

Cost and cost-effectiveness evaluations:

2020 to 2050

Data and analysis tool (GUI)

Gambiense human African trypanosomiasis (gHAT or sleeping sickness) – model data and results

User Guide

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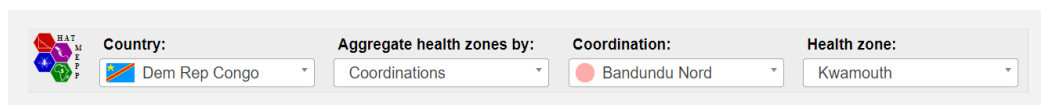
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ABOUT THIS GUIDE

DESCRIPTION	gHAT intervention strategy costs and cost-effectiveness evaluations
SOURCE	Case data: WHO HAT Atlas Cost data: National programmes, partners, literature
DATE ISSUED	October 2022
LAST UPDATED	April 2024
SPATIAL COVERAGE	Democratic Republic of Congo, 166 health zones
YEARS(S)	Fitting to 2000 to 2020, continuation of existing strategies assumed for 2021 to 2023, projections under selected intervention strategies from 2024 to 2050 and cost evaluations from 2024 to 2050
STATUS	Complete
CREATOR	Antillon et al, Swiss TPH
USAGE	Open access
CONTACT EMAIL	K.S.Rock@warwick.ac.uk

Quick guide to getting started


- 1) Go to: <https://hatmepp.warwick.ac.uk/DRCCEA/v6/>
(We recommend you use Google Chrome, Microsoft Edge or Firefox as your browser to get the best experience)
- 2) Choose **whole country, coordination or sub-region(s)** from the drop-down boxes. This version of the GUI includes 166 health zones in the DRC. Note that the country cannot be changed.



The screenshot shows a user interface with four dropdown menus. The first menu is labeled 'Country:' and has 'Dem Rep Congo' selected. The second menu is labeled 'Aggregate health zones by:' and has 'Coordinations' selected. The third menu is labeled 'Coordination:' and has 'Bandundu Nord' selected. The fourth menu is labeled 'Health zone:' and has 'Kwamouth' selected. To the left of the first menu is a logo with the letters 'HATMEPP' and a map of the DRC.

Note that health zones are aggregated to the whole country level by default.

- 3) The summary table immediately below will auto-generate based on your geographical selection showing you the following information:



The map shows the continent of Africa with the Democratic Republic of Congo (DRC) highlighted in blue. Within the DRC, several health zones are highlighted in different colors: orange, purple, red, green, and yellow.

Dem Rep Congo: Bandundu Nord Coordination: Kwamouth Health zone	
DRC population (2017)	81,339,988
Kwamouth population (est 2015)	127,205
Historical screening level (mean/max)	45% / 64%
Historical vector control (year began / linear km / case coverage)	2019 / 0km / 46%
Assumed future targeted VC (linear km/case coverage)	409km/77%
Assumed future full VC (linear km/case coverage)	813km/79%
Predicted year of elimination of transmission (median [95% prediction interval])	2024 [2021, 2036]
Strategy: Mean AS & no VC	
Most efficient strategy to achieve EoT by 2030 with ≥ 90% probability	Mean AS + targeted VC (minimum cost)

- 4) A number of [results tabs](#) can be found below the maps and table. **Charts** under each results tab will auto-generate based on your selection (whole country, coordination, health zone etc...).
- 5) You can **download charts**, by clicking on 'Save Plot' (bottom left of each screen).

