Version 1.1

# Animal Transmission: 2000 to 2050

# Data and analysis tool (GUI)

*Gambiense* Human African Trypanosomiasis (gHAT or sleeping sickness) disease transmission model - **data and results**

# User Guide

## Contents



**ABOUT THIS GUIDE**

| | |
|---|---|
| **DESCRIPTION** | Fitting two gHAT model variants with and without animal transmission |
| **SOURCE** | Projections from Warwick gHAT model fitted to WHO HAT Atlas case data |
| **DATE ISSUED** | March 2022 |
| **LAST UPDATED** | April 2022 |
| **SPATIAL COVERAGE** | Democratic Republic of Congo, provinces and health zones |
| **YEARS(S)** | Fitting to 2000 to 2016 and projections from 2017 to 2050 |
| **STATUS** | In development |
| **CREATOR** | Crump et al, University of Warwick |
| **USAGE** | Open access |
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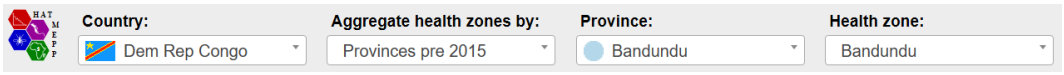
# Quick guide to getting started

1) Go to: https://hatmepp.warwick.ac.uk/animalfitting/v1/
(We recommend you use Google Chrome, Microsoft Edge or Firefox as your browser to get the best experience)

2) Choose your **province** and **health zone** from the drop-down boxes. This version of the GUI is only for DRC so the country cannot be changed.




Note that health zones will be aggregated by pre-2015 provinces as the default.
Note that province-level results are an aggregation of the health-zone level results.

3) The table immediately below will auto generate based on your entries, to show the proportion of people assumed to be screened, the screening level, predicted year of elimination of transmission without animal transmission, the support for each model and the probability that the maintenance host is animals only.

| Dem Rep Congo: Bandundu Province: Kikwit Sud Health zone | |
|---|---|
| *Information* | |
| Kikwit Sud population (est 2015) | 261,395 |
| Screening level (mean/max) | 0.00%/0.01% |
| Vector control | None |
| Predicted year of EOT (Without animal transmission) (median [95% prediction interval]) Mean active screening, no vector control | 2015 [2011, 2025] |
| Number of people actively screened [2000-2004] | 28 |
| Number of cases detected [2000-2004] | 39 |
| Model support | Weak, without animals |
| Under the animal model, what is the probability that the maintenance host is animals only | 0.00 |

4) A number of results tabs can be found under the maps and table. **Charts** under each results tab will auto-generate based on your province or health zone selection.

5) You can **download charts**, by clicking on 'Save Plot'.

# Definitions

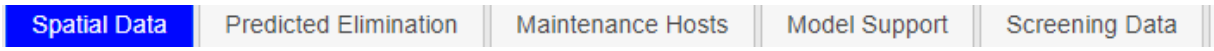
| *Terminology* | *Definition* |
|---|---|
| *Assumed (max)* | Assumed number of people screened in the projections in the selected province or health zone under a maximum level of active screening (see *Max AS below*) |
| *Assumed (mean)* | Assumed number of people screened in the projections in the selected province or health zone under a mean level of active screening (see *Mean AS* below) |
| *Fitted* | Model outputs have been fitted to actual case data from the WHO HAT Atlas |
| *Mean Active Screening (AS)* | The proportion of people screened is equal to the mean number screened during 2012–2016 |
| *Max Active Screening (AS)* | The proportion of people screened is equal to the maximum number of people screened during 2000–2016 |
| *No analysis performed* | Insufficient data to provide fitting or projections |
| *Observed* | Aggregate case data from the WHO HAT Atlas |
| *PS (Passive Screening)* | Passive screening is in place under all strategies |
| *VC (Vector Control)* | Vector control (VC) is simulated assuming a % tsetse density reduction |
| *Maintenance Hosts* | A population, or collection of populations, that is sufficient to maintain infection on their own even if infection is temporarily eliminated from other hosts (e.g. animals would be maintenance hosts if they continue to transmit in the long-term even if infection were eliminated in humans) |
| *Model Support* | The statistical evidence that either the model with animal transmission or without animal transmission is best supported by the human case data (using Bayes factors) |
| *Parameter Posterior Distributions* | These are estimated parameter values computed through model fitting to case data. Separate distributions are computed for models with and without animal transmission |
| *Ensemble Model* | Combined model using results of models with or without animal transmission according to the weighting of the model evidence |

You can also refer to the main Glossary for a description of commonly used terms and acronyms associated with the gHAT projects.

