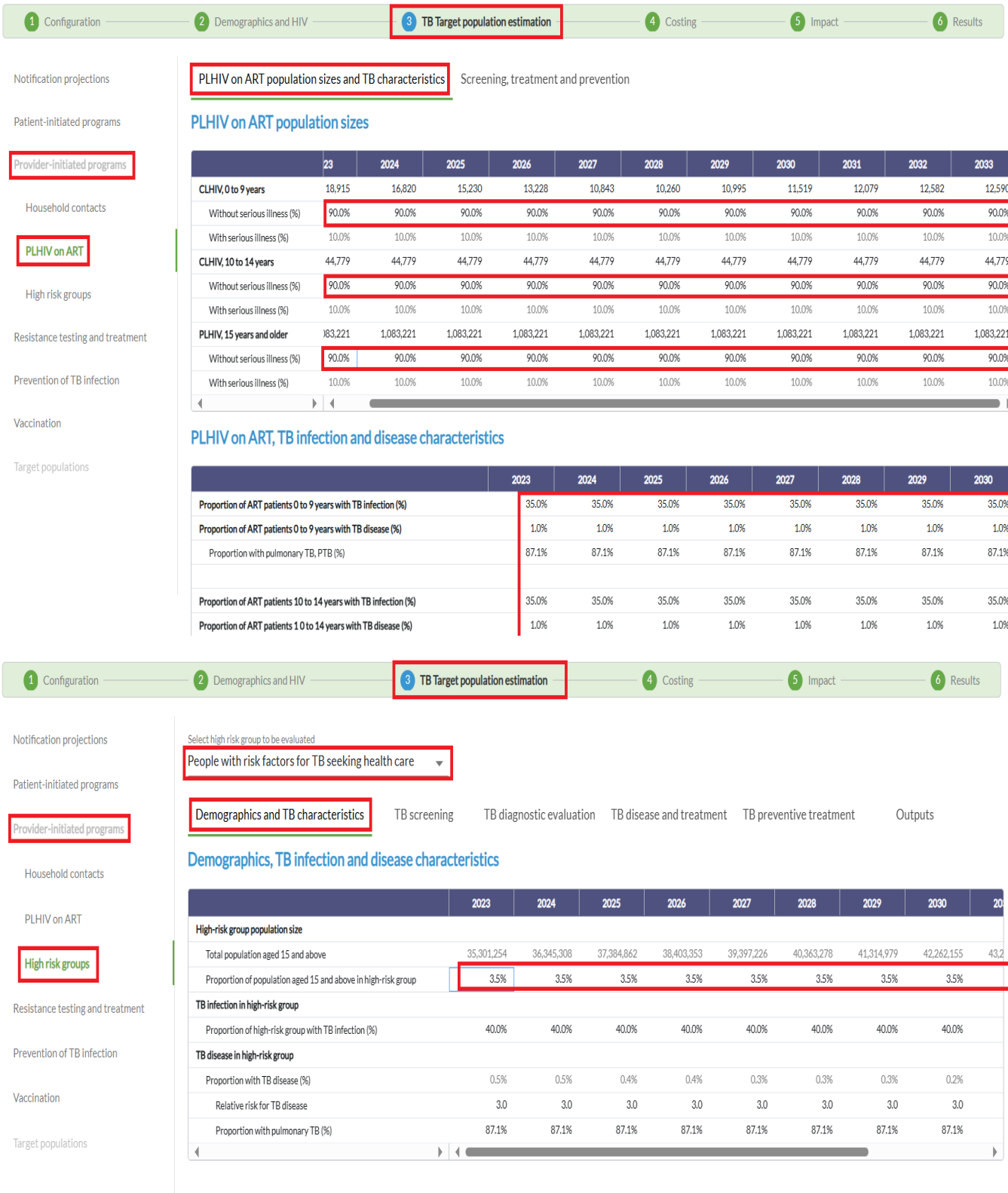
    In general, around 10% of patients on ART (who may be newly enrolled on ART) may have severe HIV disease, and that is the value used here as an example.

    As in the example below, set the proportion of patients in all three age groups with severe disease to 10%.

2. Review population sizes, TB characteristics and screening programs for other adult high-risk groups. The volumes of patients that are reachable by this program come from defining the population as a proportion of the population aged 15+. These populations include prisoners, miners, populations with structural risk factors and others.

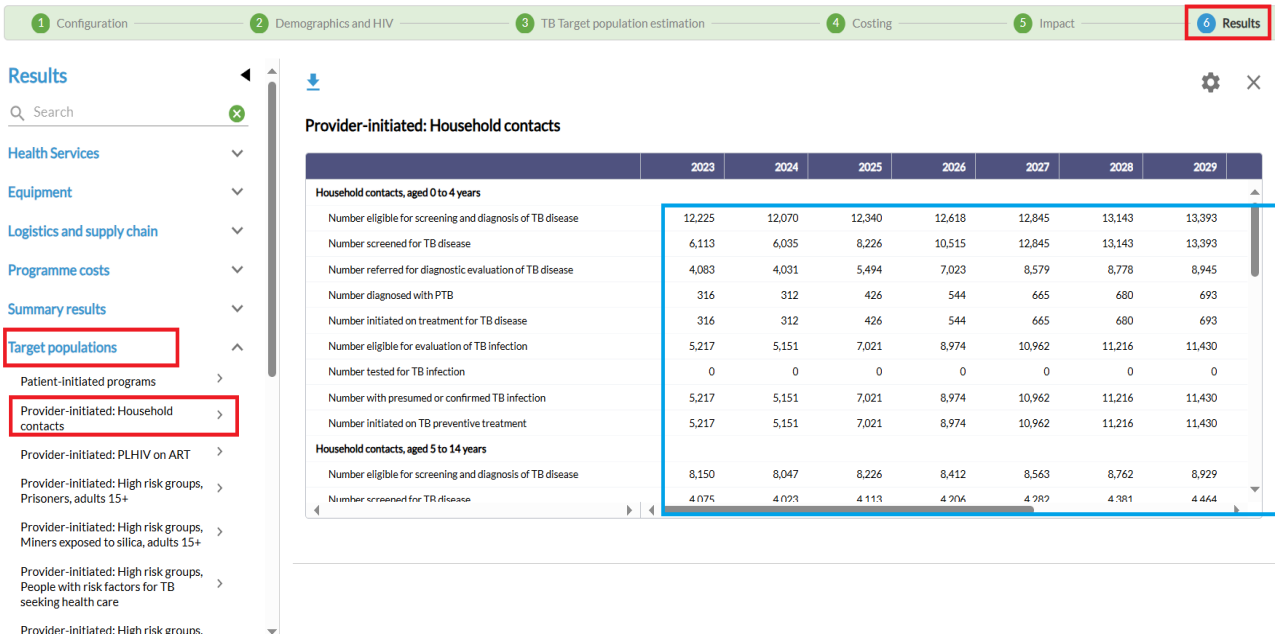
    As in the example below, you can define the population with structural risk factors and limited access to health care to be 3% of the adult (aged 15+). An example of

such a population could be those living in peri-urban communities in high TB burden countries who are often at high risk of TB disease.



Task 10: Review results for household contact programs and all provider-initiated programs

1. The various outputs provided in each editor are also available through the Results section.
2. Move to section **6 Results > Target Populations > Provider-initiated programs > Household contacts**.
3. Review numbers characterizing the care cascade from, screening, to diagnosis to treatment of active TB disease treatment and verify that they match the outputs that are displayed in the HH contact editors. Do the same for provider-initiated programs.



Quiz:

Question 1: TB found in provider-initiated patient groups is detected using algorithms for?

- ☐ Pulmonary TB only
- ☐ Pulmonary and extra-pulmonary TB

Question 2: Index cases in household contact (HH) tracing programs are generally?

- ☐ New, adult and bac-positive patients
- ☐ New, adult and child patients and of any bac-status

Question 3: What is the recommended (default) screening algorithm for adult PLHIV on ART with serious disease?

- ☐ Single screening with a mWRD method
- ☐ Parallel screening with W4SS and CXR

Question 4: Low sensitivity leads to?

- ☐ Fewer true positives missed
- ☐ More true positives missed

Question 5: Low specificity leads to?

- ☐ Fewer false positives diagnosed
- ☐ More false positives diagnosed

Question 6: Low TB prevalence in a population being screened leads to?

- ☐ A lower overall number needed to screen and test (NNTS and NNTT)
- ☐ A higher overall number needed to screen and test (NNTS and NNTT)

Question 7: Which patients are eligible for TPT in the care cascade according to WHO guidelines?

- ☐ All population members
- ☐ All screened population members
- ☐ All screened population members among who TB disease have been ruled out via screening and diagnosis

Question 8: In the TB module of IHT (TB Target population estimation) high-risk groups (other than HH contacts and PLHIV on ART) are restricted (by model design) to adults and not to children also. A reasonable model assumption is that children with TB disease will be found predominantly in programs for?

- ☐ Attending patient-initiated programs at facility level
- ☐ HH contact tracing
- ☐ CLHIV and on ART

Exercise 3.2 TB Target Population Estimation: patient-initiated screening and diagnosis

Objectives: This exercise will guide you through the process of defining and configuring patient-initiated programs. Many elements, inputs and outputs, work the same way as in provider-initiated programs with the main conceptual difference in the module being that the target population module for patient-initiated programs starts with the number diagnosed (the total obtained from WHO tuberculosis reported data) and referred for treatment and then 'back-calculates' to estimate the number screened. This is the opposite calculation flow to the one used for provider-initiated programs which starts with a defined population (with a defined size, prevalence of TB and screening algorithm) and then calculated who gets screened and then diagnosed.

Note that the algorithms provided are defined for pulmonary and extra-pulmonary TB. And PLHIV in patient-initiated programs represent PLHIV not on ART, i.e. the remainder of all PLHIV and PLHIV on ART found via provider-initiated programs. This approximation (by model design), that it will be predominantly PLHIV not on ART found in patient-initiated programs, is based on the ART programs approaching universal ART coverage, with a diminishing small proportion of PLHIV not on ART. Most of the remaining TB to be found among PLHIV will therefore be found in provider-initiated programs.

Task 1: Define TB characteristics and screening in patient-initiated programs.

1. Move to Step 3. **TB Target populations > Patient initiated programs**.
2. Move to tab **TB characteristics and screening**.
3. Edit default data that defines TB prevalence in each patient-initiated population seeking care.
    a. Note that we generally expect high prevalence of TB among those with symptoms that are severe enough to seek and initiate care. Some TB programs survey prevalence of TB disease at facility level, providing possible inputs to these prevalence editors.

    b. The user can also study the number needed to screen (NNTS) and number needed to test (NNTT) to provide insight into the prevalence estimate. Values of NNTS and NNTT of around 10 are often used as an average value for costing purposes. These estimates will require prevalence estimates of around 10% which is used as default value below.

    c. Please set the prevalence of children <15 years, HIV-negative and with pulmonary TB, the first population group, to 10%.

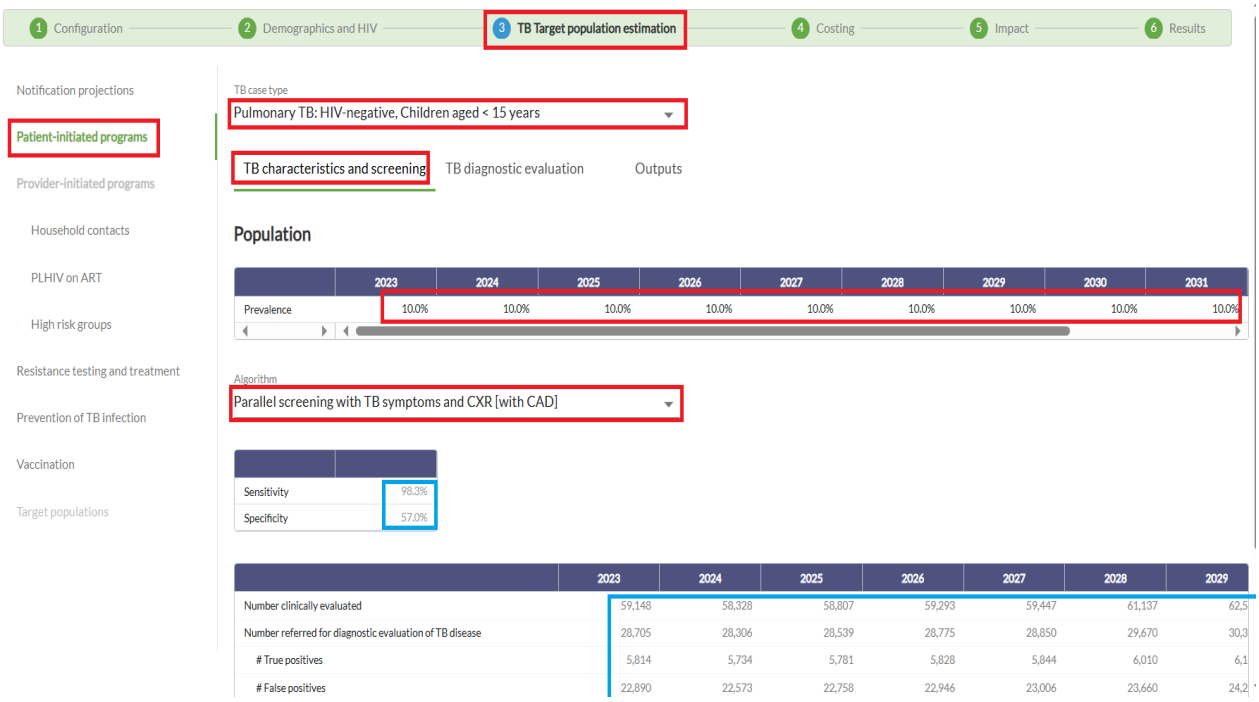
4. Prevalence in these groups may also decline in response to 1) the impact of a TB strategy 2) a change in policy that defines screening eligibility leading to a wider group of patients screened and thereby lowering average prevalence within the group screened.

5. Review default algorithm for clinical evaluation.

    a. Note that these algorithms are applied at health facility level and to patients with high risk of disease. This forms part of the reason for the default algorithms provided. For example, the parallel use of symptom-based screening with X-ray to minimize false negative outcomes. The default algorithm used below has a sensitivity of 98.3% and a specificity of 57.0% (framed in blue in the image below). These values are calculated and cannot be edited. The user can however define a custom screening algorithm giving more flexibility but is not given the ability to change the sensitivity and specificity of screening tools directly.

6. Review outputs for clinical evaluation.
    a. The outputs are the same as the outputs for screening in provider-initiated programs. The number screened comes from an estimated number of patients diagnosed among a given population, to which diagnostic and clinical evaluation sensitivity and specificity is applied to estimate the number that must have been screened to arrive at the number diagnosed. This estimation approach is needed as we have no default information on the volumes of different patient groups receiving clinical evaluation in patient-initiated programs.

    b. If the number found in provider-initiated programs is too large due to the user configuration (a function of the choice of algorithm and input of TB prevalence), then no cases can still be screened in the patient-initiated programs for the given patient groups **as the total notification target will be exceeded.** The embedded guidance contains further information on how to construct total notifications from patient- and provider-initiated programs, and on typical reasons (which should be avoided) for notifications from provider-initiated programs being unrealistically high.


1 Configuration
2 Demographics and HIV
3 TB Target population estimation
4 Costing
5 Impact
6 Results
Notification projections
Patient-initiated programs
Provider-initiated programs
Household contacts
PLHIV on ART
High risk groups
Resistance testing and treatment
Prevention of TB infection
Vaccination
Target populations
TB case type
Pulmonary TB: HIV-negative, Children aged < 15 years
TB characteristics and screening
TB diagnostic evaluation
Outputs
Population
2023 2024 2025 2026 2027 2028 2029 2030 2031
Prevalence 10.0% 10.0% 10.0% 10.0% 10.0% 10.0% 10.0% 10.0% 10.0%
Algorithm
Parallel screening with TB symptoms and CXR [with CAD]
Sensitivity 98.3%
Specificity 57.0%
2023 2024 2025 2026 2027 2028 2029
Number clinically evaluated 59,148 58,328 58,807 59,293 59,447 61,137 62,5
Number referred for diagnostic evaluation of TB disease 28,705 28,306 28,539 28,775 28,850 29,670 30,3
True positives 5,814 5,734 5,781 5,828 5,844 6,010 6,1
False positives 22,890 22,573 22,758 22,946 23,006 23,660 24,2

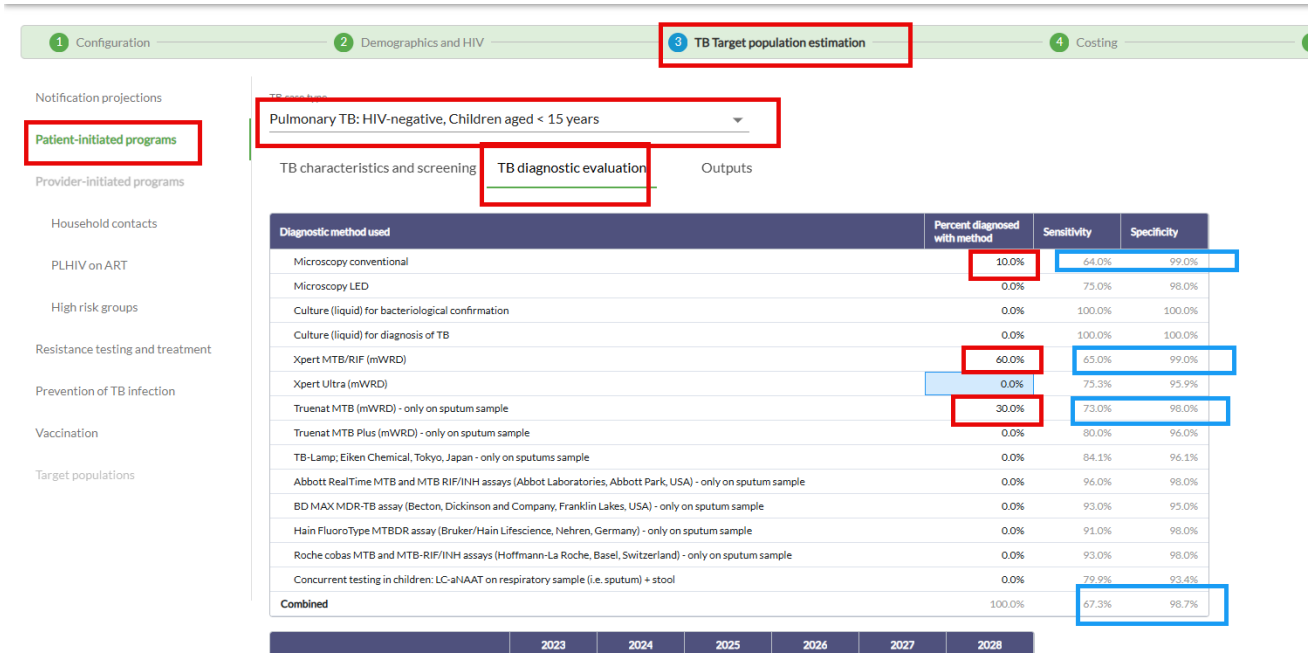
Task 2: For each patient-initiated group review the diagnostic evaluation method.

1. Configure TB diagnostic evaluation.

   For each population the user can edit the distribution of diagnostic tools that are applied to a population screened and referred for diagnosis (i.e. the TP and FP outcomes of the screening step). The default value featured is that “Xpert MTB/RIF (mWRD)” will be used, which has a sensitivity and specificity for diagnosing TB disease of 84% and 97% respectively.

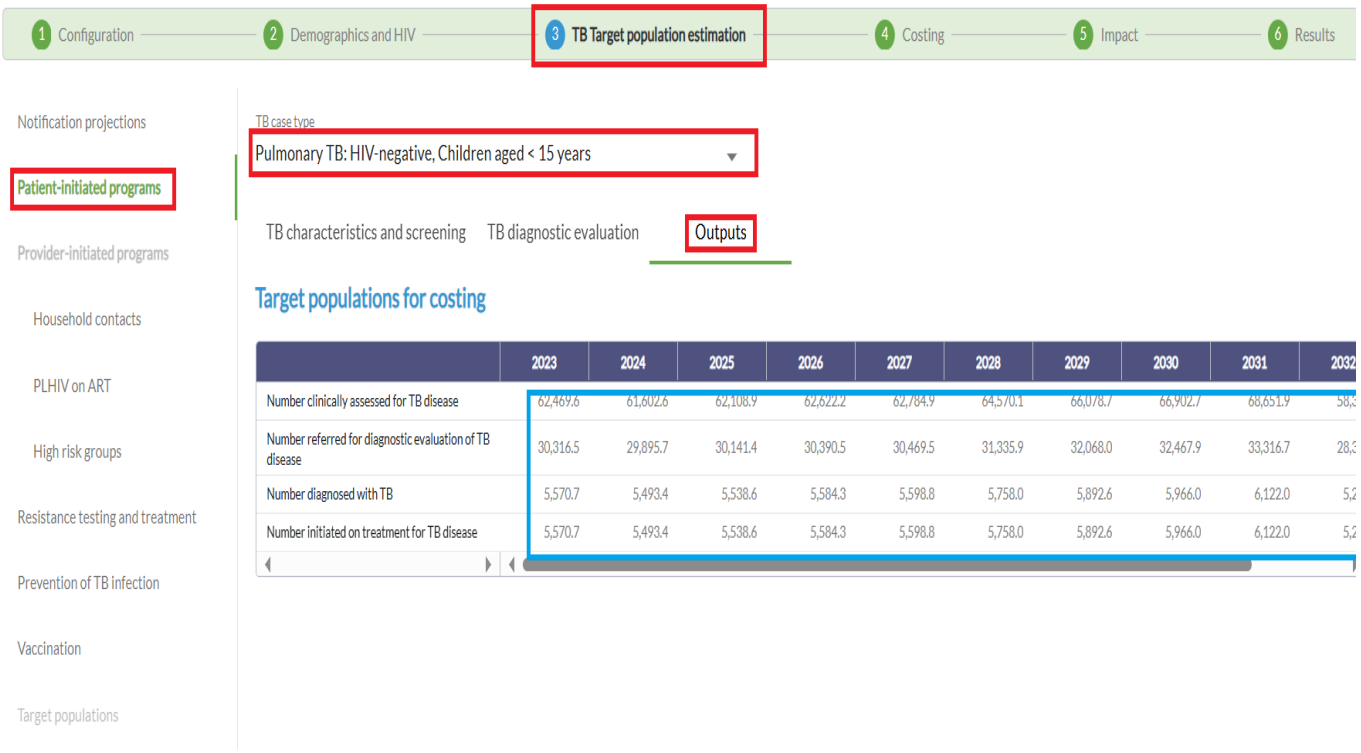
   A typical country setup may include a combination of mWRD (e.g. Xpert, Truenat) technologies with a small proportion of patients diagnosed with smear microscopy, to cover situations of operational challenges with mWRD methods. In the example, set diagnostic coverage with Xpert at 60%, Truenat at 30% coverage and smear microscopy at 10% coverage resulting in an overall sensitivity of 79.3% and 97.1% for the diagnostic algorithm. Repeat this for each pulmonary TB case type (e.g. “Pulmonary TB: HIV-negative, Adults 15 years and above). You can use copy and paste to expedite the process.

2. Review TB diagnostic outputs. Based on these and on preceding inputs, a projection is presented of:
   a. The number who received a diagnostic evaluation.
   b. The number diagnosed with TB disease, which comprise those with true and false positive outcomes following the diagnostic step.
   c. The number of true positive cases/patients missed, which can be used to highlight the impact of lack of perfect sensitivity.
   d. The number evaluated (among all screened) to confirm one TB case (NNTT-number needed to test) which is used to summarize the yield of screening and diagnosis for TB in this population.


1 Configuration
2 Demographics and HIV
3 TB Target population estimation
4 Costing
Notification projections
Patient-initiated programs
Provider-initiated programs
Household contacts
PLHIV on ART
High risk groups
Resistance testing and treatment
Prevention of TB infection
Vaccination
Target populations
Pulmonary TB: HIV-negative, Children aged < 15 years
TB characteristics and screening
TB diagnostic evaluation
Outputs
Diagnostic method used
Percent diagnosed with method
Sensitivity
Specificity
Microscopy conventional 10.0% 64.0% 99.0%
Microscopy LED 0.0% 75.0% 98.0%
Culture (liquid) for bacteriological confirmation 0.0% 100.0% 100.0%
Culture (liquid) for diagnosis of TB 0.0% 100.0% 100.0%
Xpert MTB/RIF (mWRD) 60.0% 65.0% 99.0%
Xpert Ultra (mWRD) 0.0% 75.3% 95.9%
Truenat MTB (mWRD) - only on sputum sample 30.0% 73.0% 98.0%
Truenat MTB Plus (mWRD) - only on sputum sample 0.0% 80.0% 96.0%
TB-Lamp; Eiken Chemical, Tokyo, Japan - only on sputums sample 0.0% 84.1% 96.1%
Abbott RealTime MTB and MTB RIF/INH assays (Abbot Laboratories, Abbott Park, USA) - only on sputum sample 0.0% 96.0% 98.0%
BD MAX MDR-TB assay (Becton, Dickinson and Company, Franklin Lakes, USA) - only on sputum sample 0.0% 93.0% 95.0%
Hain FluoroType MTBDR assay (Bruker/Hain Lifescience, Nehren, Germany) - only on sputum sample 0.0% 91.0% 98.0%
Roche cobas MTB and MTB-RIF/INH assays (Hoffmann-La Roche, Basel, Switzerland) - only on sputum sample 0.0% 93.0% 98.0%
Concurrent testing in children: LC-aNAAT on respiratory sample (i.e. sputum) + stool 0.0% 79.9% 93.4%
Combined 100.0% 67.3% 98.7%
2023
2024
2025
2026
2027
2028

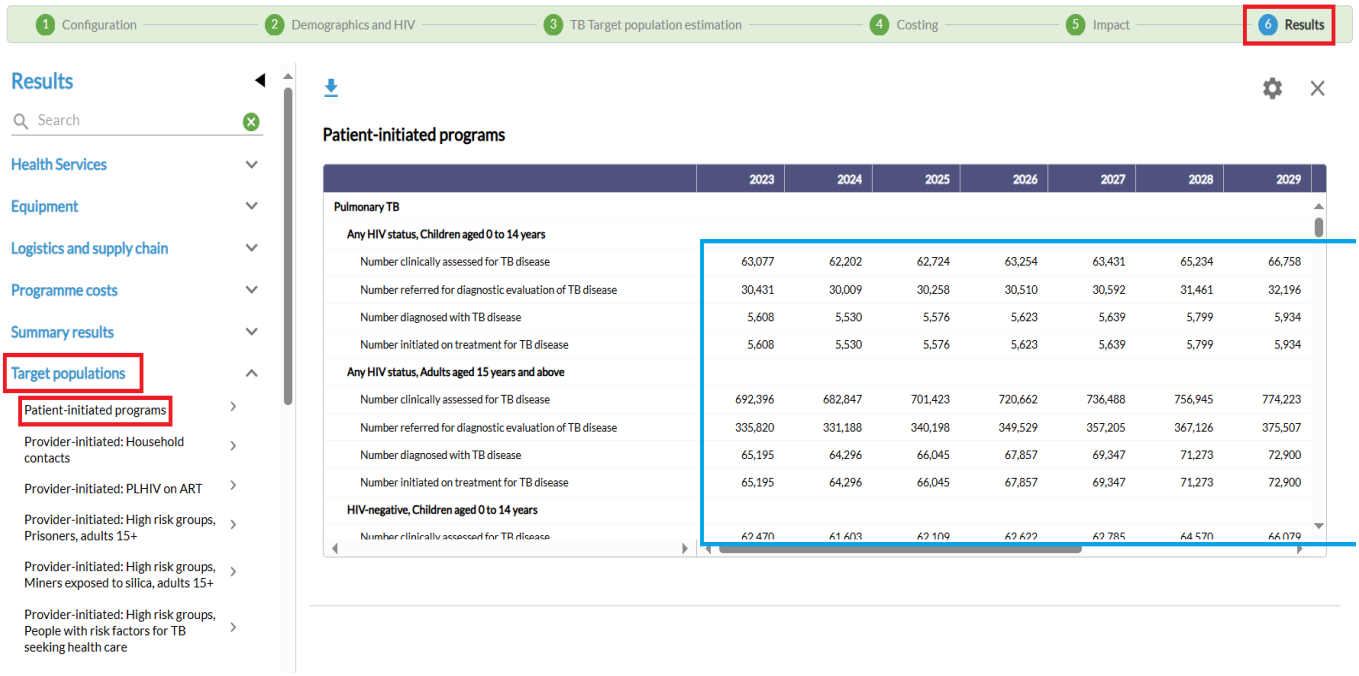
Task 3: For each patient-initiated group, review care cascade outputs.

1. Outputs outlining the cascade comprising screening and diagnosis of active TB disease, to treatment of TB disease include:
    a. Number eligible for screening and diagnosis of TB disease
    b. Number screened for TB disease
    c. Number referred for diagnostic evaluation of TB disease
    d. Number diagnosed with pulmonary TB
    e. Number initiated on treatment for TB disease
2. Note that by model design, TB preventive treatment (TPT) administration is not featured in patient-initiated programs nor in its associated output table.



Task 4: Review Result section for patient-initiated programs

1. The various outputs provided in each editor are also available through the Results section.
2. Move to **section 6 Results > Target Populations > Patient-initiated programs > Household contacts**.
3. Review numbers characterizing the care cascade from, screening, to diagnosis to treatment of active TB disease treatment of TB infection (presumptively or following LTBI testing)



Quiz

Question 1: TB disease found in patient-initiated patient groups is detected using algorithms for?

- ☐ Pulmonary TB
- ☐ Pulmonary and extra-pulmonary TB

Question 2: TB prevention therapy (TPT) is?

- ☐ Included in patient-initiated programs (< TB Target population estimation)
- ☐ Not included in patient-initiated programs and is restricted to provider-initiated programs (e.g. household contact tracing) only

Question 3: What is the recommended screening algorithm for HIV-negative children under the age of 15 years old?

- [ ] TB symptoms
- [ ] Parallel screening with TB symptoms and Xray
- [ ] Parallel screening with TB symptoms and Xray [with CAD]

Question 4: With a prevalence of TB of 10% in a patient-initiated program, and using the default clinical evaluation and diagnostic algorithm provided, the number needed to test to find one case is around?

- [ ] NNTT ~ 10, a value traditionally in costing screening and diagnostic algorithms
- [ ] Much higher values of NNTT, e,g, NNTT > 50

Question 5: Select a patient-initiated population and half the prevalence of TB among patient seeking care. The NNTT

- [ ] Is reduced by a factor of approximately 2?
- [ ] Is increased by a factor of approximately 2?

Question 6: When the number of patients screened in a patient-initiated populations is calculated to be 0, the likely reasons include?

- [ ] An incorrect screening or diagnostic algorithm was selected for a patient-initiated population
- [ ] The target for the total number of notifications is too low

Notifications from provider-initiated programs, which is subtracted from the total notification target to obtain the patient-initiated target, is too high relative to the total notification target

Question 7: PLHIV on ART are reached predominantly through?

- [ ] Provider-initiated programs
- [ ] Patients-initiated programs

Exercise 3.3 TB Target Population Estimation: drug-resistance testing and treatment

Objectives: This exercise will guide you through the process of defining and configuring drug resistance testing and treatment, and other inputs that are needed to model the population requiring testing and treatment with various technologies or interventions.

Note that at this stage of the care cascade the model does not keep track of the origin of patients i.e. whether they are linked to treatment from patient- or provider-initiated.

This section provides input that determines the eligibility for appropriate treatment is given. For example, Rifampicin resistance (RR) and Isoniazid (INH) resistance and patients not receiving appropriate drug sensitivity testing (DST), will receive first line treatment. RR and Fluoroquinolone (FQ) resistant (pre-XDR) patients receiving DST for RR and not for FQ resistance may sub-optimally receive BPAL for RR.

The proportion of patients with resistance to Rifampicin is obtained from the WHO tuberculosis data (i.e. indicators for RR). The profile consists of two branches namely patients with RR and without RR. With branches FQ resistant and FQ sensitive (on the RR branch) and INH resistant and sensitive (on the Rif sensitive) .

