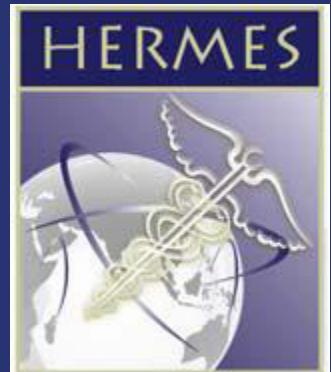


# User Guide



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# 1 Installation

## 1.1 System requirements

### 1.1.1 Operating System

HERMES can run on any platform: Windows 7 or better, Mac OSX or better, Linux any version.

### 1.1.2 Memory

HERMES requires 4GB of RAM.

### 1.1.3 Disk Space

HERMES only needs about 150MB of disk space.

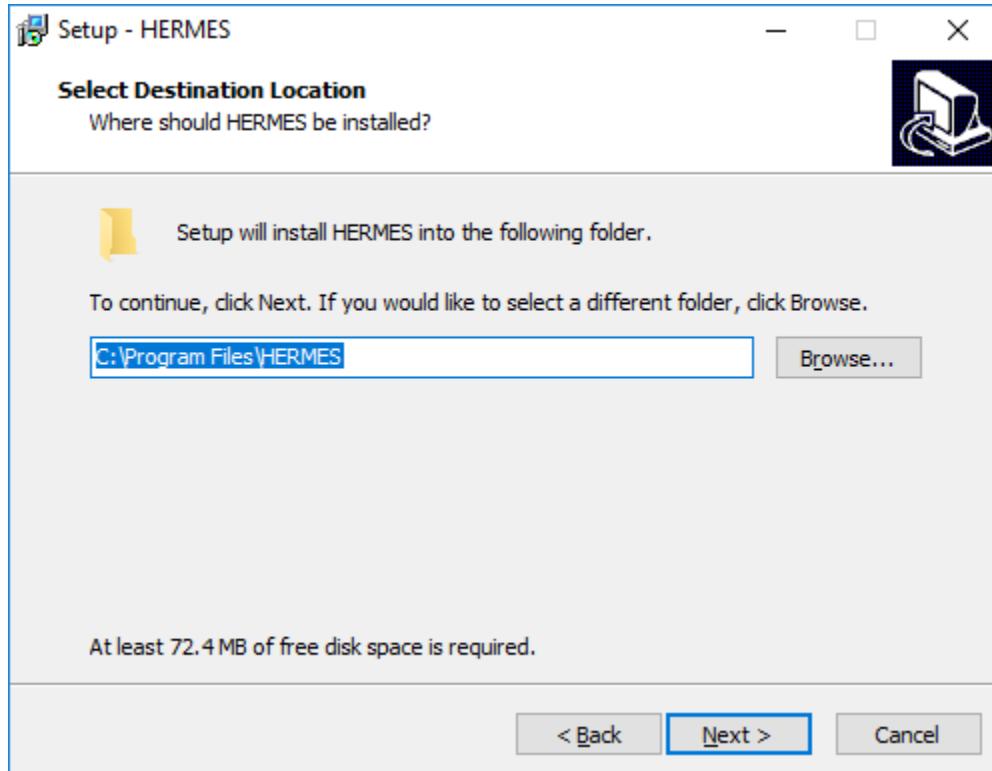
## 1.2 Installation

### 1.2.1 Windows

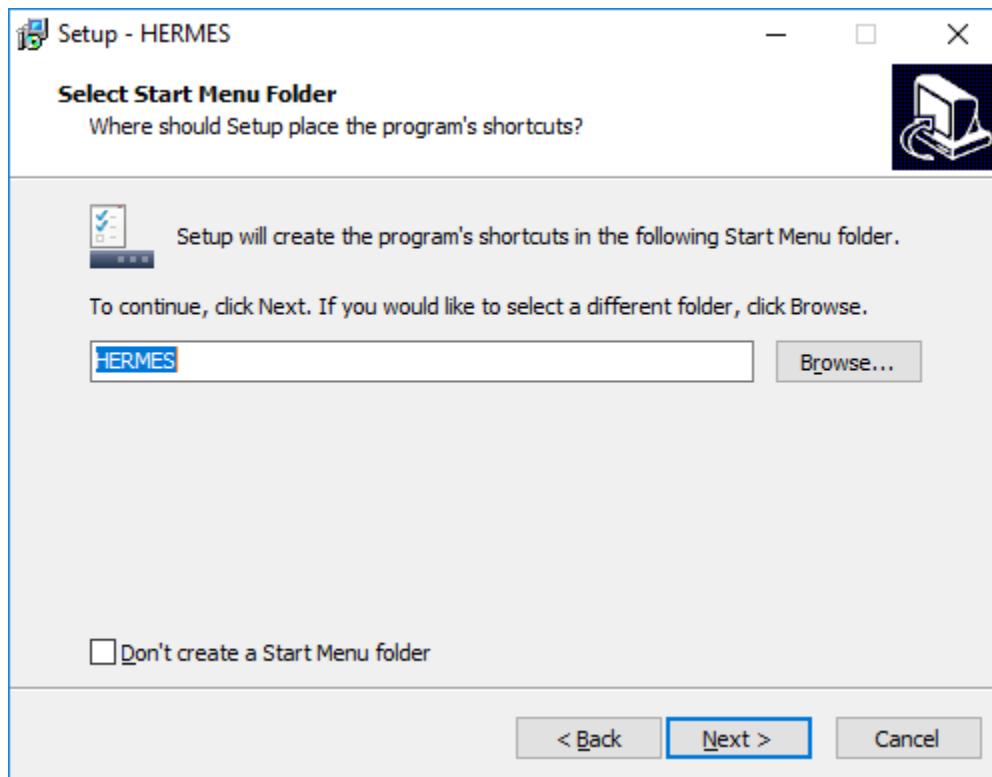
- Download the setup file hermes-setup.exe
- Double-click on the setup file and when asked click Yes to allow the program to make changes to the computer (make sure “Program name” says hermes-setup.exe). If necessary, type in admin password.
- Select Setup Language. This will bring up the HERMES Setup Wizard. Click Next to continue.



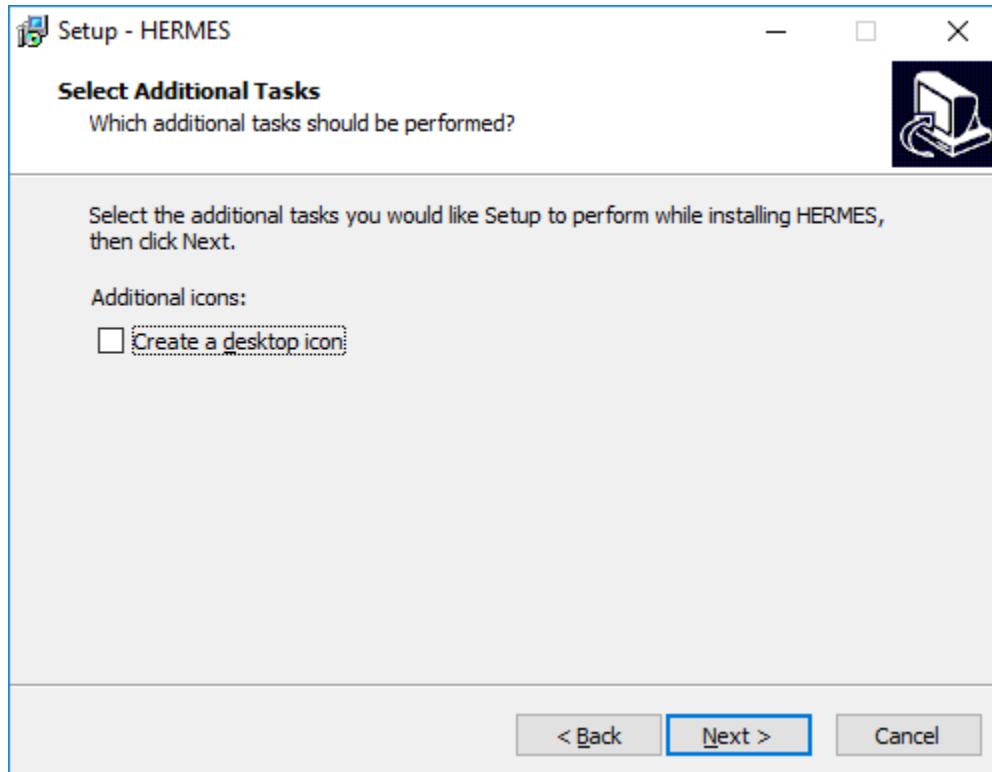
- Follow the instructions in the Setup Wizard. If you want to change the location to which HERMES is saved, do so on this screen but make a note of the location in case you want to save a backup of your database.



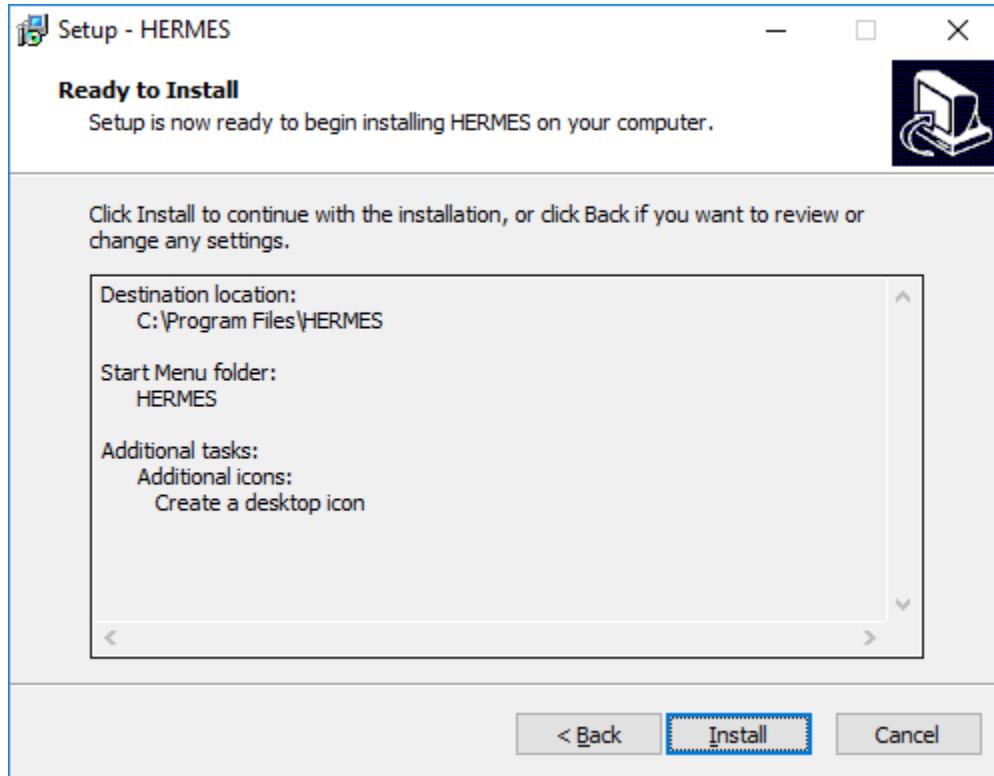
- Where Start Menu items are saved



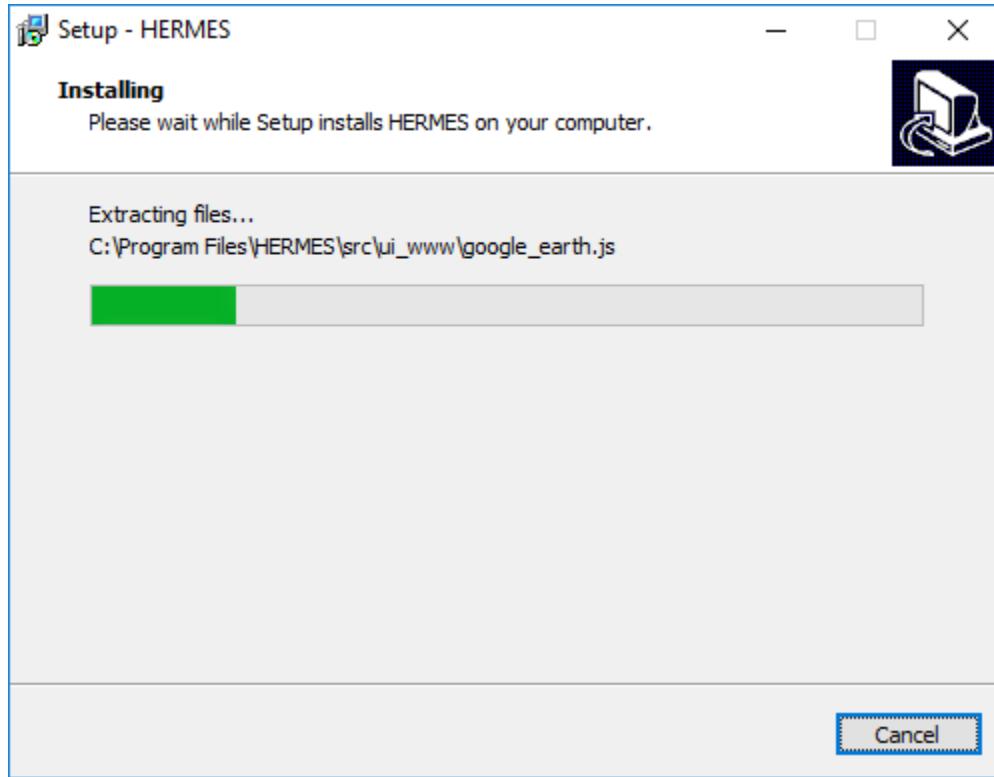
- The installation does not create a desktop icon by default. Make sure to check the box on this screen if you want a shortcut available from your desktop.



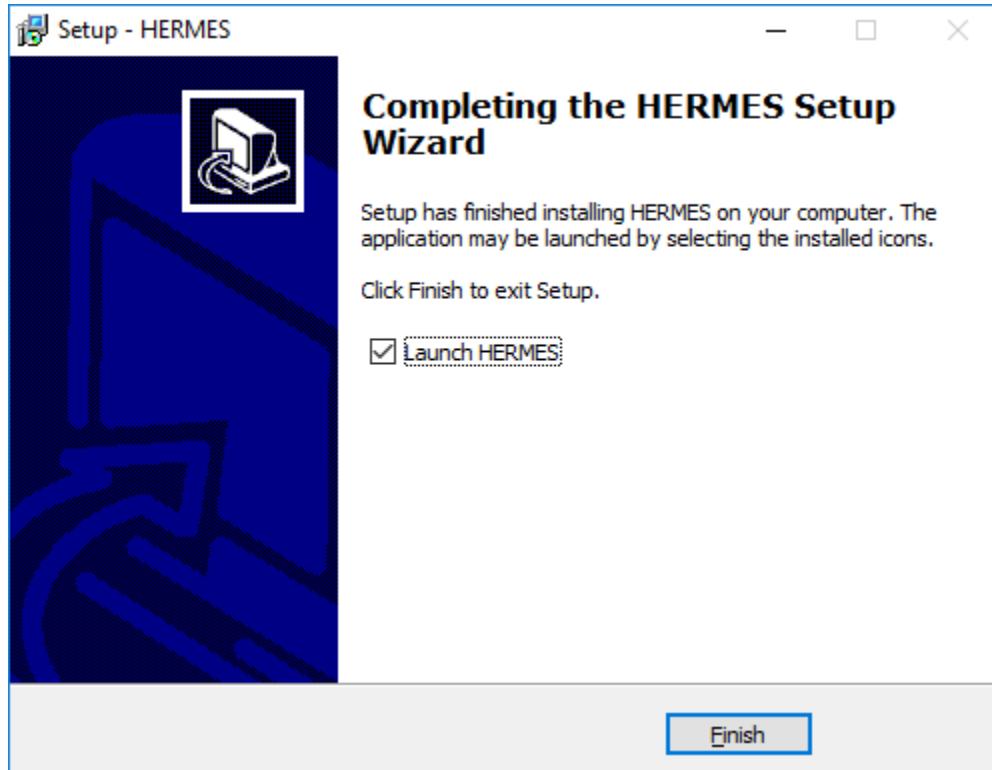
- Review the choices you have made and press Back if you want to change anything or Install if you are ready to Install. If you have not chosen to install a desktop icon, the Additional Tasks section will not be shown.