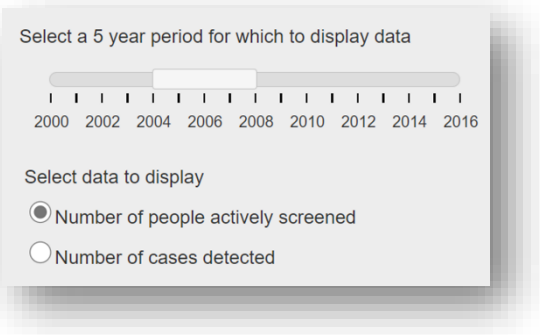
# Results tabs

Spatial Data | Predicted Elimination | Maintenance Hosts | Model Support | Screening Data | Active Detections | Passive Detections | New Infections | Parameter Posterior Distributions

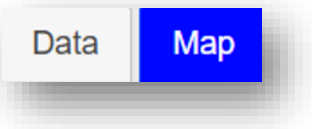
## Spatial Data




The **Spatial Data** results tab will show you the number of people actively screened and the number of cases detected in 5 year period blocks between 2000-2016 for 158 endemic health zones in the DRC with sufficient data for fitting both the model without animal transmission and the model with animal transmission.

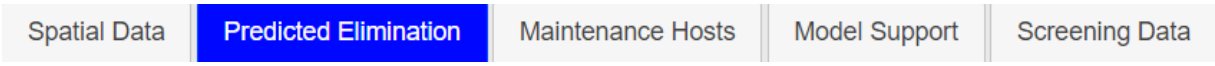



**Amend** the **5-year period block** by toggling between 2000 to 2016 and select the data to be displayed. Results will display on the map according to the legend colour coding on the right-hand side of the map.

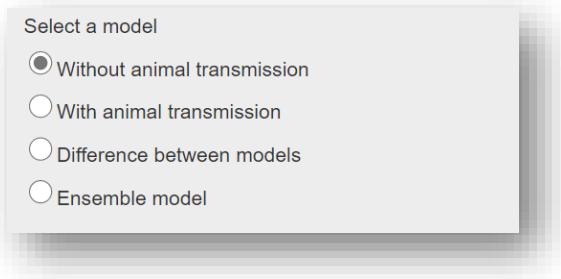



***Note*:** The map will default to whole-country view. To show one province only click on the map sub-tab.

# Predicted Elimination

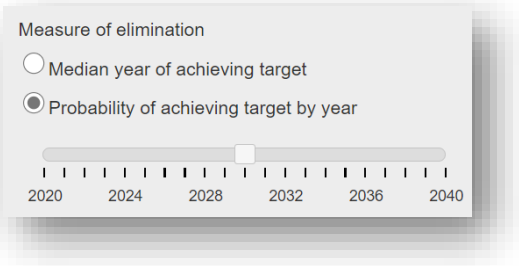



The **Predicted Elimination** results tab will show you the model predictions for the **year of elimination of transmission (EOT)** of gHAT for each health zone according to the model variant selected.

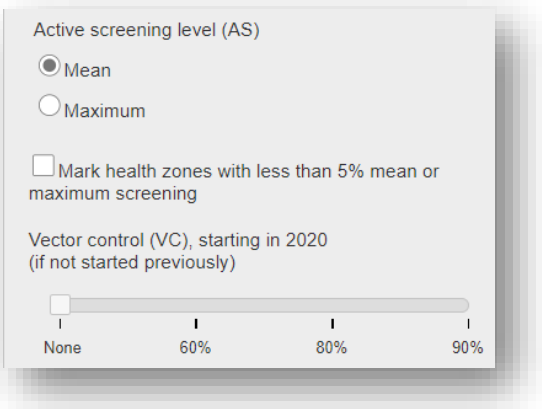



**Toggle between** the model variants in the box on the left-hand side to display the results in the map.

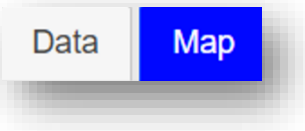
**Amend** how the elimination target is displayed. Select between the *median year of achieving elimination* or according to the *probability of achieving the target* between 2020 to 2040 (the year can be selected using the toggle bar).




***Tip:*** Dark orange to dark red health zones indicate a predicted elimination year post 2030 when *median year of achieving target* is selected. This indicates those health zones that require more intensive interventions (maximum screening and/or vector control) to reach EOT by 2030.