Definitions

<i>Terminology</i>	<i>Definition</i>
<i>Assumed (intensified)</i>	Assumed number of people screened in the projections in the selected coordination, province, health zone or whole country under a maximum level of active screening (see <i>Int AS</i> below).
<i>Assumed (mean)</i>	Assumed number of people screened in the projections in the selected coordination, province, health zone or whole country under a mean level of active screening (see <i>Mean AS</i> below).
<i>Fitted</i>	Model outputs have been fitted to actual case data from the WHO HAT Atlas.
<i>Mean AS</i>	The proportion of people screened is equal to the mean number screened during 2016–2020.
<i>Int AS</i>	The proportion of people screened is equal to the maximum number of people screened during 2000–2020 or 30% (whichever is highest).
<i>No analysis performed</i>	Insufficient data to provide predictions.
<i>Observed</i>	Aggregate case data from the WHO HAT Atlas.
<i>PS (Passive Screening)</i>	Passive screening (screening in fixed health facilities) is in place under all strategies except some strategies for Bas Uélé.
<i>VC (Vector Control)</i>	Vector control (VC) is simulated assuming a % tsetse density reduction.
<i>Targeted VC</i>	Vector control coverage reflecting current or future deployment plans by the Liverpool School of Tropical Medicine (LSTM).
<i>Full VC</i>	Vector control covering all major rivers in the health zone
<i>Treatment</i>	Treatment of infected patient in either first stage of the disease (which is when the trypanosomes multiply in subcutaneous tissues, blood and lymph) or the second stage of the disease (which is when the parasites cross the blood-brain barrier to infect the central nervous system).
<i>Whole country excl Bas Uélé</i>	Considers results aggregated for the whole country except the northeastern region of Isangi (Bas-Uélé).
<i>Elimination of Transmission (EoT)</i>	Globally this is the 2030 goal for gHAT; here we also consider local EoT for health zones.
<i>Disability-adjusted life-year (DALY)</i>	In order to present the burden of disease as one common metric across diseases, DALYs are calculated in cost-effectiveness analyses. This is the sum of the years lived with disability due to the disease and the years of life lost by fatal cases.
<i>Willingness-to-Pay (WTP)</i>	The amount of money that payers would pay to avert one DALY arising from the disease in the analysis (gHAT).

You can also refer to the main [Glossary](#) for a description of commonly used terms and acronyms associated with the HAT projects.

Results tabs

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Predicted elimination

[Predicted Elimination](#)
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The **Predicted elimination** results tab will show you the model predictions for the year of elimination of transmission of gHAT for each of the health zones, resulting from different levels of active screening (mean and intensified) and vector control coverage (Status quo, targeted or full – see [Definitions](#) for details) assuming an 80% reduction in tsetse populations after one year of biannual target deployments (except for Yasa Bonga which assumes a 90% reduction).

Tips:

- Use the slider bar to amend the target year of elimination to see the predicted probability (% chance) of achieving elimination of transmission by this date.



Active screening level (AS)

Mean
 Intensified

Mark health zones with less than 5% screening under this strategy

Vector control (VC), starting in 2024

None Status quo Targeted Full

Save Plot

- Amend** the active screening level and vector control coverage to see the impact on the year of elimination of transmission (EoT), shown on the map via colour coding. Dark orange to dark red health zones indicates a predicted elimination year post 2030, therefore requiring more intensive interventions (intensified active screening and/or vector control) to reach EoT by 2030.

Optimal strategy

Predicted Elimination	Optimal Strategy	Screening Data	Active Detections	Passive Detections	New Infections	Deaths	DALYs	Cost Breakdown	Cost Effectiveness	Forecasting
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The **Optimal Strategy** tab will confirm the intervention strategy through the model predictions necessary to maximise the probability of EoT by 2030 or 2040 with greater than 90% probability for all health zones (Note that hashed areas represent health zones that do not achieve this). This tab also includes optimal interventions to achieve economic objectives including “minimum cost” and willingness-to-pay (WTP) thresholds to avert disease burden (DALYS - see [definitions](#)).

The map is colour-coded by optimal strategy type (No PS, AS nor VC; Int AS + no PS; Mean AS; Int AS; Mean AS + targeted VC; Int AS + targeted VC; Mean AS + full VC; Int AS + full VC – see [definitions](#)) for all 166 health zones. The default map indicates which health zones need intensified interventions to achieve EoT by 2030 (see illustration 1). The optimal strategy target probability default is 90% (predicted 90% chance of achieving EoT by 2030).

