Vector Borne Disease Network Update

User Friendly Interfaces
Single Node - OM and EMOD Expert for specific sites,
Representative Scenario,
(Multinode simulation interface (spatial analyses))

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and Frank Collins on behalf of the VecNet Consortium
Explore the VecNet Toolset

VecNet provides a simplified interface to model the impacts of interventions on malaria transmission for control and eradication. Learn more About VecNet

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Transmission Simulator offers user-friendly interfaces to two simulation modelling packages, EMOD (The Institute for Disease Modeling) and OpenMalaria (Swiss Tropical and Public Health Institute). Both EMOD and OpenMalaria are accessible in VecNet via basic and expert user interfaces to create scenarios to analyse malaria transmission and its control. They share a number of common features: each requires mosquito (entomological) and human disease (epidemiological) inputs. The outputs of each are accessible as downloadable graphs and datasets. Both EMOD and OM generate the following outputs:

- Entomological Inoculation Rate (EIR),
- Number of malaria infections by age group,
- Fever prevalence,
- And number of new infections (diagnostic test).

The two models have different features, however, which may make the model more attractive depending on the data available to the user as inputs as well as in the outputs that are generated.
Select a simulation type:

**SINGLE NODE SIMULATION**

The EMOD System allows the user to build a temporal model that simulates both a baseline of malaria transmission across time in a simulated environment as well as the possible impact on this baseline of different combinations of malaria interventions. The model runs at daily time steps, and in its simplest form, it simulates events at a single point or node. This kind of simulation can conceptually represent a region across which all conditions of malaria transmission and control are represented by the single node simulation.

**MULTIPLE NODE SIMULATION**

More spatially explicit simulations can be produced two ways. The simplest is to establish a single node simulation that is directly modified by linearly increasing or decreasing the model output parameters by application of an external scaling factor called the Larval_Habitat_Multiplier. These different versions of the single node simulation are linked by data that are shared across each version. A more complex approach that is also much more robust is to run multiple different simulations, each with its own unique parameter settings, that are allowed to communicate with each other at each time step by rules that involve the movement of people and parasites across the different nodes.
Select a data type:

EXPERT DATA Track

The EXPERT DATA Track invites the user to create a malaria transmission baseline, along with interventions, that are designed as closely as possible to represent malaria in a real location, such as Garki, Nigeria, where very specific data can be used to set parameter values. This Track also allows the user to select several such sites where the baseline parameter values have already been set and made publicly available by other VecNet users. In addition, this track exposes the user to the highest number of model parameters that can be user defined, although default settings are suggested for users who do not have their own values.

REPRESENTATIVE DATA

Here, the user is guided to build a malaria transmission baseline by making a series of guided choices from among a small range of settings (typically High, Medium, or Low) that end up defining the weather pattern, the demographic characteristics, the vector or vectors and the parasites present and their endemcity. Calibration of fitted parameters and ‘burn-in’ is the same as described above. The resulting baseline may be designed to represent malaria transmission under conditions that closely resemble a true site that the VecNet user is attempting to emulate, but strictly speaking the site produced is hypothetical. The main goal of this track is to give the user a relatively simple means of exploring transmission and interventions in a range of different hypothetical settings.
Step 1 of 9: Select Location

Selecting a Location provides default values for EMOD parameters, including weather and demographics files. You can change input parameters later.
1. Name and describe the simulation

2. Specify duration of simulation
Climate data for any geographic location will be provided by the digital library.
Please review the temperature data.

The small bottom chart is a "summary overview" of the main chart. Drag the "handles" at right and left of the overview to change the range of the main chart.
Drag or click on a Species in the lower box to add it to the simulation. Drag Species within the simulation (upper box) to reorder. If no appropriate Species exists, Create a new one.
<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anthropophily</td>
<td>0.95</td>
</tr>
<tr>
<td>Days Between Feeds</td>
<td>2.5</td>
</tr>
<tr>
<td>Indoor Feeding Fraction</td>
<td>0.16</td>
</tr>
<tr>
<td>Egg Batch Size</td>
<td>60</td>
</tr>
<tr>
<td>Adult Life Expectancy</td>
<td>6</td>
</tr>
<tr>
<td>Transmission Rate</td>
<td>0.4</td>
</tr>
<tr>
<td>Required Habitat Factor</td>
<td>12500000000.0</td>
</tr>
<tr>
<td>Aquatic Arrhenius 1</td>
<td>84200000000</td>
</tr>
<tr>
<td>Aquatic Arrhenius 2</td>
<td>8328</td>
</tr>
<tr>
<td>Infected Arrhenius 2</td>
<td>8336</td>
</tr>
<tr>
<td>Infected Arrhenius 1</td>
<td>117000000000</td>
</tr>
<tr>
<td>Immature Duration</td>
<td>2</td>
</tr>
<tr>
<td>Infectious Human Feed Mortality Factor 1.5</td>
<td></td>
</tr>
<tr>
<td>Habitat Type</td>
<td>BRACKISH SWAMP</td>
</tr>
<tr>
<td>Aquatic Mortality Rate</td>
<td>0.1</td>
</tr>
<tr>
<td>Acquire Modifier</td>
<td>0.1</td>
</tr>
<tr>
<td>Infected Egg Batch Factor</td>
<td>0.8</td>
</tr>
</tbody>
</table>
User selects the prevalence (range)...