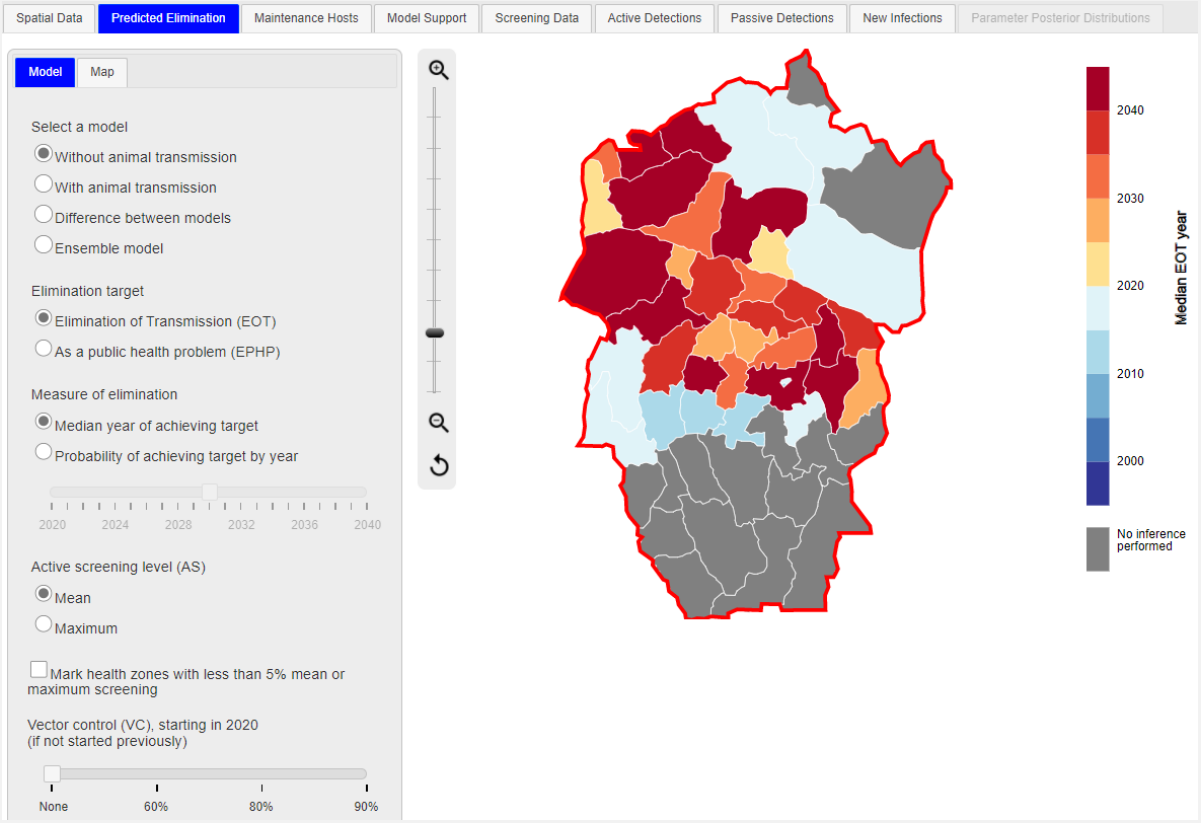



**Amend** the **active screening level** (select between Mean AS and Maximum AS – see definitions) and **vector control** in the bar on the left-hand side to see the impact on the year of elimination of transmission (EOT), shown on the map via colour coding, where there is sufficient data.




***Note*:** The map will default to whole-country view. To show one province only click on the map sub-tab.

*Illustration 1*: Predicted year of elimination of transmission according to the model without (top figure) and with animal (bottom figure) transmission under mean active screening and no vector control.