Note: Hashed health zones indicate those that do not achieve EoT by 2030 with greater than 90% probability even under the most efficient strategy. Grey health zones indicate those that had insufficient data to provide predictions.

Select strategy aim

Most efficient strategy to achieve EoT with $\geq 90\%$ probability

by 2030

by 2040

Optimal strategy to avert disease burden based on willingness-to-pay

Minimum cost

Status quo

USD per DALY averted

250 500 750 1,000 1,250 1,500

Select time horizon 2024-2040 ▾

Apply a discount rate of 3%

Tips:

- Amend the first selection under *select strategy aim* to ‘optimal strategy to avert disease burden based on willingness-to-pay’.
- Select your willingness-to-pay between \$250 and \$1500 per DALY averted (see illustration 2).
- You can also amend the time horizon or remove the discount rate.

Illustration 1: Most efficient strategy to achieve EoT with $\geq 90\%$ probability between 2024 and 2040 (discounted)

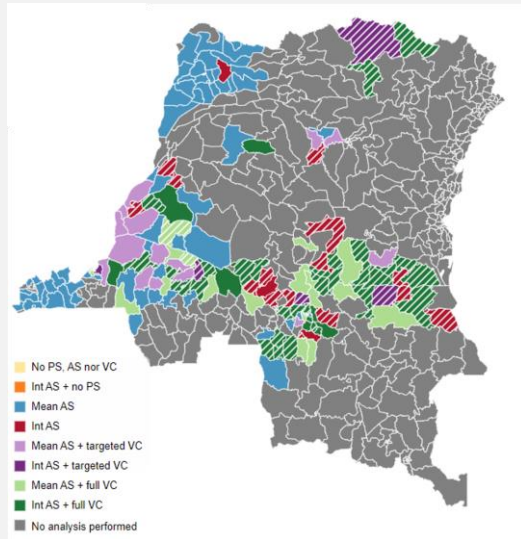
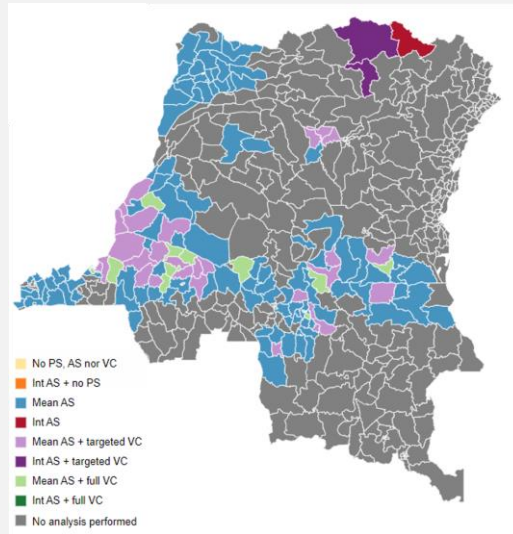


Illustration 2: Strategy where willingness-to-pay is \$250 per DALY averted between 2024 and 2040 (discounted)