- While installing, several progress bars will run, indicating file extraction and installation. Additionally, you may notice a command prompt window open and close. This is normal.

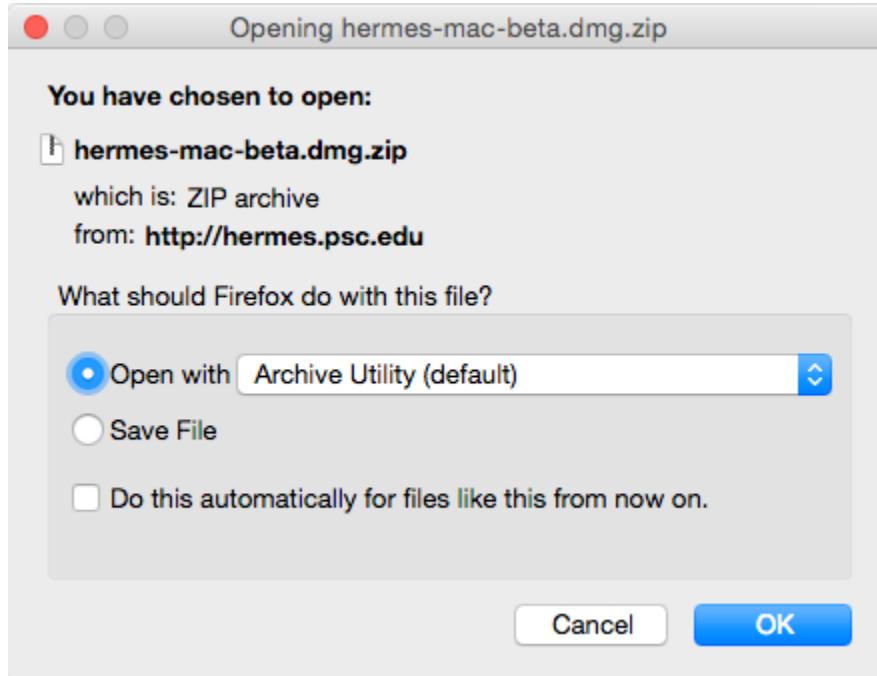


- You can choose to launch HERMES or not when you finish installation. Click Finish after you decide. If you have chosen to launch HERMES, your default browser should open a window with the HERMES Welcome screen.

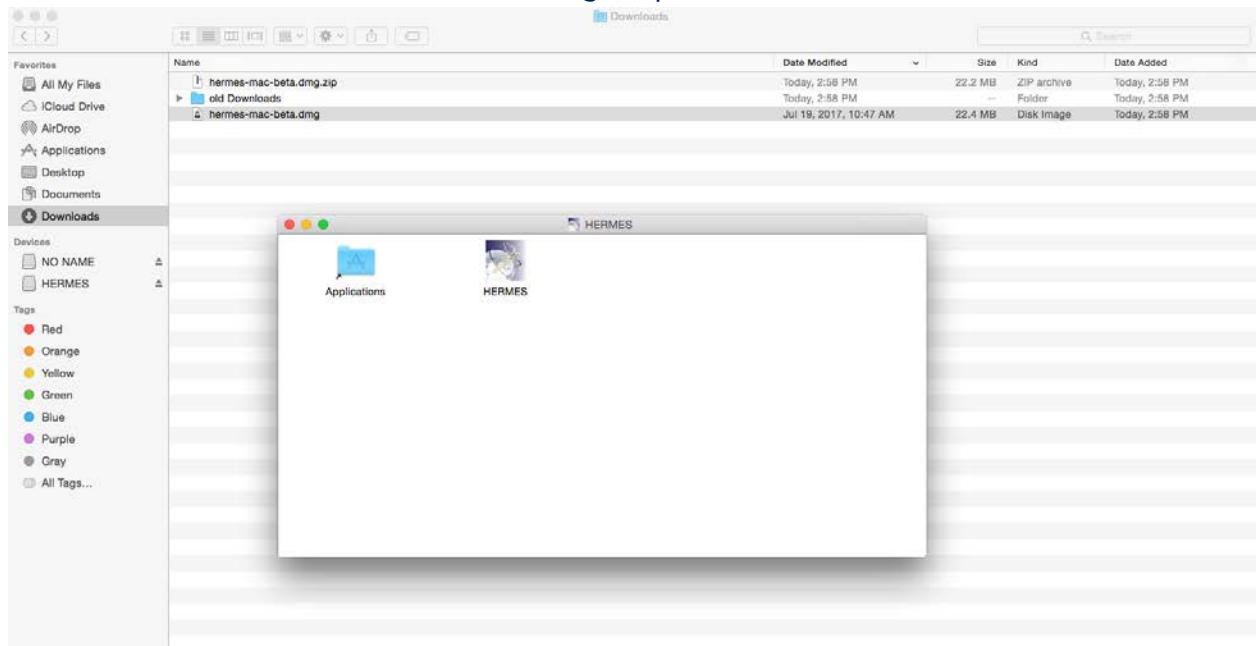


### 1.2.2 Mac

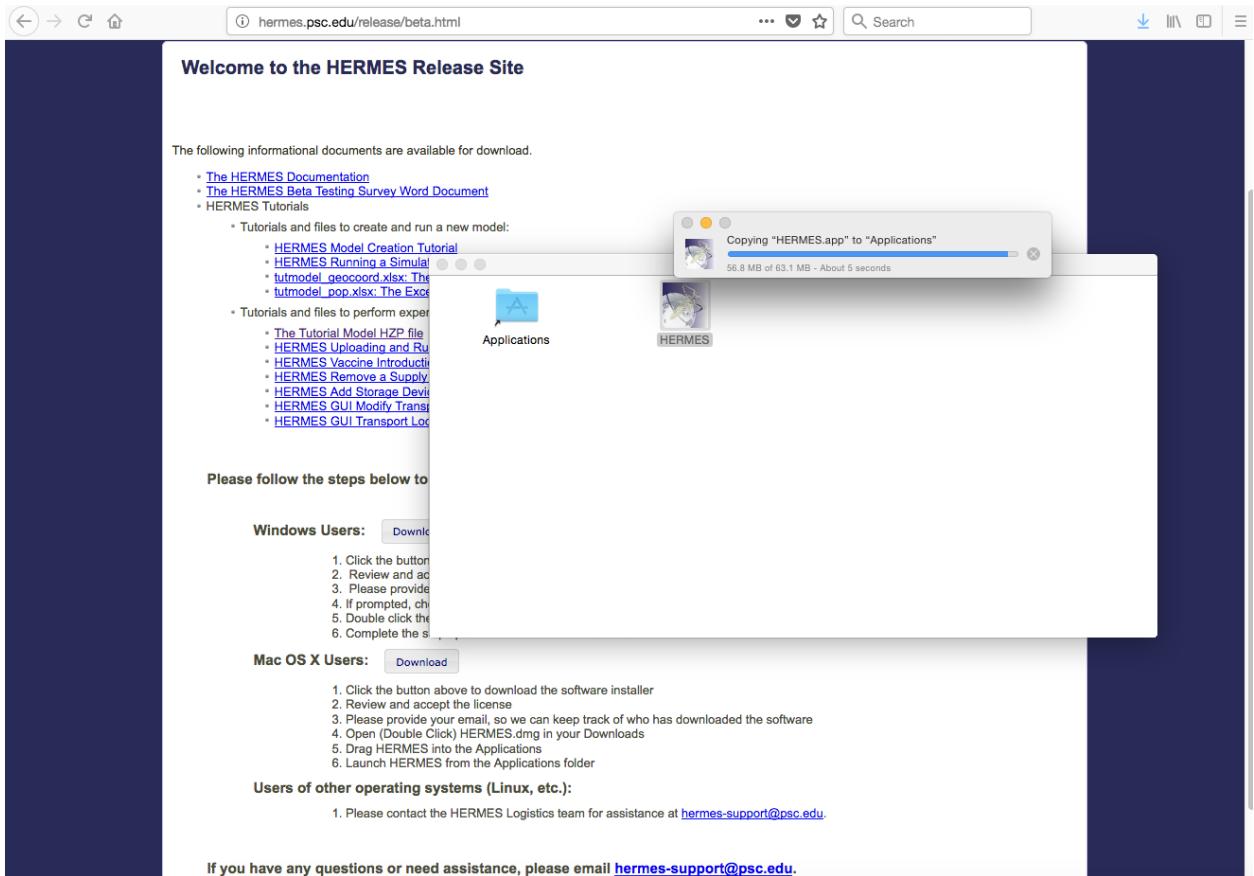
- Download the DMG file `hermes-mac-beta.dmg.zip`
- Choose Open with... Archive Utility (default) to have the file `hermes-mac-beta.dmg` extracted to your Finder and its folder location opened.



- Double click on the file `hermes-mac-beta.dmg` to open the HERMES installation folder



- Drag the HERMES icon onto the Applications folder. You should receive a message that the HERMES app is being copied.



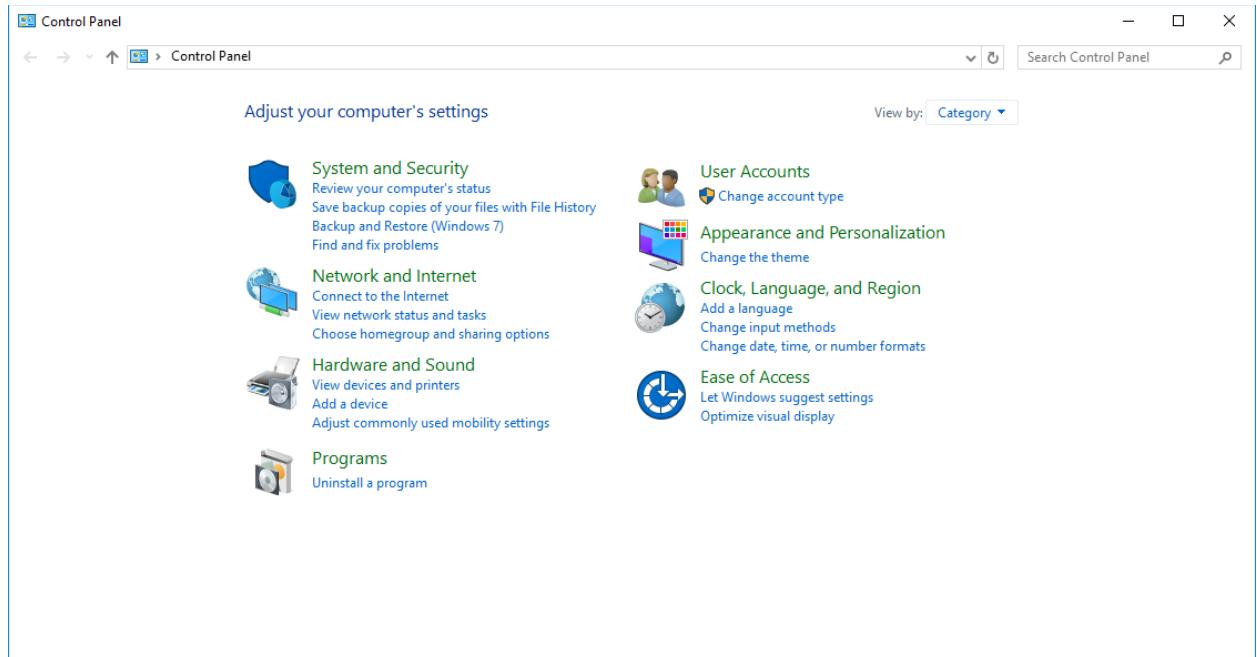
### 1.2.3 Linux

Please contact the HERMES Logistics team for assistance at [hermes-support@psc.edu](mailto:hermes-support@psc.edu).

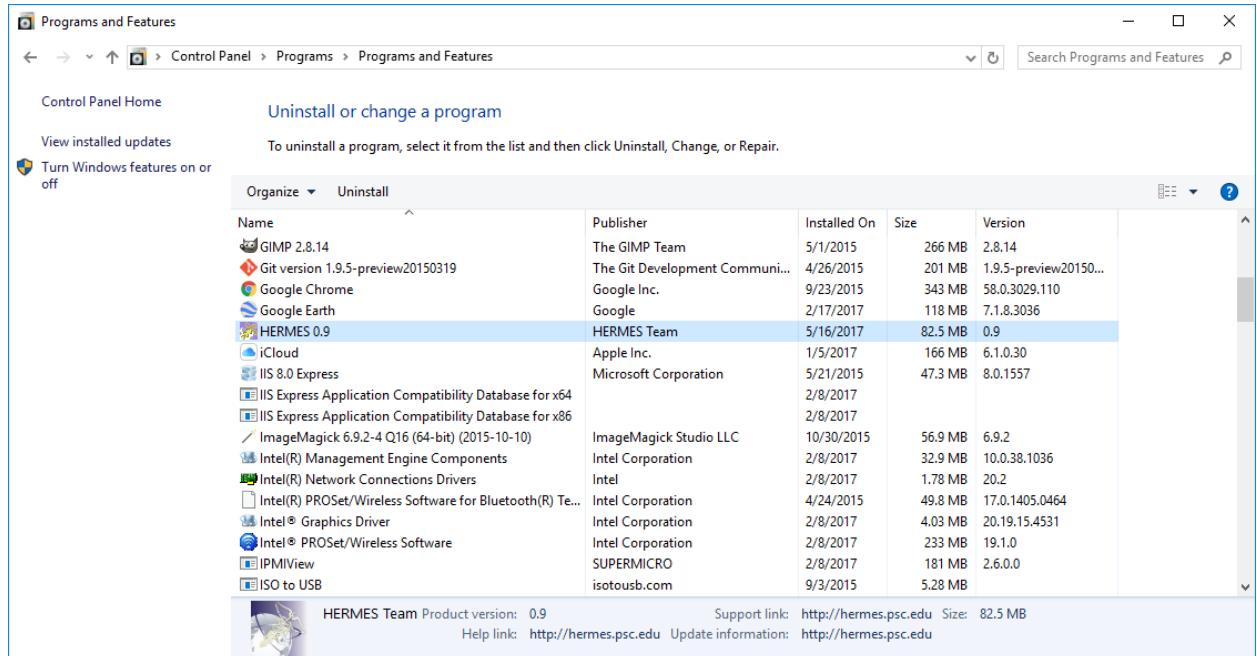
## 1.3 Uninstalling

### 1.3.1 Windows

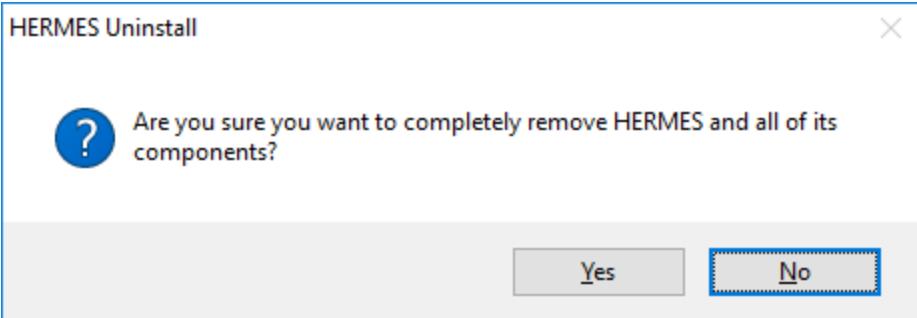
- Like with most programs in Windows, open the Control Panel and under Programs click on Uninstall a Program



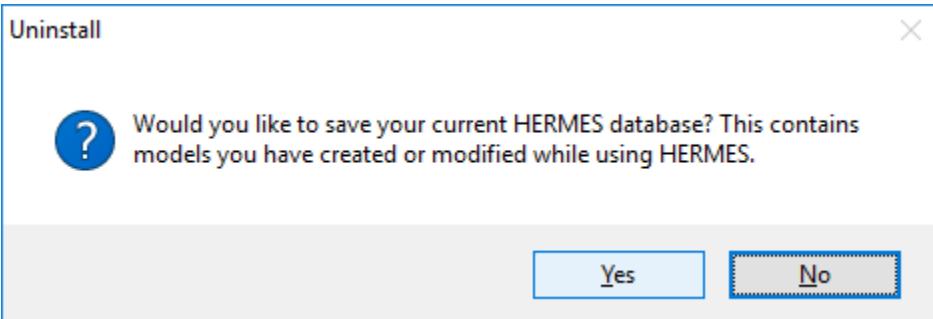
- Select HERMES from the list of programs and then click Uninstall from the blue bar above the list



- Supply admin information if necessary, agree to allow program to make changes to computer and answer Yes to the question "Are you sure..."