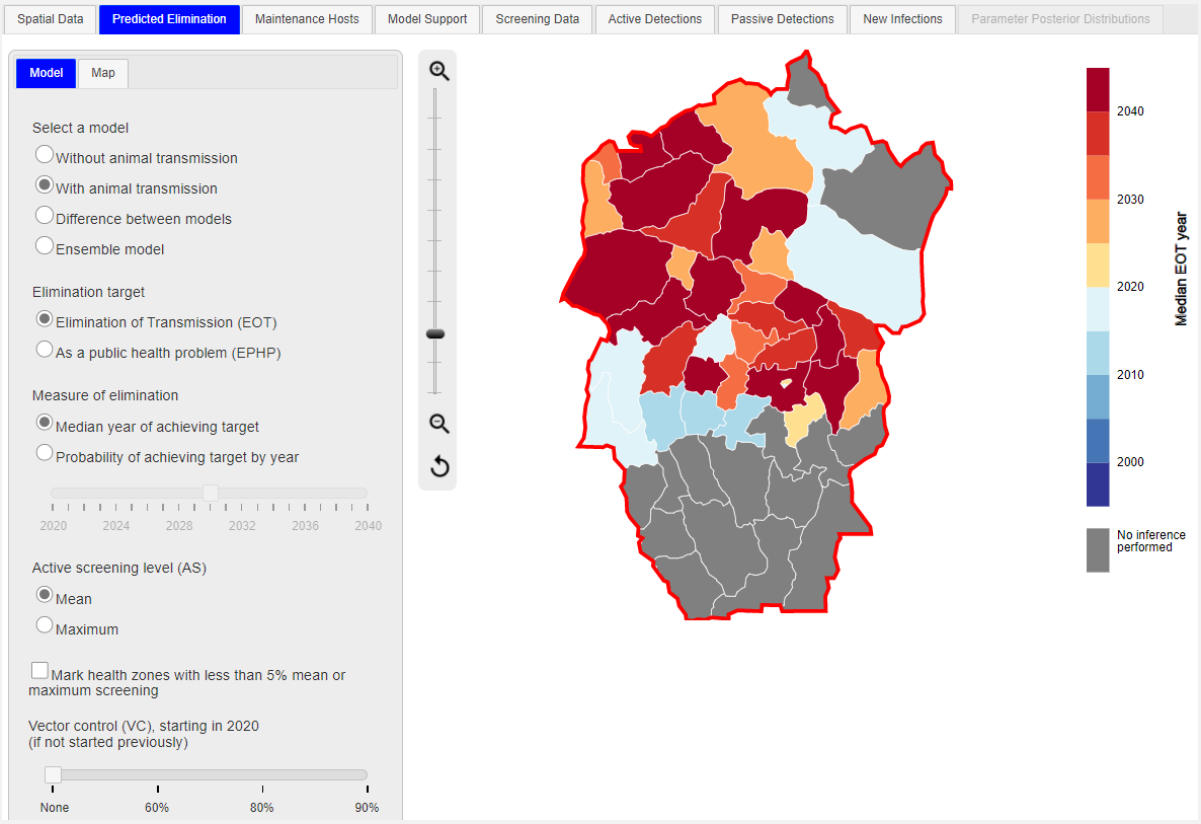
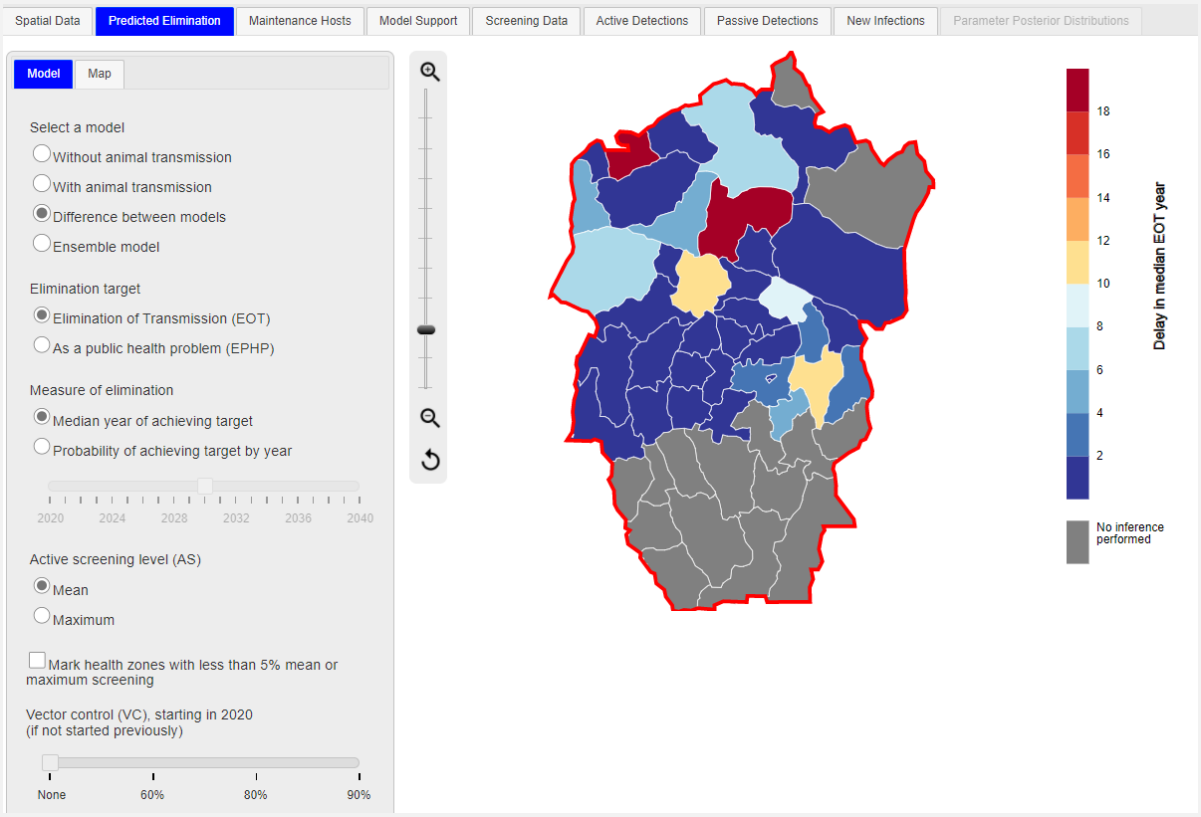



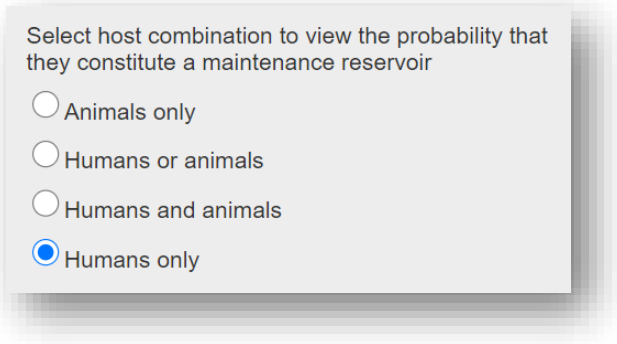
*Illustration 2*: Predicted delay in the elimination of transmission year under mean active screening and no vector control under the model with animal transmission compared to the model without animal transmission.