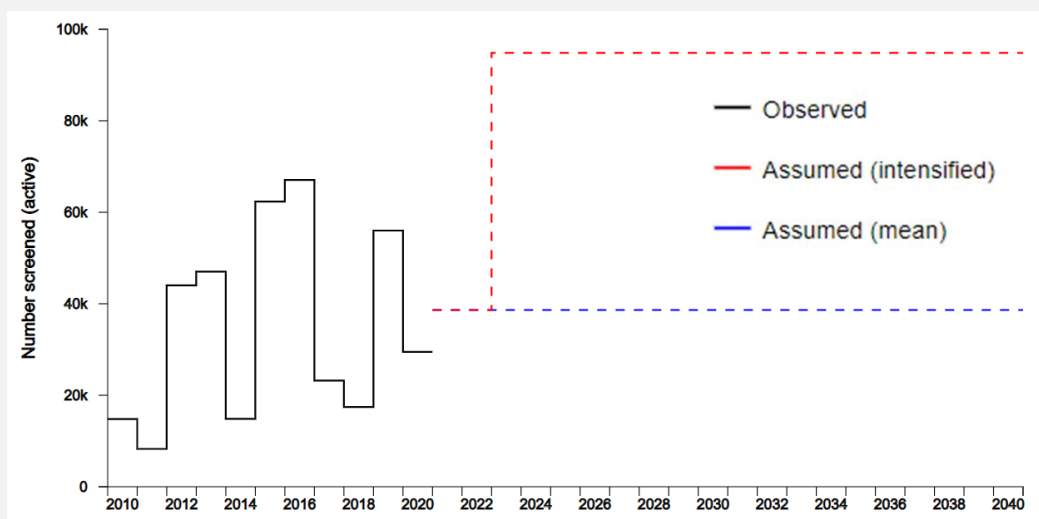


Screening data

Predicted Elimination	Optimal Strategy	Screening Data	Active Detections	Passive Detections	New Infections	Deaths	DALYs	Cost Breakdown	Cost Effectiveness	Forecasting
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The **Screening** results tab provides a chart showing you (i) the number of people actively screened by year from 2000-2020 (i.e. the “observed” level in the data) and (ii) the assumed number of people screened in the health zone under a mean level of active screening in 2021 to 2023 and either a mean or intensified level of active screening (see [definitions](#)) from 2024 onwards.

Illustration 3: Assumed number of people to be screened under a mean and intensified level of active screening



Please note that the “Display year range” is defaulted to show the results from 2010 to 2040. You can change this year range by changing the default selection in the drop-down boxes in the menu on the left-hand side of the screen.

Detections & new infections

Predicted Elimination	Optimal Strategy	Screening Data	Active Detections	Passive Detections	New Infections	Deaths	DALYs	Cost Breakdown	Cost Effectiveness	Forecasting
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These three tabs provide charts to show you past (2000 to 2020) and projected (2024 to 2050) active and passive case reporting by year for the location you have selected, as well as new infections that wouldn't be picked up in the data, viewable for each intervention strategy or objective selected. Note that from 2021 to 2023 it is assumed that existing strategies continue.

Select Objectives

- Status quo
- Optimal strategy, min cost
- Optimal strategy, WTP \$250 per DALY averted
- Optimal strategy, WTP \$500 per DALY averted
- Optimal strategy, WTP \$1,000 per DALY averted
- Optimal strategy, WTP \$1,500 per DALY averted
- Most efficient strategy for EoT by 2030
- Most efficient strategy for EoT by 2040

Results viewed at the whole country level (including or excluding the Bas-Uélé region):

The list of objectives is a tick box function allowing you to select and compare the results based on different aims (see opposite). The tick box will default to "Most efficient strategy for EoT by 2030" and "Status quo".

Results viewed at the coordination or sub-region(s) selected:

The list of strategies (see opposite) is a tick box function allowing you to select and compare the results based on different intervention strategies. The tick box will default to Mean AS, regardless of preferred strategy (see illustration below).