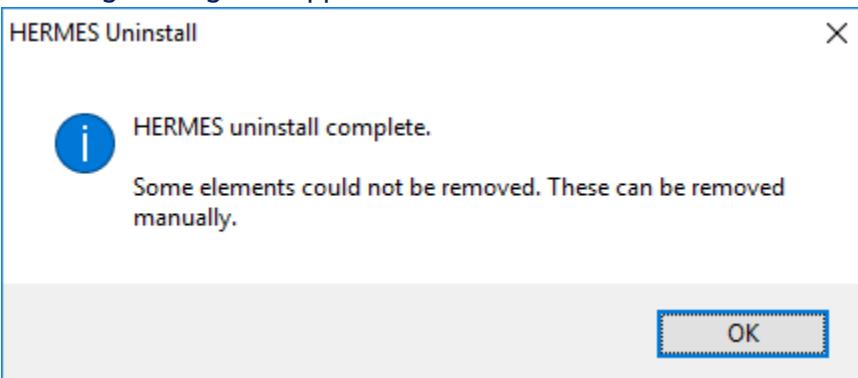


- If you want to save the models you have created for use on another machine or with a newly installed version of HERMES, the uninstall process gives you the opportunity.



Select Yes and then choose location and filename for your backup.

- Sometimes, the uninstall process is unable to remove all elements, in which case the following message will appear.



In this case, you should be able to delete the entire HERMES folder containing those items directly (most likely C:\Program Files\HERMES or where you noted the installation path in section 1.2.1).

### 1.3.2 Mac

- Find the HERMES icon in your Applications folder.
- Drag the HERMES icon onto the Trash icon in the Dock at the bottom of the screen.

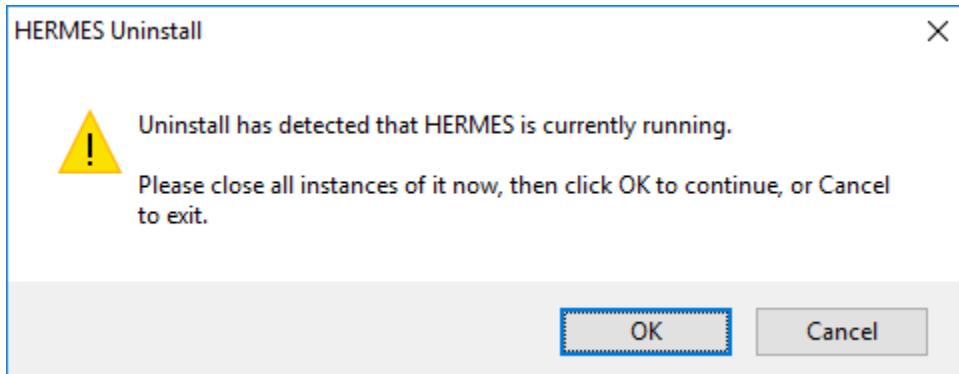
### 1.3.3 Linux

Please contact the HERMES Logistics team for assistance at [hermes-support@psc.edu](mailto:hermes-support@psc.edu).

## 1.4 Troubleshooting/Tips

### 1.4.1 If HERMES is running when you try to uninstall it

HERMES will not uninstall while the program is running. You will receive the following error message:



Close the browser window in which HERMES is running and then click OK to continue the uninstall.

### 1.4.2 Saving your database between versions

When you uninstall HERMES you are offered the choice of saving the database which contains your models to another location. It is good practice to make a backup of these models if you are upgrading the HERMES code or if you plan on making major revisions. The database is saved on Windows as hermes.db in C:\ProgramData\HERMES. Save a copy to a different name or location to create a backup. Copy the backup to C:\ProgramData\HERMES\hermes.db if you need to revert.

## 2 Introduction

### 2.1 Overview

HERMES, or the Highly Extensible Resource for Modeling Event-Driven Supply Chains, is a software platform that allows users to generate a detailed discrete event simulation model of any vaccine supply chain. This simulation model can serve as a "virtual laboratory" for decision makers (e.g., policy makers, health officials, funders, investors, vaccine and other technology developers, manufacturers, distributors, logisticians, scientists, and researchers) to address a variety of questions such as:

- What will be the impact of introducing new technologies (e.g., vaccines, storage, or monitoring)?
- What are the effects of altering the characteristics of vaccines and other technologies (e.g., vaccine vial size, vaccine thermostability, or cold device capacity)?
- How do the configuration and the operations of the supply chain (e.g., storage devices, shipping frequency, personnel, or ordering policy) affect performance and cost?
- What may be the effects of differing conditions and circumstances (e.g., power outages, delays, inclement weather, transport breakdown, or limited access)?

- How should one invest or allocate resources (e.g., adding refrigerators vs. increasing transport frequency)?
- How can vaccine delivery be optimized (e.g., minimize the cost per immunized child or maximize immunization availability)?

The model can represent every storage location, immunization location, storage device, transport vehicle/device, person, vaccine vial, and vaccine accessory in a supply chain. The model represents each vaccine vial, diluent vial, or vaccine accessory with an entity which can assume a variety of characteristics such as type, size, number of doses per vial, temperature profile, age, and expiration date. Millions of different vaccine vials and accessories can flow through the model simultaneously just as in a real supply chain. There is practically no limit to the number of vaccines, storage locations, devices, and vehicles that the model can simulate.

At each immunization location, virtual people arrive each day when they are ready to receive a particular vaccine or set of vaccines. The policy at that location determines when the health workers open vaccine vials and, if necessary, reconstitute the vaccines. (The user can specify policies for each immunization location.) The client arrival rates can come from either actual demand data or census plus birth data. If the correct vaccine is available at the immunization location then the person is successfully immunized. If the vaccine is not available, then the person counts as a missed vaccination opportunity. Once an immunization occurs, the remaining vial and accessories count as medical waste. Unused doses in open vaccine vials count as open vial wastage.

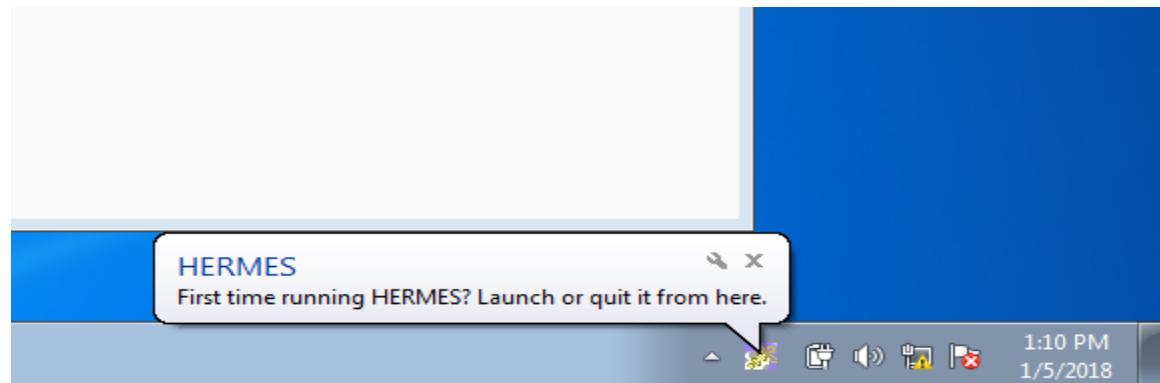
## 2.2 Open HERMES

### 2.2.1 Windows



Double-click the HERMES icon on your Desktop.

This will open your default browser to the welcome page. If it is your first time using HERMES, you may see the following message indicating that an icon has been added to your taskbar which indicates that the server is running.



If you do not have a HERMES icon on your Desktop, navigate to C:\Program Files\HERMES (or the folder to which you installed HERMES if you chose a different location) and double-click on hermes-tray.exe

HERMES will then automatically open your default browser to the HERMES welcome page.

## 2.2.2 Mac

Double-click the HERMES icon in your Applications folder or the HERMES shortcut on your



Desktop, if one has been created.

This will first open a HERMES window which when finished should look something like this, with "Hit Ctrl-C to quit." at the end.

A screenshot of a Mac OS X terminal window titled "HERMES". The window contains the following text:

```
{u'Newborn': 1, u'PW': 0, u'VaccineType': u'OPV_WHO_Shipping_Guide_10Dose_v2', u'Notes': u'', u'1-11months': 3}, {u'Newborn': 0, u'PW': 2, u'VaccineType': u'Tetanus_Toxoid_SerumIndia_10Dose', u'Notes': u'', u'1-11months': 0}, {u'Newborn': 0, u'PW': 0, u'VaccineType': u'Measles_SerumIndia_10Dose', u'Notes': u'', u'1-11months': 1}, {u'Newborn': 0, u'PW': 0, u'VaccineType': u'DTPHepBHB_SerumIndia_10Dose_v2', u'Notes': u'', u'1-11months': 3}, {u'Newborn': 0, u'PW': 0, u'VaccineType': u'PCV10_GSK_2Dose', u'Notes': u'', u'1-11months': 3}]  
2  
locale = <locale>, localeDir = </Applications/HERMES.app/Contents/Resources/HERMES2/src/tools/.../  
ui_server/locale>  
['en_US', 'fr_FR', 'pt_PT']  
POCOMPILE didn't work  
No module named zest.pocompile.compile  
/Applications/HERMES.app/Contents/Resources/HERMES2/src/sim/.../src/tools  
Attempting to add initial model: MozGaza.zip  
Bottle v0.11.6 server starting up (using WSGIRefServer())...  
Listening on http://127.0.0.1:8080/  
Hit Ctrl-C to quit.
```

The window has a standard OS X title bar with red, yellow, and green buttons. In the bottom right corner, there is a "Cancel" button.

HERMES will then automatically open your default browser to the HERMES welcome page.

## 2.2.3 Linux

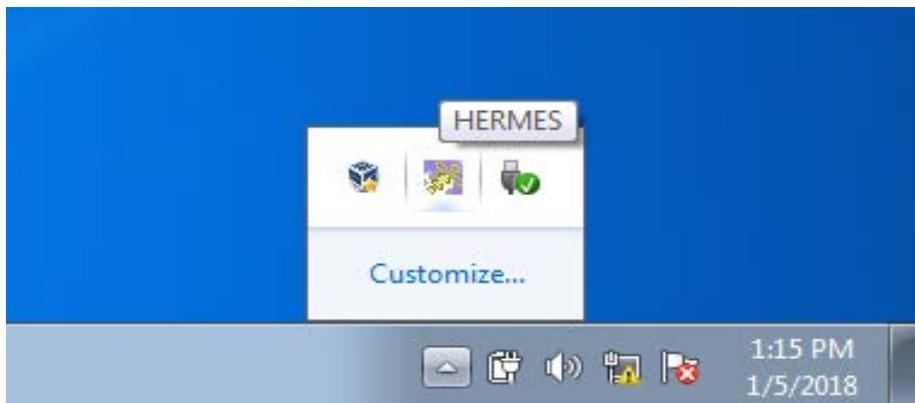
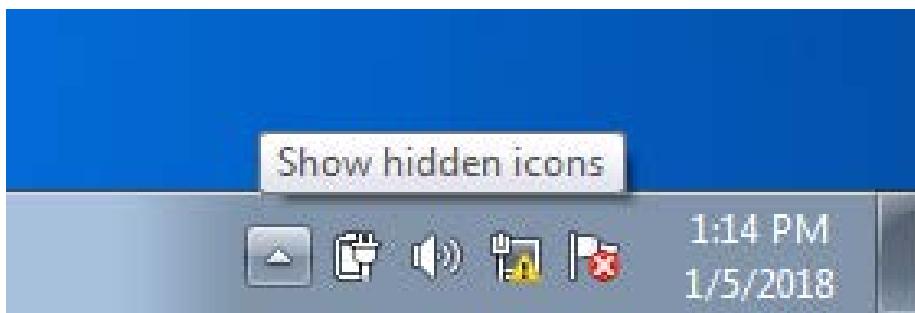
Please contact the HERMES Logistics team for assistance at [hermes-support@psc.edu](mailto:hermes-support@psc.edu).

## 2.3 Exit HERMES

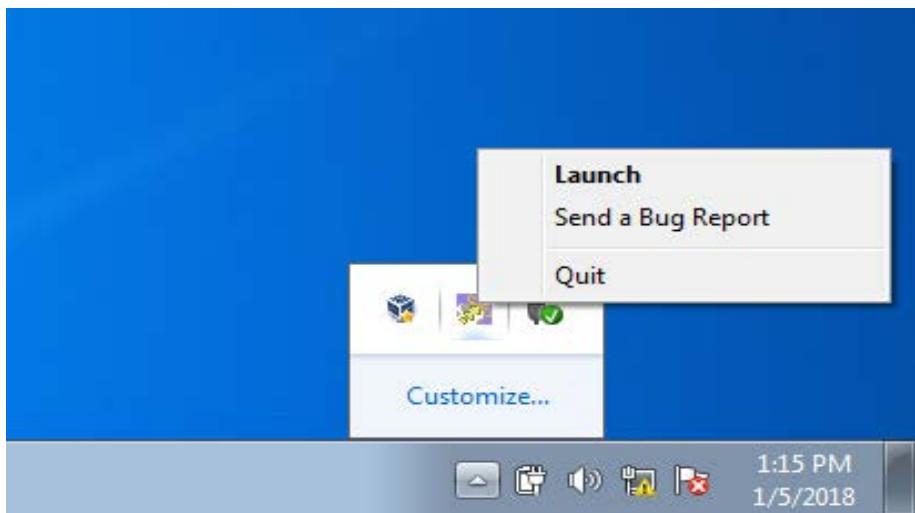
Just closing the browser you used will not exit the HERMES server. Leaving the server running can cause complications the next time you try to start the user interface. Please follow the appropriate instructions below to exit the server when you are done making models and running simulations.