# Maintenance Hosts

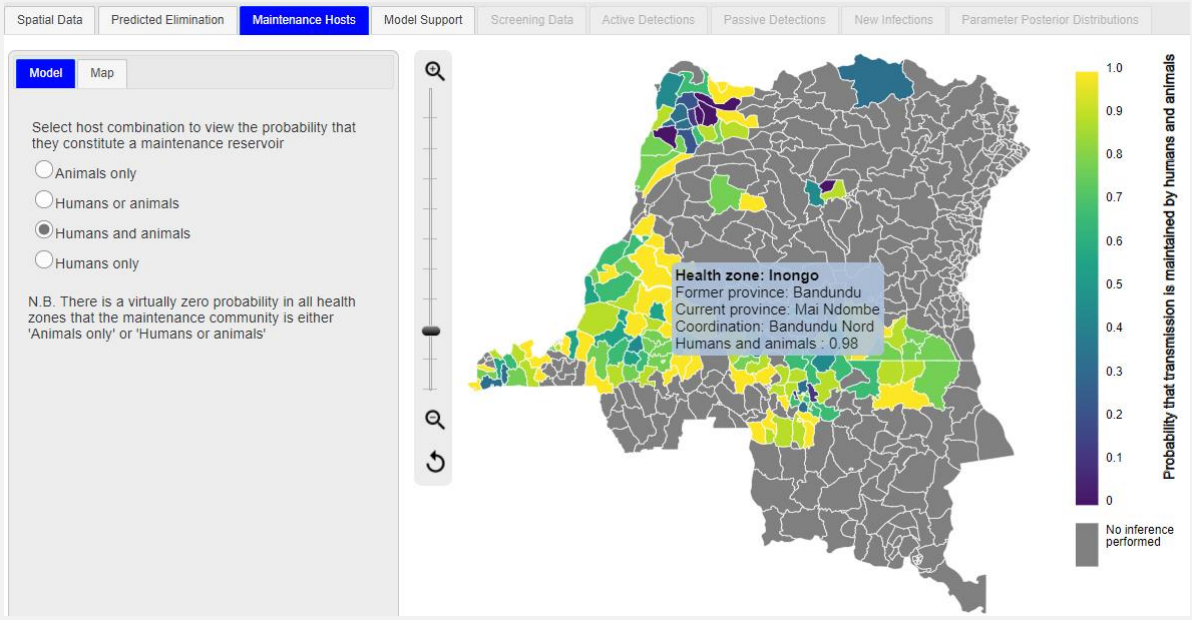
Spatial Data | Predicted Elimination | **Maintenance Hosts** | Model Support | Screening Data

The **Maintenance Hosts** tab displays the probability that the selected host combination can maintain a transmission reservoir.




**Select** the host combination in the grey bar on the left-hand side and display results at country or province level. Hover over a health zone for the probability that transmission is maintained by the selected host. ***Note:*** When selecting either *'Animals only'* or *'Humans or animals'* there is a virtually zero probability in all health zones that transmission is maintained.

*Illustration 3*: Probability that transmission is maintained by humans and animals combined (i.e. both are necessary for continued transmission). Hover over health zones for probability details.




***N.B.*** 1. "*Humans only*" indicates humans maintain infection on their own without the need for animal transmission AND animals could not maintain infection without human contributions.
2. "*Humans and animals*" indicates that both host types are needed to maintain infection and if neither species could maintain infection without contributions from the other.

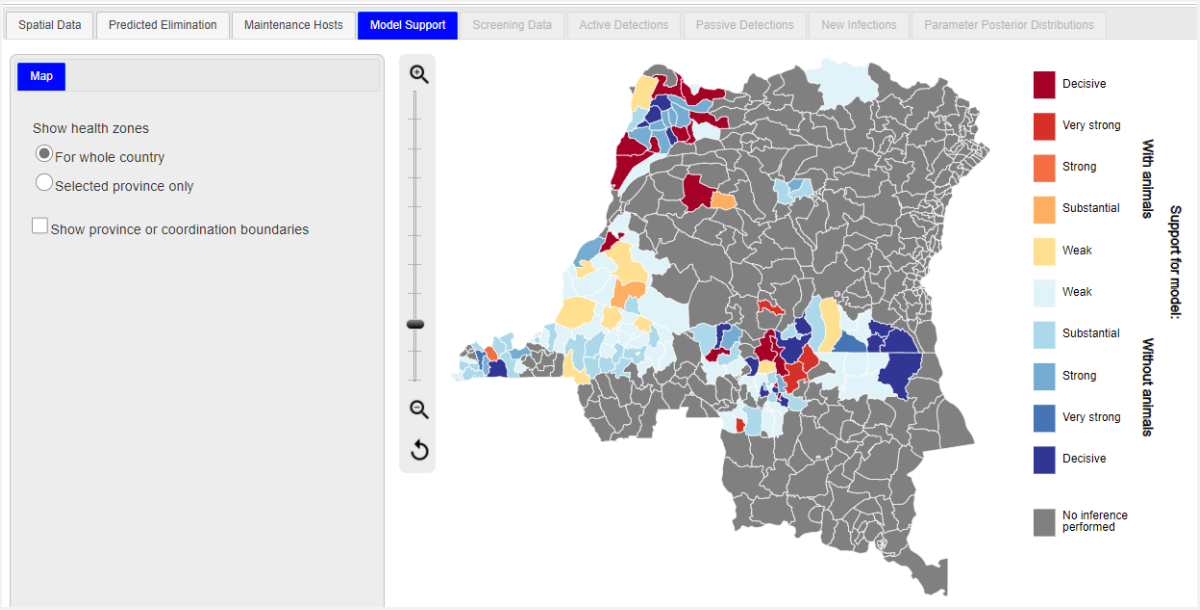
3. “*Humans or animals*” would mean either host could maintain infection on their own without the need for the other host type – although there is virtually zero probability of this occurring in these results across all health zones.
4. “*Animals only*” would mean animals maintain infection on their own without the need for human transmission AND humans could not maintain infection without animal contributions – again, there is virtually zero probability of this occurring in these results across all health zones