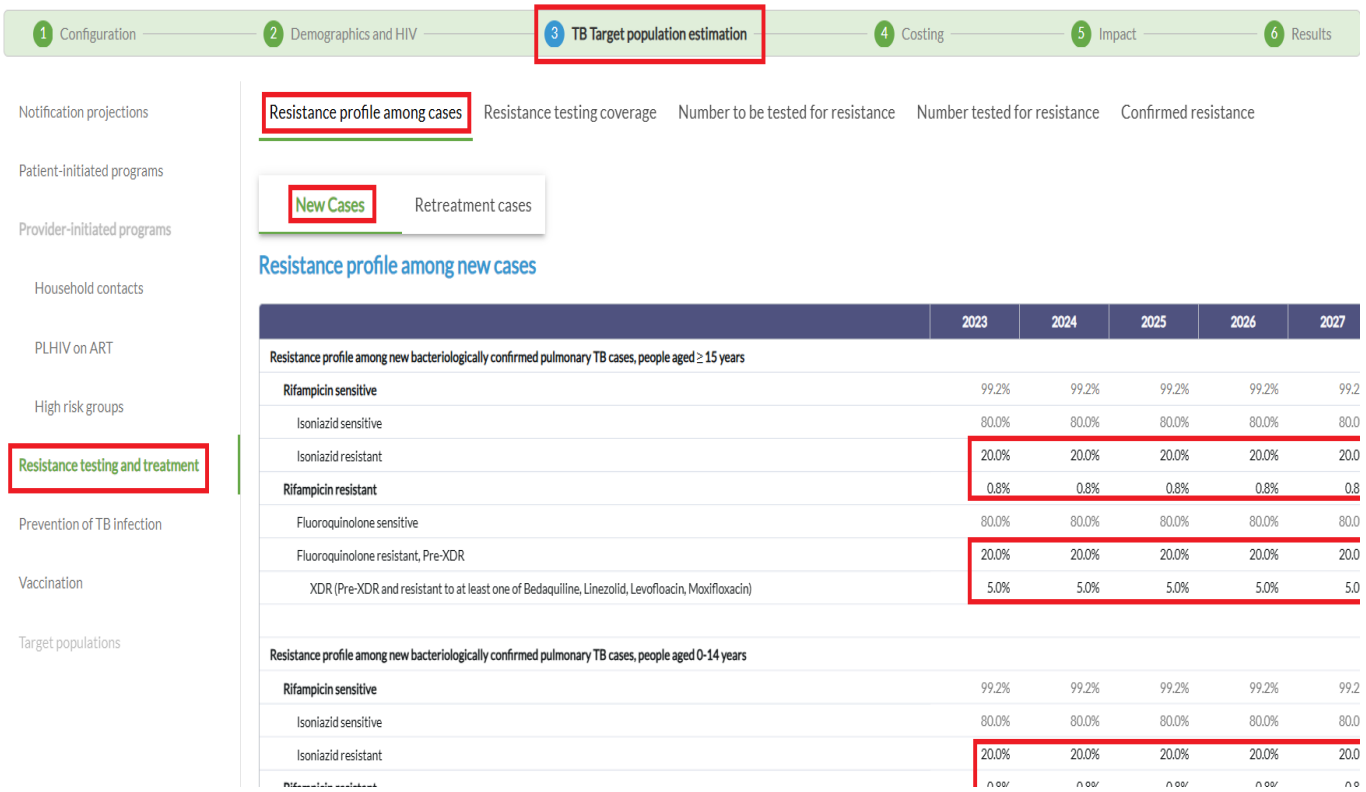
Task 1: Define/edit the resistance profile for new patients and patients previously treated. Define/edit proportions RR and INH sensitive and eligible for short-term regimens (e.g. 2HRZE/4HR or 2HRZ/4HR), proportion RR and INH sensitive with meningitis (and therefore eligible for 6HRZE) and the proportion of patients needing lung resection surgery and patients whose curative treatment options have been completely exhausted (requiring palliative care).

1. Move to Step 3. **TB Target populations > Resistance testing and treatment**
2. Move to tab **Resistance profile among new and previously treated patients**.
    a. Review the proportion of patients with RR. WHO tuberculosis data is used to provide the default proportion of RR. This estimate is reviewed and not edited.
    b. Set the proportion of patients that are INH resistant to 20% and the proportion of RR patients with FQ resistance (pre-XDR) to 20%. Systematically collected data are not available to estimate these proportions. The default values provided are highly approximate and set to high values to ensure enough resources are available to treat resistance.
    c. Set the proportion of patients with RR and FQ resistance with XDR to 5% for both adults and children.
    d. Set the proportion without severe disease to 90% – these patients are eligible for short course FL regimens.
    e. Set the proportion of patients with meningitis to 5% – these patients are eligible for longer course FL regimens.

f. Set the proportion MDR/XDR-TB patients requiring lung resection surgery to 5%. The patients have confirmed XDR and require lung surgery.

g. Set the proportion of patients whose curative treatment options have been completely exhausted to 5%. These patients have confirmed XDR and require palliative care.

3. Inputs for new and previously treated, adult and child patients all follow the same format. In the example below, we show an input editor for new adult patients.



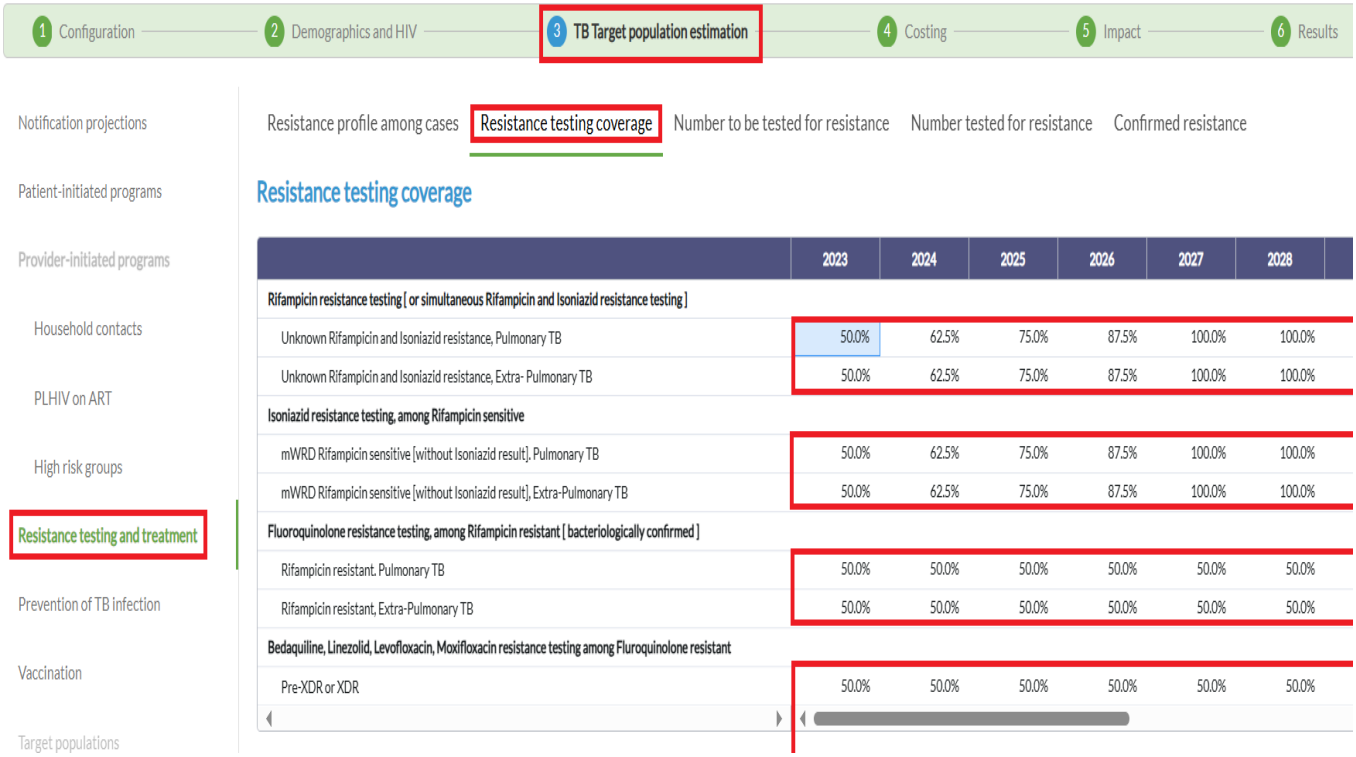
	2023	2024	2025	2026	2027
Resistance profile among new bacteriologically confirmed pulmonary TB cases, people aged ≥ 15 years					
Rifampicin sensitive	99.2%	99.2%	99.2%	99.2%	99.2
Isoniazid sensitive	80.0%	80.0%	80.0%	80.0%	80.0
Isoniazid resistant	20.0%	20.0%	20.0%	20.0%	20.0
Rifampicin resistant	0.8%	0.8%	0.8%	0.8%	0.8
Fluoroquinolone sensitive	80.0%	80.0%	80.0%	80.0%	80.0
Fluoroquinolone resistant, Pre-XDR	20.0%	20.0%	20.0%	20.0%	20.0
XDR (Pre-XDR and resistant to at least one of Bedaquiline, Linezolid, Levofloacin, Moxifloxacin)	5.0%	5.0%	5.0%	5.0%	5.0
Resistance profile among new bacteriologically confirmed pulmonary TB cases, people aged 0-14 years					
Rifampicin sensitive	99.2%	99.2%	99.2%	99.2%	99.2
Isoniazid sensitive	80.0%	80.0%	80.0%	80.0%	80.0
Isoniazid resistant	20.0%	20.0%	20.0%	20.0%	20.0

Proportion with non-severe TB (inclusion criterion for short-course regimen)					
People aged ≥ 15 years	90.0%	90.0%	90.0%	90.0%	90.0%
People aged 0-14 years	90.0%	90.0%	90.0%	90.0%	90.0%
Proportion of patients with drug-susceptible TB meningitis and pericarditis (inclusion criterion for longer-course regimen)					
People aged ≥ 15 years	5.0%	5.0%	5.0%	5.0%	5.0%
People aged 0-14 years	5.0%	5.0%	5.0%	5.0%	5.0%
Proportion MDR/XDR-TB patients requiring lung resection surgery					
People aged ≥ 15 years	5.0%	5.0%	5.0%	5.0%	5.0%
People aged 0-14 years	5.0%	5.0%	5.0%	5.0%	5.0%
Patients whose curative treatment options have been completely exhausted					
People aged ≥ 15 years	5.0%	5.0%	5.0%	5.0%	5.0%
People aged 0-14 years	5.0%	5.0%	5.0%	5.0%	5.0%

Task 2: Define DST coverage

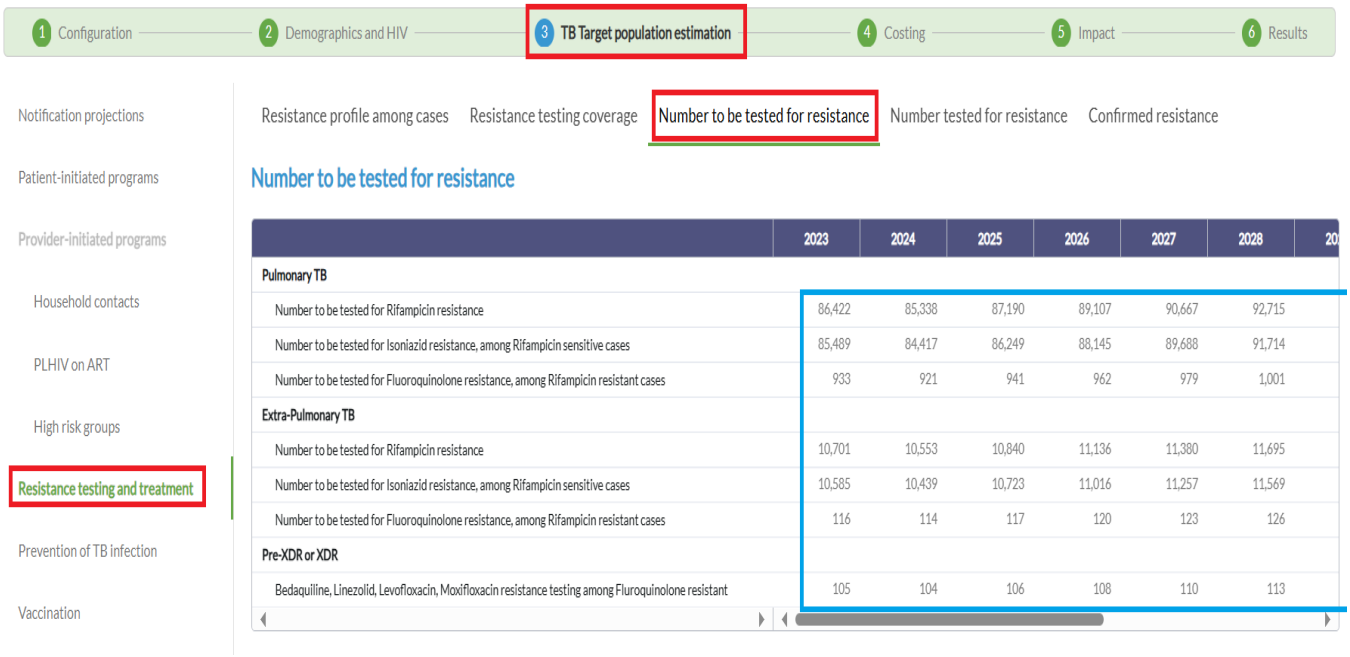
Note that default data for Rif, INH and FQ resistance testing are not available, and the default values provided must be changed to reflect in-country realities.

1. Move to Step 3. **TB Target populations > Resistance testing and treatment**
2. Move to tab **Resistance testing coverage:**
3. Specify coverage of Rifampicin resistance testing
    a. Among those with unknown Rifampicin and Isoniazid resistance, Pulmonary TB
    b. Among those with unknown Rifampicin and Isoniazid resistance, Extra-Pulmonary TB
    c. As in the example below, increased coverage linearly from 50% in 2023 to 100% in 2026.
4. Isoniazid resistance testing
    a. mWRD Rifampicin sensitive [without an Isoniazid result]. Pulmonary
    b. mWRD Rifampicin sensitive [without an Isoniazid result], Extra-Pulmonary TB
    c. As in the example below, increase coverage linearly from 90% in 2023 to 100% in 2026.
5. Fluoroquinolone resistance testing, among Rifampicin resistant
    a. Rifampicin resistant, Pulmonary TB
    b. Rifampicin resistant, Extra-Pulmonary TB
    c. As in the example below, increase coverage linearly from 50% in 2023 to 100% in 2026.
6. Number tested for resistance to Bedaquiline, Linezolid, Levofloxacin, Moxifloxacin
    a. Among pre-XDR or XDR patients
    b. As in the example below, increase coverage linearly from 50% in 2023 to 100% in 2026.

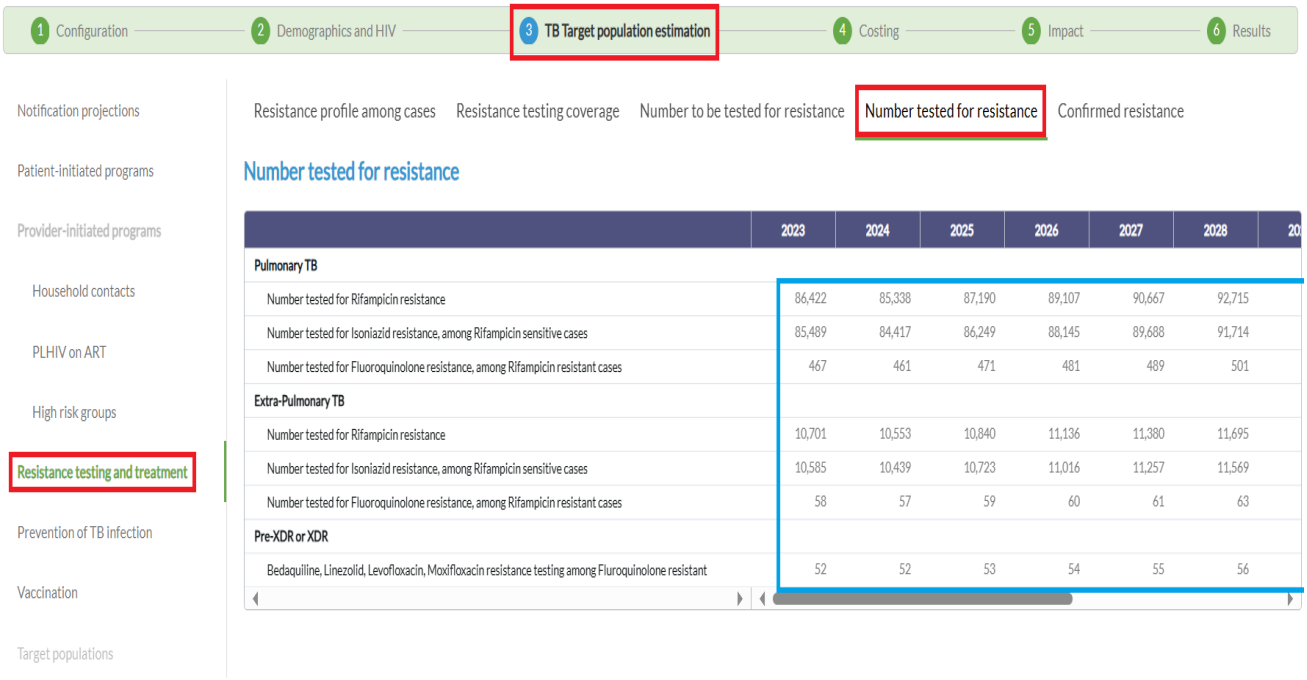

1 Configuration
2 Demographics and HIV
3 TB Target population estimation
4 Costing
5 Impact
6 Results
Notification projections
Patient-initiated programs
Provider-initiated programs
Household contacts
PLHIV on ART
High risk groups
Resistance testing and treatment
Prevention of TB infection
Vaccination
Target populations
Resistance profile among cases
Resistance testing coverage
Number to be tested for resistance
Number tested for resistance
Confirmed resistance
Resistance testing coverage
2023 2024 2025 2026 2027 2028
Rifampicin resistance testing [or simultaneous Rifampicin and Isoniazid resistance testing]
Unknown Rifampicin and Isoniazid resistance, Pulmonary TB 50.0% 62.5% 75.0% 87.5% 100.0% 100.0%
Unknown Rifampicin and Isoniazid resistance, Extra- Pulmonary TB 50.0% 62.5% 75.0% 87.5% 100.0% 100.0%
Isoniazid resistance testing, among Rifampicin sensitive
mWRD Rifampicin sensitive [without Isoniazid result], Pulmonary TB 50.0% 62.5% 75.0% 87.5% 100.0% 100.0%
mWRD Rifampicin sensitive [without Isoniazid result], Extra-Pulmonary TB 50.0% 62.5% 75.0% 87.5% 100.0% 100.0%
Fluoroquinolone resistance testing, among Rifampicin resistant [bacteriologically confirmed]
Rifampicin resistant, Pulmonary TB 50.0% 50.0% 50.0% 50.0% 50.0% 50.0%
Rifampicin resistant, Extra-Pulmonary TB 50.0% 50.0% 50.0% 50.0% 50.0% 50.0%
Bedaquiline, Linezolid, Levofloxacin, Moxifloxacin resistance testing among Fluroquinolone resistant
Pre-XDR or XDR 50.0% 50.0% 50.0% 50.0% 50.0% 50.0%

Task 3: Review volumes of patients eligible for different drug sensitivity tests, the number of patients who are tested and the number of confirmed drug resistance detected.

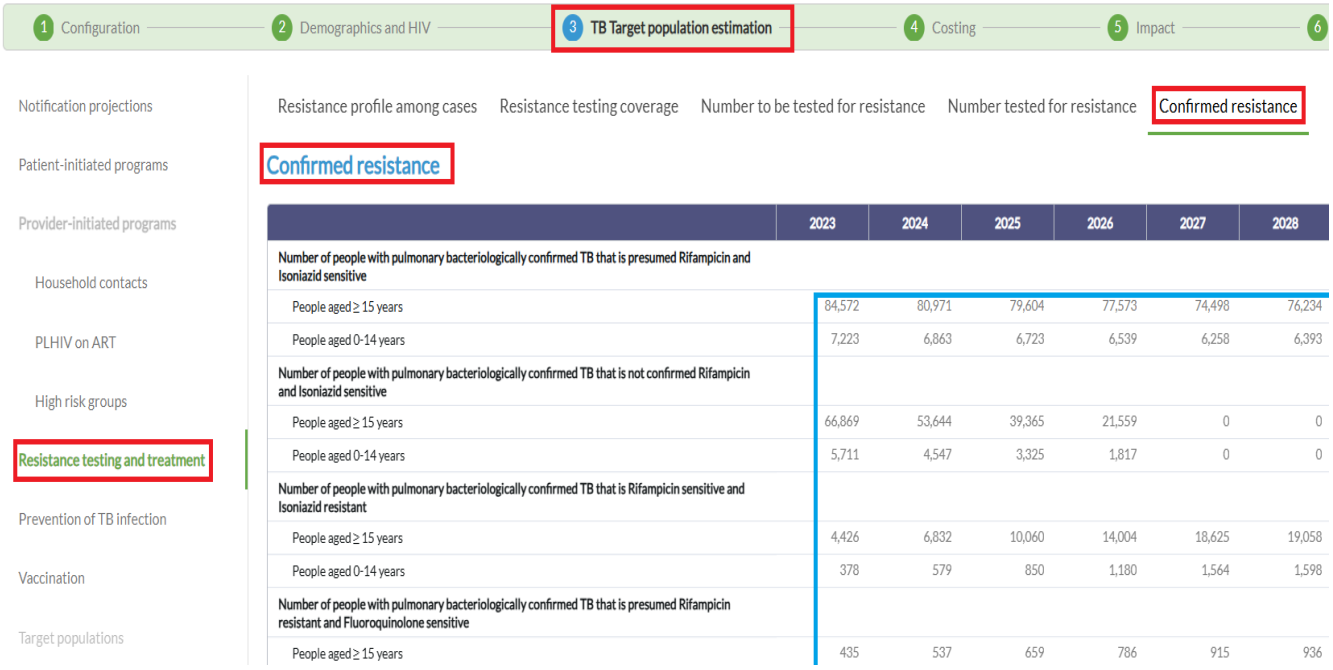
1. Move to Step 3. **TB Target populations > Resistance testing and treatment**
2. Move to tab **Number to be tested for resistance**.
    a. Among pulmonary and extra-pulmonary patients and patients with pre-XR or XDR TB, review:
        - The number to be tested (or eligible for testing) for Rifampicin resistance,
        - Isoniazid resistance,
        - Fluoroquinolone resistance, and for
        - resistance to Bedaquiline, Linezolid, Levofloxacin, Moxifloxacin



3. Move to tab **Number tested for resistance**.
    a. Among pulmonary and extra-pulmonary patients and patient with pre-XR or XDR TB, review:
        - The number tested for Rifampicin resistance,
        - Isoniazid resistance,
        - Fluoroquinolone resistance, and for
        - resistance to Bedaquiline, Linezolid, Levofloxacin, Moxifloxacin



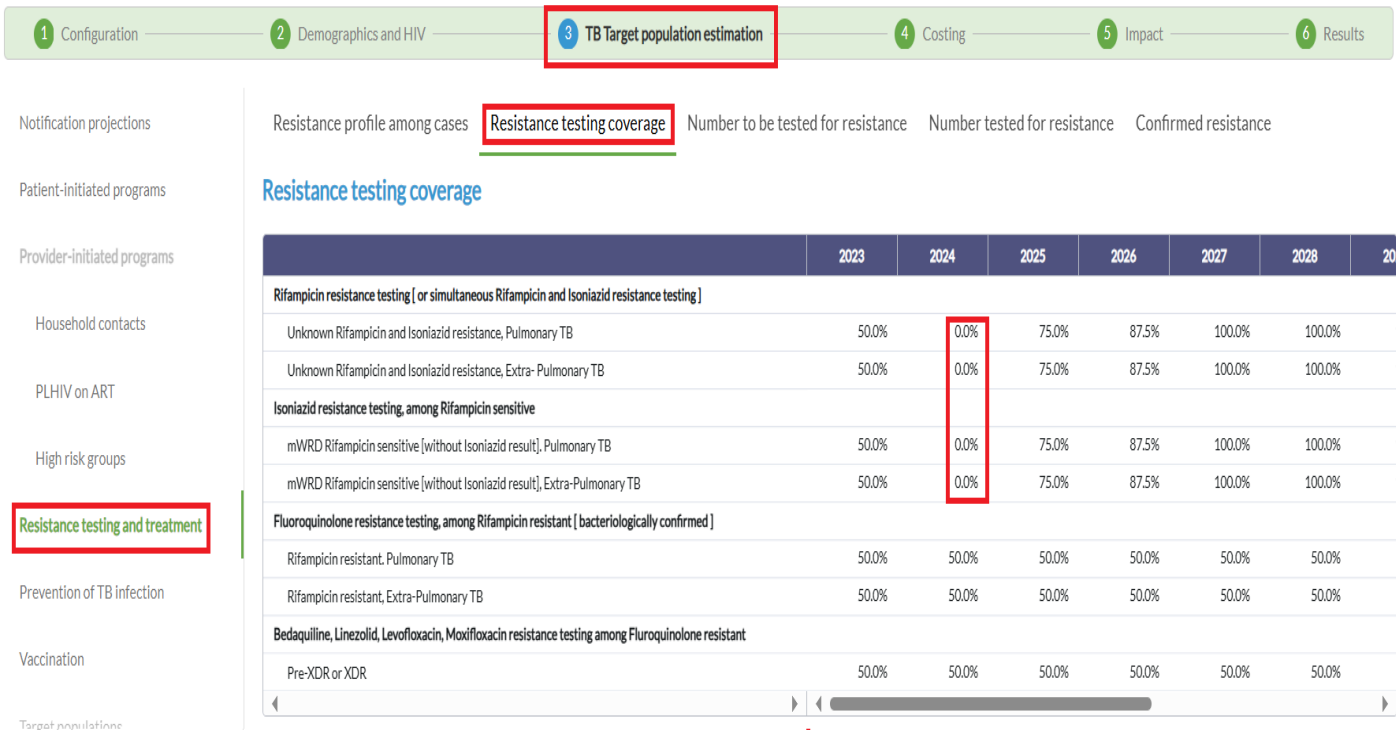
4. Move to tab **Confirmed resistance**.
    a. Among children aged 0-14 years and adults aged 15+ years review:
        - Number presumed Rifampicin and Isoniazid sensitive-
            - This number represents the sum of confirmed (with RR and INH sensitivity) cases and patients who did not receive a resistance test.
        - Number not confirmed Rifampicin and Isoniazid sensitive
            - Number confirmed Rifampicin sensitive and Isoniazid resistant
        - Number presumed Rifampicin resistant and Fluoroquinolone sensitive-
            - This number represents the sum of confirmed (with RR and FQ sensitivity) cases and patients who received a RR but not a FQ resistance test.
        - Number not confirmed Rifampicin resistant and Fluoroquinolone sensitive
        - Number confirmed Rifampicin resistant and Fluoroquinolone resistant, pre-XDR
        - Number resistant to at least one of Bedaquiline, Linezolid, Levofloxacin, Moxifloxacin, XDR



	2023	2024	2025	2026	2027	2028
Number of people with pulmonary bacteriologically confirmed TB that is presumed Rifampicin and Isoniazid sensitive						
People aged ≥ 15 years	84,572	80,971	79,604	77,573	74,498	76,234
People aged 0-14 years	7,223	6,863	6,723	6,539	6,258	6,393
Number of people with pulmonary bacteriologically confirmed TB that is not confirmed Rifampicin and Isoniazid sensitive						
People aged ≥ 15 years	66,869	53,644	39,365	21,559	0	0
People aged 0-14 years	5,711	4,547	3,325	1,817	0	0
Number of people with pulmonary bacteriologically confirmed TB that is Rifampicin sensitive and Isoniazid resistant						
People aged ≥ 15 years	4,426	6,832	10,060	14,004	18,625	19,058
People aged 0-14 years	378	579	850	1,180	1,564	1,598
Number of people with pulmonary bacteriologically confirmed TB that is presumed Rifampicin resistant and Fluoroquinolone sensitive						
People aged ≥ 15 years	435	537	659	786	915	936