### 2.3.1 Windows

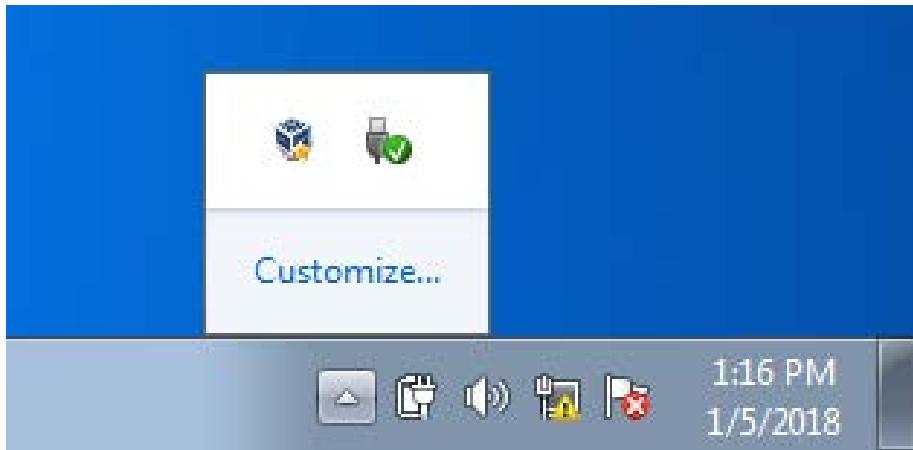
Right-click the HERMES icon in the taskbar. Depending on your settings, the icon may not be visible unless you click the Show hidden icons arrow to expose it.



After you right-click, you will see a menu of options. Left-click on Quit to exit the server.

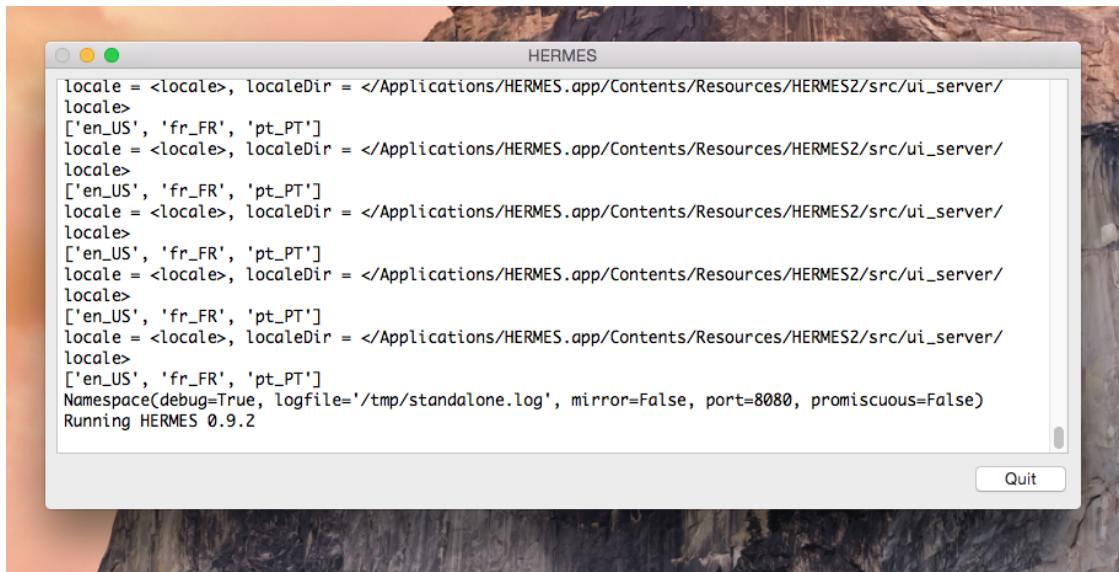


If you have successfully exited the server, the HERMES icon will no longer appear in your taskbar or the hidden icons section.



### 2.3.2 Mac

Bring the HERMES Application into focus by clicking on the window that was opened when you started the server



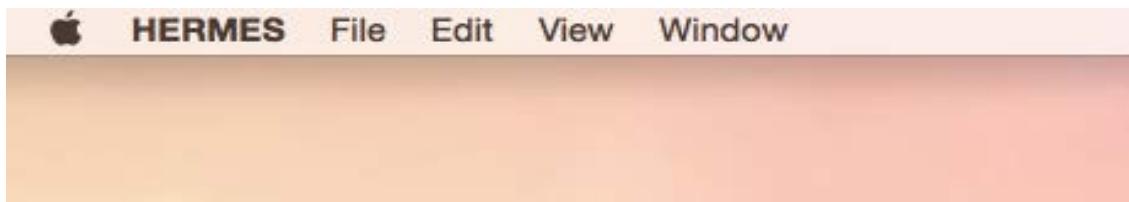
You can quit HERMES by pressing the Quit button on this window.

If the window is not visible, you can bring HERMES to the forefront by single-clicking on the HERMES icon in the Dock at the bottom of the screen.



or by using the Finder to open the Applications folder.

If HERMES is in focus, you can also click on the HERMES at the top of the screen



and select Quit HERMES from the menu that opens.



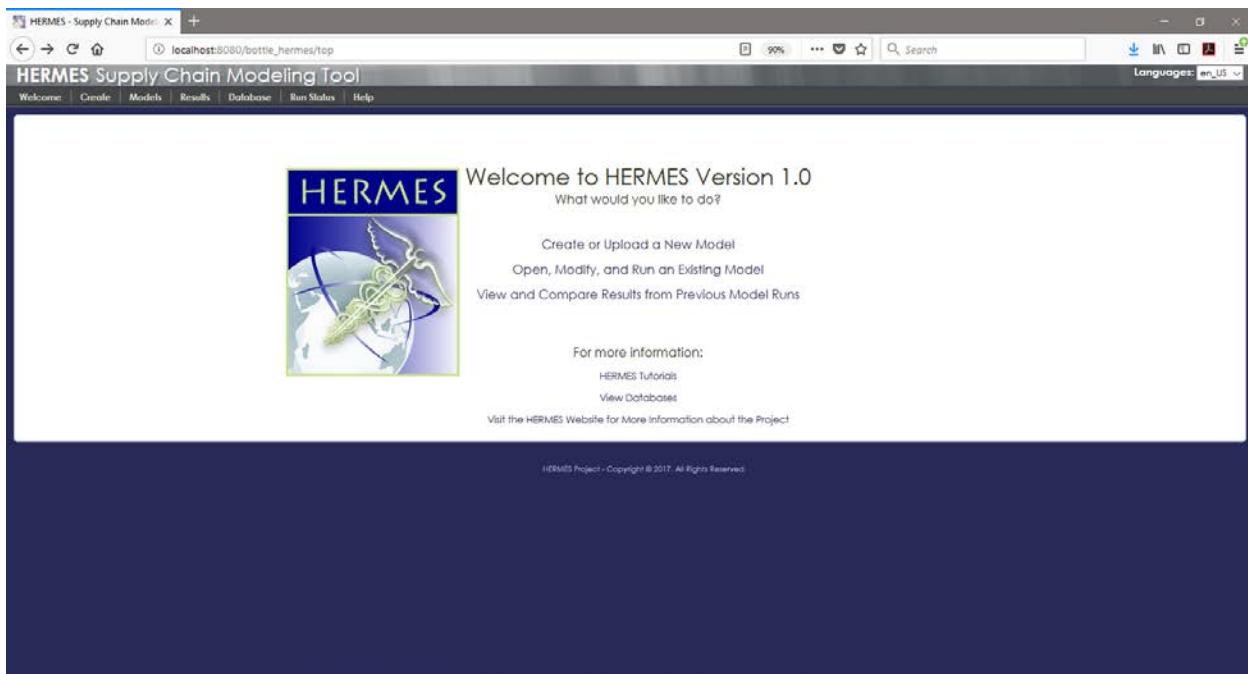
Notice that you can use Command-Q  to exit as well as long as the information bar at the top of the screen says that HERMES is in focus.

### 2.3.3 Linux

Please contact the HERMES Logistics team for assistance at [hermes-support@psc.edu](mailto:hermes-support@psc.edu).

## 2.4 The Welcome Page

Upon opening HERMES, you should see the following screen with options of tasks to perform:

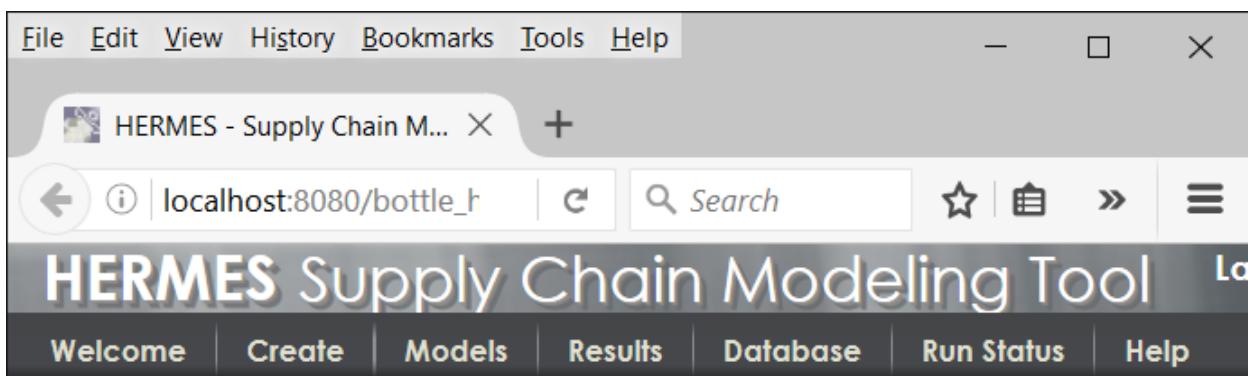


The options are:

- Create or Upload a New Model
- Open, Modify, and Run an Existing Model
- View and Compare Results from Previous Model Runs
- View Databases
- HERMES Demo
- Visit the HERMES Website for More Information about the Project

## 2.5 The Main Menu

The main menu is located at the top left of every page, under the HERMES/Page Title line (in this case, Page Title is equal to Supply Chain Modeling Tool) and has many of the same options as the Welcome Page.



The menu options are:

- Welcome      opens the Welcome Page
- Create      starts same dialogue as Create or Upload a New Model (Sections 3.1 and 3.2)
- Models      opens page for viewing and utilizing available models (Section 2.6)
- Results      opens page for viewing and comparing results (Section 8)
- Database      opens page for exploring the HERMES databases of vaccines, transportation, storage, population, per diems, and staff (Section 9.2)
- Run Status      opens page for viewing runs done during the session and checking status (Section 7.4)
- Help      opens the HERMES user guide (this document)

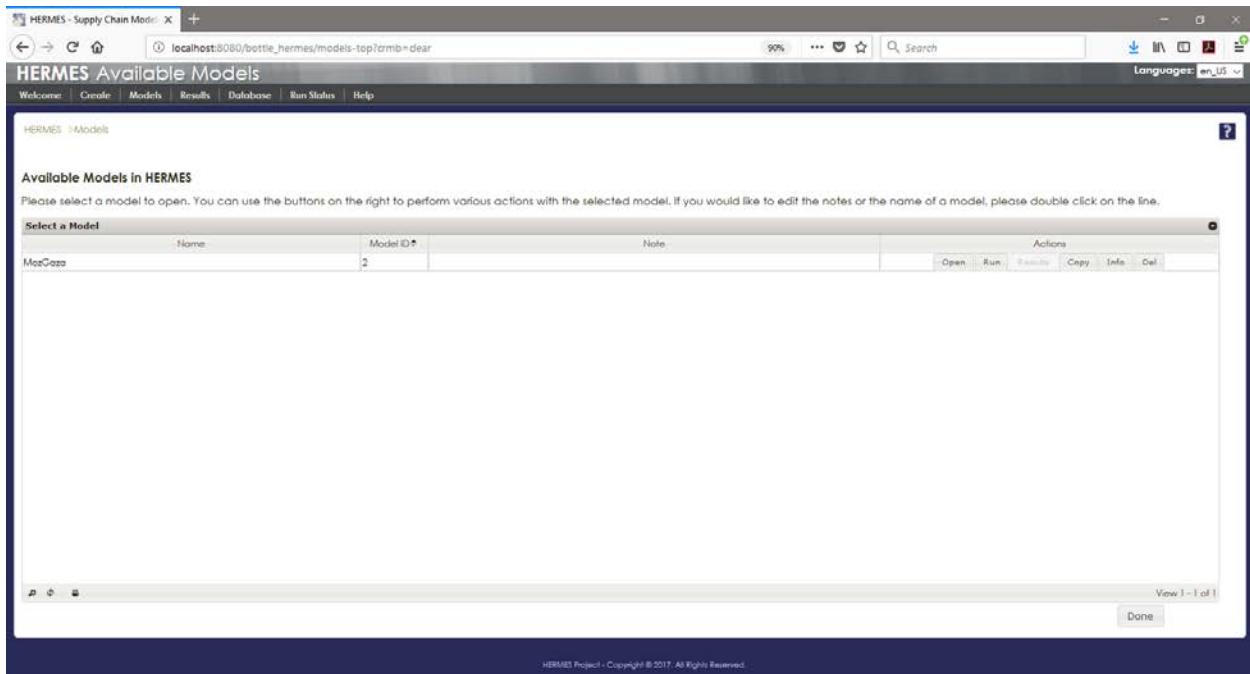
## 2.6 The Available Models Page

### 2.6.1 Open the Available Models Page

On Welcome Page, click “Open, Modify, and Run an Existing Model”

-or-

On Main Menu, click “Models”

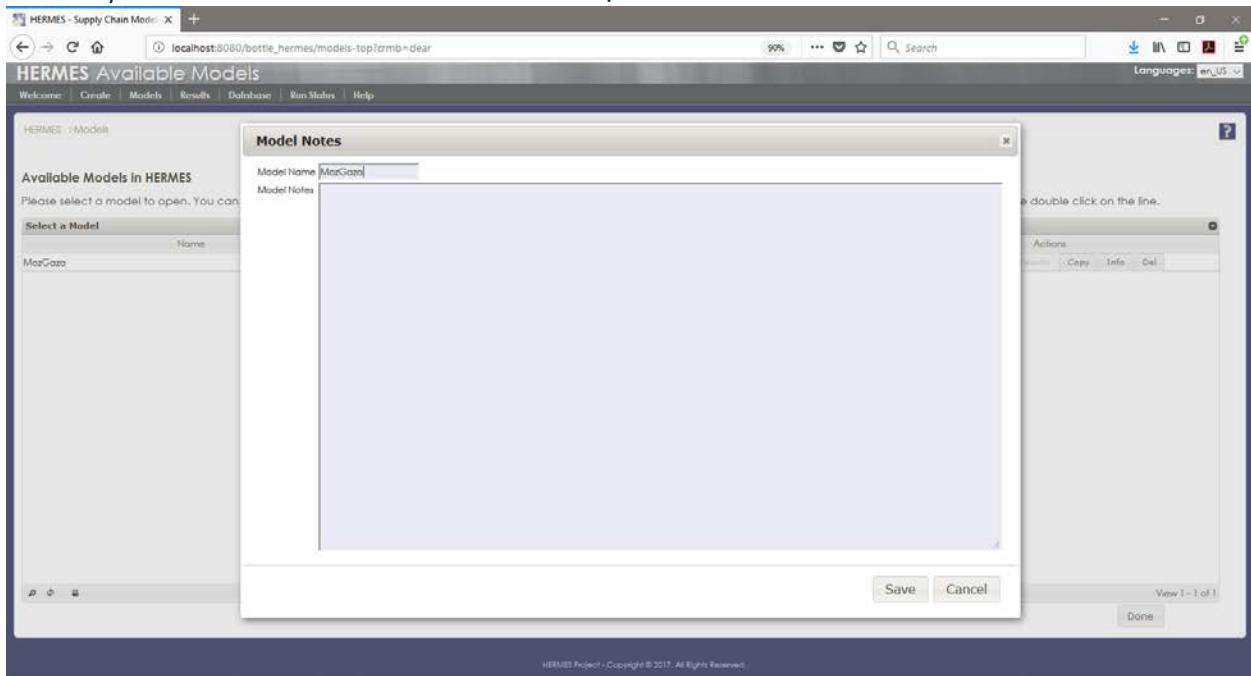


### 2.6.2 Interact with Models

The available models table lists your existing models, including any models you have created or uploaded, as well as an example model (titled “MozGaza”) included in the HERMES software.