... and the sensitivity of the diagnostic test
Step 8 of 9: Run Simulation

Run this simulation. Once the results have been processed, you can change the parameters in the previous steps before rerunning it. You will also be able to accept the simulation as approved (this will allow addition of interventions).

Name  
Test Run 2015-01-20 17:58:38.5983

You can change the name of this test run if you want to.

If you have run this simulation and not made changes since, you may skip this step.

Previous Step  Skip to Review previous Run  Run Simulation
Calibrate against biting rate and parasite prevalence
Simple_Bednets_(predefined)
No interventions

ITNs

Chloroquine & Primaquine

Chloroquine & Primaquine
User friendly interface for editing input parameters
Expert (xml) mode is available
Basic User workflow starts with describing the scenario

User can either use existing template or upload their own file
User specifies the outputs, and frequency of the outputs and duration of the simulation
User selects population size and age distribution
User specifies drugs used and access

User defines vectors, relative abundance and biological characteristics

Interventions identified, effectiveness, when deployed
Run Successful

11/11 test runs complete.
Experiment: Test
This experiment contains 0 scenarios.

- Notify me by email when simulation is completed

- Delete Experiment
- Download experiment
- Go to Experiment Creator
Experiment output

Survey Output

Continuous Output
Published Data on Malaria Vectors: 1985-2013

Sinka and Moyes, Malaria Atlas Project
Data assembly, Map by T Russell
Parity Rates

Daily Survivorship

Sinka and Moyes, Malaria Atlas Project
Data assembly, Map by T Russell
The daily weather is generated using the monthly values shown in the graph.
Representative Scenario Vectors Attributes

Mosquito species

Species present
- An. gambiae
- An. funestus
- An. arabiensis
- An. minor

Feeding behavior
- Indoor feeding: How often the species will try to feed on humans indoors.
  - LOW
  - MEDIUM
  - HIGH

Early stages and survival
- Life expectancy: How long the mosquito will leave.
  - SHORT
  - MEDIUM
  - LONG

Anthropophily: How much the species will prefer feeding on humans over animals.
- LOW
- MEDIUM
- HIGH

Gonotrophic cycle: How long a full gonotrophic cycle will take.
- SHORT
- MEDIUM
- LONG

Habitat selection
- Water vegetation: Habitat related to the presence of water vegetation.
- Temporary rainfall: Habitat dependant on the rain.
- Human population: Habitat due to the presence of human in the area.
- Brackish swamp: Habitat that will fill up with rain but eventually emptying if rainfall is too important.
- Constant: Constant habitat that doesn't depend on anything.
The user defines the species biting rate and the annual EIR per species (Graphs are automatically generated to show this distribution)
Demographics and transmission

<table>
<thead>
<tr>
<th>Human birth rate</th>
<th>Parasite prevalence</th>
</tr>
</thead>
<tbody>
<tr>
<td>How often new born are introduced to the simulation.</td>
<td>How intense the transmission is. Also drive the immunity of the population.</td>
</tr>
<tr>
<td>LOW</td>
<td>LOW</td>
</tr>
<tr>
<td>MEDIUM</td>
<td>MEDIUM</td>
</tr>
<tr>
<td>HIGH</td>
<td>HIGH</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Human life expectancy</th>
</tr>
</thead>
<tbody>
<tr>
<td>How long an average person lives.</td>
</tr>
<tr>
<td>SHORT</td>
</tr>
<tr>
<td>MEDIUM</td>
</tr>
<tr>
<td>LONG</td>
</tr>
</tbody>
</table>

Launch calibration!
Create a simulation

This interface allows you to create a multi-node EMOD simulation.

From this interface you can:
- customize the larval habitat multiplier for each node of the grid.
- select a baseline and visualize the associated weather.
- modify the weather for the selected baseline.

Name of the simulation

Baseline
Kisumu, Kenya

Habitat multipliers

Mosquito species
- An. Arabiensis
- An. Funestus
- An. Gambiae
- Minor

Selected weather

Air temp. (°C) 23.5 24.0 23.5 23.0 22.5 22.0 22.0 22.5 23.5 23.5 23.5 23.5
Rainfall (mm) 48 81 140 191 155 84 58 76 64 56 86 102
Rain days 6 8 12 14 14 9 8 10 8 7 9 8
Humidity 0.505 0.515 0.57 0.63 0.67 0.645 0.64 0.615 0.565 0.51 0.525 0.51

Multinode Simulations
Key Dates: EMOD and OM Expert Interfaces - Q2 2015
Representative Scenario Interface - Q3 2015