Task 4: Set resistance testing targets

1. Move to Step 3. **TB Target populations > Resistance testing and treatment > Resistance testing coverage**
2. Set RR testing to 0% in 2024 and INH resistance testing to 0% in 2024.
3. Go to Confirmed resistance and verify that the number presumed and not confirmed RR and INH sensitive patients are the same in 2023.
4. Return to Resistance testing coverage and set RR testing to 50% in 2024 and INH resistance testing to 50% in 2024.
5. Go to Confirmed resistance and verify that the number of not confirmed RR and INH sensitive patients are not 0 in 2024 and that the number of presumed RR and INH sensitive patients is smaller than the number found in 3)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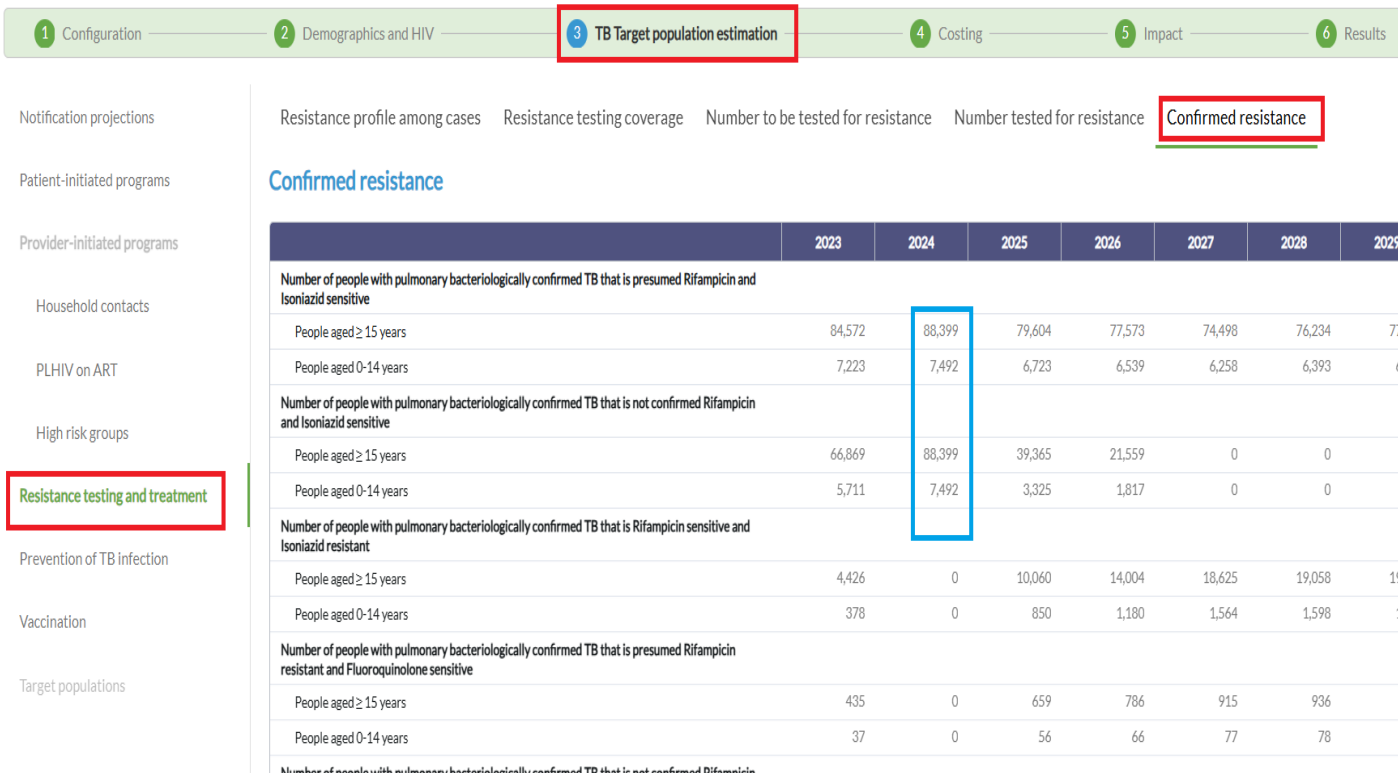
Provider-initiated programs
Household contacts
PLHIV on ART
High risk groups
Resistance testing and treatment
Prevention of TB infection
Vaccination
Resistance profile among cases
Resistance testing coverage
Number to be tested for resistance
Number tested for resistance
Confirmed resistance
Resistance testing coverage
2023 2024 2025 2026 2027 2028
Rifampicin resistance testing [or simultaneous Rifampicin and Isoniazid resistance testing]
Unknown Rifampicin and Isoniazid resistance, Pulmonary TB 50.0% 0.0% 75.0% 87.5% 100.0% 100.0%
Unknown Rifampicin and Isoniazid resistance, Extra- Pulmonary TB 50.0% 0.0% 75.0% 87.5% 100.0% 100.0%
Isoniazid resistance testing, among Rifampicin sensitive
mWRD Rifampicin sensitive [without Isoniazid result], Pulmonary TB 50.0% 0.0% 75.0% 87.5% 100.0% 100.0%
mWRD Rifampicin sensitive [without Isoniazid result], Extra-Pulmonary TB 50.0% 0.0% 75.0% 87.5% 100.0% 100.0%
Fluoroquinolone resistance testing, among Rifampicin resistant [bacteriologically confirmed]
Rifampicin resistant, Pulmonary TB 50.0% 50.0% 50.0% 50.0% 50.0% 50.0%
Rifampicin resistant, Extra-Pulmonary TB 50.0% 50.0% 50.0% 50.0% 50.0% 50.0%
Bedaquiline, Linezolid, Levofloxacin, Moxifloxacin resistance testing among Fluroquinolone resistant
Pre-XDR or XDR 50.0% 50.0% 50.0% 50.0% 50.0% 50.0%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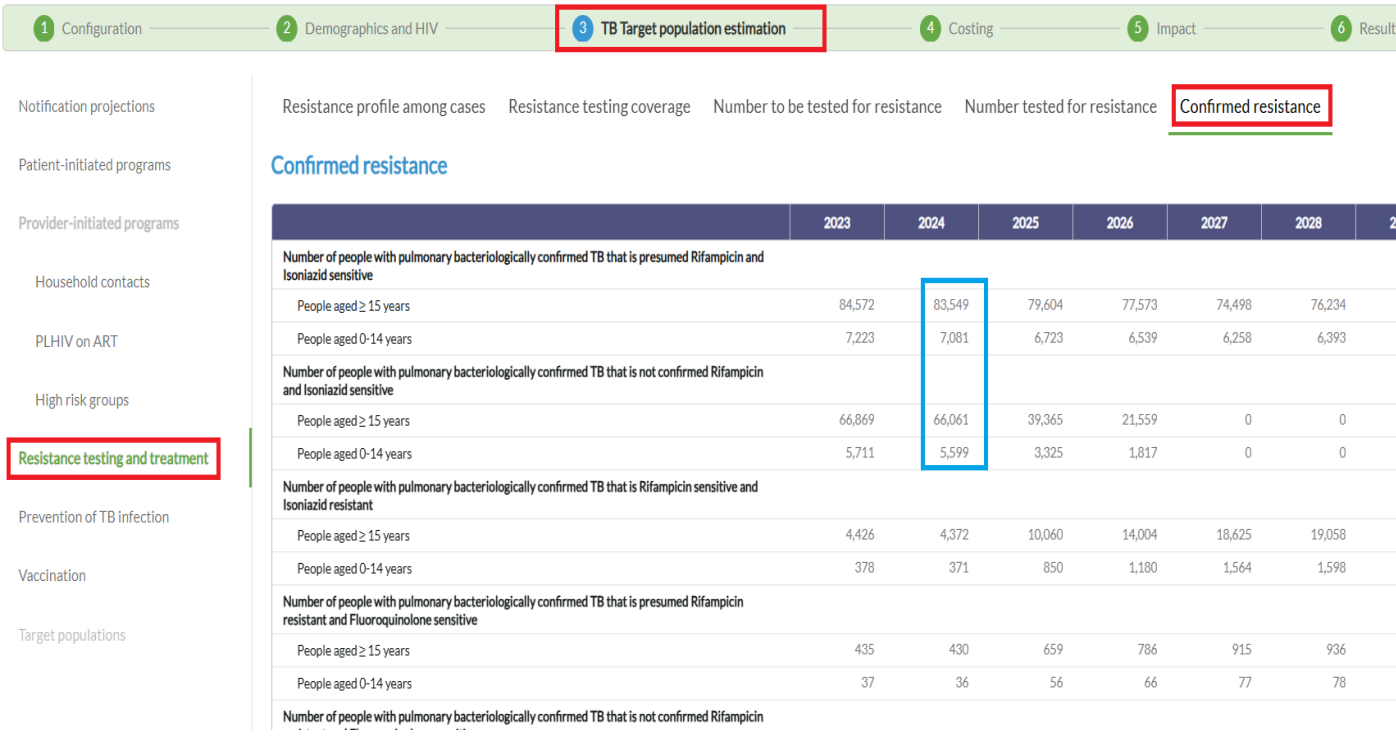
High risk groups
Resistance testing and treatment
Prevention of TB infection
Vaccination
Target populations
Resistance profile among cases
Resistance testing coverage
Number to be tested for resistance
Number tested for resistance
Confirmed resistance
Confirmed resistance
2023 2024 2025 2026 2027 2028
Number of people with pulmonary bacteriologically confirmed TB that is presumed Rifampicin and Isoniazid sensitive
People aged ≥ 15 years 84,572 88,399 79,604 77,573 74,498 76,234
People aged 0-14 years 7,223 7,492 6,723 6,539 6,258 6,393
Number of people with pulmonary bacteriologically confirmed TB that is not confirmed Rifampicin and Isoniazid sensitive
People aged ≥ 15 years 66,869 88,399 39,365 21,559 0 0
People aged 0-14 years 5,711 7,492 3,325 1,817 0 0
Number of people with pulmonary bacteriologically confirmed TB that is Rifampicin sensitive and Isoniazid resistant
People aged ≥ 15 years 4,426 0 10,060 14,004 18,625 19,058
People aged 0-14 years 378 0 850 1,180 1,564 1,598
Number of people with pulmonary bacteriologically confirmed TB that is presumed Rifampicin resistant and Fluoroquinolone sensitive
People aged ≥ 15 years 435 0 659 786 915 936
People aged 0-14 years 37 0 56 66 77 78

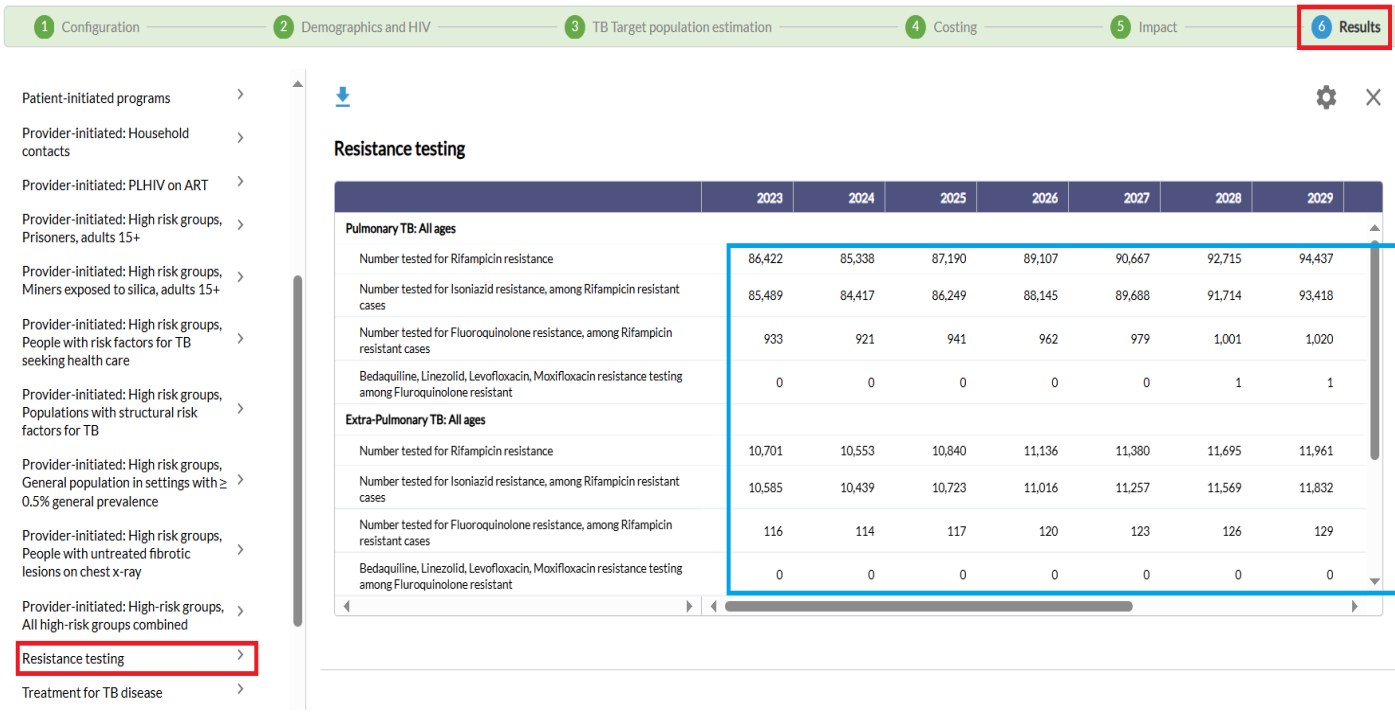


	2023	2024	2025	2026	2027	2028
Number of people with pulmonary bacteriologically confirmed TB that is presumed Rifampicin and Isoniazid sensitive						
People aged ≥ 15 years	84,572	83,549	79,604	77,573	74,498	76,234
People aged 0-14 years	7,223	7,081	6,723	6,539	6,258	6,393
Number of people with pulmonary bacteriologically confirmed TB that is not confirmed Rifampicin and Isoniazid sensitive						
People aged ≥ 15 years	66,869	66,061	39,365	21,559	0	0
People aged 0-14 years	5,711	5,599	3,325	1,817	0	0
Number of people with pulmonary bacteriologically confirmed TB that is Rifampicin sensitive and Isoniazid resistant						
People aged ≥ 15 years	4,426	4,372	10,060	14,004	18,625	19,058
People aged 0-14 years	378	371	850	1,180	1,564	1,598
Number of people with pulmonary bacteriologically confirmed TB that is presumed Rifampicin resistant and Fluoroquinolone sensitive						
People aged ≥ 15 years	435	430	659	786	915	936
People aged 0-14 years	37	36	56	66	77	78
Number of people with pulmonary bacteriologically confirmed TB that is not confirmed Rifampicin						

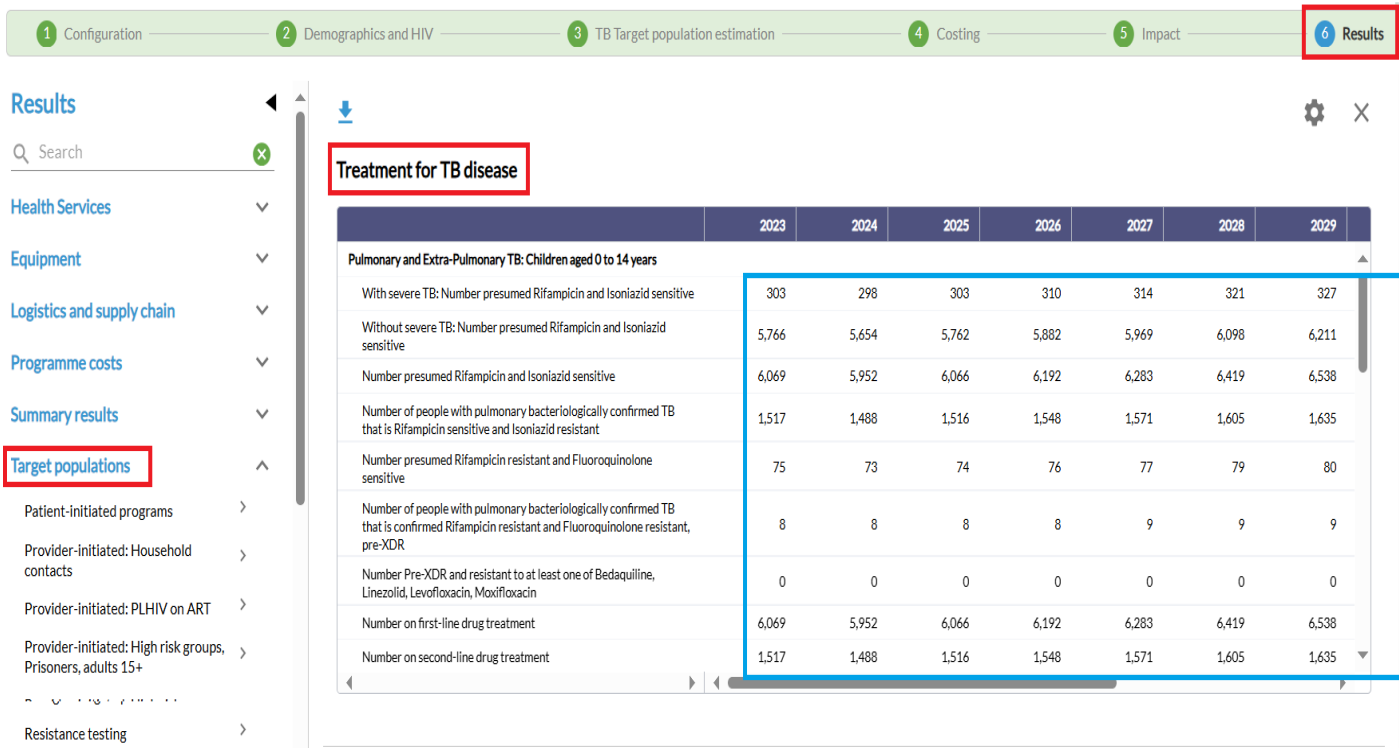
Task 5: Review Result section for drug sensitivity testing

The various outputs provided in each editor are also available through the **Results section 6**.

1. Move to section 6 Results > Target Populations > Resistance testing.
2. Review numbers for Rif, INH and FQ testing.
   a. These numbers provide the target population for costing DST programs.
3. Move to section 6 Results > Target Populations > Treatment for TB disease.
4. Review numbers with presumed and confirmed resistance, numbers with meningitis drug sensitive TB, number of patients whose curative options have been completely exhausted.
   a. These numbers provide the target population for costing treatment programs.
5. Note that the number of XDR patients needing lung surgery or whose curative options have been completely exhausted are a subset of XDR patients and these numbers depend strongly on the inputs. They will appear small with the default inputs.



	2023	2024	2025	2026	2027	2028	2029
Pulmonary TB: All ages							
Number tested for Rifampicin resistance	86,422	85,338	87,190	89,107	90,667	92,715	94,437
Number tested for Isoniazid resistance, among Rifampicin resistant cases	85,489	84,417	86,249	88,145	89,688	91,714	93,418
Number tested for Fluoroquinolone resistance, among Rifampicin resistant cases	933	921	941	962	979	1,001	1,020
Bedaquiline, Linezolid, Levofloxacin, Moxifloxacin resistance testing among Fluroquinolone resistant	0	0	0	0	0	1	1
Extra-Pulmonary TB: All ages							
Number tested for Rifampicin resistance	10,701	10,553	10,840	11,136	11,380	11,695	11,961
Number tested for Isoniazid resistance, among Rifampicin resistant cases	10,585	10,439	10,723	11,016	11,257	11,569	11,832
Number tested for Fluoroquinolone resistance, among Rifampicin resistant cases	116	114	117	120	123	126	129
Bedaquiline, Linezolid, Levofloxacin, Moxifloxacin resistance testing among Fluroquinolone resistant	0	0	0	0	0	0	0



	2023	2024	2025	2026	2027	2028	2029
Pulmonary and Extra-Pulmonary TB: Children aged 0 to 14 years							
With severe TB: Number presumed Rifampicin and Isoniazid sensitive	303	298	303	310	314	321	327
Without severe TB: Number presumed Rifampicin and Isoniazid sensitive	5,766	5,654	5,762	5,882	5,969	6,098	6,211
Number presumed Rifampicin and Isoniazid sensitive	6,069	5,952	6,066	6,192	6,283	6,419	6,538
Number of people with pulmonary bacteriologically confirmed TB that is Rifampicin sensitive and Isoniazid resistant	1,517	1,488	1,516	1,548	1,571	1,605	1,635
Number presumed Rifampicin resistant and Fluoroquinolone sensitive	75	73	74	76	77	79	80
Number of people with pulmonary bacteriologically confirmed TB that is confirmed Rifampicin resistant and Fluoroquinolone resistant, pre-XDR	8	8	8	8	9	9	9
Number Pre-XDR and resistant to at least one of Bedaquiline, Linezolid, Levofloxacin, Moxifloxacin	0	0	0	0	0	0	0
Number on first-line drug treatment	6,069	5,952	6,066	6,192	6,283	6,419	6,538
Number on second-line drug treatment	1,517	1,488	1,516	1,548	1,571	1,605	1,635

Quiz:

Question 1: A resistance profile has the following structure:

- ☐ A Rif resistant and a Rif sensitive branch, each with sub-branches
- ☐ Branches at the same level for Rif, INH and FQ resistance

Question 2: Generally, Rif resistance will be higher

- [ ] in new TB patients
- [ ] in previously treated TB patients

Question 3: DST coverage below 100% will typically lead to

- [ ] Appropriate treatment for all, i.e. all patients receiving the recommended regimen for their resistance profile.
- [ ] Inappropriate treatment for many, i.e. many patients not receiving the recommended regimen for their resistance profile.

Question 4: Fluoroquinolone resistance is often found at high levels in

- [ ] All TB programs
- [ ] TB programs with high private-sector involvement where Fluoroquinolones are widely provided to patients to treat bacterial infections

Question 5: The input for Drug-susceptible TB meningitis and pericarditis

- [ ] Controls the proportion of child and adolescent patients eligible for meningitis treatment
- [ ] Controls the proportion of child and adolescent patients eligible who are Rif sensitive and require a longer course FL regimen

Question 6: The input for Proportion MDR/XDR-TB patients requiring lung resection surgery

- [ ] Controls the proportion of all patients eligible for lung surgery
- [ ] Controls the proportion of all confirmed XDR patients eligible for lung surgery

Question 7: In Task 4, why is the number of presumed RR and INH sensitive patients smaller when using 50% coverage compared to 0% coverage for RR and INH resistance testing?

- [ ] A proportion of RR and INH resistant patients are identified and are shifted to other categories of resistance
- [ ] All RR and INH resistant patients are identified and are shifted to other categories of resistance

Exercise 3.4 TB Target Population Estimation: notification projection and TB prevention

Objectives: This exercise will guide you through the process of inputting an overall notification target as well as reviewing and editing the proportion of notified cases of different types.

The table in the TB Case type split/Distribution editor shows the various splits that are based on the WHO notification's database, including new and relapsed cases, HIV status, age, and the breakdown between pulmonary and extra-pulmonary.

The distribution of patient types found in these splits is drawn from the most recent year of WHO data (currently 2023) and case definitions available[2], and are presented as both absolute values, and percentages for the first year. These percentages are used to calculate the numbers of patients by type in future years. This tool component does not support editing of these values given the complexity of ensuring consistency between the full range of overlapping categories.

The entries in this editor will define target populations which appear downstream in the calculations, including distribution by age, HIV and ART status, pulmonary/extra pulmonary, household contacts index case calculations etc.

Task 1: Define/edit the overall notification target.

1. Move to Step 3. **Notification projection > Projection of total TB notifications**

2. The final year of reported notifications from (WHO TB data), currently 2023, is shown and it is used to benchmark the Projected Baseline trend.

3. The Projected Baseline trend is based on statistical projection that is run when the projection is created, using the Statistical Impact model baseline projection. It uses historic WHO TB reported data for total notifications. It is benchmarked to the value of the final year of reported data from the previous input step. The projected baseline trend cannot be edited and serves as a counterfactual against which impact (reduction in TB cases and TB deaths) is measured.
    a. Note that in addition to producing a baseline notification trend, the statistical model also produces baseline trends for TB incidence and TB mortality.

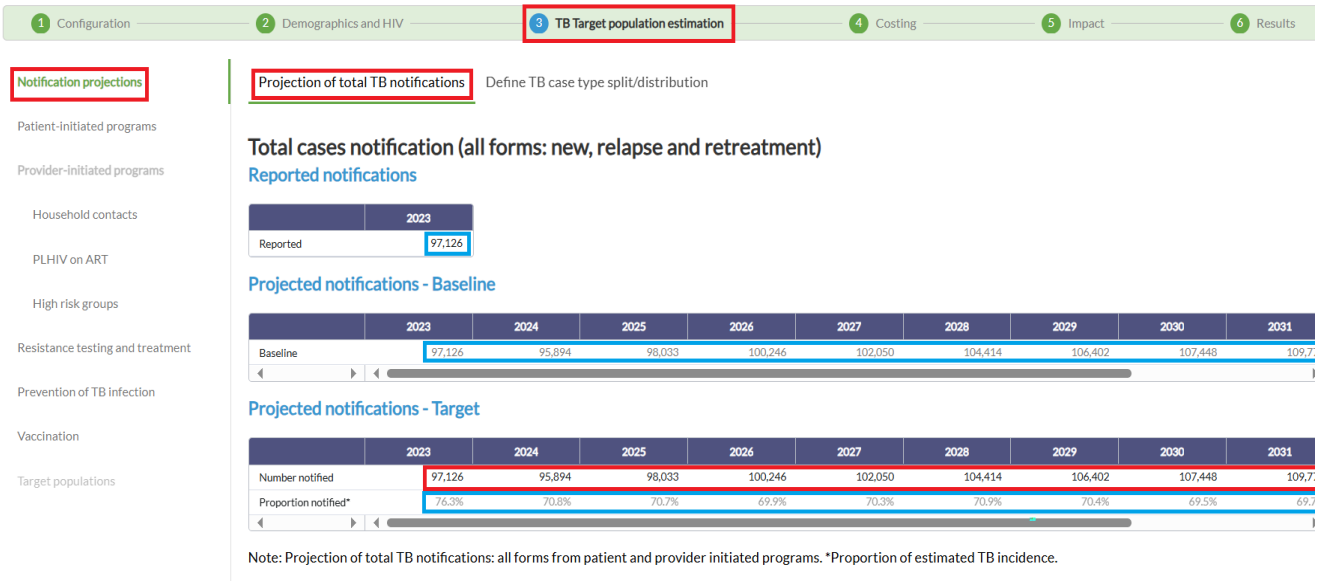
4. Below this input is the **Projected notifications target** which is set at default to the baseline notification trend. This target is typically stated in the objectives of a national strategy for TB and the user can state the notification target here.

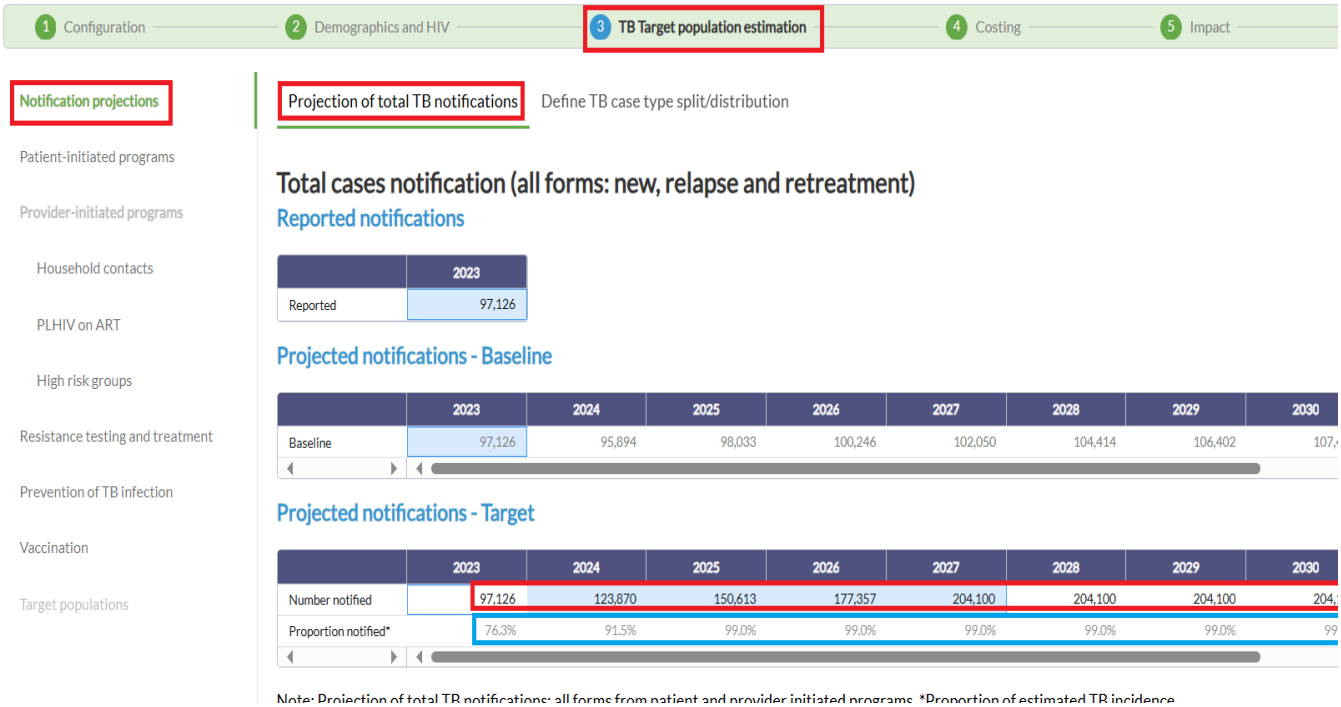
[2] https://iris.who.int/handle/10665/376612.

b. As in the example below, increase the default Projected notifications- Target total by 100% in 2026, and linear interpolate notification inputs between 2023 and 2026.

5. Below the **Projected notifications** target row is the ***Proportion Notified.** This estimated is calculated by the model and cannot be directly edited (hence greyed out)**.**

c. This is the ratio between the notification target and estimated total incidence (from the statistical model). The *Proportion Notified too is only a guide to the user for notification target setting and plays a role in impact estimations which will be discussed in the presentation & exercise related to Impact (TB module of IHT). The maximum value that will be displayed is 99%, implying that the total notification target is equal to or exceeds estimated TB incidence.

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High risk groups
Resistance testing and treatment
Prevention of TB infection
Vaccination
Target populations
Projection of total TB notifications
Define TB case type split/distribution
Total cases notification (all forms: new, relapse and retreatment)
Reported notifications
2023
Reported
97,126
Projected notifications - Baseline
2023 2024 2025 2026 2027 2028 2029 2030
Baseline
97,126 95,894 98,033 100,246 102,050 104,414 106,402
Projected notifications - Target
2023 2024 2025 2026 2027 2028 2029 2030
Number notified
97,126 123,870 150,613 177,357 204,100 204,100 204,100
Proportion notified*
76.3% 91.5% 99.0% 99.0% 99.0% 99.0% 99.0%
Note: Projection of total TB notifications: all forms from patient and provider initiated programs. *Proportion of estimated TB incidence

Task 2: Define/edit the overall notification target.

1. Move to **Step 3. TB Target population estimation > Notification projection > Define TB case type split/distribution**.

2. Review (read-only) the split of cases according to New, Relapse and Previously treated (excluding relapse).

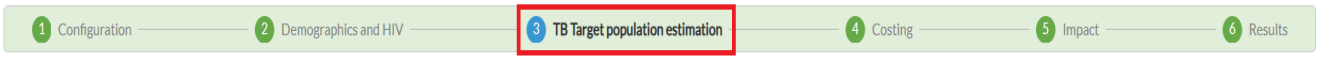
These splits add to 100% are based on the latest year of WHO TB data. In the current version of the software the user cannot edit these as there are dependencies that must be maintained when any data point is edited.

These splits are multiplied with the total notifications to project the split forward in time. In the current version of the software, since the split cannot be edited and since there is no data to inform trends in these splits, the same split/distribution is used for all years of the forward projection.

3. Review (read-only) the split according to age. These age categories are based on the age disaggregation of new and relapse cases reported by WHO TB data. It should be noted that the same age split is applied to cases by other variables than age: method of diagnosis

(bacteriologically positive, clinically diagnosed or extra-pulmonary) and HIV status.

4. Review (read-only) the split according to HIV. These HIV categories are based on the HIV disaggregation of new and relapse cases reported by WHO TB data. It should be noted that the same HIV split is applied to cases by other variables than HIV status: method of diagnosis (bacteriologically positive, clinically diagnosed or extra-pulmonary) and age category.



Notification projections

Patient-initiated programs

Provider-initiated programs

Household contacts

PLHIV on ART

High risk groups

Resistance testing and treatment

Prevention of TB infection

Vaccination

Target populations

Projection of total TB notifications | Define TB case type split/distribution

TB case type split by treatment history and pulmonary status

	Split					
	2023 (#)	2023 (%)	2024	2025	2026	2027
Total notified	97,126	100.0%	123,870	150,613	177,357	204,100
New cases or previous treatment history unknown	88,936	91.6%	87,808	89,766	91,793	93,445
Pulmonary, bacteriologically confirmed	43,730	45.0%	43,175	44,138	45,135	45,947
Pulmonary, clinically diagnosed	33,400	34.4%	32,976	33,712	34,473	35,093
Extrapulmonary, bacteriologically confirmed or clinically diagnosed	11,806	12.2%	11,656	11,916	12,185	12,405
Relapse cases	5,717	5.9%	5,644	5,770	5,901	6,007
Pulmonary, bacteriologically confirmed	3,243	3.3%	3,202	3,273	3,347	3,407
Pulmonary, clinically diagnosed	2,087	2.1%	2,061	2,106	2,154	2,193
Extrapulmonary, bacteriologically confirmed or clinically diagnosed	386	0.4%	381	390	398	406
New and relapse cases	94,653	97.5%	93,453	95,537	97,694	99,452
Pulmonary, bacteriologically confirmed	46,973	48.4%	46,377	47,412	48,482	49,354
Pulmonary, clinically diagnosed	35,487	36.5%	35,037	35,818	36,627	37,286
Extrapulmonary, bacteriologically confirmed or clinically diagnosed	12,192	12.6%	12,037	12,306	12,584	12,810
Previously treated	10,663	11.0%	10,528	10,763	11,006	11,204
Previously treated, excluding relapse	2,473	2.5%	2,442	2,496	2,552	2,598
Previously treated, including relapse	8,190	8.4%	8,086	8,266	8,453	8,605
New and relapse cases total, by age						

Task 3: Estimate the number of bacteriologically positive adult notifications

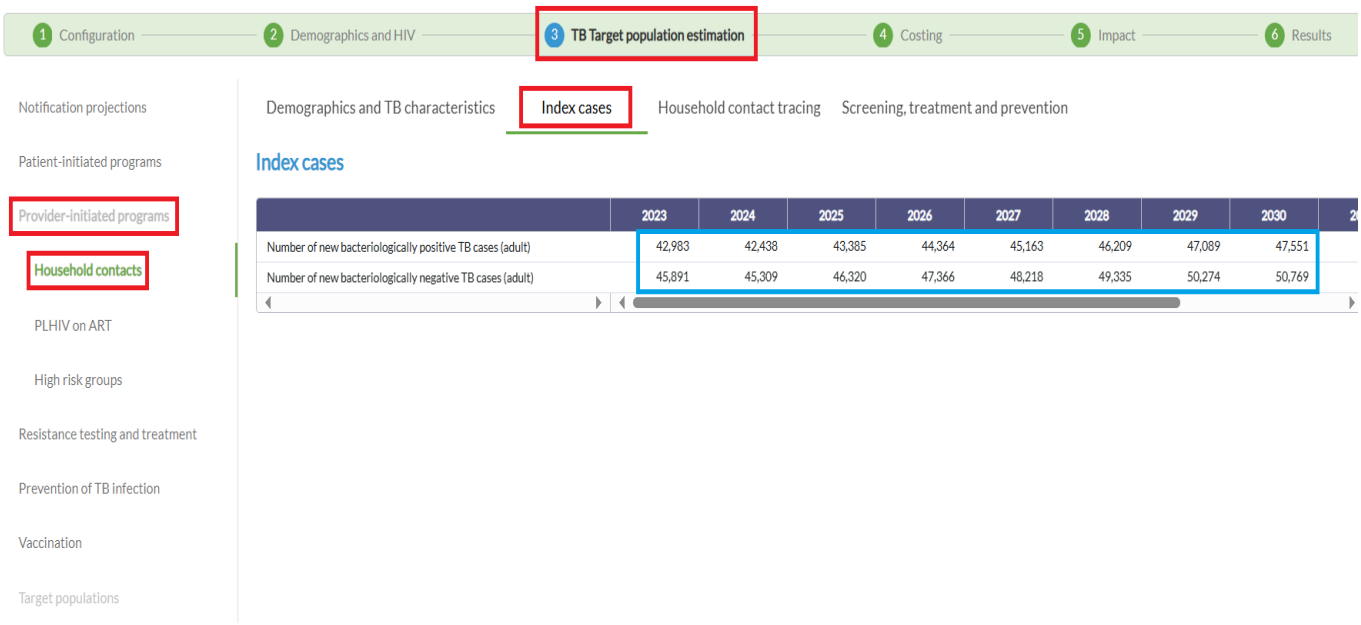
1. Move to **Step 3. TB Target population estimation > Notification projection > Define TB case type split/distribution.**

2. Calculate the proportion of total notifications that are new and bacteriologically positive in 2023. In 2023, the value is 45.02% (among new cases) + 3.33% (among relapse cases) = 48.36%.