Select Strategies

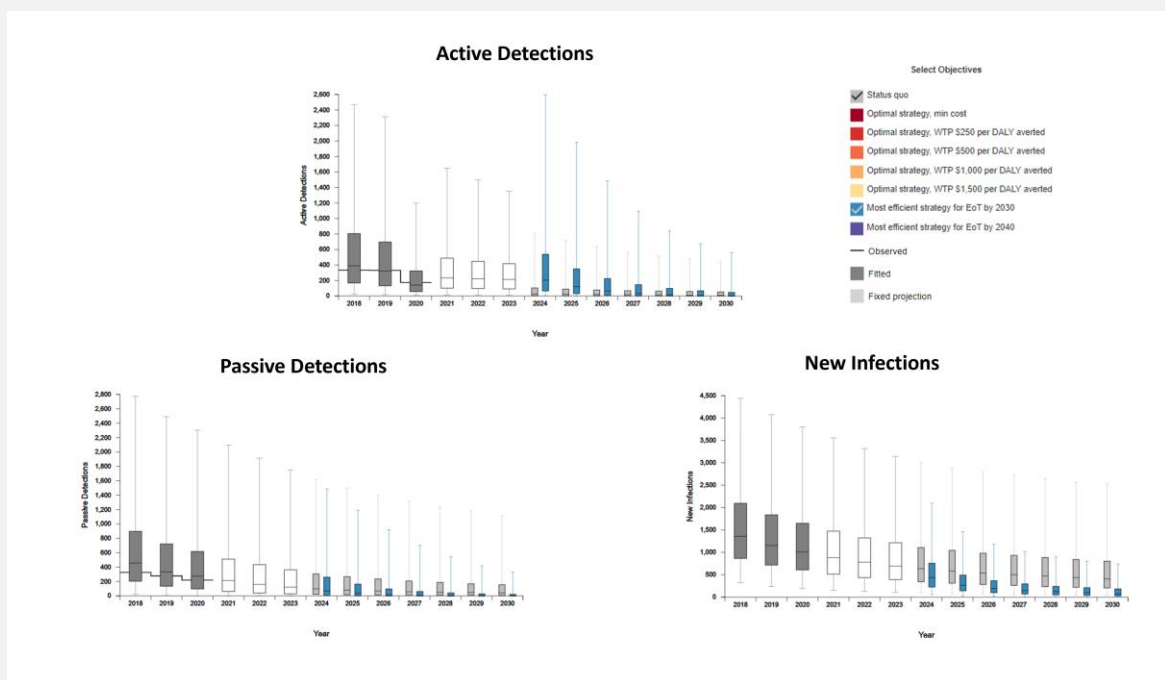
- Mean AS
- Int AS
- Mean AS + targeted VC
- Int AS + targeted VC
- Mean AS + full VC
- Int AS + full VC

Note: Not all health zones have projections for all 6 strategies as this depends on existing or future plans for vector control. Strategies in health zones of the Bas-Uélé region differ from those in the rest of the country.

Tips:

- Amend the time as required (defaulted to 2010 to 2040, but this can be scaled to any period between 2000 and 2050).
- Hover over the results for the year you are interested in to view an information box confirming the predicted highest, lowest and median number of cases within the range.

Illustration 4: Predicted active detections, passive detections and new infections under *Status Quo* and *Most efficient strategy to EoT by 2030* objectives for the whole country (excluding Bas-Uélé) from 2018 to 2030.