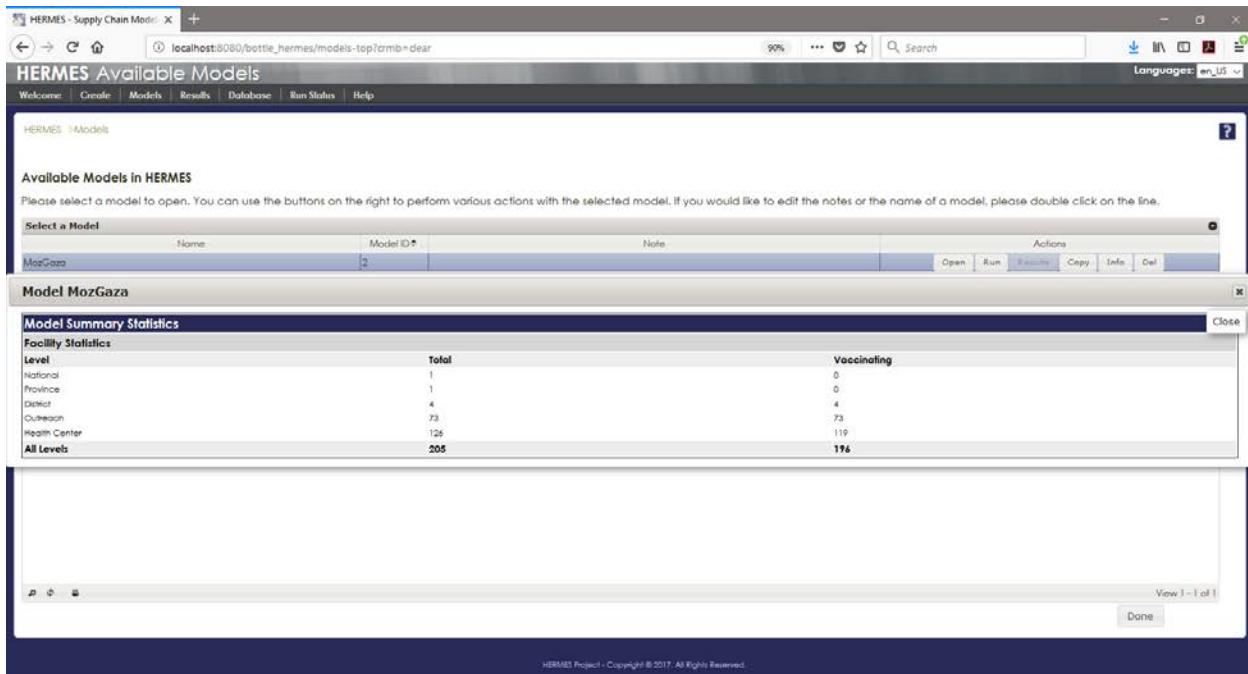
### 2.6.2.1 Edit name and notes

Double-click any row in the list to open a dialogue box allowing you to edit the name of the model and add/edit a note for that model. Notes are optional and will not affect how the model runs.



### 2.6.2.2 Buttons

- The "Open" button will take you to the Model page where you will be able to explore the model in detail, and perform tasks such as updating or editing the model for simulation experiments.
- The "Run" button will open the Run Simulations page which will allow you to set up and execute a simulation run with this model.
- The "Results" button will be active if simulations have been performed with this model. If there are no results for this model yet, then the button will be greyed out until there are results available.
- The “Copy” button will copy the model and prompt you for a new name for it. This is helpful if you plan to alter or edit the model to create a new scenario.
- The “Info” Button lists model summary statistics (example shown below).
- The “Del” Button allows you to permanently delete the model. This will also remove any results that have been generated by running this model.



## 3 Model Creation

Overview of building a new model and copying/modifying an existing model

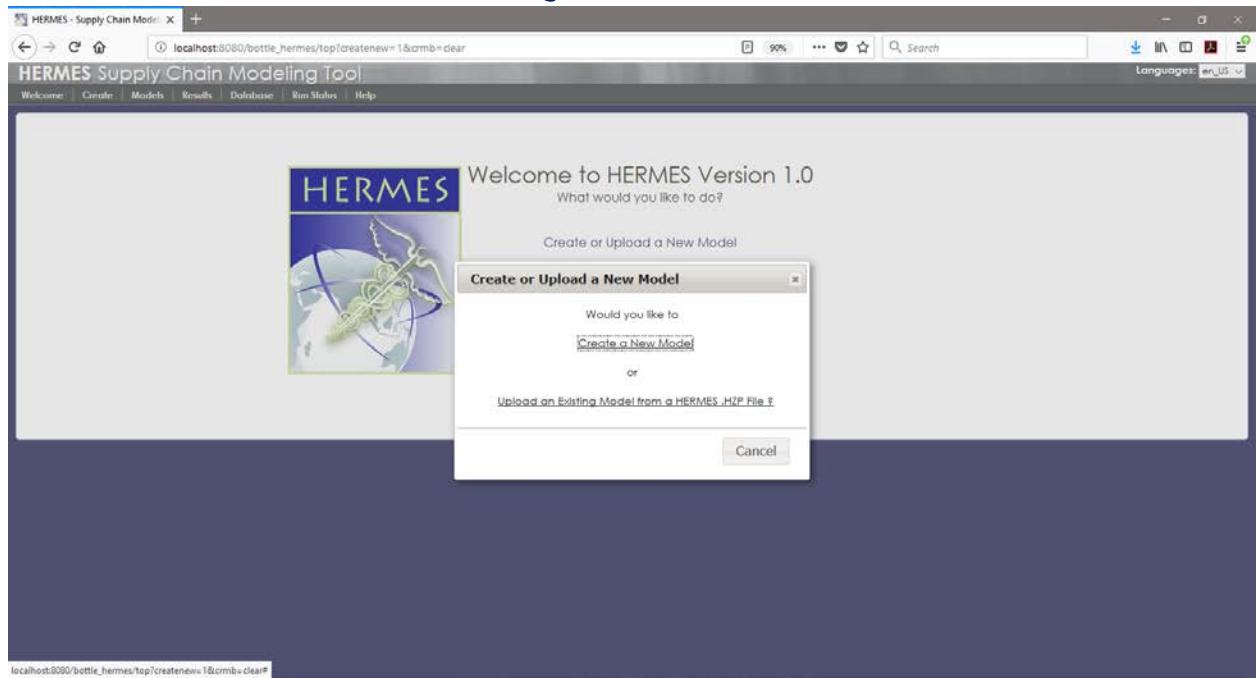
### 3.1 Building a New Model

To simulate a system for which a HERMES model does not already exist, complete the following steps in the guided model creation workflow. This workflow will produce a simplified model of a supply chain with limited data inputs, which you can either run (Section 7) or further edit to add greater detail and complexity (Sections 4 and 5).

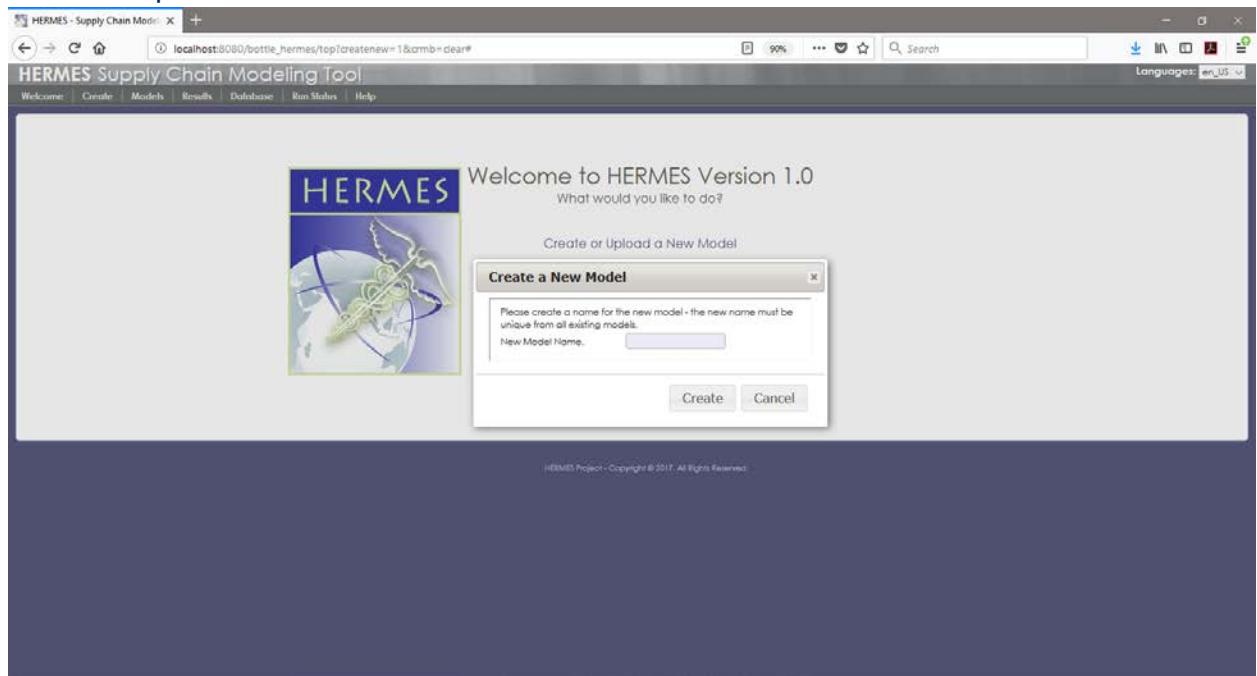
1. On Welcome Page, click “Create or Upload a New Model”  
-or-

On Main Menu, click “Create”

2. Click on “Create a New Model” in the dialogue box



3. Enter a unique name for the new model and click Create.



4. A new window should open that will start guiding you through filling out information for the new model, with a dynamic diagram that automatically updates as you make selections. It will take you through the following steps:
  - a. Edit supply chain structure
  - b. Edit shipping policy
  - c. Edit shipping times

- d. Make adjustments
- e. Add/remove components
- f. Vaccine dose schedule
- g. Assign equipment
- h. Assign transport vehicles

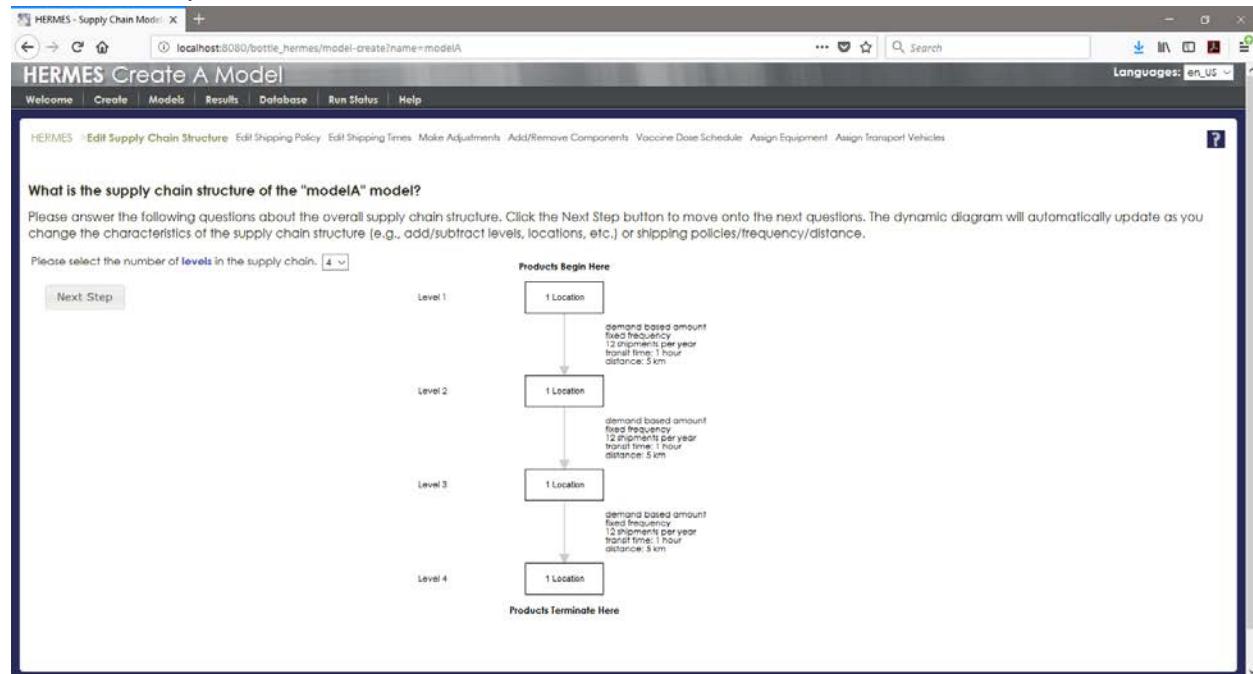
### 3.1.1 Edit supply chain structure

On this page, you will be asked to answer three basic questions that will define the structure of your supply chain. You will be able to return here later and alter any information you have entered, except the number of levels in the supply chain. If you have chosen the wrong number of levels to start with, you must start the creation process over from the beginning.