3. Calculate the proportion of new and relapse adult cases that are bacteriologically positive. In 2023, 91.5% of new and relapse cases are among adults, and the proportion of bacteriologically positive new cases that are adults is 48.36% x 91.5% = 44%

4. Apply this proportion to total notifications in 2023. In 2023, the value is 44% x 97,126 = 42,983.

5. This value should equal the number of Index cases that is used in the household contact tracing program. Go to **Household contacts > Index cases** and verify the number as in the display below.

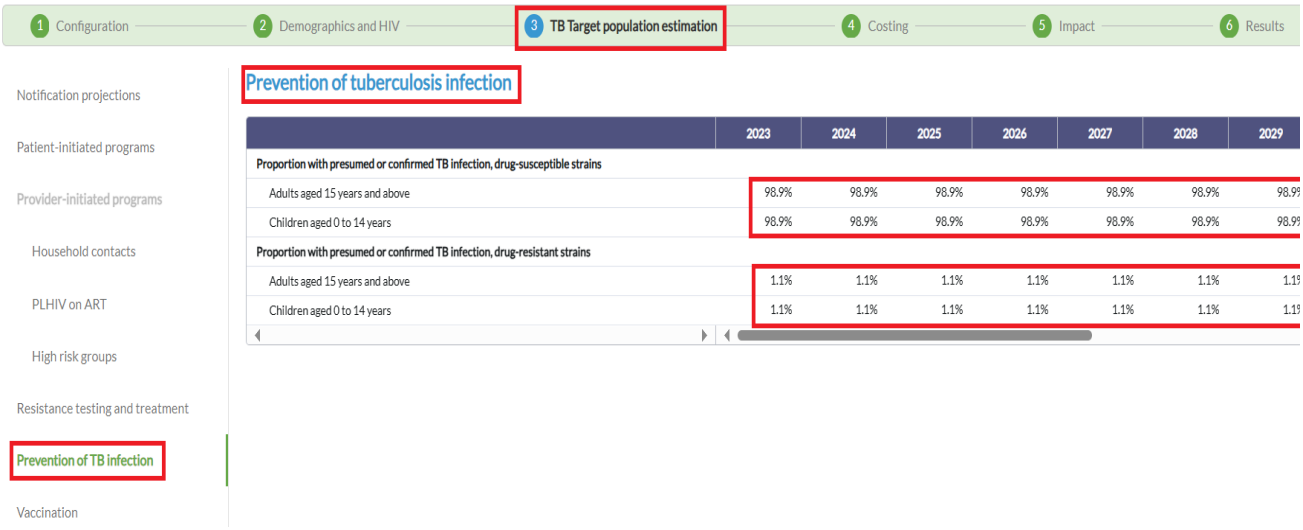


Task 4: Define/edit distribution of regimens for TB prevention.

1. Move to **Step 3. TB Target Population > Prevention of infection**
2. Provide the proportion of patients eligible for TPT that will receive regimen to prevent drug sensitive TB in children and adults.

3. Provide the proportion of patients eligible for TPT that will receive regimen to prevent MDR/RR TB in children and adults.

4. Default values provided are based on the default burden of RR according to WHO Tuberculosis data.



Quiz

Question 1: What is the total notification number reported for 2023 in the example country?

- ☐ 97,126
- ☐ 87,126

Question 2: Describe the baseline notification trend in the example country:

- ☐ Slowly/steadily increasing
- ☐ Constant
- ☐ Slowly/steadily decreasing

Question 3: If the notification target in 2027 is increased by 100% from the baseline value, what is the notification value in 2027 and the *Proportion Notified in 2026?

- [ ] 204,100 and 99%
- [ ] 194,100 and 56.07%

Question 4: For the example country given, what proportion of all notifications are bacteriologically confirmed?

- [ ] 48.36%
- [ ] 58.56%

Question 5: For the example country given, what proportion of all notifications are extrapulmonary?

- [ ] 12.55%
- [ ] 11.55%

Question 6: For the example country given, what proportion of new and relapse TB cases are children 0-9 years old?

- [ ] 6.0%
- [ ] 7.0%

Question 7: For the example country given, what proportion of TPT patients will receive a regimen for preventing MDR/RR TB according to the inputs?

- [ ] 2.1%
- [ ] 1.1%

Exercise 4: Impact estimation via statistical model

Objectives: This exercise will guide you through the process of using two different projections using the Tuberculosis module of IHT to obtain an estimate for the health impact of a costed TB plan in terms of averting new TB cases, prevalent TB cases and TB deaths.

File 1 > Counterfactual (Baseline): this file describes a continuation of current service levels, with total notifications continuing recent trends according to WHO TB data.

File 2 > Current scenario (Scale-up): this file describes a scale up of service levels of policy/reach of a TB program, with total notifications increasing above recent trends.

Task 1: Setup the Counterfactual (Baseline) projection/file

1. **Create a new file for your country and define the baseline scenario.**
   a. Note that this file will contain a default notification target based on statistical projection.
   b. It will contain default population and intervention configuration with no intervention scale-up.
   c. Go through the patient-initiated and provider-initiated populations and for each population set to constant (i.e. for all years from 2023, the base year, onward):
      i. Prevalence of TB in the population group
      ii. Prevalence of latent TB in the provider-initiated population groups
      iii. Screening coverage in the provider-initiated population groups
      iv. TPT coverage via presumptive or testing routes in the provider-initiated population groups.
      v. Select and set algorithms in all population groups.
      vi. Finalize resistance profiles and set DST coverage for all regimen types to constant for all years.
      vii. The point of the above is to set all country-specific elements in the base year of the analysis, prior to any scale-up.
   d. Use the "Save as" option to save the file as "[MyFile_name]Baseline" where [MyFile_name] provides a description of your country and scenario description.
      i. **Saving this file will keep it saved on your IHT user account and make it sharable with others.**

2. **Configure the impact section of the baseline projection/file.**
   a. The impact editor below comprises two parts: hazard rates for the counterfactual and hazard rates for the scale-up scenarios. The term 'hazard' is

borrowed terminology from statistical modeling methods and refers to the probability of an outcome after receiving an intervention.

b. There are three 'hazard' ratios in each scenario section:
   - **i.** The total number notified.
   - **ii.** Reduction in population-level risk for TB disease (adjusted for higher risk in population groups receiving TPT).
   - **iii.** Treatment success rate for new and relapse cases.

c. The first two hazards are calculated by the model and the treatment success rate is an input (which is typically available in the WHO TB data[3] for each country).

d. The ratio between these hazards, called "HR" below, determines epidemic impact. For example, the user may increase notification by 100% by 2027.

   With hazard of prevention Hi0 at baseline and Hi1 at scaleup, let Hi0=0.8% and Hi1=2% then the hazard ratio for prevention is

   HRi = (1-2%) / (1-0.8%) = 98.0% leading to a 2% reduction in risk of disease.

   With hazard of treatment success Ht0 at baseline and Ht1 at scaleup, let Ht0=84% and Ht1=90% then the hazard ratio for prevention is

   HRt = 1-90%) / (1-84%) = 62.5% leading to 37.5% reduction in risk of TB death for those receiving treatment.

e. When the Current scenario (scale-up) (bottom) and Counterfactual (Baseline) top section are equal, as the example below, then there is no impact associated with the scenario/file. That is what is needed for the counterfactual **baseline file** – it should have no impact as it is meant to be a starting point from which to measure impact.

f. The top section therefore serves as a reference (baseline scenario) for hazards ratio for impact estimation.

g. Since the hazards are calculated in the bottom section, the bottom section must be copied to top section to make a permanent copy of the reference (baseline) hazards.

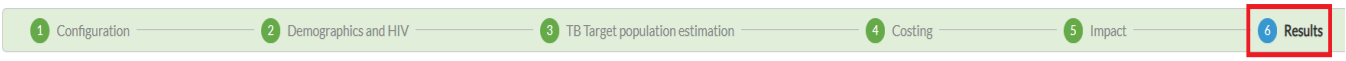
h. Therefore, you can trigger a run of the model by going to section 6: Results, which will produce the hazard ratios in the bottom section which can then be copied to the top section. When the top and bottom sections agree, run the model again and go to **6 Results > Impact results** and look for example at Incidence and confirm there is no impact.

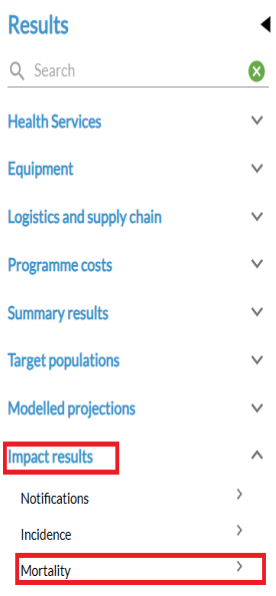
i. Save the baseline file.

[3] https://www.who.int/teams/global-tuberculosis-programme/data

Impact ratios

	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Counterfactual (Baseline)										
Total cases notified (#)	97,126	95,894	98,033	100,246	102,050	104,414	106,402	107,448	109,772	110,51
Reduction in population-level risk for TB disease (adjusted for higher risk in population groups receiving TPT) (%)	0.7%	0.7%	0.7%	0.7%	0.7%	0.7%	0.7%	0.7%	0.7%	0.69
Treatment success rate for new and relapse cases (%)	84.0%	84.0%	84.0%	84.0%	84.0%	84.0%	84.0%	84.0%	84.0%	84.09
Current scenario (Scale-up)										
Total cases notified (#)	97,126	95,894	98,033	100,246	102,050	104,414	106,402	107,448	109,772	110,51
Reduction in population-level risk for TB disease (adjusted for higher risk in population groups receiving TPT) (%)	0.7%	0.7%	0.7%	0.7%	0.7%	0.7%	0.7%	0.7%	0.7%	0.69
Treatment success rate for new and relapse cases (%)	84.0%	84.0%	84.0%	84.0%	84.0%	84.0%	84.0%	84.0%	84.0%	84.09



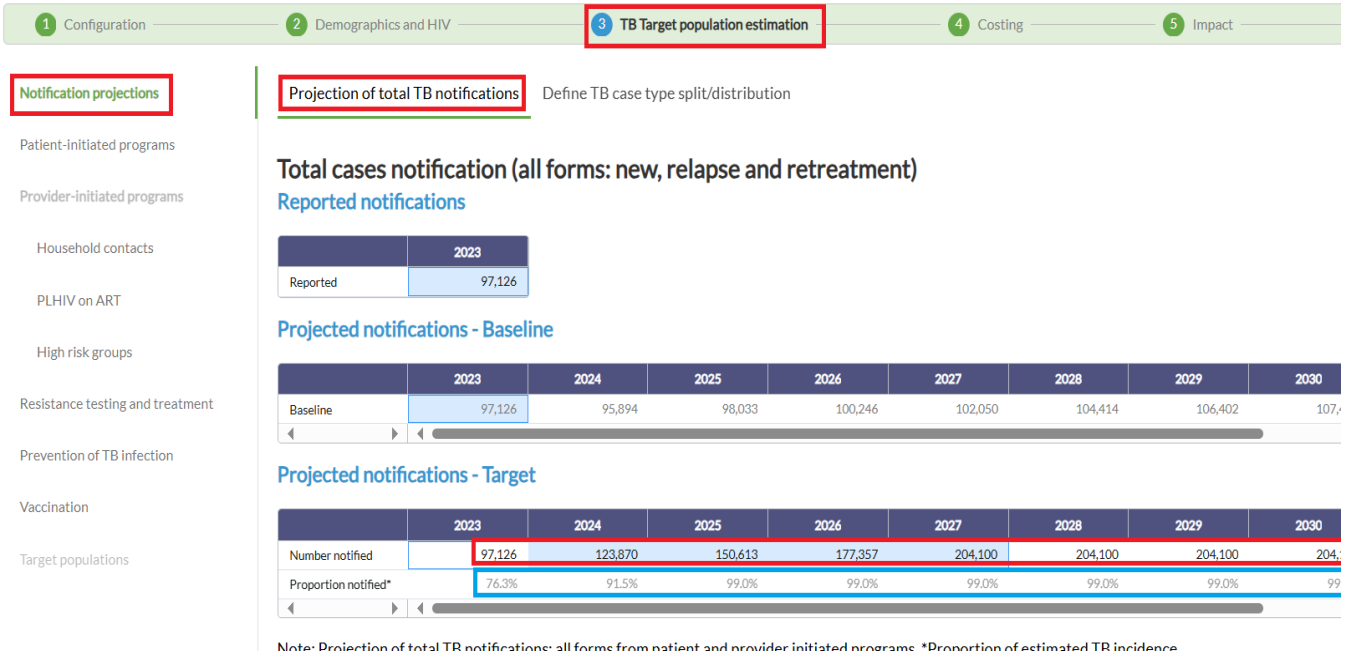


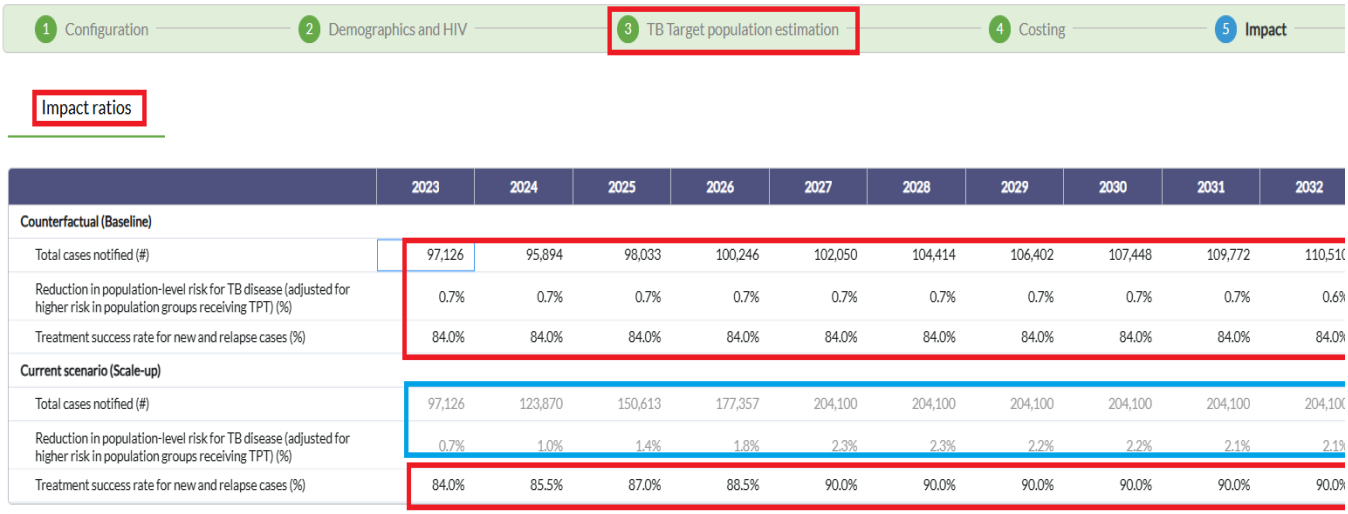
Mortality

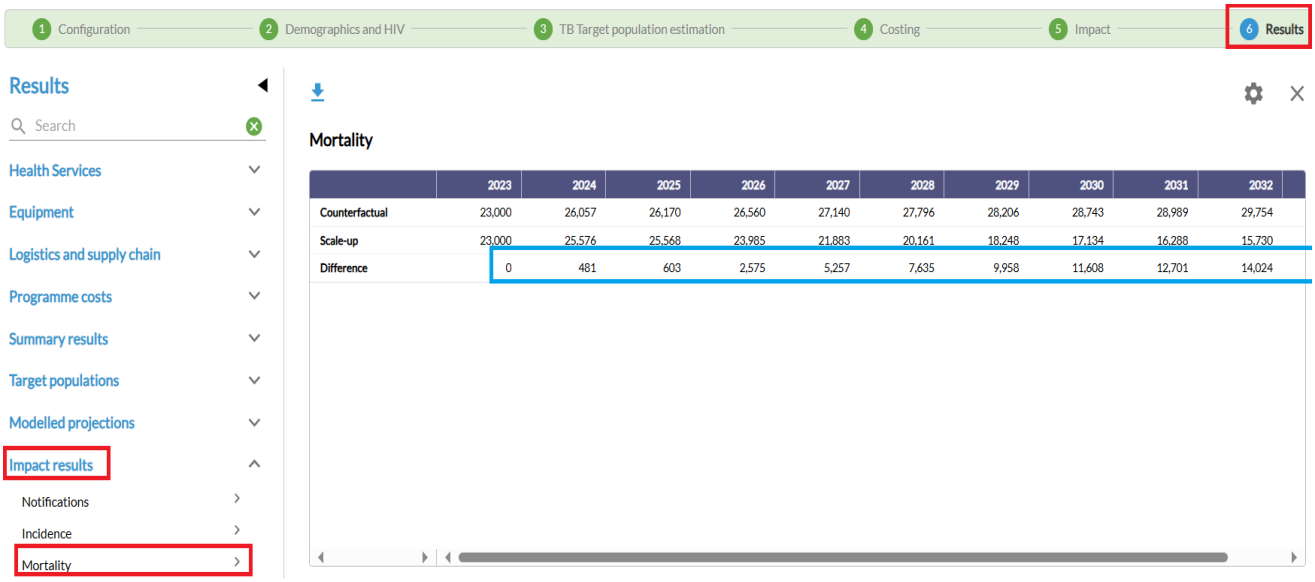
	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Counterfactual	23,000	26,057	26,170	26,560	27,140	27,796	28,206	28,743	28,989	29,754
Scale-up	23,000	26,057	26,170	26,560	27,140	27,796	28,206	28,743	28,989	29,754
Difference	0	0	0	0	0	0	0	0	0	0

Task 2: Setup the Counterfactual (Baseline) projection/file

1. Make a copy of the **saved baseline file** to serve as a starting point for developing a scale-up scenario.
   a. Use the "Save as" option to save the file as "[MyFile_name]Scaleup" or "[MyFile_name]NSP" where [MyFile_name] provides a description of your country and scenario description and Scaleup or NSP describes the scenario.
2. Go through the patient-initiated and patient-initiated populations and for each population input the scale-up pattern implied by the proposed strategy:
   a. Set the notification target. For example, in the example below we set a 100% increase (from 102,050 to 204,100 in this example) in baseline notifications by 2027 and linearly interpolate from 2023 to 2027.
   b. Set screening coverage increases in the provider-initiated population groups.
   c. Set TPT coverage increases by either increasing presumptive TPT or increasing TPT following LTBI testing in the provider-initiated population groups.
   d. Keep the algorithms as selected in the baseline file in all population groups.
   e. Keep resistance profiles and set DST coverage for all regimen types for all years according to the strategy.
   f. Trends for prevalence of TB in the population group can be set at a later stage but in principle a decline of prevalence can be inputted in some cases.
   g. The point of the above is to set all country-specific elements in the scale-up patterns of all inputs that define interventions and therefore policy & strategy to be costed and for which impact must be evaluated.
3. Trigger a run of the model by going to section 6: Results, which will produce the hazard ratios in the bottom section which can then be compared (not copied) to the top section. Notice the increase in the total notifications and the increase in the hazards of preventions and treatment outcomes in the scale-up scenarios.
4. Go to 6 **Results >Impact results** and look for example at Prevalence and confirm there is impact from 2024 onward.
5. Use the configuration option on the Impact result to show a chart instead of a table.
6. Save the scenario file.


1 Configuration
2 Demographics and HIV
3 TB Target population estimation
4 Costing
5 Impact
Notification projections
Patient-initiated programs
Provider-initiated programs
Household contacts
PLHIV on ART
High risk groups
Resistance testing and treatment
Prevention of TB infection
Vaccination
Target populations
Projection of total TB notifications
Define TB case type split/distribution
Total cases notification (all forms: new, relapse and retreatment)
Reported notifications
2023
Reported
97,126
Projected notifications - Baseline
2023 2024 2025 2026 2027 2028 2029 2030
Baseline
97,126 95,894 98,033 100,246 102,050 104,414 106,402
Projected notifications - Target
2023 2024 2025 2026 2027 2028 2029 2030
Number notified
97,126 123,870 150,613 177,357 204,100 204,100 204,100
Proportion notified*
76.3% 91.5% 99.0% 99.0% 99.0% 99.0% 99.0%
Note: Projection of total TB notifications: all forms from patient and provider initiated programs *Proportion of estimated TB incidence


1 Configuration
2 Demographics and HIV
3 TB Target population estimation
4 Costing
5 Impact
Impact ratios
2023 2024 2025 2026 2027 2028 2029 2030 2031 2032
Counterfactual (Baseline)
Total cases notified (#)
97,126 95,894 98,033 100,246 102,050 104,414 106,402 107,448 109,772 110,51
Reduction in population-level risk for TB disease (adjusted for higher risk in population groups receiving TPT) (%)
0.7% 0.7% 0.7% 0.7% 0.7% 0.7% 0.7% 0.7% 0.7% 0.6%
Treatment success rate for new and relapse cases (%)
84.0% 84.0% 84.0% 84.0% 84.0% 84.0% 84.0% 84.0% 84.0% 84.0%
Current scenario (Scale-up)
Total cases notified (#)
97,126 123,870 150,613 177,357 204,100 204,100 204,100 204,100 204,100 204,10
Reduction in population-level risk for TB disease (adjusted for higher risk in population groups receiving TPT) (%)
0.7% 1.0% 1.4% 1.8% 2.3% 2.3% 2.2% 2.2% 2.1% 2.1%
Treatment success rate for new and relapse cases (%)
84.0% 85.5% 87.0% 88.5% 90.0% 90.0% 90.0% 90.0% 90.0% 90.0%



	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Counterfactual	23,000	26,057	26,170	26,560	27,140	27,796	28,206	28,743	28,989	29,754
Scale-up	23,000	25,576	25,568	23,985	21,883	20,161	18,248	17,134	16,288	15,730
Difference	0	481	603	2,575	5,257	7,635	9,958	11,608	12,701	14,024

Quiz:

Question 1: When a projection is created, baseline notifications are provided from?

- ☐ User input
- ☐ A statistical projection based on WHO TB data with final year currently in 2023.

Question 2: A TB care cascade generates impact on TB via:

- ☐ Increased detection, prevention, and successful treatment.
- ☐ Constant detection, prevention, and successful treatment.

Question 3: Impact is generated by:

- ☐ The hazard rates in a scale-up scenario
- ☐ The ratio of hazard rates between a scale-up scenario and a baseline scenario

Question 4: Looking at the Mortality results of Task 1.2, in which there is scale-up and no impact we see that projected mortality is slowly increasing. In this example, growth in prevalence is about 3.5% per year. Possible reasons for this include.

- ☐ There is an ongoing background growth in TB transmission, reactivation, and morality.
- ☐ The statistical model is finding evidence of growth from increased incidence and from population growth leading to growth in mortality at a similar rate.

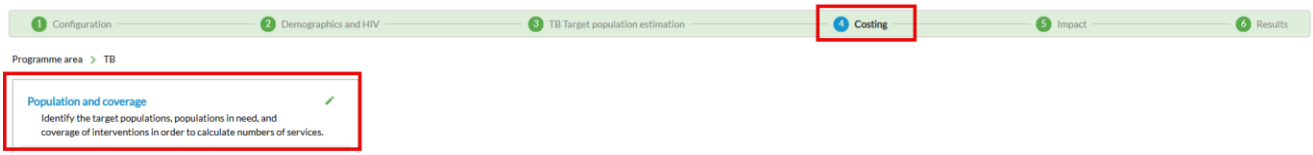
Question 5: In general, the largest impact is expected to result from a large ratio in

- ☐ The total number notified (via increased notification in the scale-up scenario)
- ☐ The population-level risk for TB disease (via increased TPT in the scale-up scenario)
- ☐ The treatment success rate for new and relapse cases (via increased treatment success in the scale-up scenario)

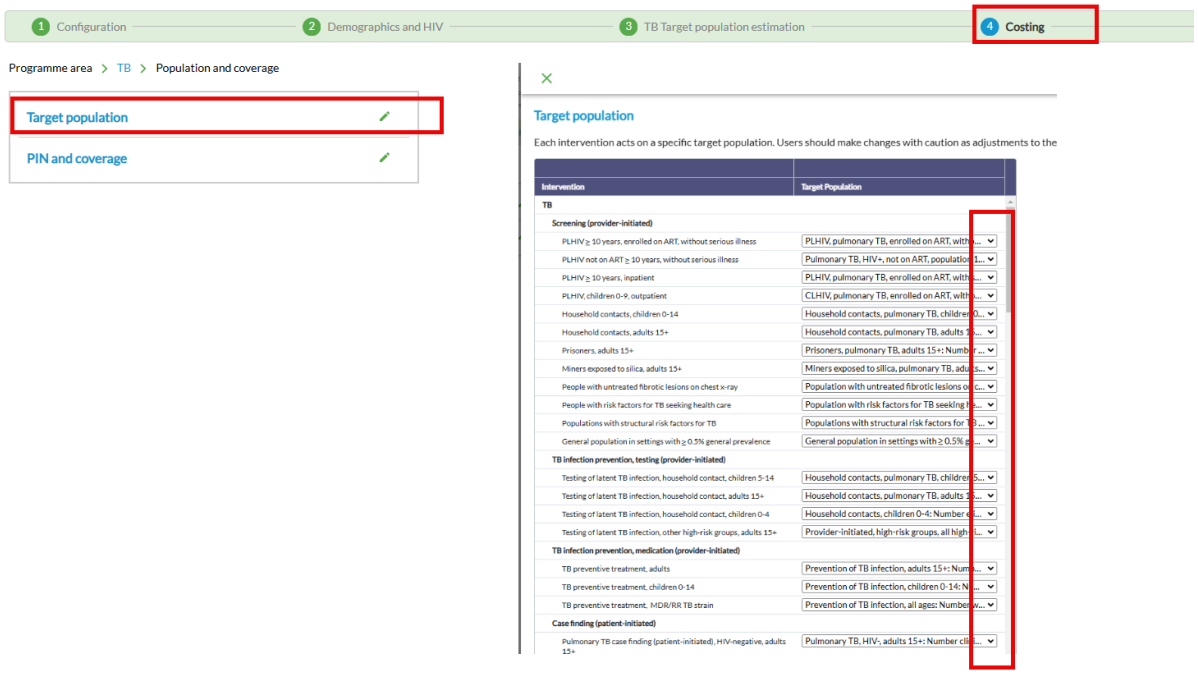
Exercise 5: Estimating numbers of people served based on populations and coverage

Task 1: Understand how target populations are drawn into costing

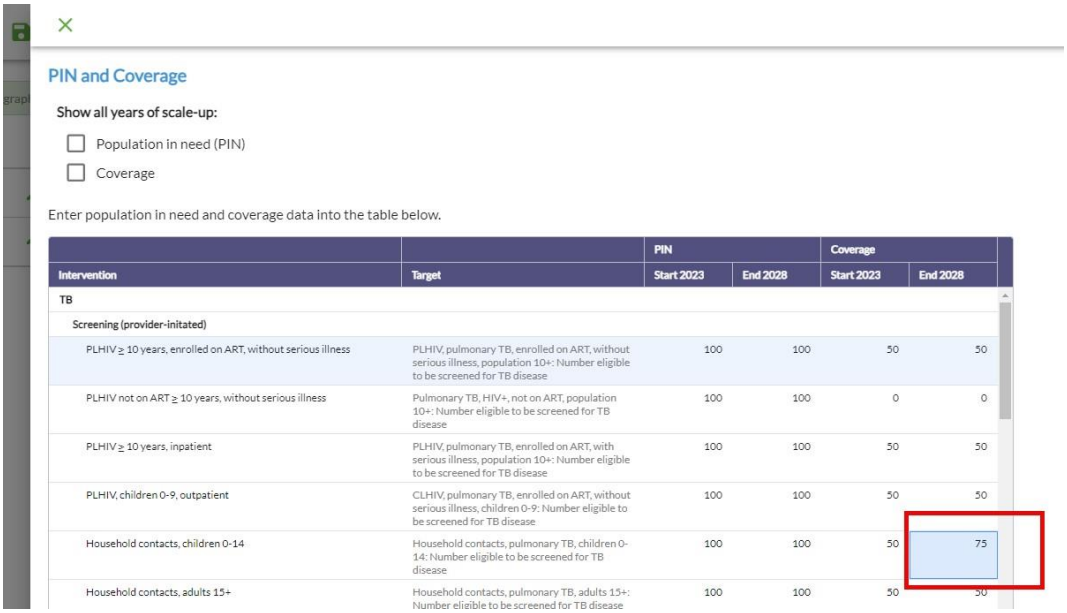
1. Open your projection file, move to section 4: Costing, and navigate to "Population and coverage."



2. Click on the pencil icon, and then "Target population." Review the target populations using the dropdown menu beside each intervention. You will see that they are named for populations which can be drawn from the TB target population estimates step.



3. Review PIN and coverage for the interventions. You should see 50% coverage of household screening for children 0-14 for 2023. Set the target coverage to 75%.