# Model Support

Spatial Data | Predicted Elimination | Maintenance Hosts | **Model Support** | Screening Data

The **Model Support** tab displays the statistical evidence that either the model with animal transmission or without animal transmission is best supported by the human gHAT case data (using Bayes factors). Dark red to orange indicate decisive to substantial support for the model with animal transmission and dark blue to blue indicate decisive to substantial support for the model without animal transmission. Results can be displayed for the whole country or for the selected province.

*Illustration 4*: Support for the model with and without animals contributing to the transmission of gHAT for the whole DRC.

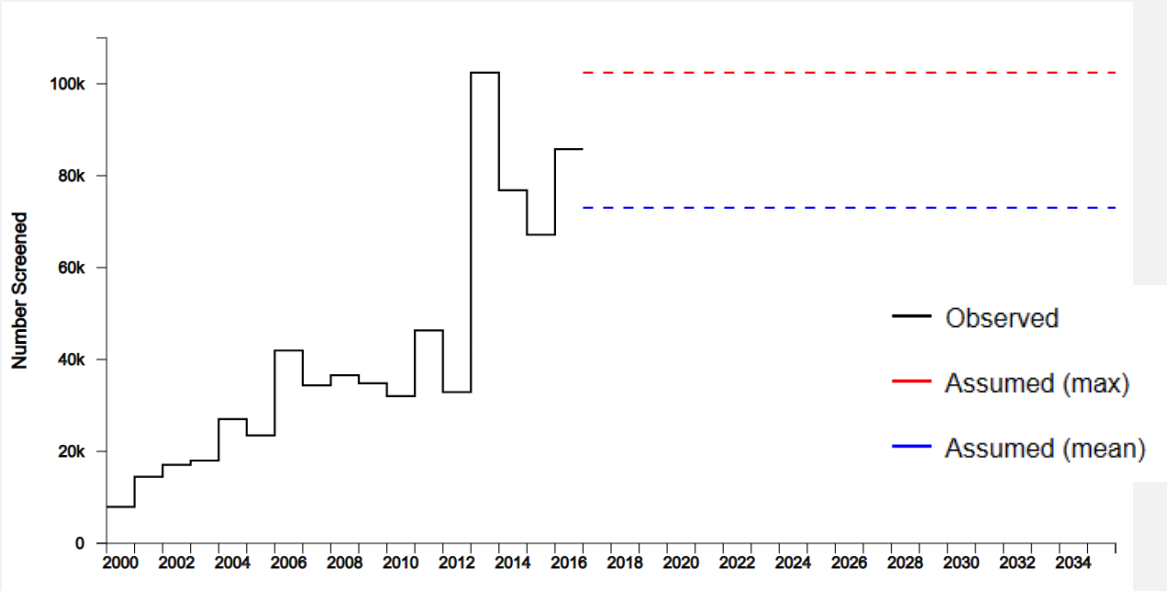


# Screening Data

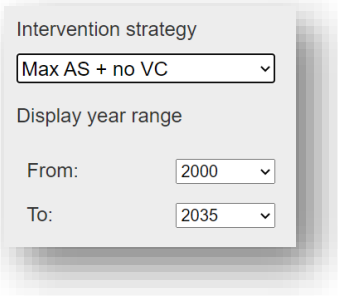
Spatial Data | Predicted Elimination | Maintenance Hosts | Model Support | **Screening Data**

The **Screening** results tab provides a chart showing you (i) the number of people actively screened by year from 2000-2016 (*i.e.* the "observed" level in the data) and (ii) the assumed number of people that are screened in the selected province or health zone under a mean level of active screening compared to a maximum level of active screening (see definitions for mean AS and maximum AS) from 2017 onwards.

*Illustration 5*: Assumed number of people to be screened under a mean and maximum level of active screening

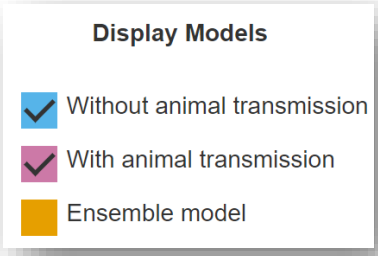


# Detections & new infections


The **detections and new infections** results tabs provide charts to show you the predicted active and passive case reporting by year, by health zone, as well as the new infections that wouldn't be picked up in the data. These results are viewable according to the intervention strategy, which can be selected from the drop-down box, for each of the model variants (Display Models).