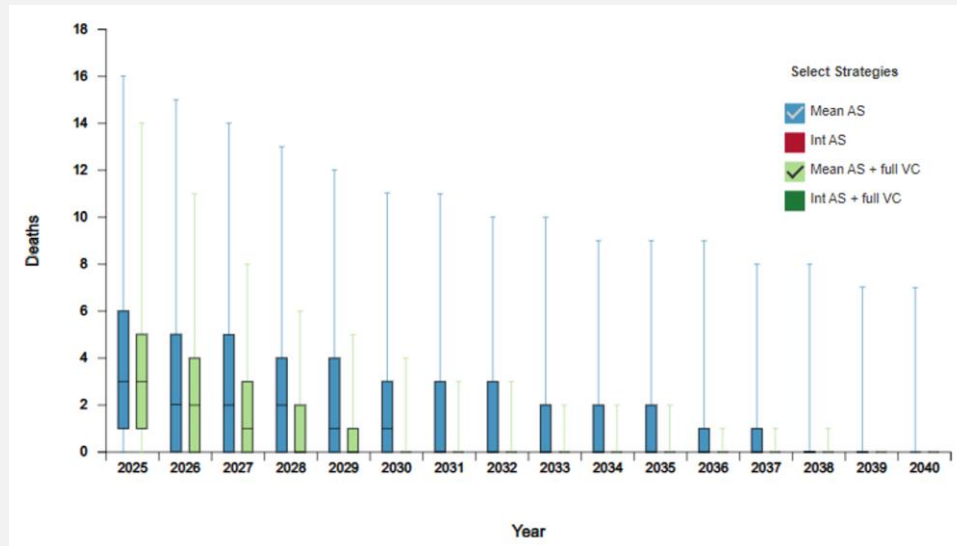


Deaths and DALYs

Predicted Elimination	Optimal Strategy	Screening Data	Active Detections	Passive Detections	New Infections	Deaths	DALYs	Cost Breakdown	Cost Effectiveness	Forecasting
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As with **Detections & New Infections**, the results tabs for **Deaths and DALYs** provide charts to show you predicted cases by year for the location you have selected.

Illustration 5: Predicted deaths under *Mean AS, Mean AS + full VC* intervention strategies in Vanga health zone from 2025 to 2040

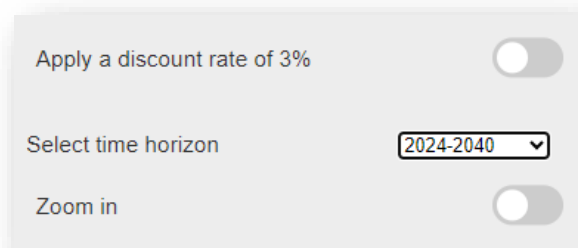


Tip: The time horizon defaults to 2010-2040 however you can amend the time horizon up to 2050.

Cost breakdown

Predicted Elimination | Optimal Strategy | Screening Data | Active Detections | Passive Detections | New Infections | Deaths | DALYs | **Cost Breakdown** | Cost Effectiveness | Forecasting

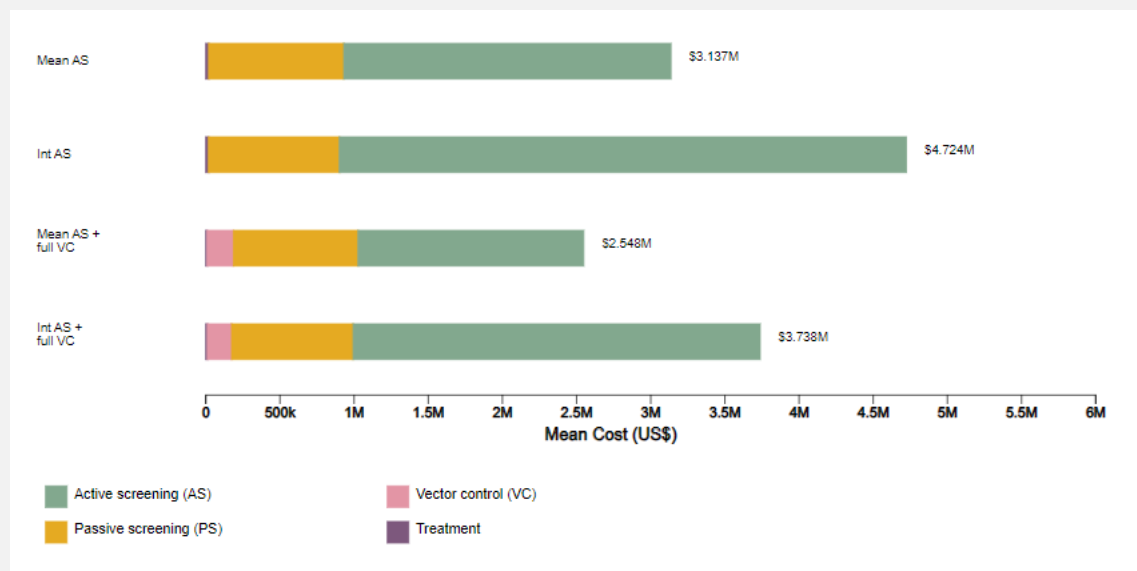
The **Cost Breakdown** tab shows the total cost in dollars of the different intervention strategies or objectives and their individual components (mean costs) (see illustration 6 below, also see [definitions](#)).