Intervention	Target	PIN		Coverage	
		Start 2023	End 2028	Start 2023	End 2028
TB					
Screening (provider-initated)					
PLHIV ≥ 10 years, enrolled on ART, without serious illness	PLHIV, pulmonary TB, enrolled on ART, without serious illness, population 10+: Number eligible to be screened for TB disease	100	100	50	50
PLHIV not on ART ≥ 10 years, without serious illness	Pulmonary TB, HIV+, not on ART, population 10+: Number eligible to be screened for TB disease	100	100	0	0
PLHIV ≥ 10 years, inpatient	PLHIV, pulmonary TB, enrolled on ART, with serious illness, population 10+: Number eligible to be screened for TB disease	100	100	50	50
PLHIV, children 0-9, outpatient	CLHIV, pulmonary TB, enrolled on ART, without serious illness, children 0-9: Number eligible to be screened for TB disease	100	100	50	50
Household contacts, children 0-14	Household contacts, pulmonary TB, children 0-14: Number eligible to be screened for TB disease	100	100	50	75
Household contacts, adults 15+	Household contacts, pulmonary TB, adults 15+: Number eligible to be screened for TB disease	100	100	50	50

4. Click on section 6: Results. This will instruct the tool to run projection results, including calculating the number of services, or number of people served

   a. How many household contacts 0-14 eligible for screening and diagnosis in 2028?_____ (Hint: Results > target populations > household contacts)

   b. What is the PIN in 2028? _____

   c. What is the coverage in 2028?_____

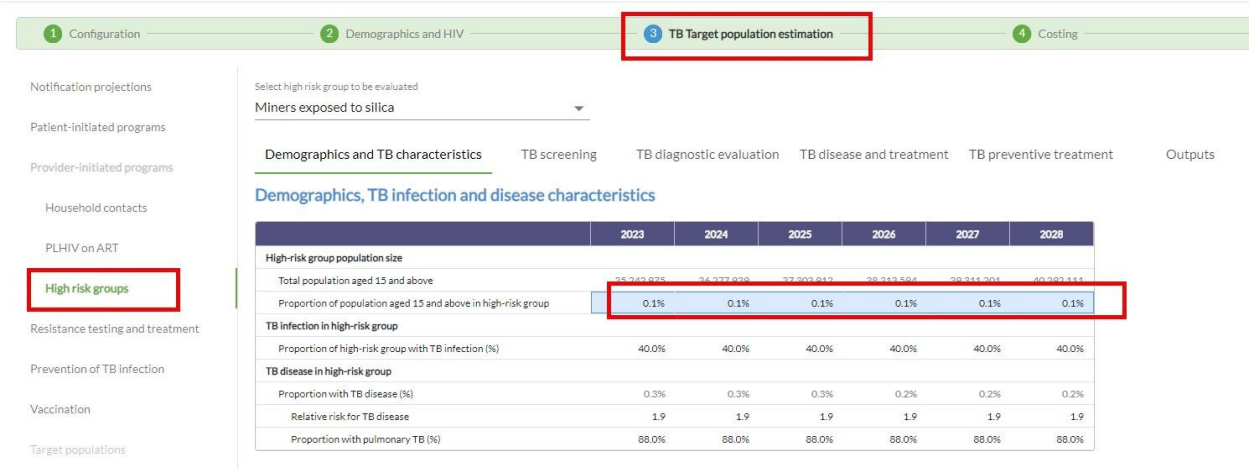
   Multiply the answers to a,b,c to estimate the number of services you should find:

   _____

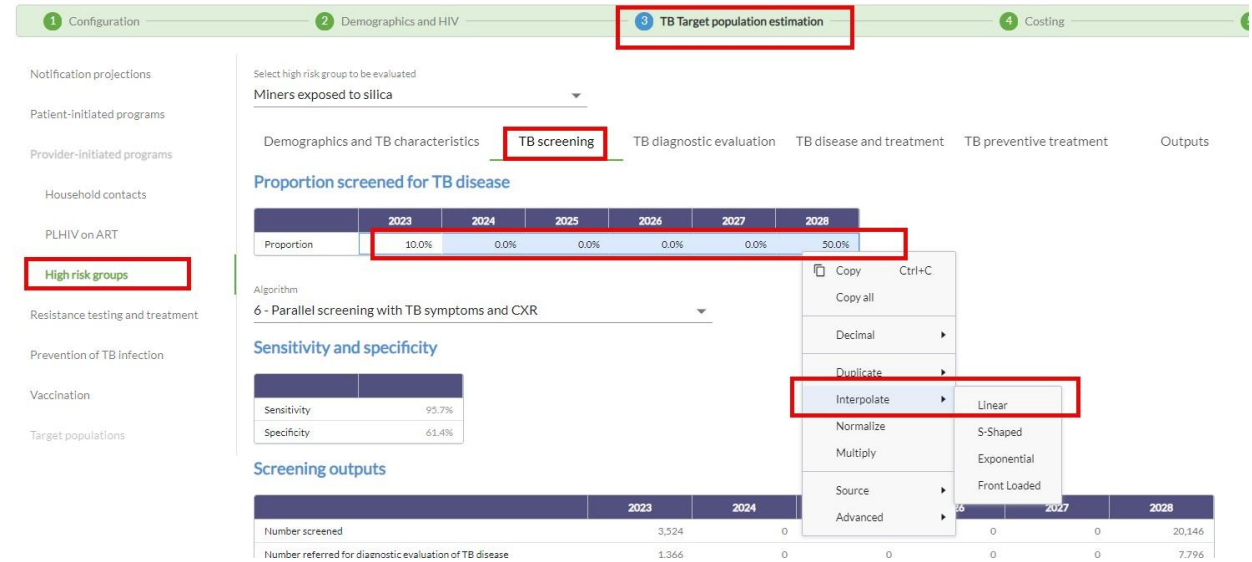
   Run the number of services result and compare with calculated number of services (available in Result > Health services > Total number of services by service package). Do they match?

Task 2: Manage coverage for high risk group screening and treatment for rifampicin and fluroquinolone resistant clients.

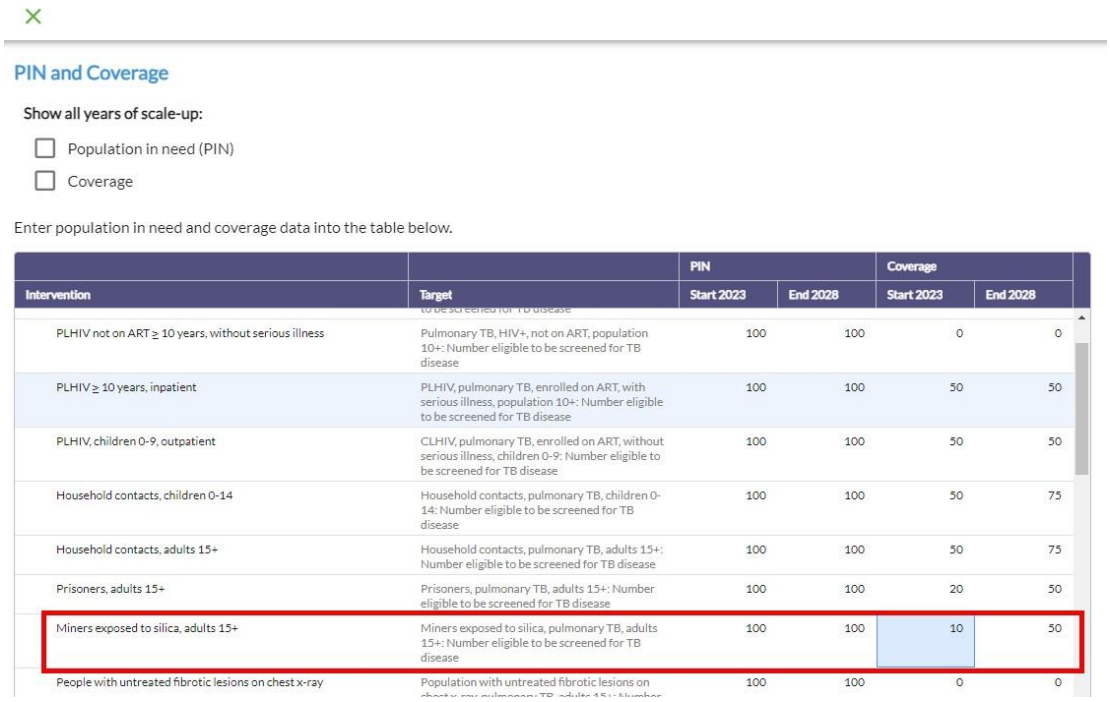
1. Go to TB Target population estimation > High risk groups and enter a enter a population size for miners: assume that they are 0.1% of the population.



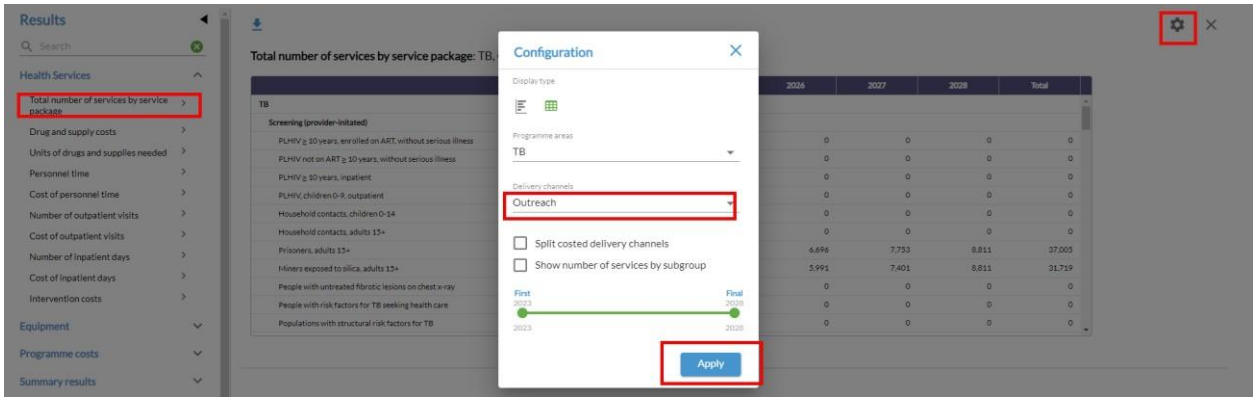
Next, enter TB screening coverage for miners. Assume 10% coverage in the base year, climbing to 50% coverage by the end year. Interpolate to assign coverage in intermediate years.



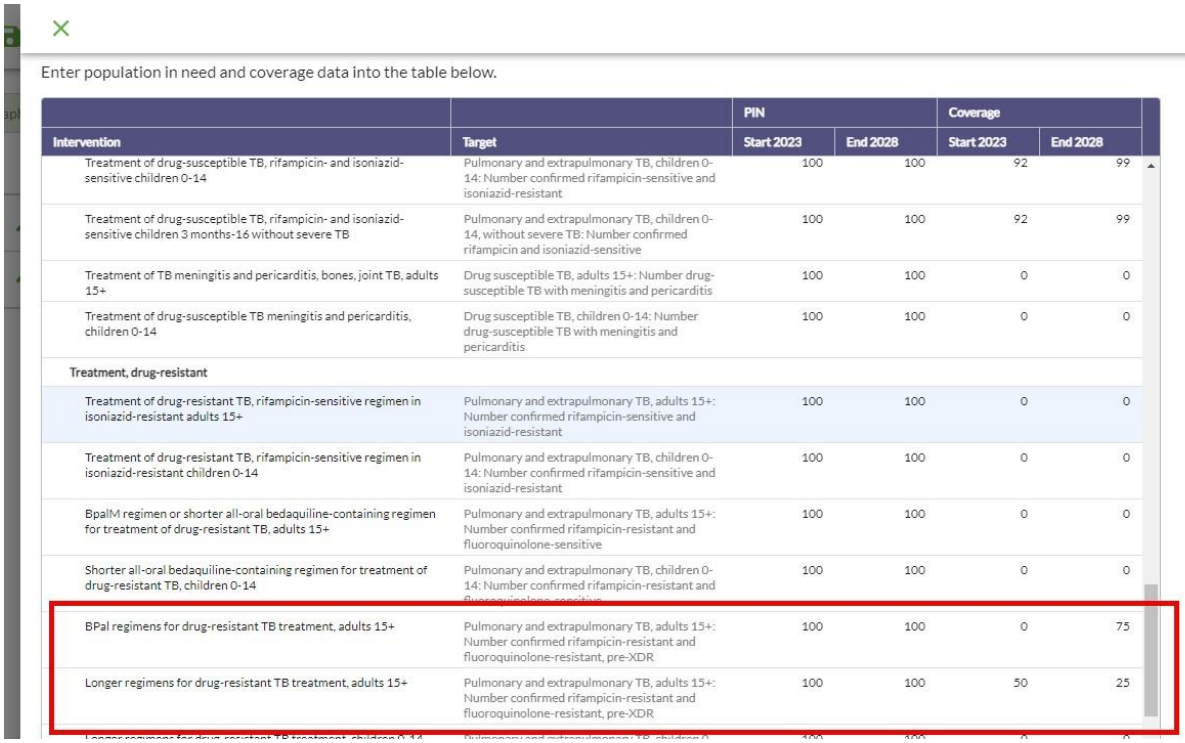
2. Go to Costing > Population and coverage > PIN and coverage. You should see identical screening coverage for miners (10-50%). The coverage transfers automatically between the target population estimates entry for screening coverage for prisoners and the Costing>Coverage editor.



3. Navigate to 6: Results and run the number of services result for screening for miners. Select the gear icon to disaggregate by delivery channel. How many miners are screened at the outreach level in 2028?



4. Navigate to the “PIN and coverage” editor and locate the rows which represent coverage for pre XDR TB. Set coverage in the base year for longer regimens to 50%, and 0% for BPal regimens. Assume that treatment coverage of this resistance profile scales up and these alternatives trade off, so that by the final year BPal coverage is 75% for adults 15+, and 25% for longer regimens for drug resistant TB.



Enter population in need and coverage data into the table below.

Intervention	Target	PIN		Coverage	
		Start 2023	End 2028	Start 2023	End 2028
Treatment of drug-susceptible TB, rifampicin- and isoniazid-sensitive children 0-14	Pulmonary and extrapulmonary TB, children 0-14: Number confirmed rifampicin-sensitive and isoniazid-resistant	100	100	92	99
Treatment of drug-susceptible TB, rifampicin- and isoniazid-sensitive children 3 months-16 without severe TB	Pulmonary and extrapulmonary TB, children 0-14, without severe TB: Number confirmed rifampicin and isoniazid-sensitive	100	100	92	99
Treatment of TB meningitis and pericarditis, bones, joint TB, adults 15+	Drug susceptible TB, adults 15+: Number drug-susceptible TB with meningitis and pericarditis	100	100	0	0
Treatment of drug-susceptible TB meningitis and pericarditis, children 0-14	Drug susceptible TB, children 0-14: Number drug-susceptible TB with meningitis and pericarditis	100	100	0	0
Treatment, drug-resistant					
Treatment of drug-resistant TB, rifampicin-sensitive regimen in isoniazid-resistant adults 15+	Pulmonary and extrapulmonary TB, adults 15+: Number confirmed rifampicin-sensitive and isoniazid-resistant	100	100	0	0
Treatment of drug-resistant TB, rifampicin-sensitive regimen in isoniazid-resistant children 0-14	Pulmonary and extrapulmonary TB, children 0-14: Number confirmed rifampicin-sensitive and isoniazid-resistant	100	100	0	0
BpalM regimen or shorter all-oral bedaquiline-containing regimen for treatment of drug-resistant TB, adults 15+	Pulmonary and extrapulmonary TB, adults 15+: Number confirmed rifampicin-resistant and fluoroquinolone-sensitive	100	100	0	0
Shorter all-oral bedaquiline-containing regimen for treatment of drug-resistant TB, children 0-14	Pulmonary and extrapulmonary TB, children 0-14: Number confirmed rifampicin-resistant and fluoroquinolone-sensitive	100	100	0	0
BPal regimens for drug-resistant TB treatment, adults 15+	Pulmonary and extrapulmonary TB, adults 15+: Number confirmed rifampicin-resistant and fluoroquinolone-resistant, pre-XDR	100	100	0	75
Longer regimens for drug-resistant TB treatment, adults 15+	Pulmonary and extrapulmonary TB, adults 15+: Number confirmed rifampicin-resistant and fluoroquinolone-resistant, pre-XDR	100	100	50	25

5. Review results for numbers of services:
    - How many people will receive BPal regimens in 2024? _____ 2028?_____

Task 3: Add assumptions for your custom intervention

1. In the Costing > Target population section, set the target population for genome sequencing to "Number to be tested for resistance to bedaquiline, linezolid, levofloxacin and moxifloxacin."
2. Set the PIN to 100% and coverage to 0% at baseline and 75% at the end year.
3. Run results for numbers of services. How many genome sequencing services will be delivered in 2024?_____ 2028?_____

Save your file.

Quiz

Question 1: What entries are used to calculate number of people served? (select all which apply)

- ☐ Coverage
- ☐ Population in need
- ☐ Drug costs
- ☐ Target population

Question 2: True or false: Coverage must be entered only in the costing editors and cannot be entered in the target population editors

- ☐ True
- ☐ False

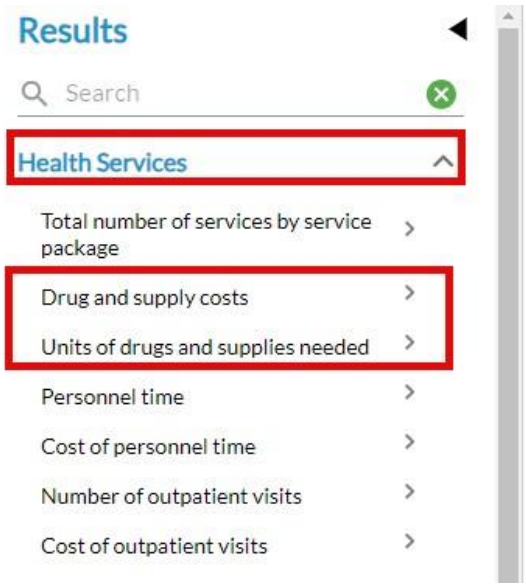
Question 3: How are results for numbers of services available (Results > Health services)? Select all which apply.

- ☐ By year
- ☐ Total
- ☐ By delivery channel
- ☐ By subgroup

Exercise 6: Intervention inputs

Task 1: Review the structure of intervention inputs

1. Run results for drug and supply costs and units of drugs and supplies needed.



2. How many doses of BpaL (6 month) are needed in 2024? _____

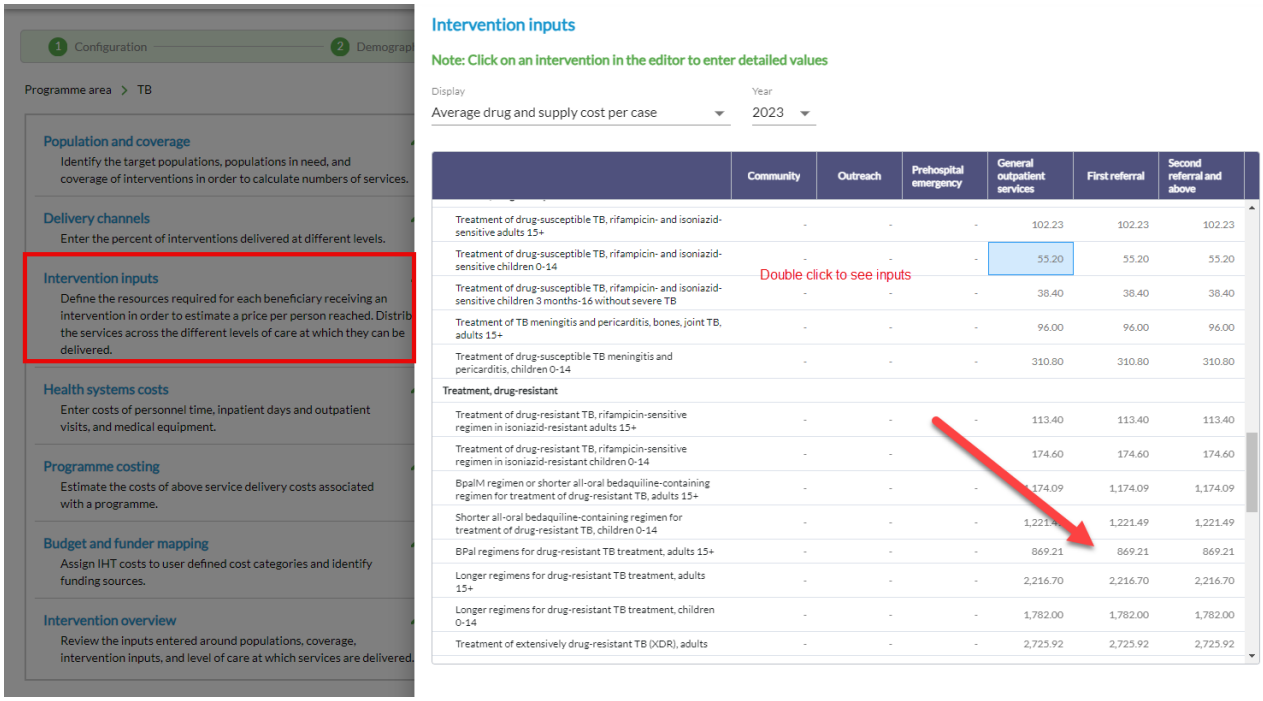
   In 2028?_____

3. What are the costs of BpaL regimens for drug resistant TB (adults) in 2024?_____

   In 2028?_____

4. Navigate to Costing > Intervention inputs. Double click on the cell for BpaL regimens for drug resistant TB (adults).

5. Review the inputs for drugs and supplies, health providers, and visits. Note that provider time for treatment delivery and monitoring is included in monitoring interventions; any additions to the provider time should take this assumption into account to avoid double counting.


1 Configuration
2 Demograp
Programme area › TB
Population and coverage
Identify the target populations, populations in need, and coverage of interventions in order to calculate numbers of services.
Delivery channels
Enter the percent of interventions delivered at different levels.
Intervention inputs
Define the resources required for each beneficiary receiving an intervention in order to estimate a price per person reached. Distrib the services across the different levels of care at which they can be delivered.
Health systems costs
Enter costs of personnel time, inpatient days and outpatient visits, and medical equipment.
Programme costing
Estimate the costs of above service delivery costs associated with a programme.
Budget and funder mapping
Assign IHT costs to user defined cost categories and identify funding sources.
Intervention overview
Review the inputs entered around populations, coverage, intervention inputs, and level of care at which services are delivered.
Intervention inputs
Note: Click on an intervention in the editor to enter detailed values
Display
Average drug and supply cost per case
Year
2023
Community
Outreach
Prehospital emergency
General outpatient services
First referral
Second referral and above
Treatment of drug-susceptible TB, rifampicin- and isoniazid-sensitive adults 15+ 102.23 102.23 102.23
Treatment of drug-susceptible TB, rifampicin- and isoniazid-sensitive children 0-14 55.20 55.20 55.20
Double click to see inputs
Treatment of drug-susceptible TB, rifampicin- and isoniazid-sensitive children 3 months-16 without severe TB 38.40 38.40 38.40
Treatment of TB meningitis and pericarditis, bones, joint TB, adults 15+ 96.00 96.00 96.00
Treatment of drug-susceptible TB meningitis and pericarditis, children 0-14 310.80 310.80 310.80
Treatment, drug-resistant
Treatment of drug-resistant TB, rifampicin-sensitive regimen in isoniazid-resistant adults 15+ 113.40 113.40 113.40
Treatment of drug-resistant TB, rifampicin-sensitive regimen in isoniazid-resistant children 0-14 174.60 174.60 174.60
BpalM regimen or shorter all-oral bedaquiline-containing regimen for treatment of drug-resistant TB, adults 15+ 1,174.09 1,174.09 1,174.09
Shorter all-oral bedaquiline-containing regimen for treatment of drug-resistant TB, children 0-14 1,221.49 1,221.49
BPal regimens for drug-resistant TB treatment, adults 15+ 869.21 869.21 869.21
Longer regimens for drug-resistant TB treatment, adults 15+ 2,216.70 2,216.70 2,216.70
Longer regimens for drug-resistant TB treatment, children 0-14 1,782.00 1,782.00 1,782.00
Treatment of extensively drug-resistant TB (XDR), adults 2,725.92 2,725.92 2,725.92

Task 2: Change the percent of clients getting a given input

1. Now assume that 75% of adult BPaL clients will receive the six month regimen, and 25% will use the 9 month regimen. (Hint: you can adjust inputs in one delivery channel, then use the green “Copy to all channels button”)

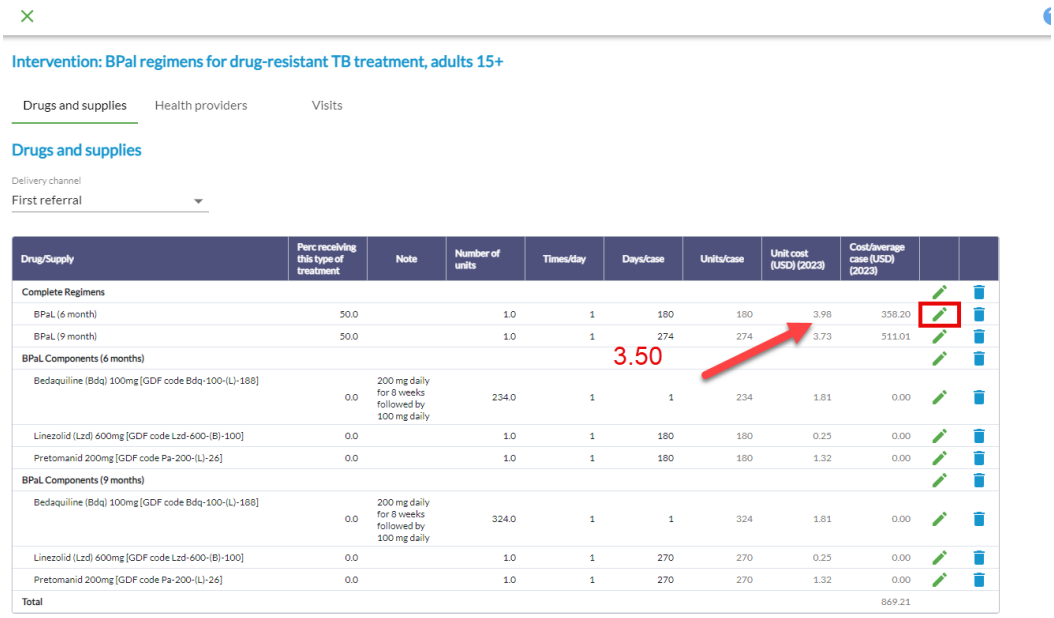
Drug/Supply	Perc receiving this type of treatment	Note	Number of units	Times/day	Days/case	Units/case	Unit cost (USD) (2023)	Cost/average case (USD) (2023)		
Complete Regimens										
BPaL (6 month)	75.0		1.0	1	180	180	3.98	537.30		
BPaL (9 month)	25.0		1.0	1	274	274	3.73	255.50		
BPaL Components (6 months)										
Bedaquiline (Bdq) 100mg [GDF code Bdq-100-(L)-188]	0.0	200 mg daily for 8 weeks followed by	234.0	1	1	234	1.81	0.00		

Rerun results for total number of drugs and supplies needed (Results>Health services>. How many total doses of BPaL (6 month) are needed in 2024? _____ In 2028?_____

How did this change from your answer under the previous task?_____

Task 3: Change the unit price for an input

1. Navigate to the intervention inputs for the six and nine month BPaL regimens and change the per day unit price for all years to 3.50, assuming a new and lower negotiated rate.



Drug/Supply	Perc receiving this type of treatment	Note	Number of units	Times/day	Days/case	Units/case	Unit cost (USD) (2023)	Cost/average case (USD) (2023)
Complete Regimens								
BPaL (6 month)	50.0		1.0	1	180	180	3.98	358.20
BPaL (9 month)	50.0		1.0	1	274	274	3.73	511.01
BPaL Components (6 months)								
Bedaquiline (Bdq) 100mg [GDF code Bdq-100-(L)-188]	0.0	200 mg daily for 8 weeks followed by 100 mg daily	234.0	1	1	234	1.81	0.00
Linezolid (Lzd) 600mg [GDF code Lzd-600-(B)-100]	0.0		1.0	1	180	180	0.25	0.00
Pretomanid 200mg [GDF code Pa-200-(L)-26]	0.0		1.0	1	180	180	1.32	0.00
BPaL Components (9 months)								
Bedaquiline (Bdq) 100mg [GDF code Bdq-100-(L)-188]	0.0	200 mg daily for 8 weeks followed by 100 mg daily	324.0	1	1	324	1.81	0.00
Linezolid (Lzd) 600mg [GDF code Lzd-600-(B)-100]	0.0		1.0	1	270	270	0.25	0.00
Pretomanid 200mg [GDF code Pa-200-(L)-26]	0.0		1.0	1	270	270	1.32	0.00
Total								869.21

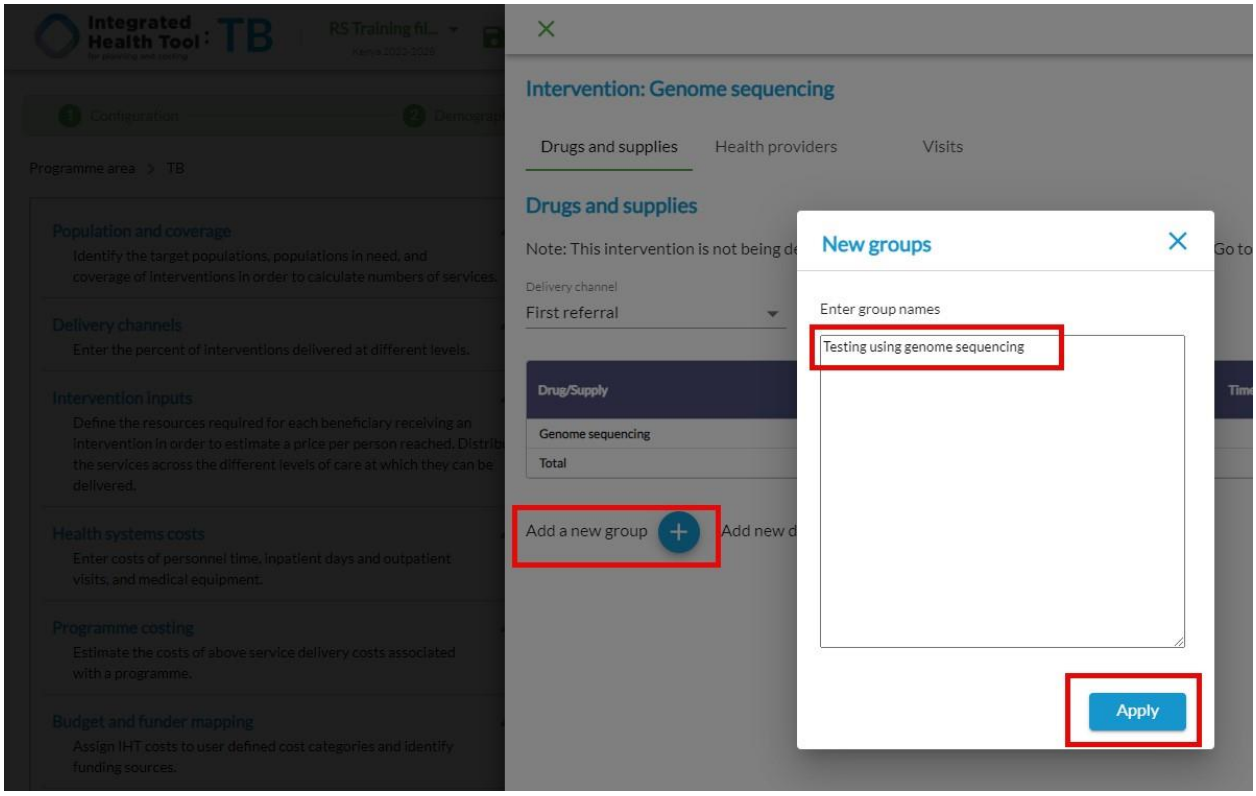
2. Rerun a result for drug and supply costs. What are the total costs of BPaL regimens for drug resistant TB (adults) in 2024?_____ In 2028?_____

   How did these change from your first task? Is it in the expected direction?