The list of models (see opposite) is a tick box function to allow you to select and compare the results based on each of the model variants including the results from fitting an ensemble of the two models. The tick box will default to the model without and with animal transmission.




***Tips***:

- Amend the intervention strategy as required (defaulted to ***Mean AS + no VC***)
- Amend the time period as required (defaulted to 2000 to 2035, but this can be scaled to any period between 2000 and 2050).
- Hover on 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.

**Example**:

1. *Selected Province:* Bandundu province and *Health zone:* Kwamouth from the top bar (or click on the health zone on the DRC map).
2. Click on the ***Active Detections*** tab and select ***Max AS + 90% VC***. The range will be from 2000-2035 by default.
3. Select 2012 in the ***From*** dropdown list on the left-hand side and 2030 in the ***To*** dropdown list.
4. Select the combined model results (weighted by the statistical support for the models with and without animal transmission) by additionally selecting the ***Ensemble model*** in the right-hand legend.
5. You can save this image by clicking ***Save Plot*** on the left-hand side.
6. To view predictions for Passive Detections and New Infections with these same settings, simply choose the corresponding tab. The selected strategies and data range will remain the same until you choose a new health zone.

*Illustration 6*: Example results – predicted active detections and passive detections under the *Max AS + 90% VC* intervention strategy for both model variants (with and without animal transmission) and the combined (ensemble) model results from 2012 to 2030

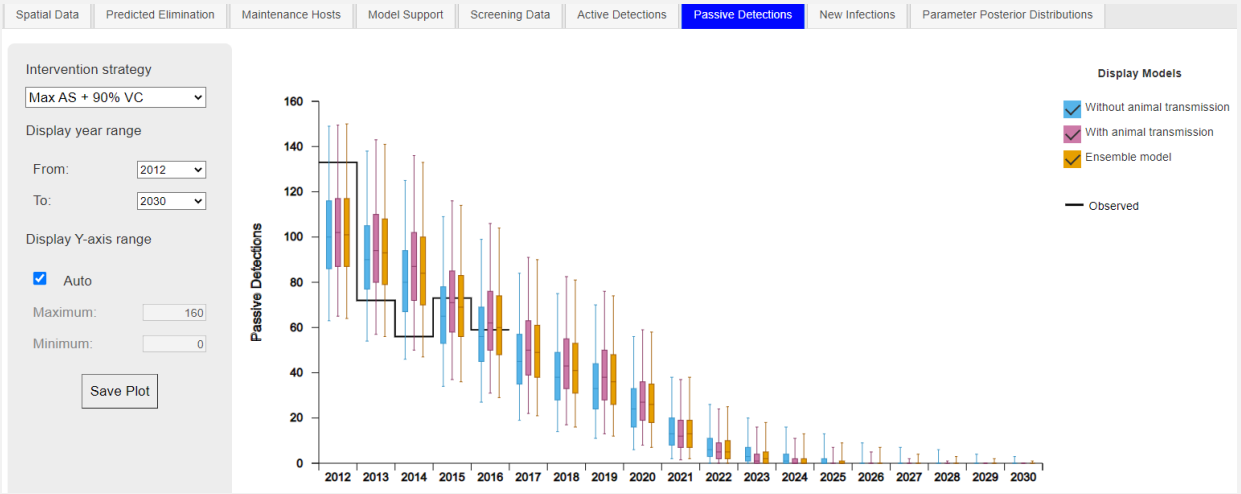
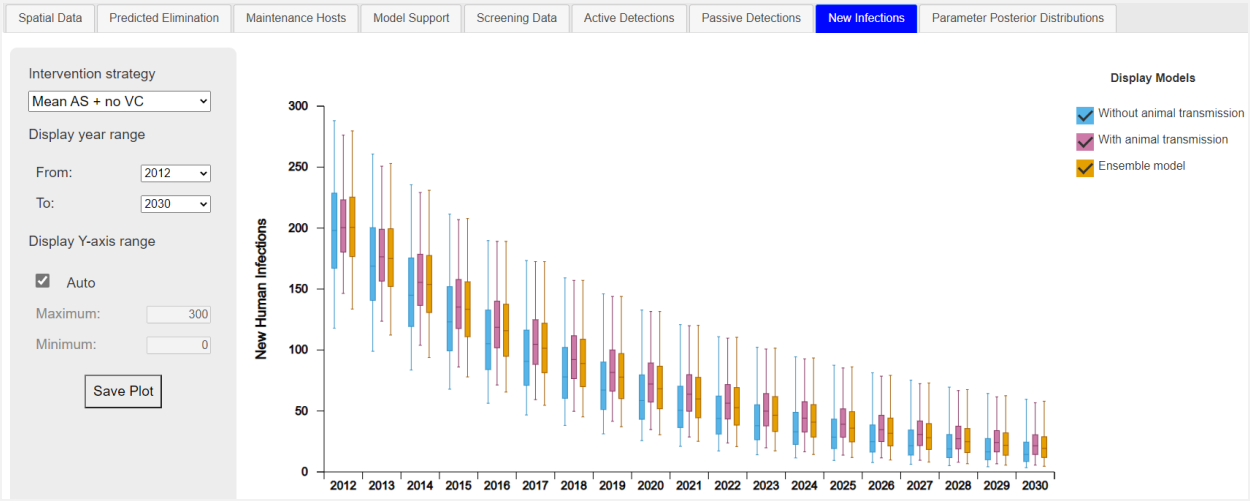