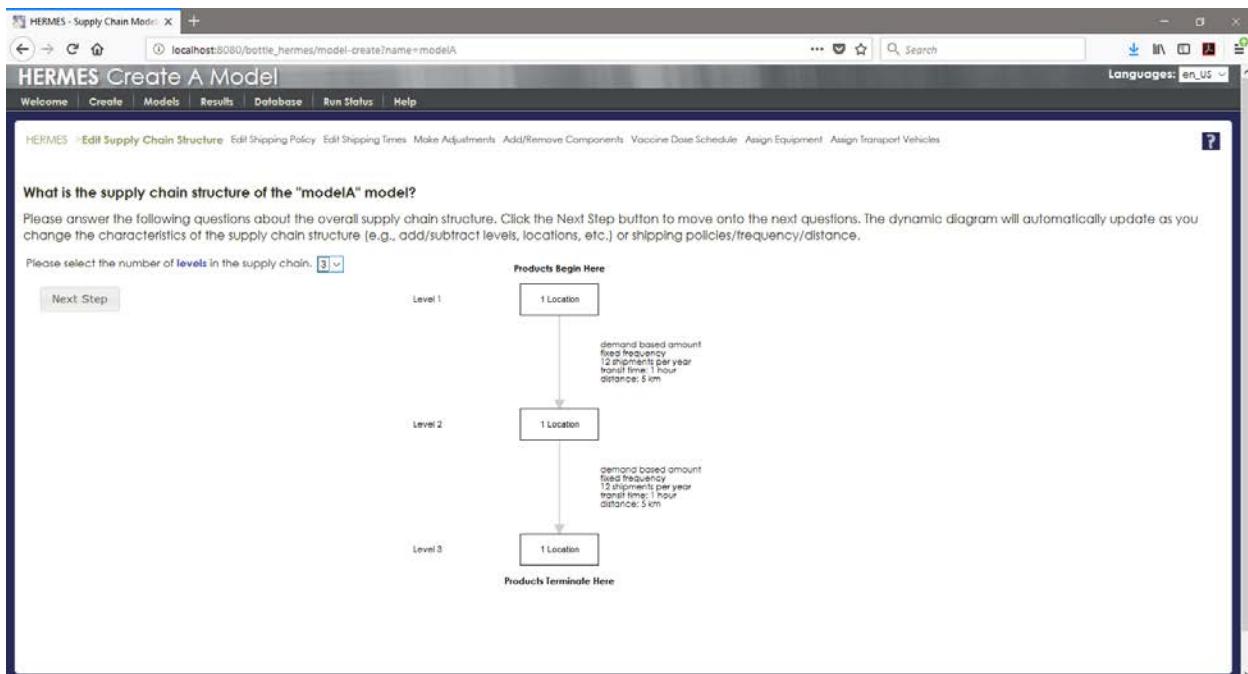
#### 3.1.1.1 Select the number of levels in the supply chain

How many levels does the supply chain have? Each supply chain is made up of a number of levels. The number of levels in a supply chain is the number of storage locations that a vaccine passes through from entering the supply chain to the location at which it is used.

The window opens with 4 levels selected.



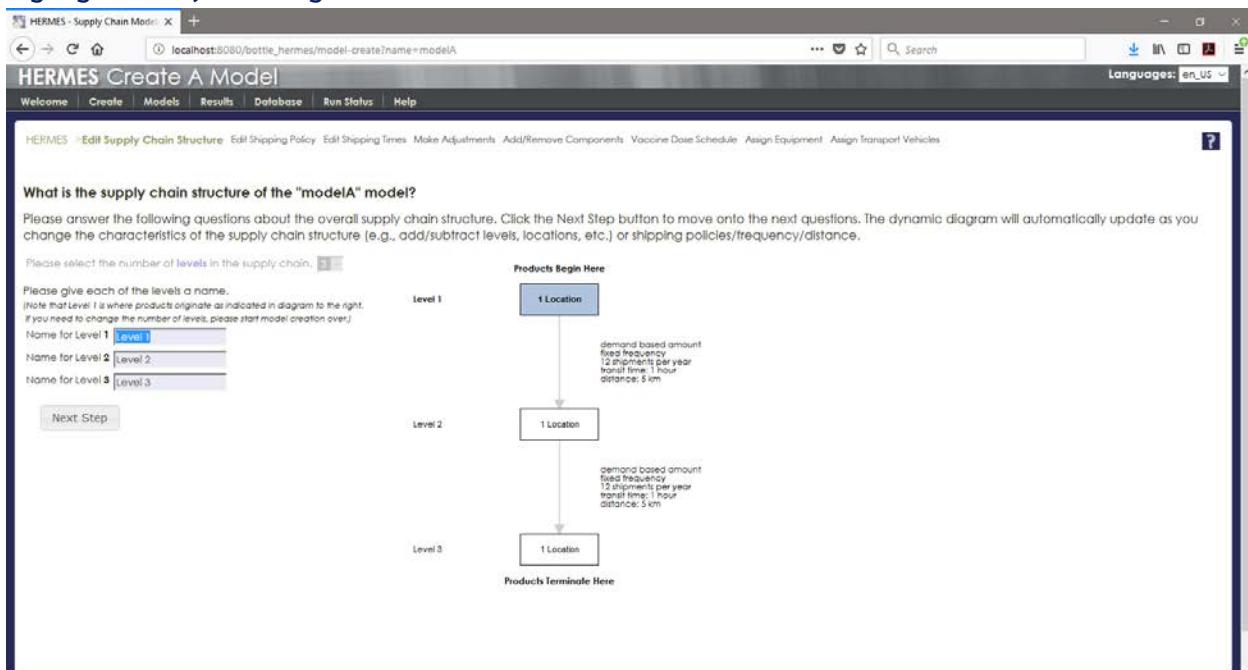
Select the number of levels you require from the dropdown box. The window will update to show the correct number of levels. For example, after choosing 3 levels, you should see the following:



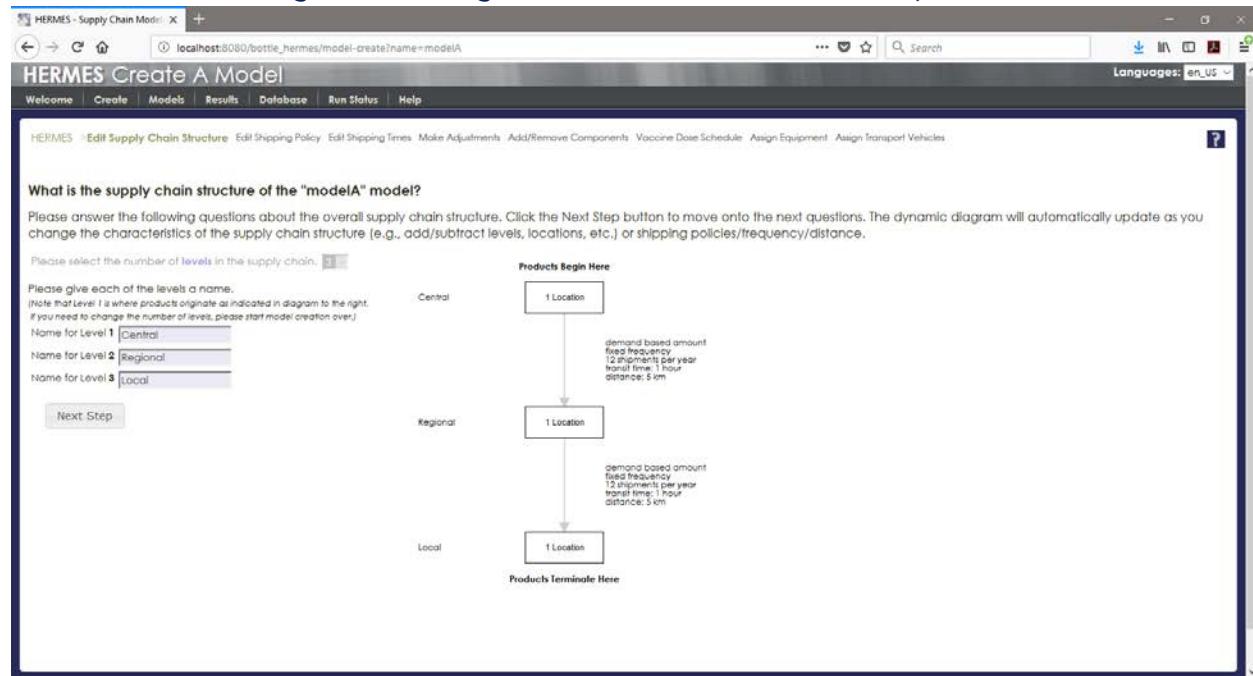
Then click Next Step

### 3.1.1.2 Give each level a name

What are the names of the supply chain levels? This is generally dependent on the supply chain you are modeling. The names default to "Level 'X'", but you should change them to match the supply chain you are modeling (e.g. the administrative units commonly referred to as "Districts" in many countries are called "Communes" in Benin). The appropriate box on the right will be highlighted as you change the names.



Level names in the diagram will change to reflect the new names as they are modified.

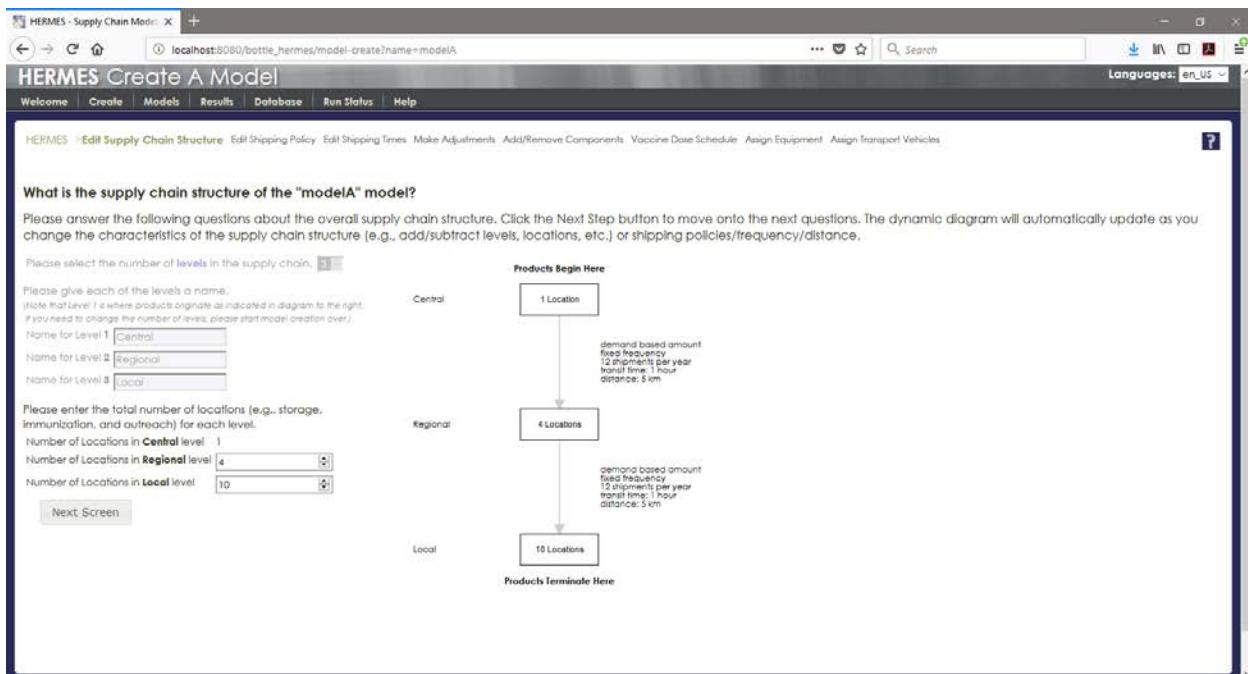


Click Next Step when you are finished naming the levels.

### 3.1.1.3 Enter the total number of locations for each level

How many locations are at each level? This number should indicate the total number of storage, administration, and outreach locations at each level in the supply chain. HERMES will automatically attempt to evenly distribute the locations at each level amongst their suppliers. For example, if there are 2 locations in the second level (locations A and B) and 9 locations in the third level (locations C-K), HERMES will assign locations C-F to be supplied by location A, and locations G-K to be supplied by location B. You will have a chance to alter this in a later step using the Advanced Editor.

Use dropdown boxes to add the number of locations at each level. The first level must always have one location. No levels can have zero or negative locations.



Then click Next Screen to go to the next section.

### 3.1.2 Edit shipping policy

In order to model transport routes between locations, you are asked to specify the shipping policies at each level in the supply chain. Shipping policies within HERMES determine how vaccines are distributed from higher levels to lower levels and depend on three parameters: how order quantities are determined, whether vaccines are shipped from the supplier or picked up by the recipient, and how frequently shipments occur.

For trips to transport vaccines, **products can be delivered by the supplier or picked up by the receiver**. Shipments delivered by the supplier begin at the supplying location; shipments picked up by the recipient begin at the receiving location. Resources used for the shipment, such as vehicles and labor, come from the location where the trip begins. For example, a shipment being dropped off by a national warehouse at a regional store would use a driver and vehicle from the national warehouse.

The **quantity of vaccines can be fixed (i.e., the same each shipment) or variable (i.e., based on demand)**. In fixed quantity shipments, a fixed number of vials is always shipped, as long as a sufficient number of vials are available at the supplying location (if there are not enough vials, all available are shipped). In variable quantity shipments, the quantity of vaccines is determined by the anticipated demand at the receiving location. For example, a health clinic that expects to need 15 BCG vaccine vials within a shipping interval would order 15 BCG vials in a variable quantity shipment, regardless of the quantity ordered in the previous interval.

**Frequency of shipments can be at fixed intervals or as-needed.** Fixed schedule shipments occur at regular time intervals, while as-needed shipments happen when the receiving location's stock level falls below a certain threshold. You can specify the frequency at which fixed-schedule shipments occur. For as-needed shipments, specify the maximum frequency (for example, if

Health Posts are assigned as-needed shipments up to 1 time per month, then the Health Posts will receive shipments when vaccines are needed but no more than once per month).

Lastly, you can specify the **frequency** and **time** periods (year, month, week) at which shipments are routinely scheduled.

HERMES initially assigns the same shipping policies to all routes between each pair of adjacent levels (e.g., for all routes between Level 1 and Level 2). All of these settings can be modified after the basic model structure is created, including modifications for specific routes, via the Make Adjustments page (Section 3.1.4) or in even further detail via the HERMES Advanced Model Editor (Section 5).

Once you are on the shipping policy screen, you have three new buttons at the bottom:

The screenshot shows the HERMES software interface for creating a supply chain model. The main title is "HERMES Create modelA". Below it, there's a navigation bar with links like Welcome, Create, Models, Results, Database, Run Status, and Help. The current page is "Edit Shipping Policy". The main content area is titled "How are goods shipped?". It contains two sets of dropdown menus for defining shipping policies. The first set is for "For routes from the Central to Regional levels:" and the second for "For routes from the Regional to Local levels:". Both sets include fields for "Products are", "for an amount that is", "on a schedule that occurs", "at a frequency of", and "time(s) per". To the right of these menus is a flowchart titled "Products Begin Here". It shows a vertical hierarchy: "Central" has "1 Location"; "Regional" has "4 Locations"; and "Local" has "10 Locations". Between each level, there are boxes containing text: "Demand based amount", "fixed frequency", "12 months per year", "travel time: 1 hour", and "distance: 5 km". At the bottom of the flowchart is a box labeled "Products Terminate Here". Below the flowchart are three buttons: "Previous Screen", "Skip to Model Editor", and "Next Screen".