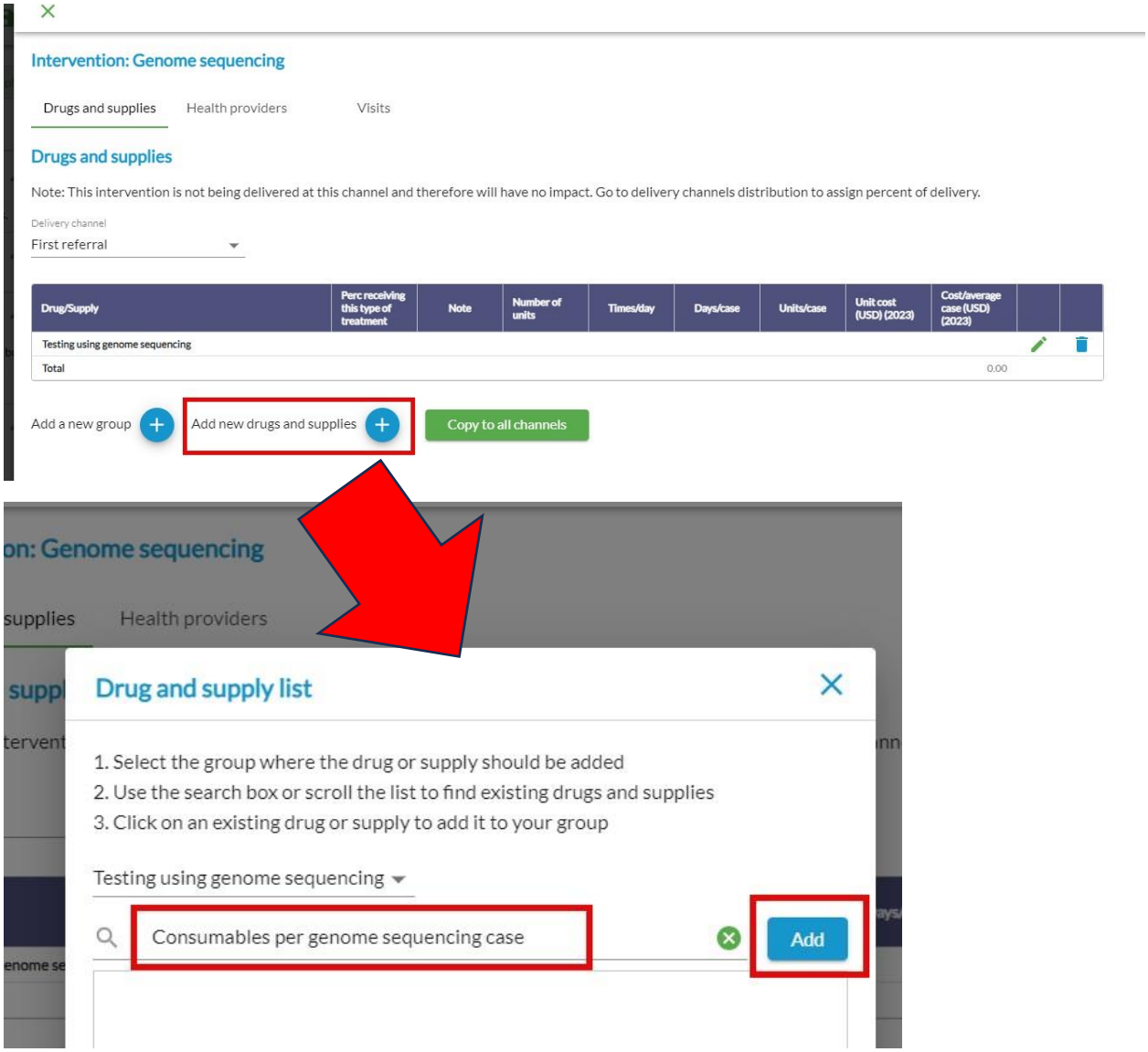
   _____

Task 4: Enter inputs for your custom intervention

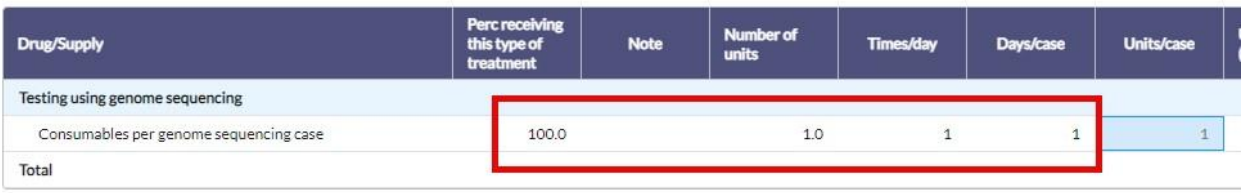
1. Navigate to Costing > Delivery channels and review delivery channels for the genome sequencing intervention. Edit the intervention so that it is delivered 50% at the first referral and 50% at second referral and above in both baseline and target years.
2. Move to the intervention inputs for the intervention. Double click on the average price cell for either first or second referral.
3. Add a new group called “Testing using genome sequencing”.



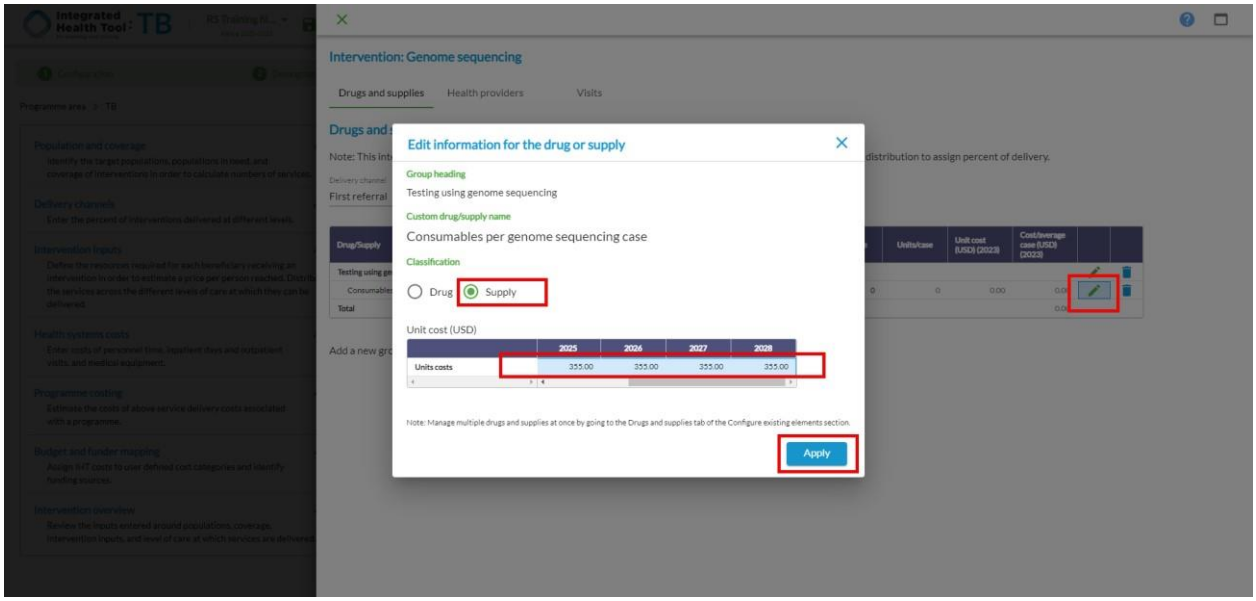
4. Add a new supply called “Consumables per genome sequencing case” by clicking on “Add new drug or supply, searching for this consumable, and then adding as it is not found.



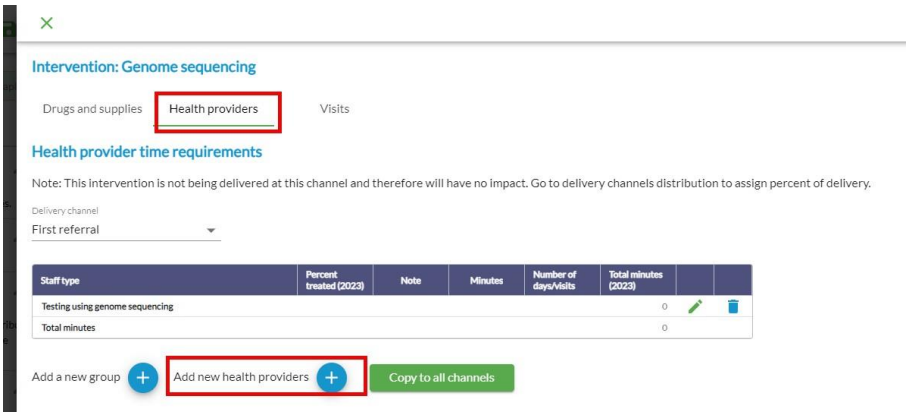
5. Assume that all clients for this intervention receive this consumable (100% receiving), and set the number of units, times per day, and days per case to 1.

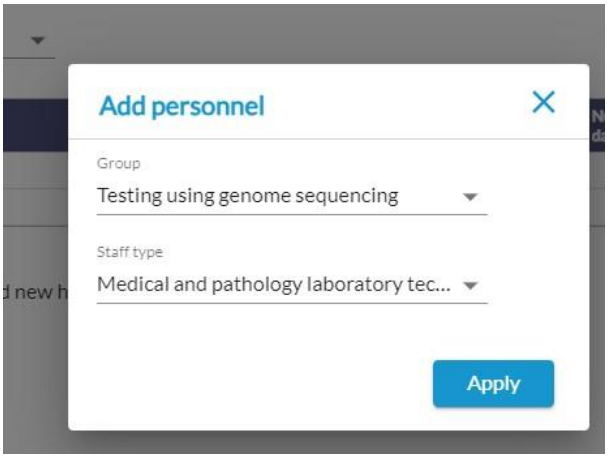


6. Set the price for genome sequencing consumables to US$ 355 and copy to all years.



7. Enter provider time inputs: assume that this intervention requires 30 minutes of medical and pathology laboratory technician time for all clients.



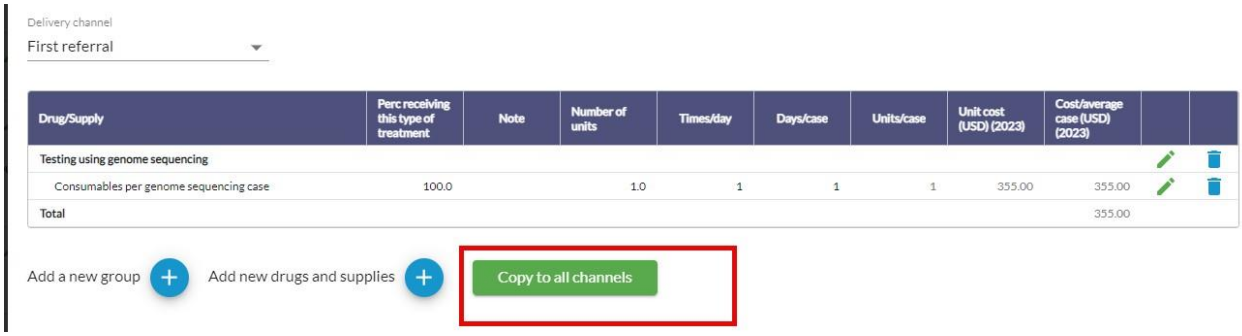


Staff type	Percent treated (2023)	Note	Minutes	Number of days/visits	Total minutes (2023)		
Testing using genome sequencing					0		
Medical and pathology laboratory technicians	100.0		30.0	1	30		
Total minutes					30		

8. Navigate to “Visits,” add a line for outpatient visits, and assume that one outpatient visit is required for this service, for patients to provide a sample. The assumption is that results are sent directly to the treatment center and thus no follow up visit is required here.

	Percent receiving (2023)	Note	Units per case	Total visits (2023)		
Testing using genome sequencing				0.0		
Outpatient visits	100.0		1	1.0		
Total visits				1.0		

9. Copy the inputs to other levels, either manually, or using the copy to all channels button.



10. Review results:

    What is the total intervention costs of genome sequencing in:

    2024? _____ 2028?_____

    What is the total consumables cost of genome sequencing given the forecasted population to receive this TB service?

    2024? _____ 2028?_____

Quiz

Question 1: Intervention inputs include what elements (select all that apply)?

- [ ] Drugs
- [ ] Inpatient day costs
- [ ] Outpatient visit costs
- [ ] Equipment
- [ ] Provider time
- [ ] Supplies

Question 2: True or false: Intervention inputs are set and cannot be changed by the user.

- [ ] True
- [ ] False

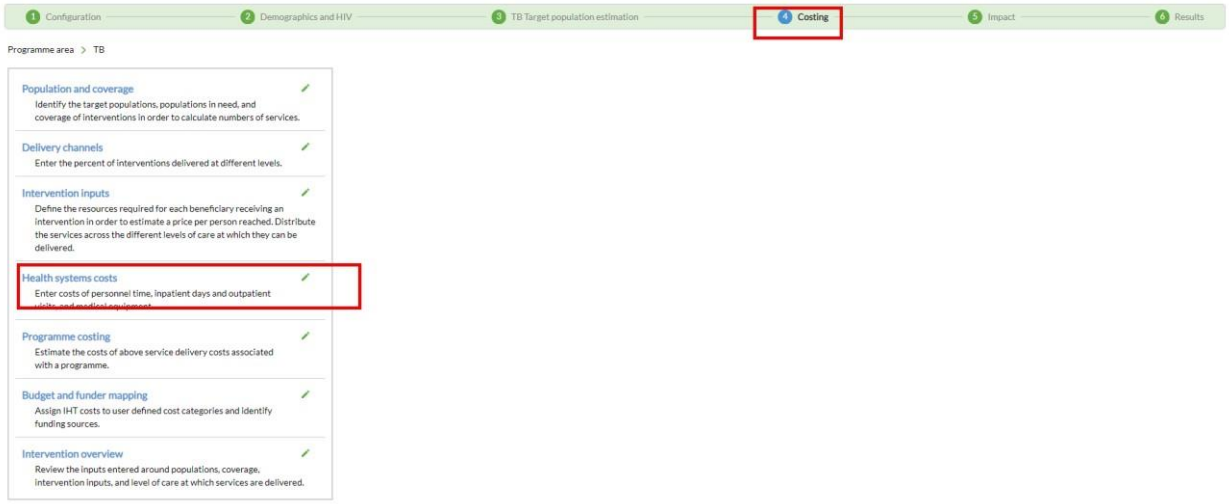
Question 3: True or false: The price entered for a drug must be the same for all years

- [ ] True
- [ ] False

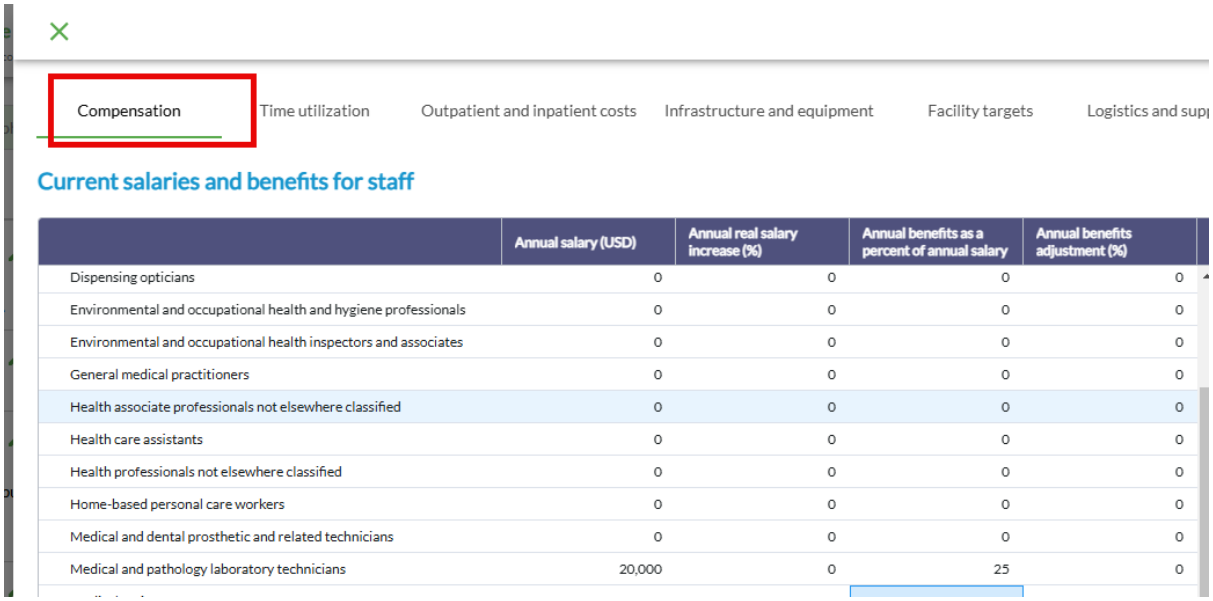
Exercise 7: Health system costs

Task 1: Review and revise health system cost entries and assumptions.

1. Navigate to Costing > Health system costs > Compensation

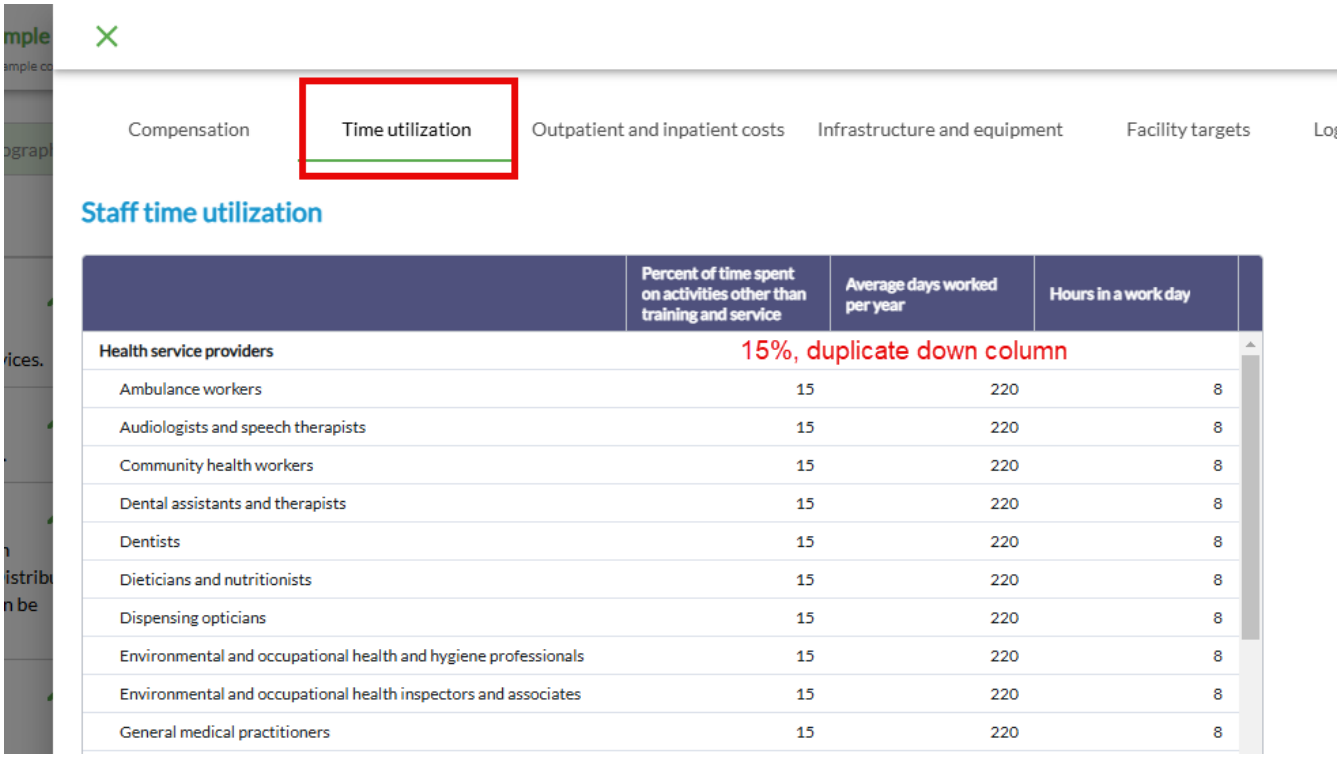


2. Review the salaries entered. Revise “Medical and pathology laboratory technicians” to $20,000 annually, assuming that in this situation these labor costs are not included in the outpatient visit costs. Add benefits at 25% of the salary costs.

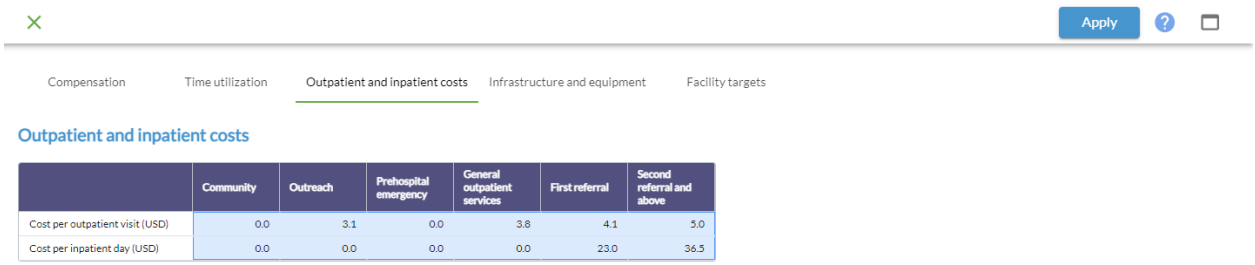


	Annual salary (USD)	Annual real salary increase (%)	Annual benefits as a percent of annual salary	Annual benefits adjustment (%)
Dispensing opticians	0	0	0	0
Environmental and occupational health and hygiene professionals	0	0	0	0
Environmental and occupational health inspectors and associates	0	0	0	0
General medical practitioners	0	0	0	0
Health associate professionals not elsewhere classified	0	0	0	0
Health care assistants	0	0	0	0
Health professionals not elsewhere classified	0	0	0	0
Home-based personal care workers	0	0	0	0
Medical and dental prosthetic and related technicians	0	0	0	0
Medical and pathology laboratory technicians	20,000	0	25	0

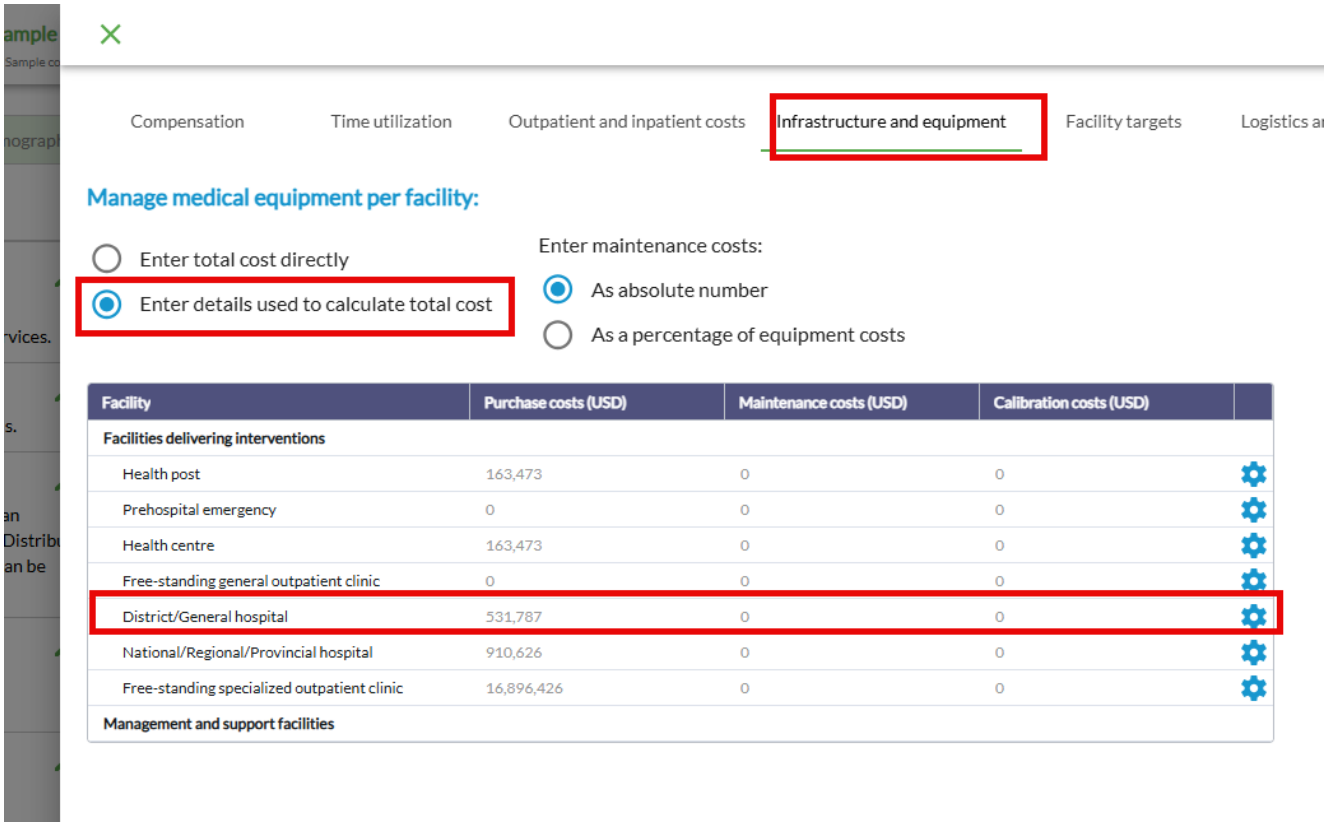
3. Move to time utilization. Assume that 15% of time is spent on items other than service delivery such as paperwork or break time.



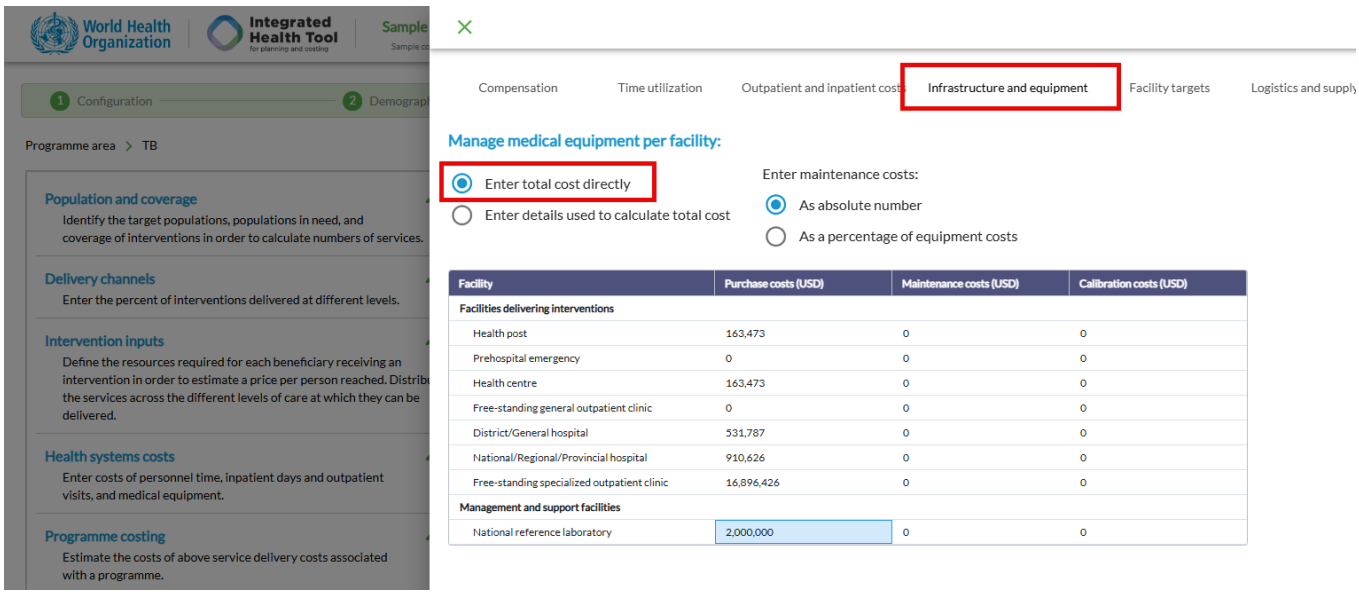
4. Review outpatient and inpatient costs. Assume that you are told that 2nd level referral and above outpatient costs are $5. Update this entry.



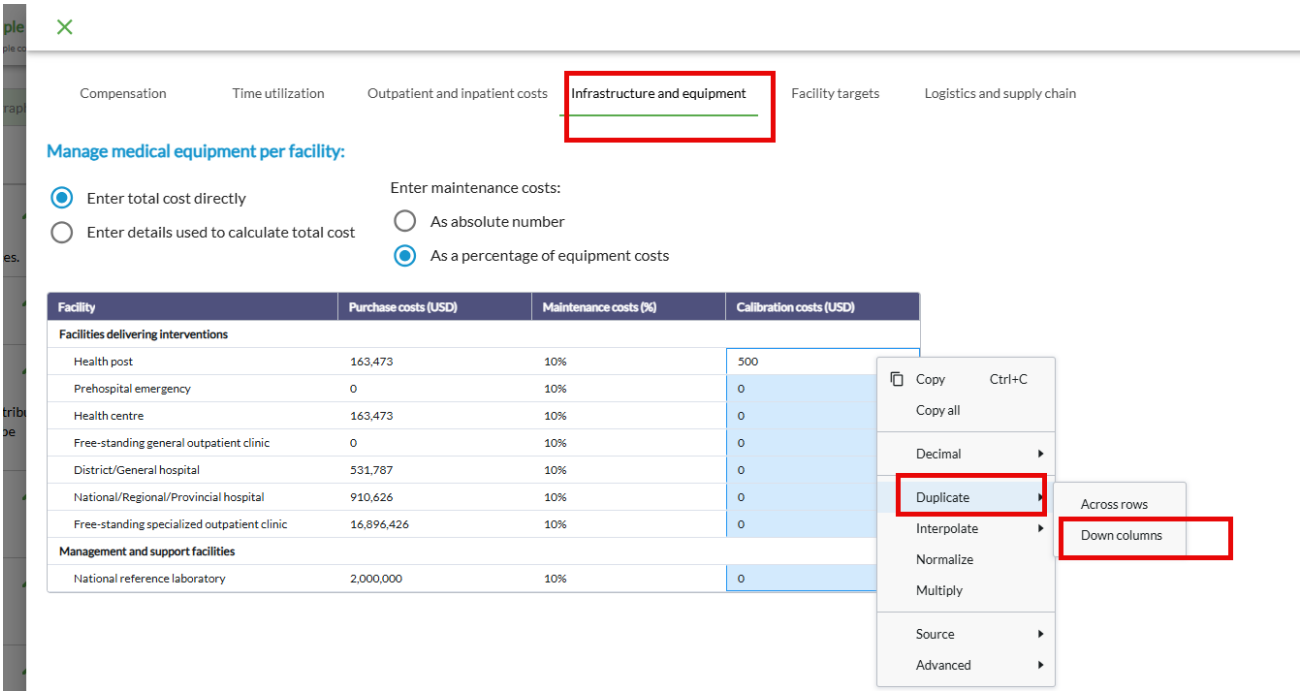
5. Review infrastructure and equipment costs. Switch to “enter details” and review the entries for the district/general hospital. How much is it anticipated that an LED microscope will cost?_____



6. Switch back to entering a total cost directly and enter a cost of $2 million for new TB equipment of a national reference lab (assuming all other infrastructure and equipment already in place).

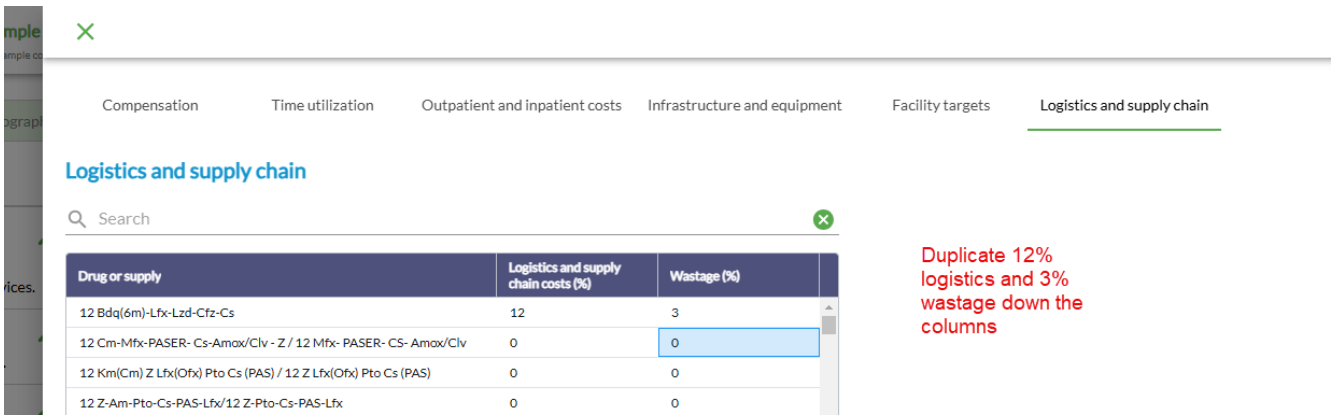


7. Add maintenance costs of 10% of purchase costs and calibration costs of $500 per facility.



8. Move to facility targets and add the assumption that you will equip 1 national reference lab in 2025, 50 health posts each year from 2025-2028, 20 health centres each year from 2025 to 2027, and 3 district hospitals in 2025, using the default equipment pack (in the TB module of IHT) for those facility types.

9. Add logistics and supply chain costs of 12% for all drugs and supplies, and assume 3% wastage.



Task 2: Review health system cost results

1. Move to Results > Health services.
2. How many FTEs of general medical practitioners are needed in 2028?_____ (Hint: generate result for personnel time, use the cog wheel to configure to show FTEs).

3. Generate costs of personnel time: How much does the personnel time cost to implement household contact screening for adults in 2028?
   _____
4. Generate costs of inpatient days. Which intervention contributes the most to inpatient days cost?_____
5. Move to the Equipment summary results. What are the costs in 2026? _____ Which facility type accounts for largest share of total equipment cost in 2026? _____ How much are maintenance and calibration costs in 2028?
6. Review logistics and supply chain summary costs. What are the total logistics and supply chain costs in 2027?_____ Wastage costs for the same year?_____

Save your file.

Quiz

Question 1: What types of health system costs are captured in the TB module of IHT? Select all which apply.