*Illustration 7*: Example results – predicted new infections under the *Max AS + no VC* intervention strategy for both model variants (with and without animal transmission) and the combined (ensemble) model results from 2012 to 2030

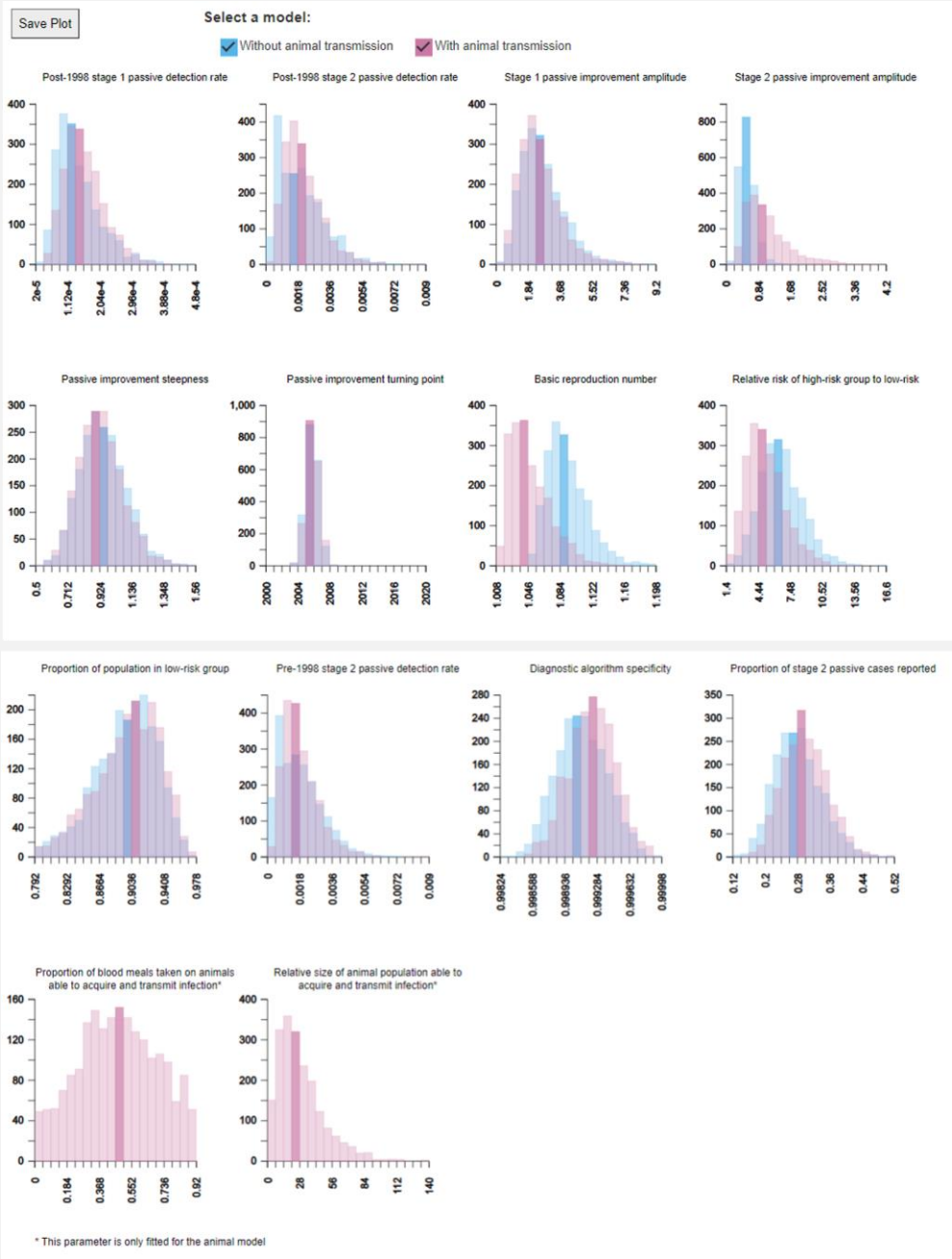


# Parameter Posterior Distributions

Active Detections | Passive Detections | New Infections | **Parameter Posterior Distributions**

The **Parameter Posterior Distribution** tab displays how posterior distributions of fitted parameters change between the models without and with animal transmission by health zone.

*Illustration 8*: Fitted parameter posterior distributions for the models with and without animal transmission for the Kwamouth health zone



Note that the model parameters "*relative size of animal population able to acquire and transmit infection*" and "*proportion of blood meals taken on animals able to acquire and transmit infections*" are only fitted for the animal model. You can save this image by clicking ***Save Plot*** on the left-hand side.