Tips:

- Use the menu on the left-hand side of the screen to amend variables such as the discount rate of 3% and time horizon.

Illustration 6: Cost of six different intervention strategies and their components for Vanga health zone (undiscounted) for the 2024-2040 time horizon



Note: Actual costs rather than discounted costs are the default option displayed in this tab.

Cost effectiveness

Predicted Elimination	Optimal Strategy	Screening Data	Active Detections	Passive Detections	New Infections	Deaths	DALYs	Cost Breakdown	Cost Effectiveness	Forecasting
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The pie chart under the **Cost Effectiveness** results tab shows the **probability** of each of the intervention strategies being optimal in terms of cost-effectiveness, which means the chance that each strategy maximises health benefits for a given investment (in terms of willingness-to-pay in US\$ per DALY averted) taking into account the cost of interventions, the cost of ill-health, and time lost to disability and death. These results are only available at the level of the health zone.

The % reflects the number of model simulations where that strategy was found to have the highest net monetary benefit. The optimal strategy in relation to cost-effectiveness is indicated on the pie chart (*). This is usually (but not always) the largest piece of the pie.

Illustration 7 shows how the lowest cost strategy for Kongolo health zone is likely to be Mean AS + targeted VC (lilac) and has an 45% probability of being optimal. Illustration 8 shows that if we are willing to pay \$1500/DALY averted then the Mean AS + targeted VC strategy remains optimal but with much lower probability (36%).

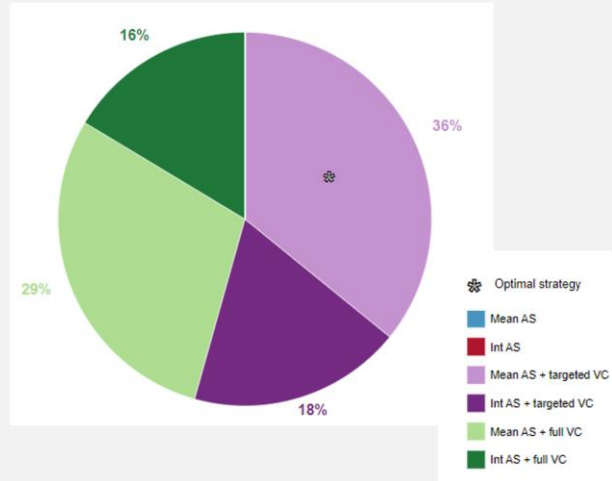
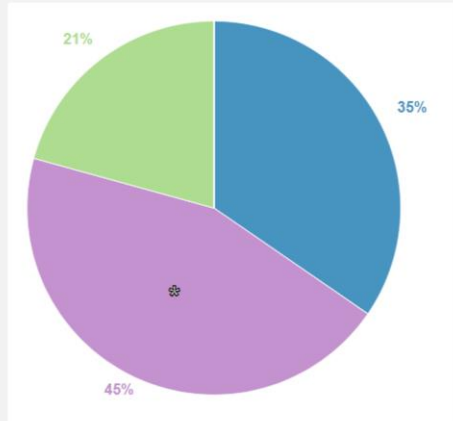
Tips:

- Use the menu on the left-hand side of the screen to amend variables such as the time horizon and the willingness-to-pay.
- Select 'minimum cost' to see the recommended, lowest cost way to reach elimination (see illustration 7).
- Alternatively, you can select your willingness-to-pay between \$250 and \$2000 per DALY averted (see illustration 8).