- [ ] Supply chain and logistics costs
- [ ] Governance costs
- [ ] Provider salaries and benefits
- [ ] Equipment costs
- [ ] Costs of outpatient visits and inpatient days

Question 2: True or false: Equipment costs can be captured as a total cost for all equipment at a facility or by individual equipment items at a facility.

- [ ] True
- [ ] False

Question 3: True or false: provider time and inpatient day/outpatient visit costs can be viewed by delivery channel/service delivery level.

- [ ] True
- [ ] False

Question 4: Maintenance costs can be estimated by device or based on total equipment purchase prices.

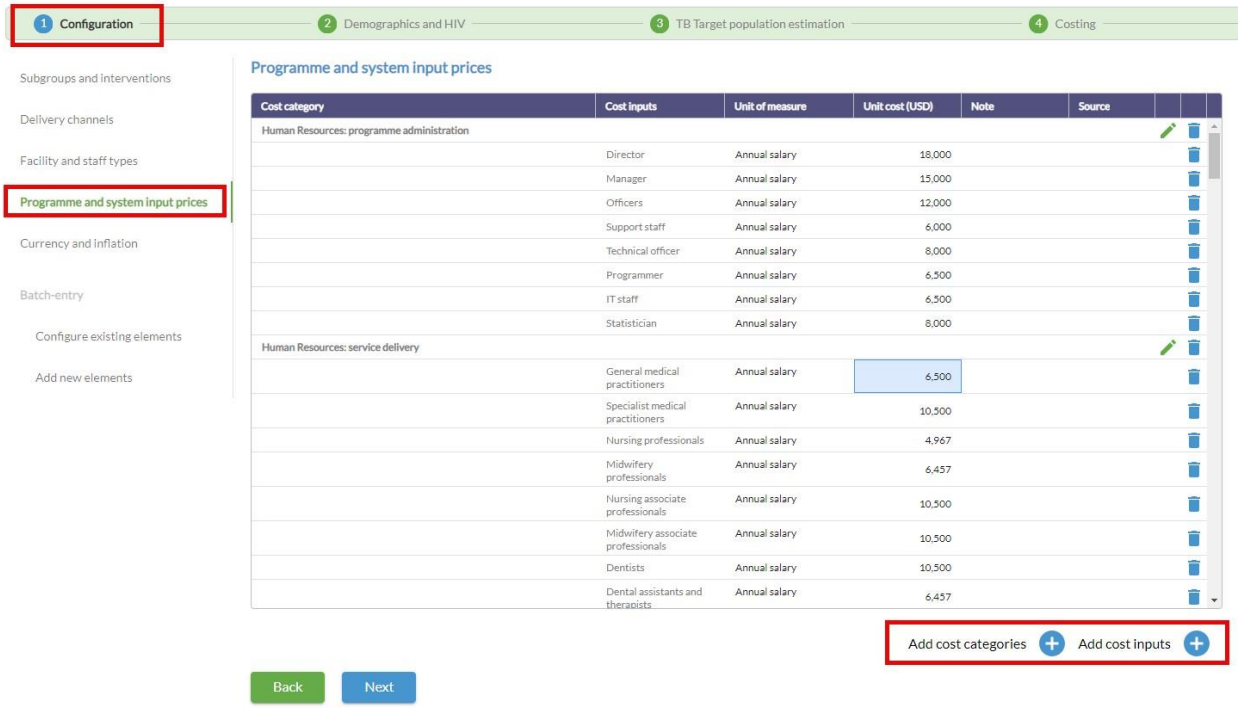
- [ ] True
- [ ] False

Exercise 8: Programme costs

Objectives: After completion of this exercise, users should be able to expand the list of activity inputs, edit prices for those inputs, and set up a list of above service delivery or programme costs which correspond to the activities represented in their tuberculosis national strategic plan, in order to estimate the annual costs of those activities.

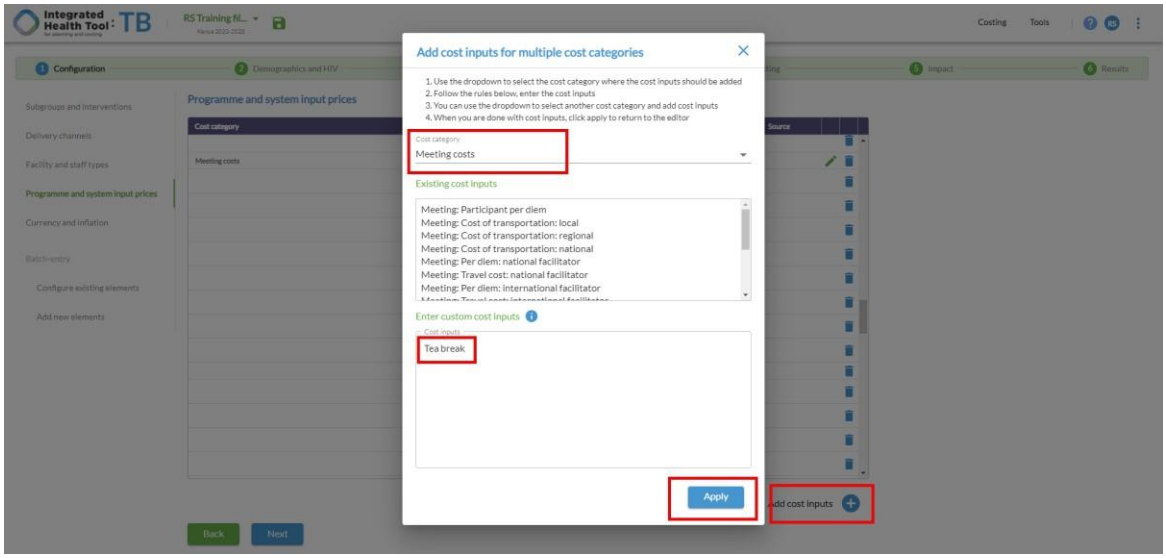
Task 1: Review and revise Programme cost inputs and unit prices.

1. Navigate to Configuration > Programme and system input prices. In this section you can put in unit prices for your activity inputs, as well as add additional cost categories and inputs.



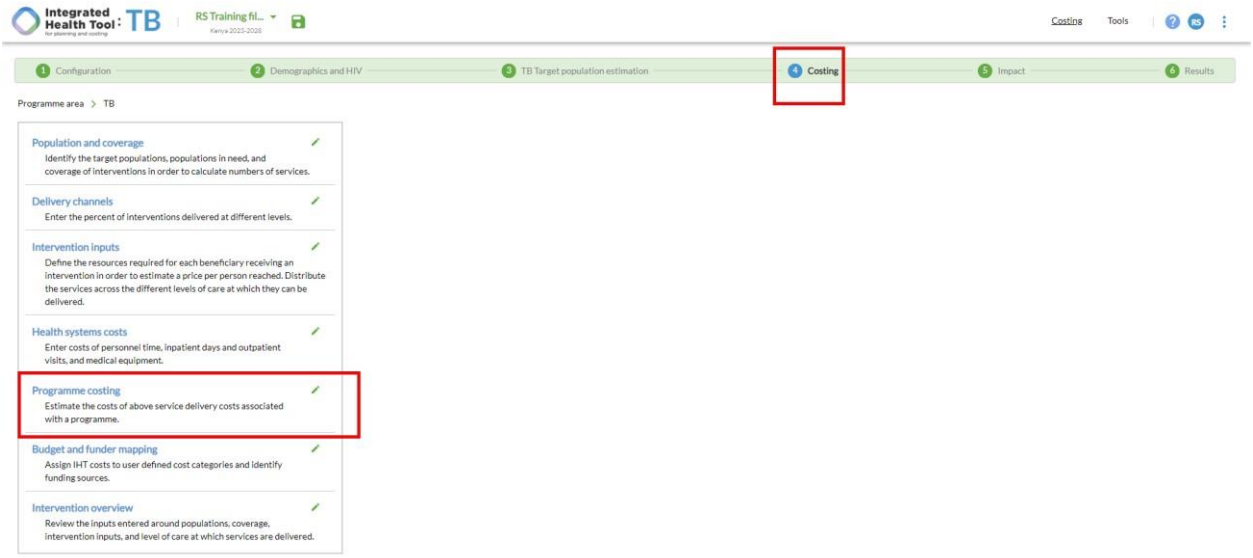
2. Enter prices for External Professional services as follows:
   - Senior international consultant daily rate: $500
   - Junior international consultant daily rate: $350

3. Add a new meeting cost for “Tea break” of $7.

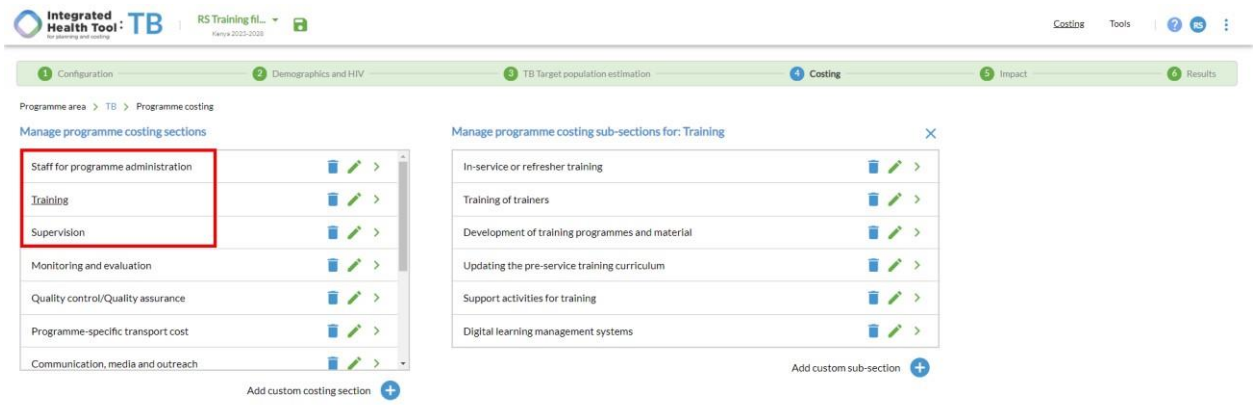


Task 2: Set up programme cost activity list to mimic NSP activities

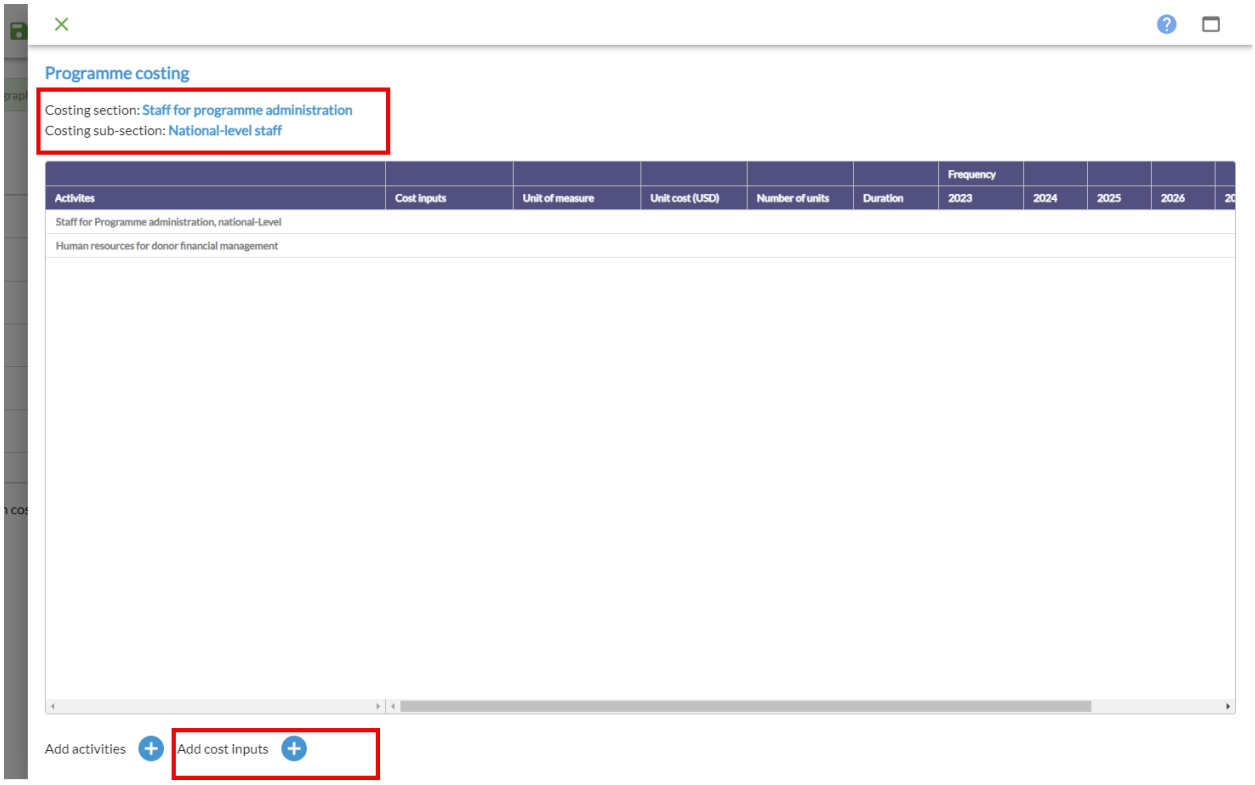
1. Navigate to Costing > Programme costing



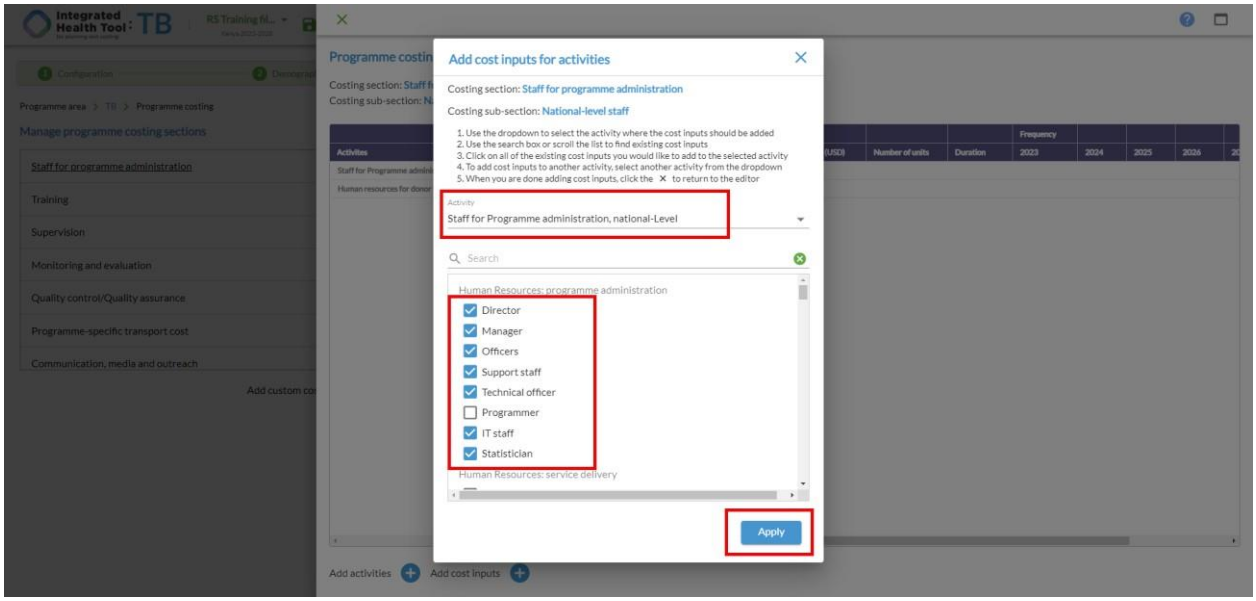
2. Review the default set of Sections and Sub sections and activities for the first few sections, including training, and supervision.



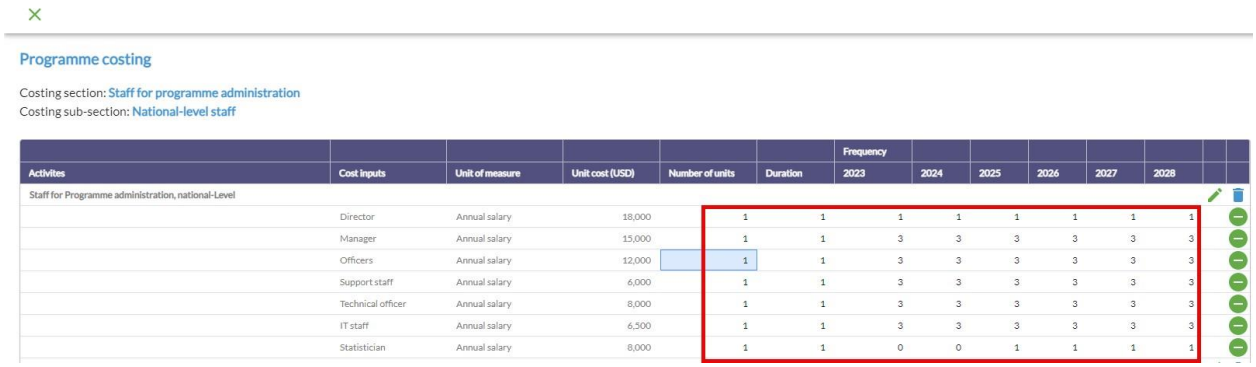
3. Move to Staff for programme administration >national level staff.
4. Click “Add cost inputs”.



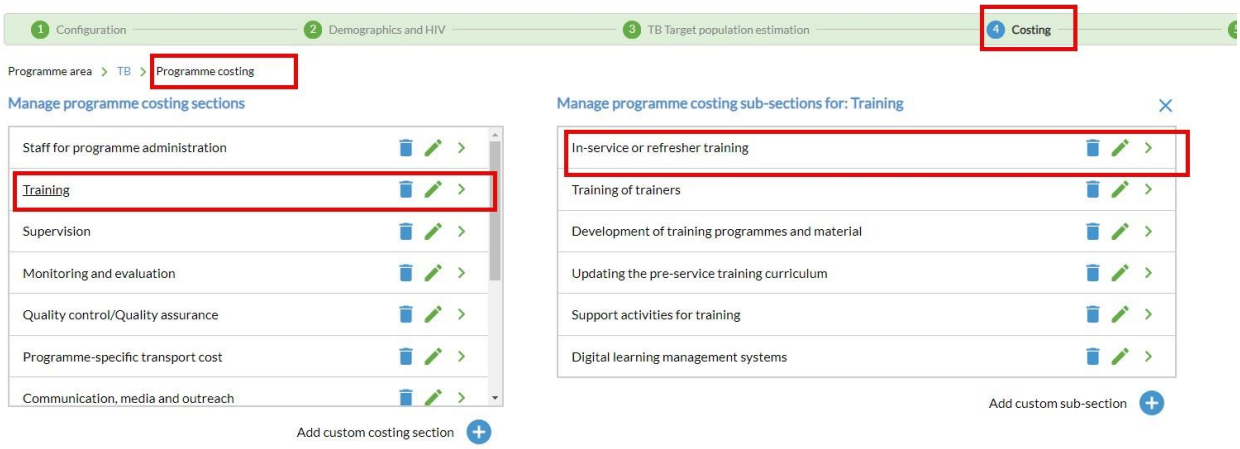
5. Check the boxes to add staff for all types apart from a Programmer, then hit the apply button to add them (hint: stop at Statistician).



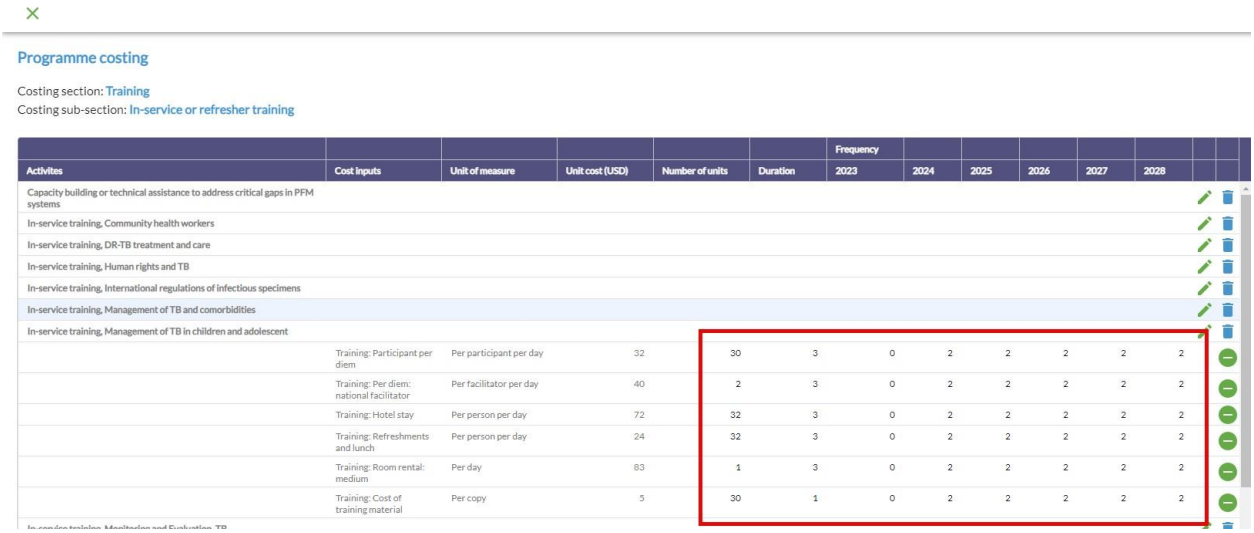
6. Assume that number of units and duration (the number of inputs given the unit of measure for that input) will be 1 for all, and enter 1 director, and 3 each for each year for the other staff types, apart from a statistician. Assume you hire 1 statistician in 2025 and retain her for the rest of the years of the plan.



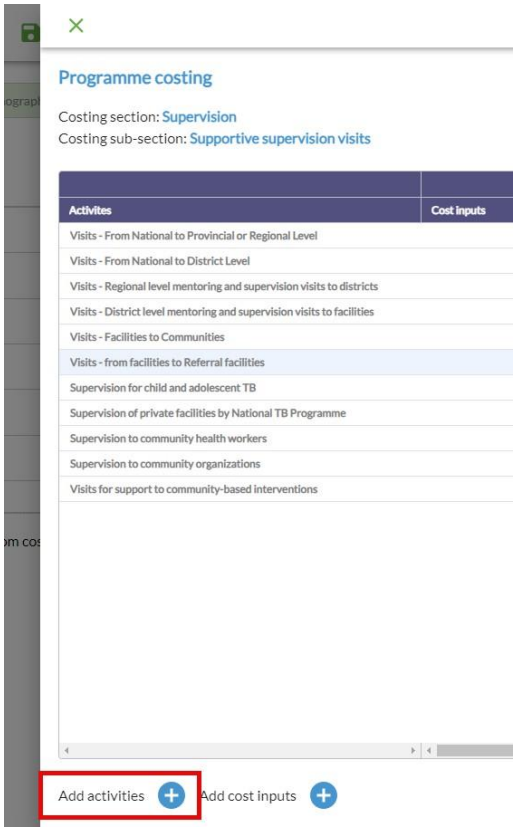
7. Move to the Training > In service training section.

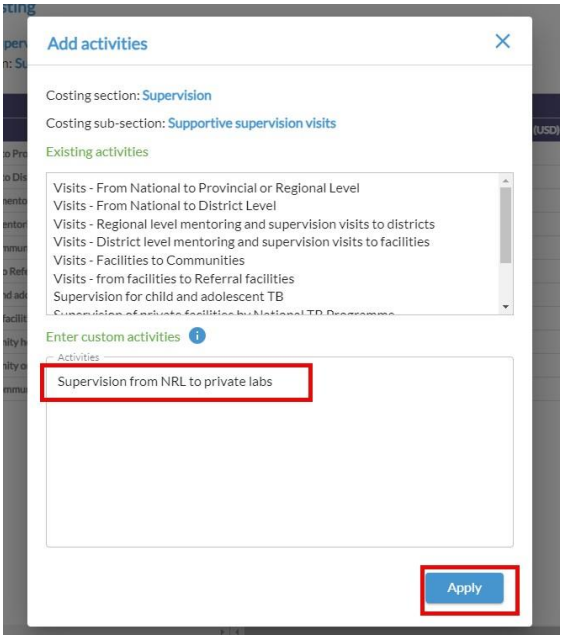


8. Populate the existing interventions for Training, HMIS and In-service training on management of TB in children and adolescents. Assume both are 3-day trainings, with 30 participants and 2 national facilitators and that there are two such trainings a year starting in 2024. See below for a sample input structure.

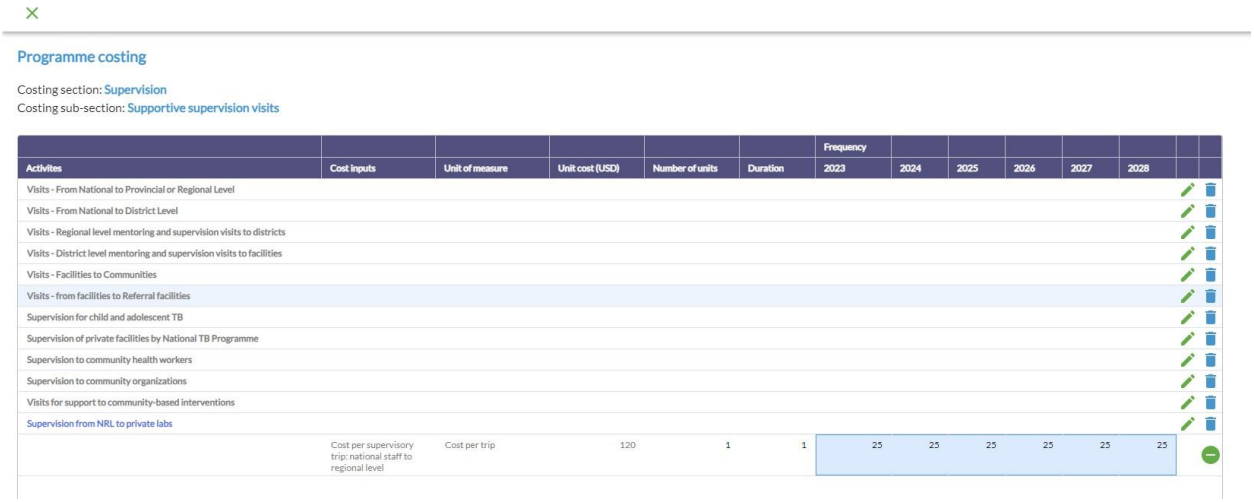


9. Move to Supervision > Supportive Supervision visit. Add a supervision activity from the National reference laboratory (NRL) to private laboratories.





10. Assume a national to regional level trip is the only input, and that there are 25 trips per year.

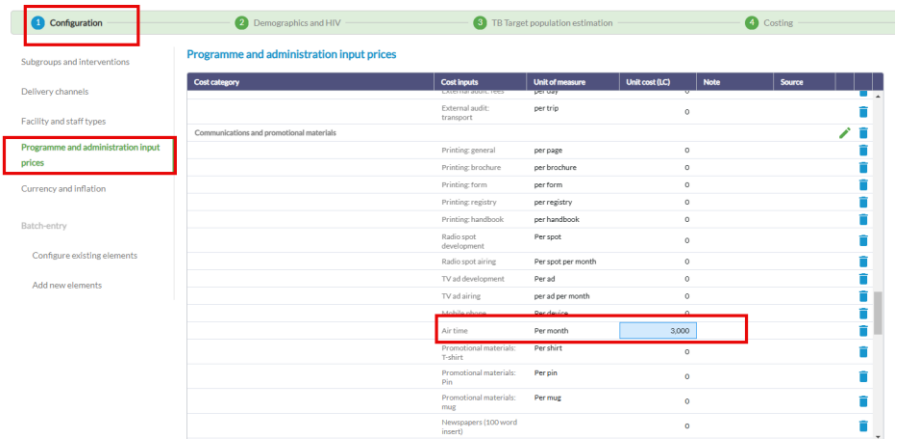


Programme costing

Costing section: Supervision
Costing sub-section: Supportive supervision visits

Activites	Cost inputs	Unit of measure	Unit cost (USD)	Number of units	Duration	Frequency 2023	2024	2025	2026	2027	2028
Visits - From National to Provincial or Regional Level											
Visits - From National to District Level											
Visits - Regional level mentoring and supervision visits to districts											
Visits - District level mentoring and supervision visits to facilities											
Visits - Facilities to Communities											
Visits - from facilities to Referral facilities											
Supervision for child and adolescent TB											
Supervision of private facilities by National TB Programme											
Supervision to community health workers											
Supervision to community organizations											
Visits for support to community-based interventions											
Supervision from NRL to private labs											
	Cost per supervisory trip: national staff to regional level	Cost per trip	120	1	1	25	25	25	25	25	25

11. Add airtime for community health workers and cost airtime using local currency unit (lcu). Go to Configuration > currency and inflation. Select local currency. Go to Programme and administration input prices and set the Communications/airtime price to 3000 lcu per month.



Go to Costing > Programme Costing > Community and Civil Society engagement, social participation and add a new sub section and activity for Community Health Care worker (CHW) support. Assume that 300 community health workers will get airtime monthly.

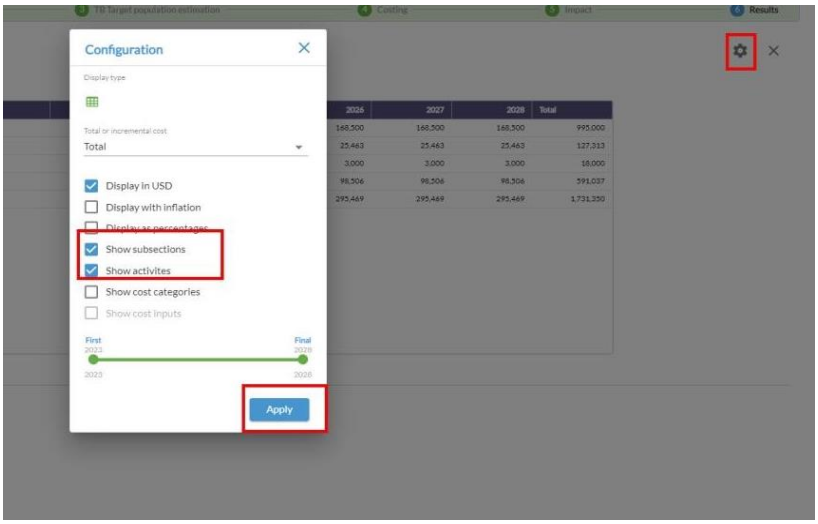
Programme costing

Costing section: Multisectoral engagement
Costing sub-section: CHW support

Activites	Cost inputs	Unit of measure	Unit cost (KES)	Number of units	Duration	Frequency 2023	2024	2025	2026	2027	2028
CHW support											
	Air time	Per month	3,000	12	1	300	300	300	300	300	300

12. Review Programme cost results. What is the total programme cost estimate for 2028?_____
Which section is your most costly?_____

Use the gears icon to regenerate results by activity. Do you see the activities you entered? What is the most costly activity?



13. Extra credit: Add activities and inputs for the following activities:
    - Social media
    - M&E for civil society (meetings and capacity strengthening)
    - Visits from facilities to communities [Supervision/visits]
    - Training community organizations
    - In service community health workers Training on TB
    - Supervision/Health committees led by community
    - Other of your choice that you envision carrying out in a country you are working with

Quiz

Question 1: Where are prices entered for programme costing inputs?

- [ ] Configuration
- [ ] Batch entry
- [ ] Programme costing

Question 2: True or false: You must accept the list of activities as provided in the tool and cannot change it.

- [ ] True
- [ ] False

Question 3: True or false: Users can add inflation to their results using the results configuration editor.

- [ ] True
- [ ] False

Exercise 9: Summary results and review

Objectives: After completion of this exercise, users should be able to generate IHT results and customize them for various purposes including tables and figures for budget chapter of the National Strategic Plan for tuberculosis, visuals for inclusion in Global Fund proposals and adjust currency, years, and other configuration elements.

Task 1: Generate results and paste them into this document following the instructions below.

1. Generate a summary result for Total Costs and Cost Drivers. Download the image, and copy it onto this document.

2. Generate a result for Summary costs/Total by cost category for 2024-2026. Adjust to the three years 2024-2026, copy all, and paste into excel.