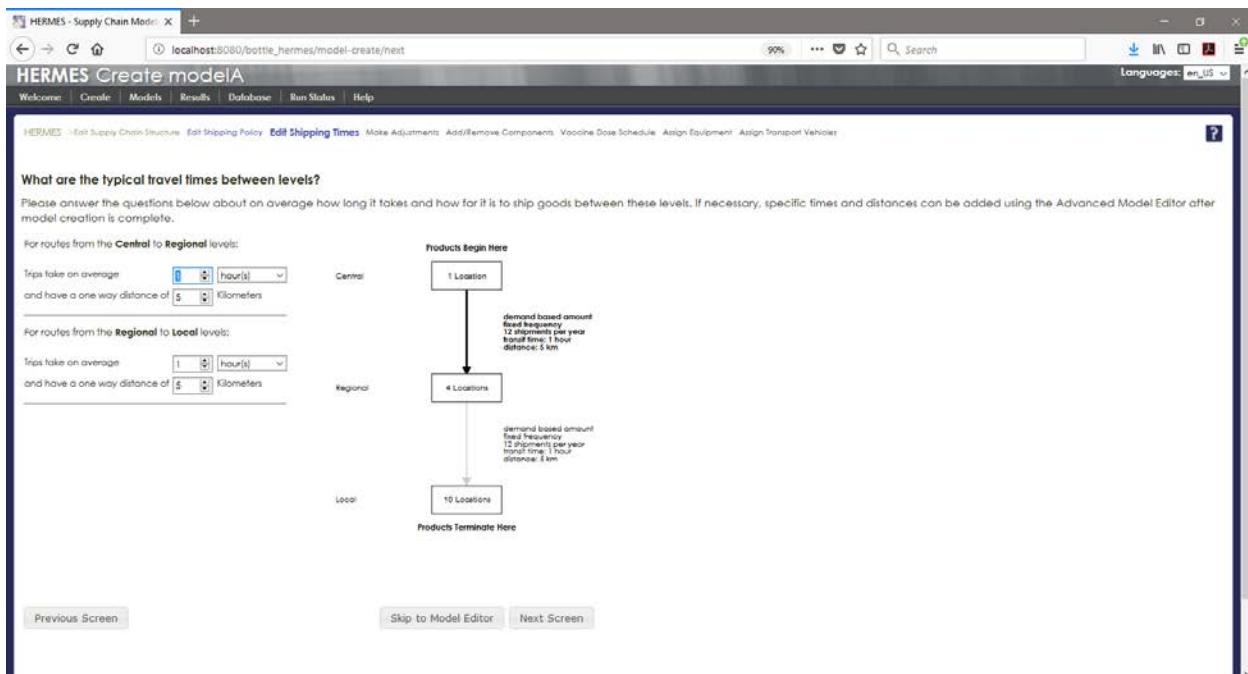
- Previous Screen will take you back to edit the supply chain structure
- Skip to Model Editor will take you to the Advanced Model Editor (Section 5)
- Next Screen will take you to edit the shipping times

Previous Screen button will ask if you want to save changes made on the current screen.

Click on "Next Screen" to continue building your new model.

### 3.1.3 Edit shipping times

Specify the average travel time between levels in the supply chain. To calculate average travel times, you may need to make assumptions. For example, if travel times between locations are unknown but average distances between levels are, you may assume a reasonable speed to determine the average travel times between levels (e.g. assuming motorbikes typically travel 60 km per hour in a given setting, one can estimate that an average trip of 135 km would take approximately 2.25 hours).



HERMES assigns the same average travel time and distance to all routes between adjacent levels in order to create the basic model structure. After the basic model structure is created, these settings can be modified for individual routes in the next step using the Make Adjustments page (Section 3.1.4) or via the HERMES Advanced Model Editor (Section 5).

### 3.1.4 Make adjustments

You may make adjustments to each of the locations and routes between locations within the Make Adjustments table. Whereas the previous steps generated location names, assigned shipping policies by level, and distributed locations evenly across suppliers, this step allows you to modify individually the names of each location and attributes of the shipping policies between locations.

**Make Adjustments**

Here you can make some minor adjustments to the supply chain. Make adjustments to the model by clicking the cell to be modified and then hitting the Enter key when finished. You can expand or collapse levels by clicking the triangle next to the location name in the Level column.

Level	Current Location Name	Idcode	Pick Up or Receive Shipments?	Scheduled or Demand-Based Schedule of Shipments	Amount of Shipment Fixed or Demand Based	Frequency of Shipments	per
► Central	Central_1	1					

Previous Screen      Next Screen

Clicking on the triangle next to the level name (in this case Central) will expose the locations it supplies.

**Make Adjustments**

Here you can make some minor adjustments to the supply chain. Make adjustments to the model by clicking the cell to be modified and then hitting the Enter key when finished. You can expand or collapse levels by clicking the triangle next to the location name in the Level column.

Level	Current Location Name	Idcode	Pick Up or Receive Shipments?	Scheduled or Demand-Based Schedule of Shipments	Amount of Shipment Fixed or Demand Based	Frequency of Shipments	per
► Central	Central_1	1					
► Regional	Regional_1	2	receive	scheduled	variable	12	year
► Regional	Regional_2	5	receive	scheduled	variable	12	year
► Regional	Regional_3	8	receive	scheduled	variable	12	year
► Regional	Regional_4	11	receive	scheduled	variable	12	year

Previous Screen      Next Screen

Clicking on each of the triangles next to the Regional levels in this example will expose the entire route structure.

**Make Adjustments**

Here you can make some minor adjustments to the supply chain. Make adjustments to the model by clicking the cell to be modified and then hitting the Enter key when finished. You can expand or collapse levels by clicking the triangle next to the location name in the Level column.

Model Transport Network							
Level	Current Location Name	Idcode	Pick Up or Receive Shipments?	Scheduled or Demand-Based Schedule of Shipments	Amount of Shipment Fixed or Demand Based	Frequency of Shipments	per
+ Central	Central_1	1	receive	scheduled	variable	12	year
▼ Regional	Regional_1	2	receive	scheduled	variable	12	year
● Local	Local_1	3	receive	scheduled	variable	12	year
● Local	Local_2	4	receive	scheduled	variable	12	year
▼ Regional	Regional_2	5	receive	scheduled	variable	12	year
● Local	Local_3	6	receive	scheduled	variable	12	year
● Local	Local_4	7	receive	scheduled	variable	12	year
▼ Regional	Regional_3	8	receive	scheduled	variable	12	year
● Local	Local_5	9	receive	scheduled	variable	12	year
● Local	Local_6	10	receive	scheduled	variable	12	year
▼ Regional	Regional_4	11	receive	scheduled	variable	12	year
● Local	Local_7	12	receive	scheduled	variable	12	year
● Local	Local_8	13	receive	scheduled	variable	12	year
● Local	Local_9	14	receive	scheduled	variable	12	year
● Local	Local_10	15	receive	scheduled	variable	12	year

Previous Screen      Next Screen

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Clicking in any row selects a location, allowing you to type or select from the available options to edit information for that particular location.

#### 3.1.4.1 Location names

Location and level names are text-only inputs and can be fully customized. The default names are used for labelling purposes only; you can customize to use the naming conventions most familiar and meaningful to you. While location names can be customized directly in this section, the names of levels can be customized as noted in section 3.1.1.2.

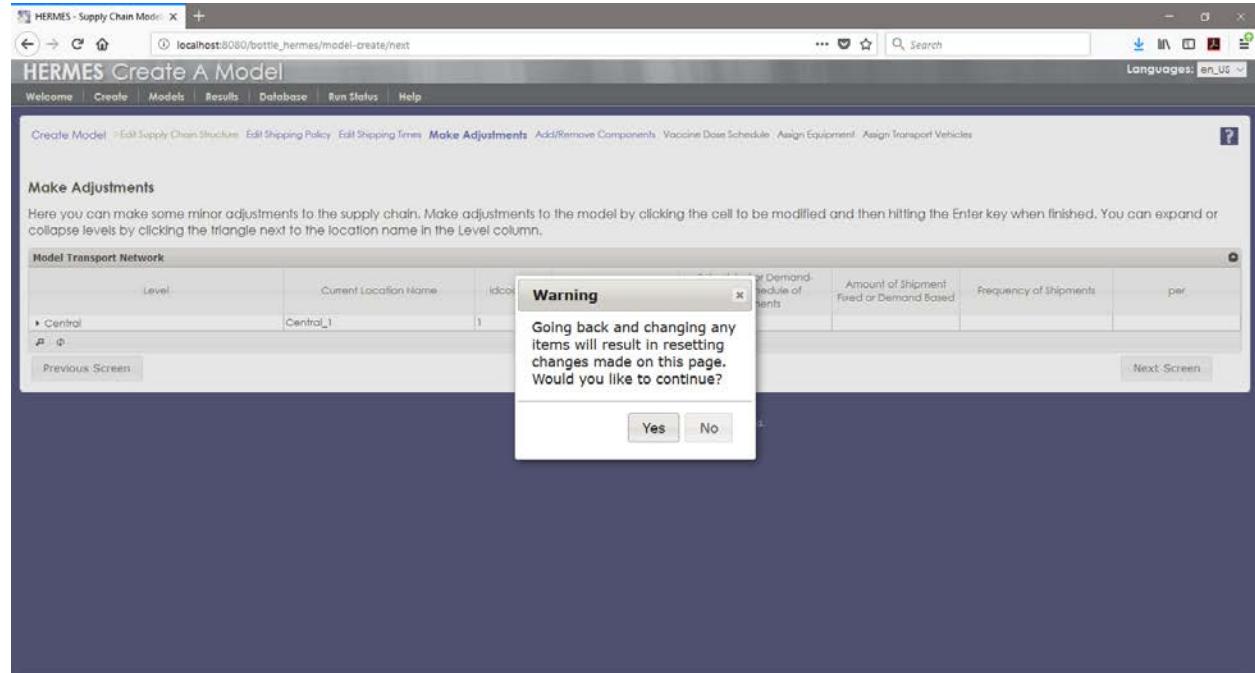
#### 3.1.4.2 Shipping policies

Edit the shipping policy for any route in the supply chain. Shipping policies within HERMES determine how vaccines are distributed from higher levels to lower levels and are described in greater detail in Section 3.1.2.

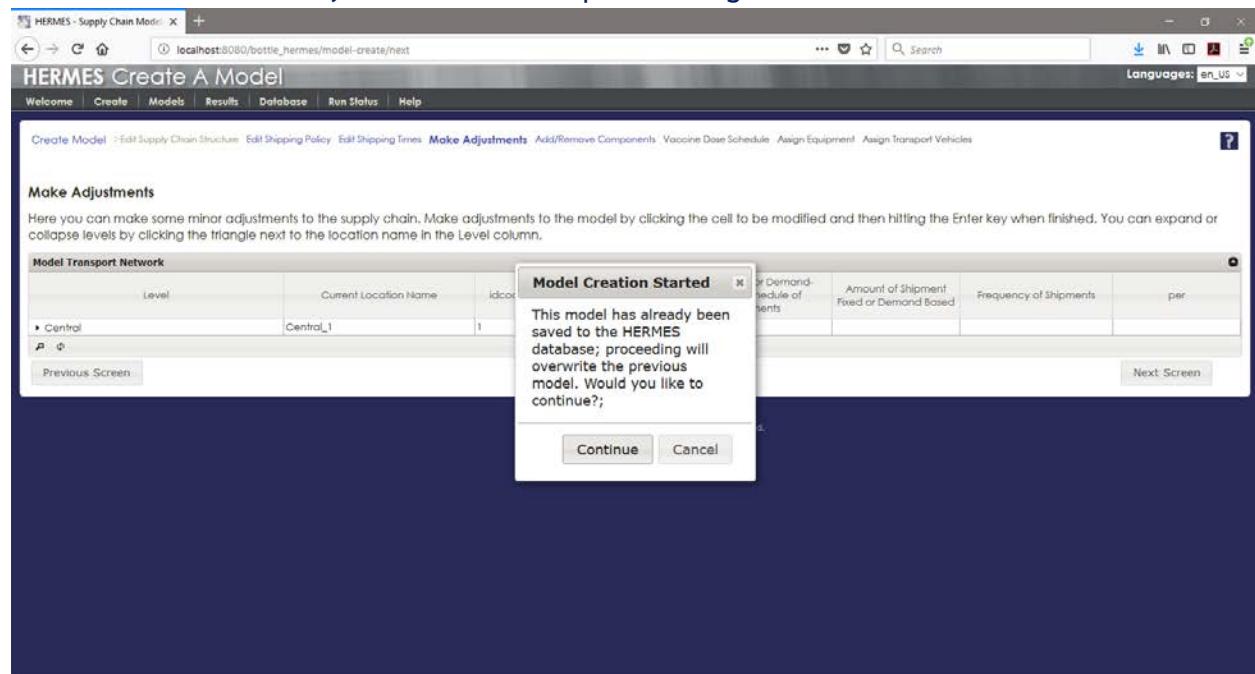
#### 3.1.4.3 Saving the model

Continuing to the Next Screen will cause this model to be saved and accessible from your Available Models table. While the model is not yet ready to run, you can exit the model creation workflow (not recommended) and return to edit the model as described in Sections 4 and 5.

Clicking Previous Screen will bring up a warning telling you that changing any items will result in resetting changes made on the Make Adjustments page.



If you have come back from the Add/Remove components page, clicking Next Screen will bring up a notice that the model has already been saved and proceeding will overwrite the previous model. It will then return you to the Edit Components Page.



### 3.1.5 Add/remove components (Edit Components Page)

In this step, you will select the components to include in the model. These components will be assigned to locations and routes in later steps in the Model Creation workflow (Sections 3.1.7 and

3.1.8) and can also be changed in the Advanced Model Editor (Section 5). All vaccine types administered, transport methods used to move vaccines, storage devices used to store vaccines, population groups immunized, per diem policies applied to vaccine transport, and staff types included in labor costs at any location in the supply chain should be added to the model in this step.

### 3.1.5.1 Information about components

Select a component category using the buttons on the left: Vaccine, Storage, Transport, Population, Staff, Per diems. You can get information about any of the components by clicking the Info button in line with it, whether in the Used Types or Available Types box. You can choose different sources using the source dropdown box. You are provided with the HERMES database and the MozGaza models as sources originally. If a component has been added to the Used Types table on the left, you can use the Edit button to update any information required. The Edit and Info buttons will bring up a dialog box appropriate to the component category you have chosen on the left.

The screenshot shows the 'Edit Components' screen of the HERMES Choose Types interface. On the left, a sidebar lists categories: Vaccine, Storage, Transport, Population, Staff, and Per Diems. The 'Vaccine' button is highlighted. In the center, there are two tables: 'Used Types' and 'Available Types'. The 'Used Types' table is currently empty. The 'Available Types' table contains the following data:

Name	Action
PCO Bulgaria-NCIPD 10 Dose (2.25 cc/dose)	Info
BCG Bulgaria-NCIPD 20 Dose (1.125 cc/dose)	Info
BCG Serum Institute of India 10 Dose (2.611 cc/dose)	Info
BCG Serum Institute of India 20 Dose (1.3 cc/dose)	Info
BCG Statens Institute 10 Dose (1.33 cc/dose)	Info
BCG WHO Shipping Guidelines 20 Dose (1.2 cc/dose)	Info
DTP BioFarma 10 Dose (2.08 cc/dose)	Info
DTP GSK 1 Dose (9.7 cc/dose)	Info
DTP Sanofi 1 Dose (20.5 cc/dose)	Info

A dropdown menu labeled 'SOURCE' is set to 'HERMES Database'. Below the tables, there are buttons for '← Add Component To Model' and 'Create a New Component'. At the bottom, there are 'Previous Screen' and 'Next Screen' buttons.

#### 3.1.5.1.1 Vaccines

Vaccine characteristics in HERMES include the doses per vial, presentation (such as liquid or lyophilized), potent lifetimes (frozen, refrigerated, at room temperature, and after opening), packaged volume per dose (for vaccine and diluent), and price per vial. Different vial sizes for the

same vaccines can be input using differentiated names and updating the doses per vial.

### 3.1.5.1.2 Storage

Storage device characteristics in HERMES include the make, model, net volume for storing vaccines (cooler or 2-8C, freezer, and room temperature), type of equipment, purchase price, expected lifetime, energy type, energy usage rate, and holdover time during a power outage. Any type of storage device that will be used at any location in the model should be added here and will be assigned to locations later.