Optimal intervention strategy for cost-effectiveness (highest net monetary benefit when comparing different intervention strategies)

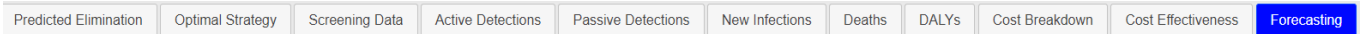
Illustration 7: Recommended, **lowest cost** strategy to achieve elimination between 2024 and 2040 (discounted)

Illustration 8: Recommended strategy if **willingness-to-pay is \$1500** per DALY averted (discounted)



Note: For the Cost-Effectiveness tab a discount rate of 3% is applied as default.

Forecasting



The **Forecasting** tab provides graphs to show you predicted numbers of drug treatments, diagnostic tests and Tiny Targets per year. Estimates can be compared by selecting the item from the *Resource* drop down menu. Results can be view at the Whole Country (excluding or including Bas-Uélé), coordination or sub-region level.

The configuration panel includes the following settings:

- Resource:** Drug treatments (dropdown menu)
- Year range:**
 - From: 2024 (dropdown menu)
 - To: 2040 (dropdown menu)
- Objective parameters:**
 - Discount rate of 3% (toggle switch, currently turned on)
- Time horizon:** 2024-2040 (dropdown menu)

The year range default is from 2024 to 2040, however, it can be adjusted up to 2050. The time horizon default is 2024-2040 but can be adjusted to 2033 or 2050. Note that a breakdown of specific drug treatments is not currently available in this version of the GUI.

Illustration 9 and Illustration 10 below shows that selecting Drug Treatment from the *Resource* drop-down menu will display the total number of drug treatments estimated for each objective or strategy (depending upon the aggregation level of the results i.e. whole country, coordination, health zone).

Note: Hover over the results to display confidence intervals and medians for each year.

Illustration 9: Estimated number of drug treatments, including uncertainty, according to the objectives Status Quo and most efficient strategy for EoT by 2030 for the Whole Country

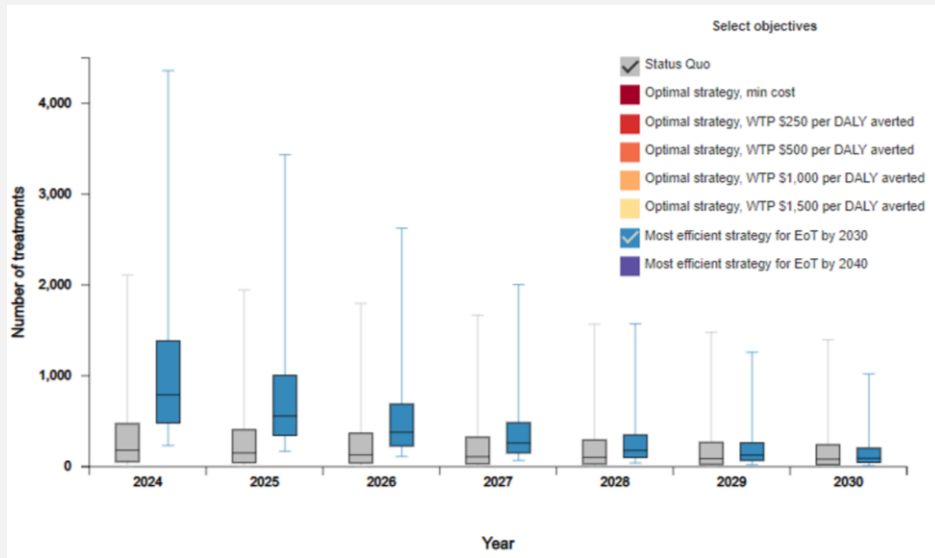


Illustration 10: Number of drug treatments for the Mean AS and Int AS + Full VC for Bokoro, Bandundu Nord