3. Change the result to local currency, add inflation, and repeat step 3. Paste into this documents the results in l.c.u.

Task 2: Checking results

1. Review the results for Total cost by cost category. Which category is the largest?

   _____

2. Follow up: within that category, which is the largest intervention or programme activity cost? Is this consistent with typical NSP priorities?

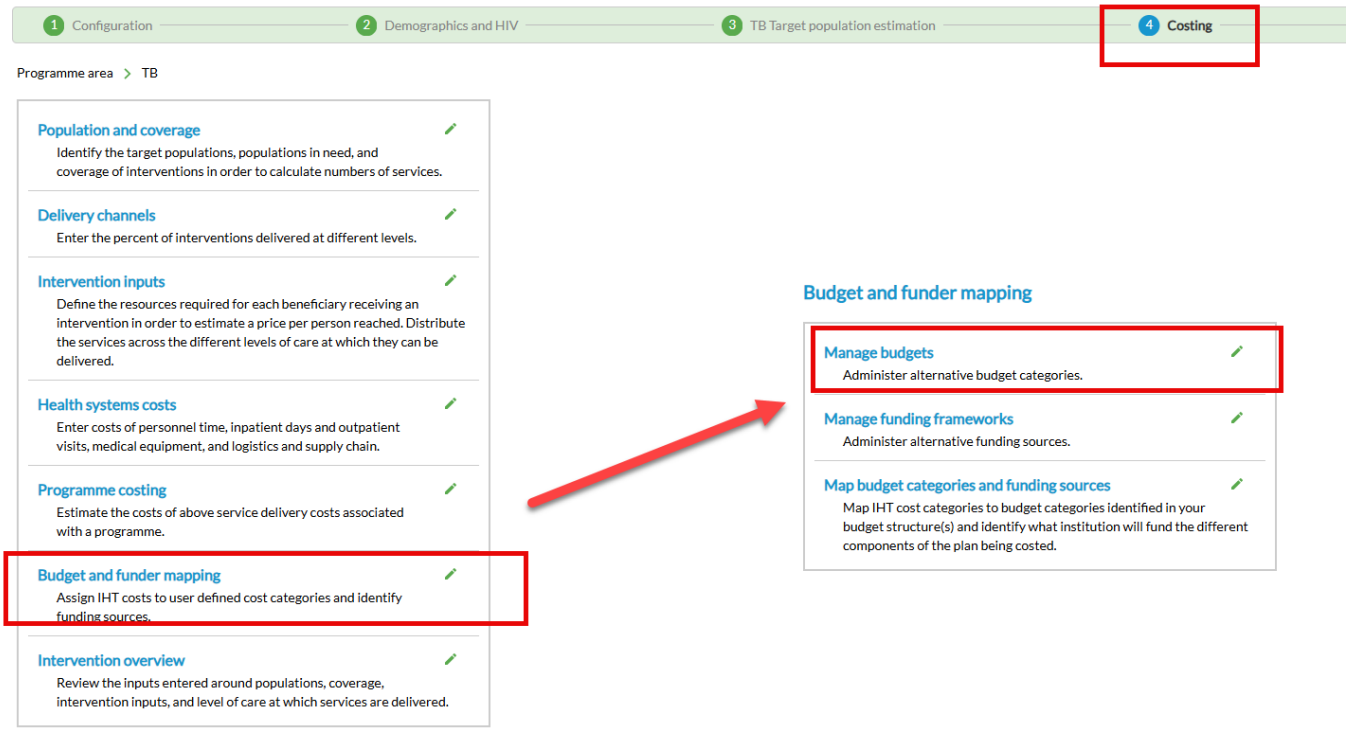
_____

Exercise 10: Budget mapping

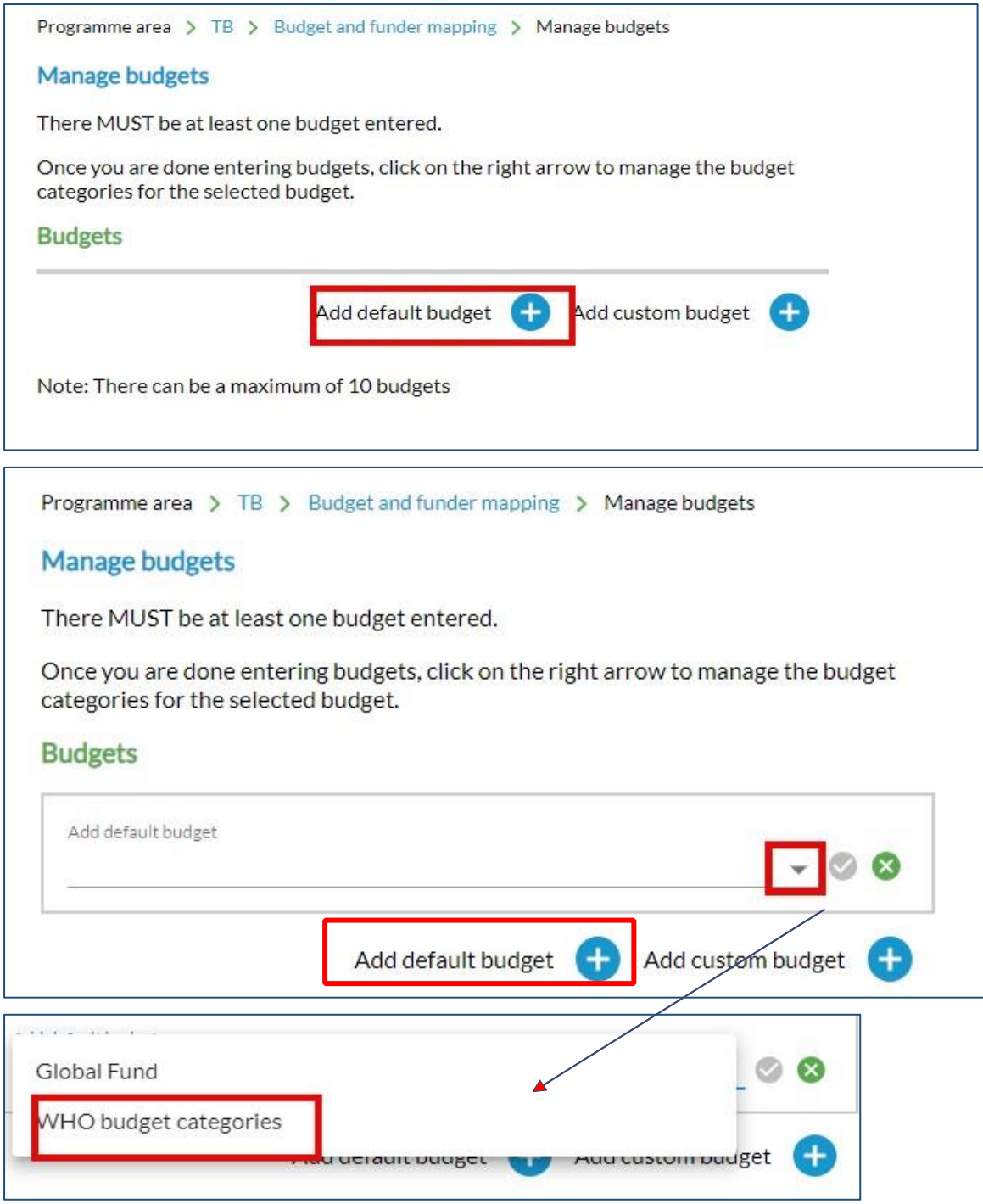
Objectives: After completion of this exercise, users should be able to map the results generated by the TB module of IHT to cost categories of their choice, and also identify the sources of funding expected per intervention and activity to be supplied by different funders (national, regional, external and any funding gap).

Task 1: Add a default budget map

1. Navigate to Costing > Budget and funder mapping, and select “Manage budgets”.



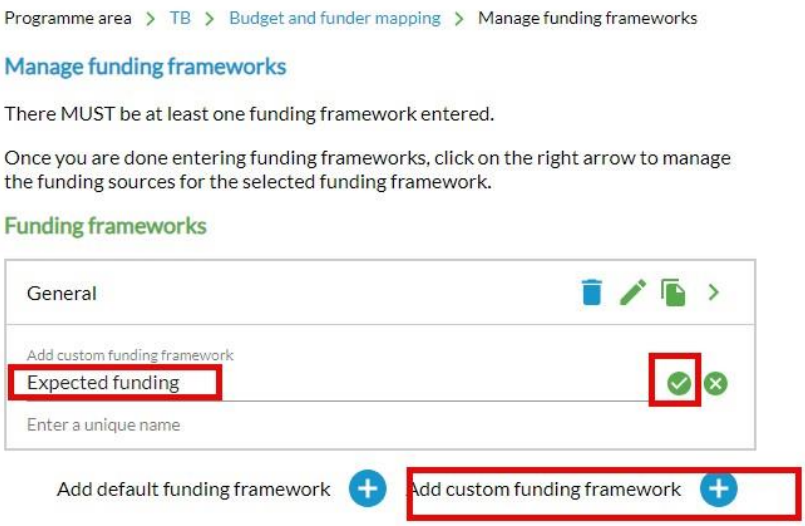
2. Use the “Add default budget” to select the default budget categories for reporting TB data annually to WHO, by using the drop down arrow to select the “WHO budget categories”.



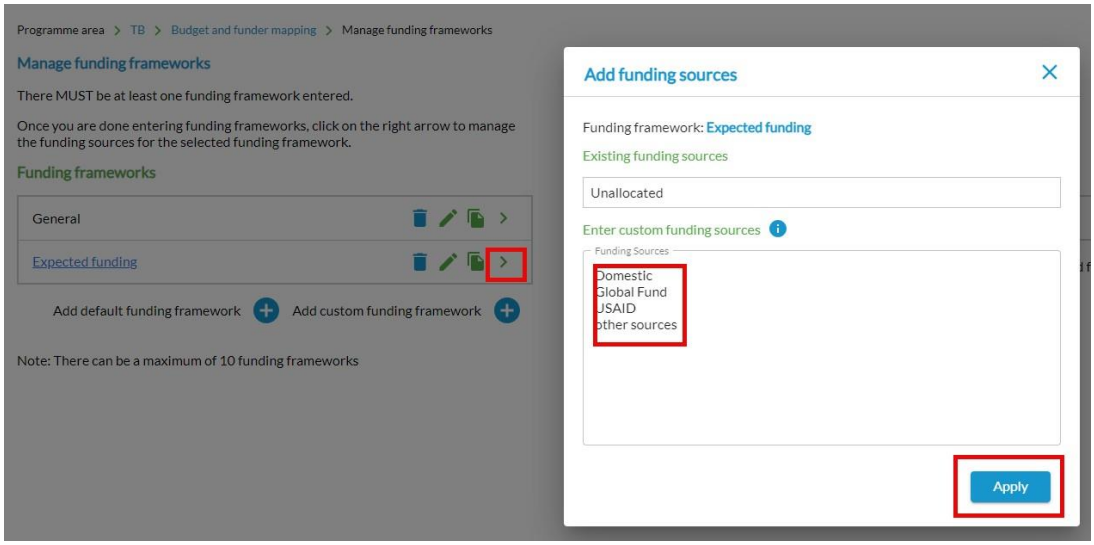
3. Click the check box to confirm use of that default budget map.

Task 2: Identify the sources of funding for all costed interventions, health systems and programme costs

1. Move to Manage Funding Frameworks.
2. Add a custom funding framework called Expected Funding. Check the box to confirm use of the map after you enter the name.

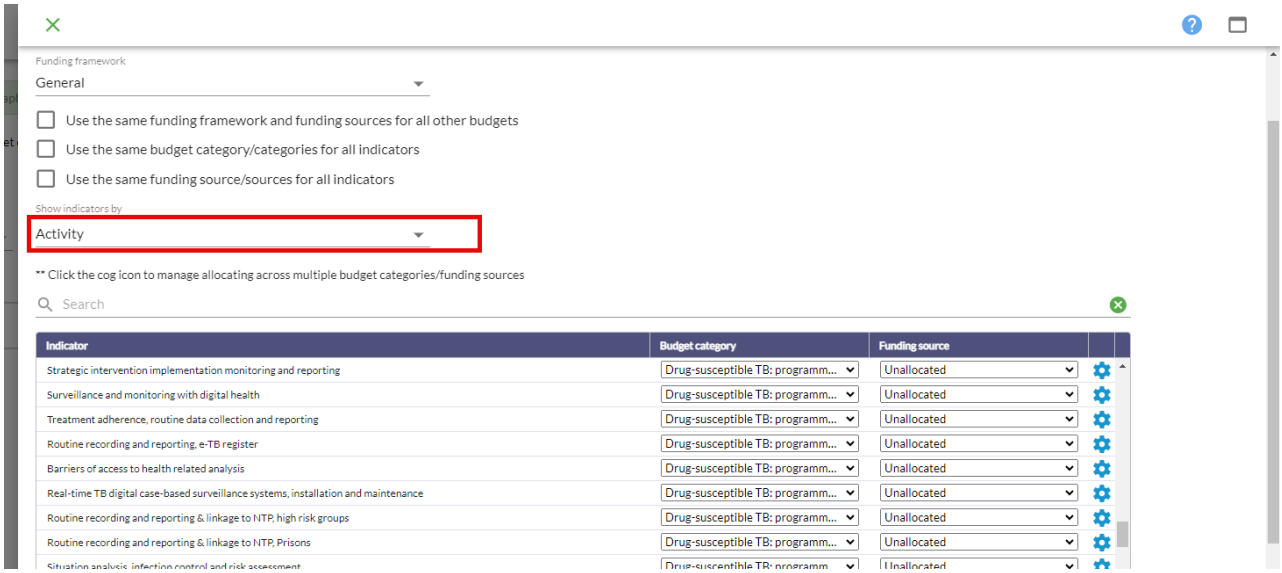


3. Use the arrow to enter this funding map (then press apply) and with the following funders:
    a. Domestic
    b. Global Fund
    c. USAID
    d. Other sources

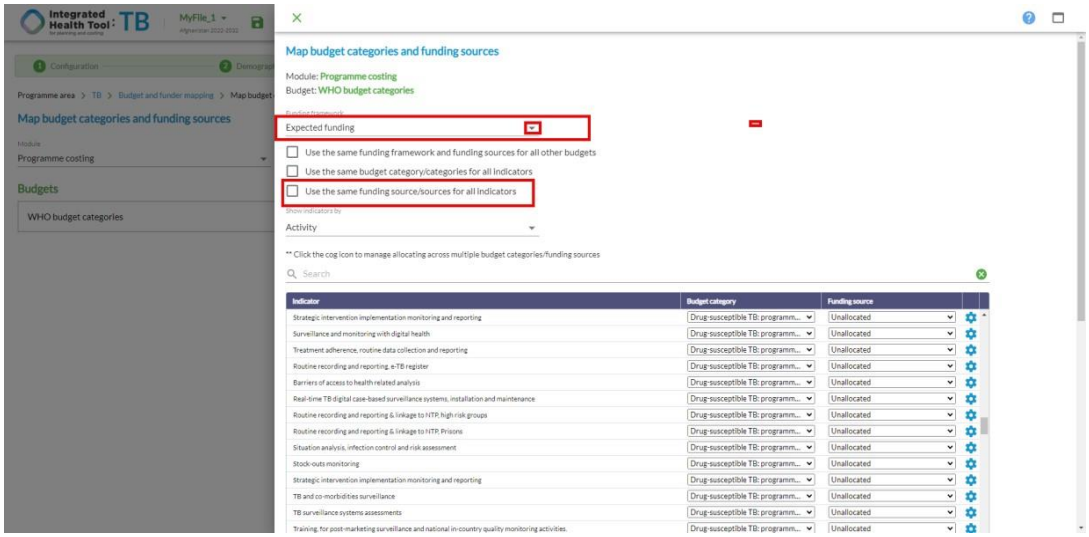


Task 3: Review and revise default mapping

1. Move to the Map Budget Categories and Funding Source section. Review the budget map for programme costing at the activity level; you should see that the activities featured by default in the TB module are mostly pre-mapped to the budget category. You can adjust these but leave as is for now.

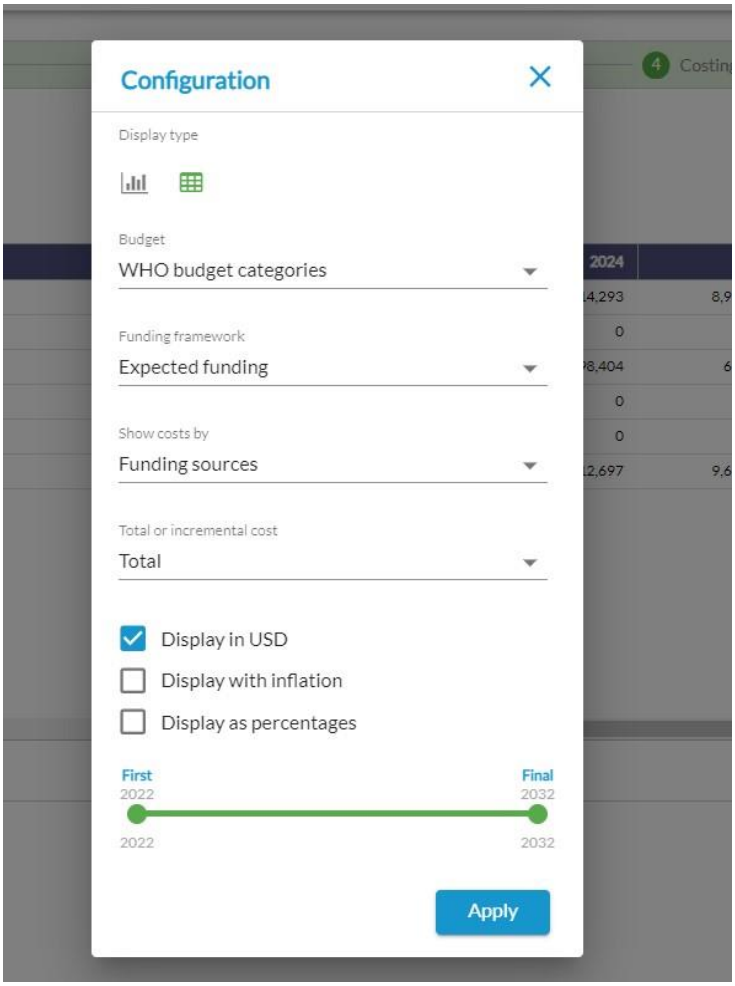


2. Move to the bottom of the editor and click “Show graph” to see a graphical representation of the results.
3. Identify the funding sources for each “indicator” as follows:
    a. Assume that Global Fund covers all drugs and supplies for TB services, as well as logistics and supply chain and wastage.
    b. Assume that USAID covers all equipment investments.
    c. Assume that Domestic sources will cover all labor, inpatient days and outpatient visits, and that Other sources will cover all tuberculosis programme costs. Hint: Use the option to map all indicators to one funding source to make each editor have all the same funding sources.



Task 4: Review results

1. Move to Results > Summary results > Budget and funder mapping and run a result. Use the cog wheel to select the options (in this case: WHO budget categories and Expected funding).



What are the total costs to USAID over all the plan years under these assumptions?_____

Quiz

Question 1: Why would users want to use the budget and funder mapping section? (select all which apply)

- [ ] To generate reports which correspond to preferred budget categories (e.g. Medium-term expenditure framework, NSP objectives, domestic budget structures etc) rather than IHT default cost categories.
- [ ] To estimate a resource gap.
- [ ] To see how their NSP costs compare to other countries

Question 2: True or false: You must accept the list of budget categories as provided in the tool and cannot change it.

- [ ] True
- [ ] False

Question 3: True or false: Users can generate results using budget mapping which correspond to either preset Global Fund or WHO Objective categories.

- [ ] True
- [ ] False

Exercise 11: Scenario analysis

Objectives: This exercise will guide you through the process of using four tuberculosis module of IHT projections/files to compare multiple options for a country's tuberculosis plan

Imagine that you have completed the first round of analysis for the NSP costs of Narnia. Estimates of resources needed for the resource-constrained scenario exceed resources available, and tough decisions must be made.

The country must consider how to plan in a resource-constrained situation. The NTP identifies two paths they might follow in addition to maintaining the status quo: prevention focus, or a treatment focus. This allows you to analyze four scenarios for consideration:

- Status quo
- Prevention focused scenario
- Treatment focused scenario
- Full package: representing full NSP and/or UNHLM commitments

Task 1: Set up new scenario files

1. Import the file shared with you named NSP sample into your library and call it "Full NSP".
2. Copy the initial scenario shared with you using either Save As or Duplicate and name as your new scenarios.
    - Status quo
    - Prevention
    - Treatment focus

    HINT: open each new file in a separate browser tab for subsequent tasks.

Task 2: Adjust coverage

Identify what would change in coverage as part of a constrained scenario:

- Status quo: flatline first year coverage to all other years, use historic trend for notifications.
- Prevention focus: maintain NSP targets for prevention, flatline DST and treatment coverage.

- Treatment focus: maintain NSP targets for DST and treatment, flatline prevention coverage.
- Full NSP: maintain ambitious goals for all programs in NSP (in this case leaving the file shared with you as is).

Task 3: Revise programme costs

Review the activities in your programme costs section of the full NSP.

- Status quo: flatline first year activities to all other years
- Prevention focus: maintain NSP activities for prevention, flatline DST and treatment activity numbers.
- Treatment focus: maintain NSP activities for DST and treatment, flatline prevention activity numbers.
- Full NSP**:** maintain ambitious goals for all programmes in NSP (in this case leaving the file shared with you as is).

Task 4: Adapt health system assumptions

- Reminder: costs of health workforce and service delivery, and the logistics and supply chain costs will scale with the number of people reached and the associated inputs for their care, which will vary with coverage. This happens automatically so no further edits needed for those sections.
- Review equipment and facility targets and remove items associated with treatment or prevention, per the scenario definitions.

Task 5: Compare and contrast scenarios

Copy the following results to the excel workbook shared with you for scenario comparison.

- Summary results/Total costs by cost category
- Impact results/Mortality
- Impact results/Incidence

Review summary results on the last tab. If selecting purely on cost per death averted, which option would be chosen?

_____

Are there political or equity considerations which might also enter into the discussion?

_____

Quiz answers

Exercise 1: IHT Configuration

Question 1: How can you add interventions in the TB module of IHT from the comprehensive IHT?

- [x] Add Custom Intervention
- [x] Batch Entry/Configure Existing Elements
- [ ] You cannot add interventions from the other health areas of IHT

Question 2: Setting up a country involves registering as an IHT user (select all that apply)

- [x] Users can explore the tool without setting up an account.
- [x] It is necessary to first register as an IHT user if you wish to save your work.
- [ ] Users must set up an account in order to access any pieces of the TB module of IHT.

Question 3: True or false: users must use the intervention list as provided by default.

- [ ] True
- [x] False

Exercise 3.1: Provider initiated

Question 1: TB found in provider-initiated patient groups is detected using algorithms for?

- [x] Pulmonary TB only
- [ ] Pulmonary and extra-pulmonary TB

Question 2: Index cases in household contact (HH) tracing programs are generally?

- [x] New, adult and bac-positive patients
- [ ] New, adult and child patients and of any bac-status

Question 3: What is the recommended (default) screening algorithm for adult PLHIV on ART with serious disease?

- [x] Single screening with a mWRD method
- [ ] Parallel screening with W4SS and CXR

Question 4: Low sensitivity leads to?

- [x] Fewer true positives missed
- [ ] More true positives missed

Question 5: Low specificity leads to?

- [x] Fewer false positives diagnosed
- [ ] More false positives diagnosed

Question 6: Low TB prevalence in a population being screened leads to?

- [ ] A lower overall number needed to screen and test (NNTS and NNTT)
- [x] A higher overall number needed to screen and test (NNTS and NNTT)

Question 7: Which patients are eligible for TPT in the care cascade according to WHO guidelines?

- [ ] All population members
- [ ] All screened population members
- [x] All screened population members among who TB disease have been ruled out via screening and diagnosis

Question 8: In the TB module of IHT (TB Target population estimation) high-risk groups (other than HH contacts and PLHIV on ART) are restricted (by model design) to adults and not to children also. A reasonable model assumption is that children with TB disease will be found predominantly in programs for?

- [ ] Attending patient-initiated programs at facility level ()
- [x] HH contact tracing
- [ ] CLHIV and on ART

Exercise 3.2: Patient initiated

Quiz answers

Question 1: TB disease found in patient-initiated patient groups is detected using algorithms for?

- [ ] Pulmonary TB
- [x] Pulmonary and extra-pulmonary TB

Question 2: TB prevention therapy (TPT) is?

- [ ] Included in patient-initiated programs (< TB Target population estimation)
- [x] Not included in patient-initiated programs and is restricted to provider-initiated programs (e.g. household contact tracing) only

Question 3: What is the recommended screening algorithm for HIV-negative children under the age of 15 years old?

- [ ] TB symptoms
- [ ] Parallel screening with TB symptoms and Xray
- [x] Parallel screening with TB symptoms and Xray [with CAD]

Question 4: With a prevalence of TB of 10% in a patient-initiated program, and using the default clinical evaluation and diagnostic algorithm provided, the number needed to test to find one case is around?

- [x] NNTT ~ 10, a value traditionally in costing screening and diagnostic algorithms
- [ ] Much higher values of NNTT, e,g, NNTT > 50

Question 5: Select a patient-initiated population and half the prevalence of TB among patient seeking care. The NNTT

- [ ] Is reduced by a factor of approximately 2?
- [x] Is increased by a factor of approximately 2?

Question 6: When the number of patients screened in a patient-initiated populations is calculated to be 0, the likely reasons include?

- [ ] An incorrect screening or diagnostic algorithm was selected for a patient-initiated population
- [x] The target for the total number of notifications is too low

Notifications from provider-initiated programs, which is subtracted from the total notification target to obtain the patient-initiated target, is too high relative to the total notification target

Question 7: PLHIV on ART are reached predominantly through?

- [x] Provider-initiated programs
- [ ] Patients-initiated programs

Exercise 3.3: Drug resistance testing and treatment

Question 1: A resistance profile has the following structure:

- [x] A Rif resistant and a Rif sensitive branch, each with sub-branches
- [ ] Branches at the same level for Rif, INH and FQ resistance

Question 2: Generally, Rif resistance will be higher

- [ ] in new TB patients
- [x] in previously treated TB patients

Question 3: DST coverage below 100% will typically lead to

- [ ] Appropriate treatment for all, i.e. all patients receiving the recommended regimen for their resistance profile.
- [x] Inappropriate treatment for many, i.e. many patients not receiving the recommended regimen for their resistance profile.

Question 4: Fluoroquinolone resistance is often found at high levels in

- [ ] All TB programs
- [x] TB programs with high private-sector involvement where Fluoroquinolones are widely provided to patients to treat bacterial infections

Question 5: The input for Drug-susceptible TB meningitis and pericarditis

- [ ] Controls the proportion of child and adolescent patients eligible for meningitis treatment
- [x] Controls the proportion of child and adolescent patients eligible who are Rif sensitive and require a longer course FL regimen

Question 6: The input for Proportion MDR/XDR-TB patients requiring lung resection surgery

- [ ] Controls the proportion of all patients eligible for lung surgery
- [x] Controls the proportion of all confirmed XDR patients eligible for lung surgery

Question 7: In Task 4, why is the number of presumed RR and INH sensitive patients smaller when using 50% coverage compared to 0% coverage for RR and INH resistance testing?

- [x] A proportion of RR and INH resistant patients are identified and are shifted to other categories of resistance
- [ ] All RR and INH resistant patients are identified and are shifted to other categories of resistance

Exercise 3.4: Notifications

Question 1: What is the total notification number reported for 2023 in the example country?

- [x] 97,126
- [ ] 87,126

Question 2: Describe the baseline notification trend in the example country:

- [x] Slowly/steadily increasing
- [ ] Constant
- [ ] Slowly/steadily decreasing

Question 3: If the notification target in 2027 is increased by 100% from the baseline value, what is the notification value in 2027 and the *Proportion Notified in 2026?

- [x] 204,100 and 99%
- [ ] 194,100 and 56.07%

Question 4: For the example country given, what proportion of all notifications are bacteriologically confirmed?

- [x] 48.36%
- [ ] 58.56%

Question 5: For the example country given, what proportion of all notifications are extrapulmonary?

- [x] 12.55%
- [ ] 11.55%

Question 6: For the example country given, what proportion of new and relapse TB cases are children 0-9 years old?

- [x] 6.0%
- [ ] 7.0%

Question 7: For the example country given, what proportion of TPT patients will receive a regimen for preventing MDR/RR TB according to the inputs?

- [ ] 2.1%
- [x] 1.1%

Exercise 4: Statistical impact

Question 1: When a projection is created, baseline notifications are provided from?

- [ ] User input
- [x] A statistical projection based on WHO TB data with final year currently in 2023.

Question 2: A TB care cascade generates impact on TB via:

- [x] Increased detection, prevention, and successful treatment.
- [ ] Constant detection, prevention, and successful treatment.

Question 3: Impact is generated by :

- [ ] The hazard rates in a scale-up scenario
- [x] The ratio of hazard rates between a scale-up scenario and a baseline scenario

Question 4: Looking at the Mortality results of Task 1.2, in which there is scale-up and no impact we see that projected mortality is slowly increasing. In this example, growth in prevalence is about 3.5% per year. Possible reasons for this include.

- [ ] There is an ongoing background growth in TB transmission, reactivation, and morality.
- [x] The statistical model is finding evidence of growth from increased incidence and from

  population growth leading to growth in mortality at a similar rate.

Question 5: In general, the largest impact is expected to result from a large ratio in

- [x] The total number notified (via increased notification in the scale-up scenario)
- [ ] The population-level risk for TB disease (via increased TPT in the scale-up scenario)
- [ ] The treatment success rate for new and relapse cases (via increased treatment success in the scale-up scenario)

Exercise 5: Number of people served

Question 1: What entries are used to calculate number of people served? (select all which apply)

- [x] Coverage
- [x] Population in need
- [ ] Drug costs
- [x] Target population

Question 2: True or false: Coverage must be entered only in the costing editors and cannot be entered in the target population editors

- [ ] True
- [x] False

Question 3: How are results for numbers of services available (Results > Health services)? Select all which apply.

- [x] By year
- [x] Total
- [x] By delivery channel
- [x] By subgroup

Exercise 6: Intervention inputs

Question 1: Intervention inputs include what elements (select all that apply)?

- [x] Drugs
- [ ] Inpatient day costs
- [ ] Outpatient visit costs
- [ ] Equipment
- [x] Provider time
- [x] Supplies

Question 2: True or false: Intervention inputs are set and cannot be changed by the user.

- [ ] True
- [x] False

Question 3: True or false: The price entered for a drug must be the same for all years

- [ ] True
- [x] False

Exercise 7: Health system costs

Question 1: What types of health system costs are captured in the TB module of IHT? Select all which apply.

- [x] Supply chain and logistics costs
- [ ] Governance costs
- [x] Provider salaries and benefits
- [x] Equipment costs
- [x] Costs of outpatient visits and inpatient days

Question 2: True or false: Equipment costs can be captured as a total cost for all equipment at a facility or by individual equipment items at a facility.

- [x] True
- [ ] False

Question 3: True or false: provider time and inpatient day/outpatient visit costs can be viewed by delivery channel/service delivery level.

- [x] True
- [ ] False

Question 4: Maintenance costs can be estimated by device or based on total equipment purchase prices.

- [x] True
- [ ] False

Exercise 8: Programme costing

Question 1: Where are prices entered for programme costing inputs?

- [x] Configuration
- [ ] Batch entry
- [ ] Programme costing

Question 2: True or false: You must accept the list of activities as provided in the tool and cannot change it.

- [ ] True
- [x] False

Question 3: True or false: Users can add inflation to their results using the results configuration editor.

- [x] True
- [ ] False

Exercise 10: Budget mapping

Question 1: Why would users want to use the budget and funder mapping section? (select all which apply)

- [x] To generate reports which correspond to preferred budget categories (e.g. Medium-term expenditure framework, NSP objectives, domestic budget structures etc) rather than IHT default cost categories.
- [x] To estimate a resource gap.
- [x] To see how their NSP costs compare to other countries

Question 2: True or false: You must accept the list of budget categories as provided in the tool and cannot change it.

- [ ] True
- [x] False

Question 3: True or false: Users can generate results using budget mapping which correspond to either preset Global Fund or WHO Objective categories.

- [x] True
- [ ] False