### 3.1.5.1.3 Transport

Transport device characteristics in HERMES include the storage capacity (either net volume or devices), purchase price, expected lifetime mileage, fuel type, and fuel consumption rate. Use the edit button to change the information for each type of transport.

The screenshot shows a web-based application window titled "HERMES Choose Types". The main menu bar includes File, Edit, View, History, Bookmarks, Tools, and Help. Below the menu is a toolbar with icons for Home, New, Open, Save, Print, and Exit. The URL in the address bar is "localhost:8080/bottle\_hermes/model-add-types?id=6&create=false". The main content area displays a "Edit Components" dialog box. On the left, a sidebar lists categories: Vaccine, Storage, Transport, Population, Staff, and PerDiems. Under Transport, "Used Types" are listed: Home, bus, delivery truck, mobile brigade truck, motorboat, national cold truck, provincial Hilux, walk, and weekly CB pickup. The central part of the dialog is titled "Edit Your Transport Type" and contains the following fields:

- Name: bus
- Capital Cost: 0 USD - United States Dollar
- Lifetime of Vehicle (KM): 1
- Fuel Type: Fixed Fare
- Fuel Consumption Rate: 0.32 per MP
- Net Storage at 2-8C: 0
- Outside of Storage Devices (L): 0

A table titled "Storage on Vehicle" shows one entry:

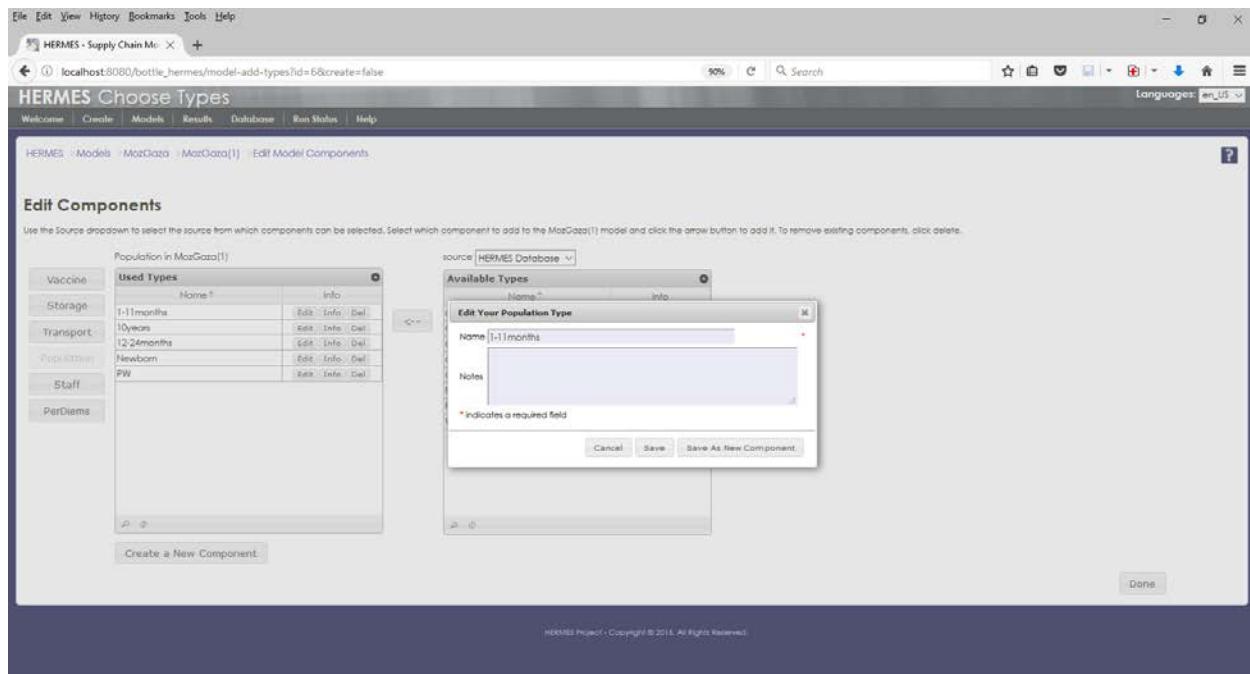
Type	Description	Below 0C (L)	2-8C (L)	Room Temperature (L)	Count	Details
Std_VC_Bk1.7CF	VC 1.7 CF	0.00	1.70	0.00	2	[Info]
	Totals	0.00	3.40	0.00	2	[Info]

At the bottom of the dialog, there is a "Notes" section and a note indicating required fields with a red asterisk (\*). Buttons for Cancel, Save, Save As New Component, and Done are at the bottom right.

Transportation methods such as public transit and walking can also be added here. For transit types that have a fixed fare associated with them (such as bus fare for public transportation), the Fuel specified should be Fixed Fare and the round-trip fare should be entered in Fuel Consumption. For transit types that incur no transportation cost, such as walking, the Fuel Type specified should be No Fuel.

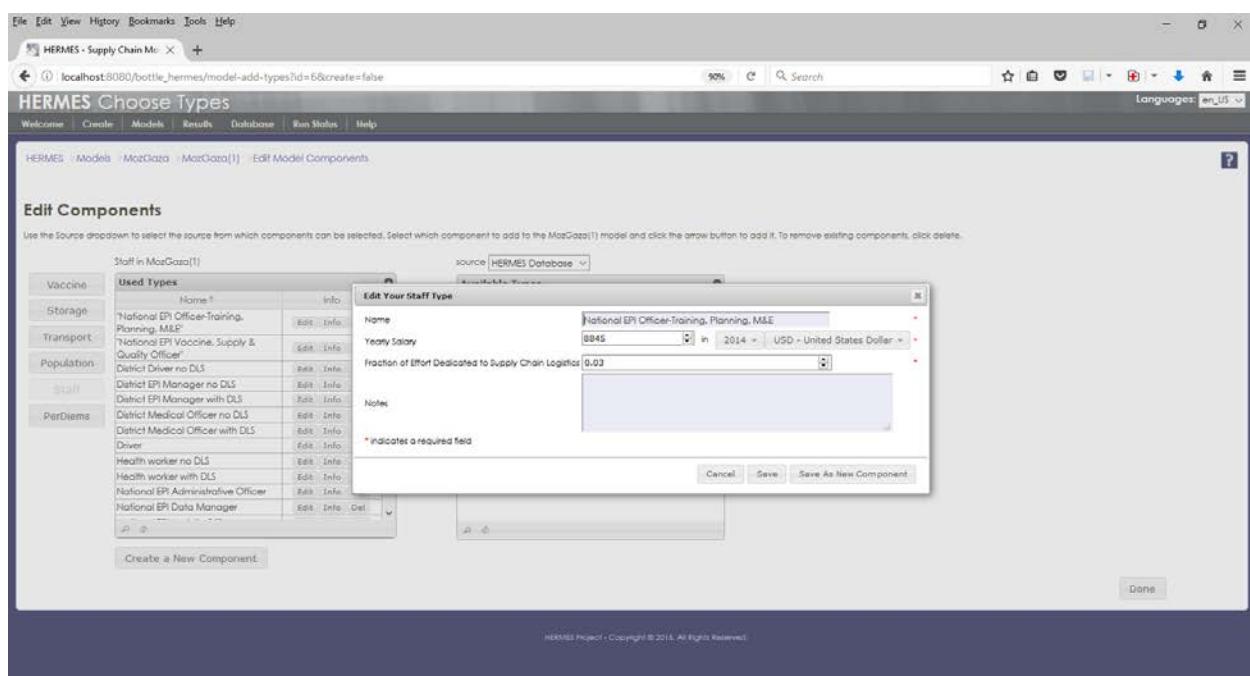
### 3.1.5.1.4 Population

All individuals in a population group require the same vaccines. The population at each immunizing location will be entered in terms of these population groups. While an actual vaccine schedule may specify doses at specific weeks or months of age, population groups should be specified based on the level of detail of available population data. For example, doses of one hypothetical vaccine may be recommended at 2 months and 8 months of age. In most cases, data is not available on the size of the population at each immunizing location at each of those specific ages, so there is no benefit to entering separate population groups for each location. However, data may be available on the total number of infants under 1 year of age, so one population type for that broader age group can be assigned to receive all vaccine doses scheduled for infants.



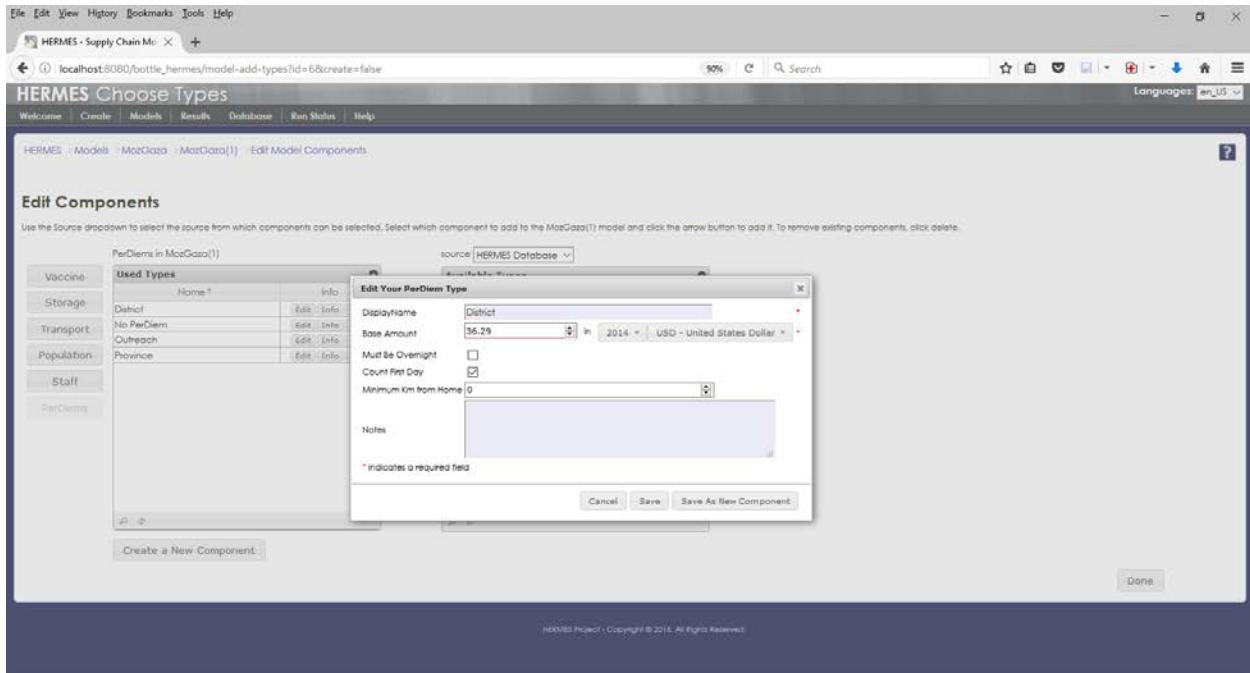
### 3.1.5.1.5 Staff

In HERMES, staff only affect cost outcomes. Thus, the same model run with and without staff will produce results that only differ in labor/personnel costs. Staff type characteristics in HERMES include annual salary and the fraction of that salary that should be counted toward the costs of the immunization program modeled. For example, if only including costs related to routine immunization logistics, then the percentage of each staff member's time that is dedicated toward routine immunization logistics would be reported.



### 3.1.5.1.6 Per diems

In any given system, there may be multiple per diem policies across different levels of the supply chain. For example, drivers on routes at higher levels may be paid per diems, while drivers on routes at lower levels may not. Per diem policies in HERMES are specified based on the amount paid per day, whether a trip must take longer than one day in order for a per diem to be paid (indicated by “must be overnight”), whether a per diem is paid for the first day of a trip or only for the additional days (indicated by “count first day”), and any minimum one-way distance required for a per diem to be paid.



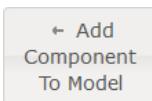
### 3.1.5.2 Add a component

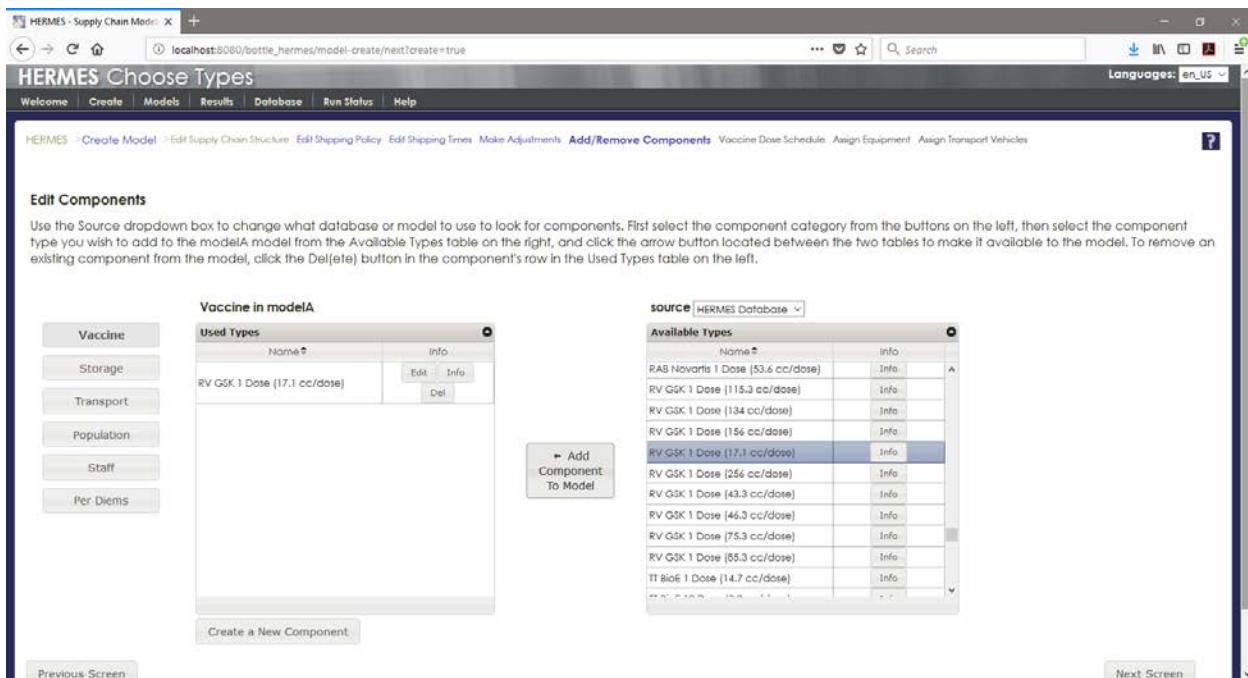
The screenshot shows the 'Edit Components' screen in the HERMES Choose Types interface. On the left, there is a sidebar with buttons for Vaccine, Storage, Transport, Population, Staff, and Per Diems. Below this is a table titled 'Used Types' with columns 'Name' and 'Info'. On the right, there is a table titled 'Available Types' with columns 'Name' and 'Info'. The 'Available Types' table contains several rows of vaccine items. A button labeled '← Add Component To Model' is located between the two tables. At the bottom of the screen, there are buttons for 'Previous Screen' and 'Next Screen'.

Items in the currently open model appear in the box on the left, and items available to add to this model appear in the Source box on the right. Use the dropdown menu to select a Source.

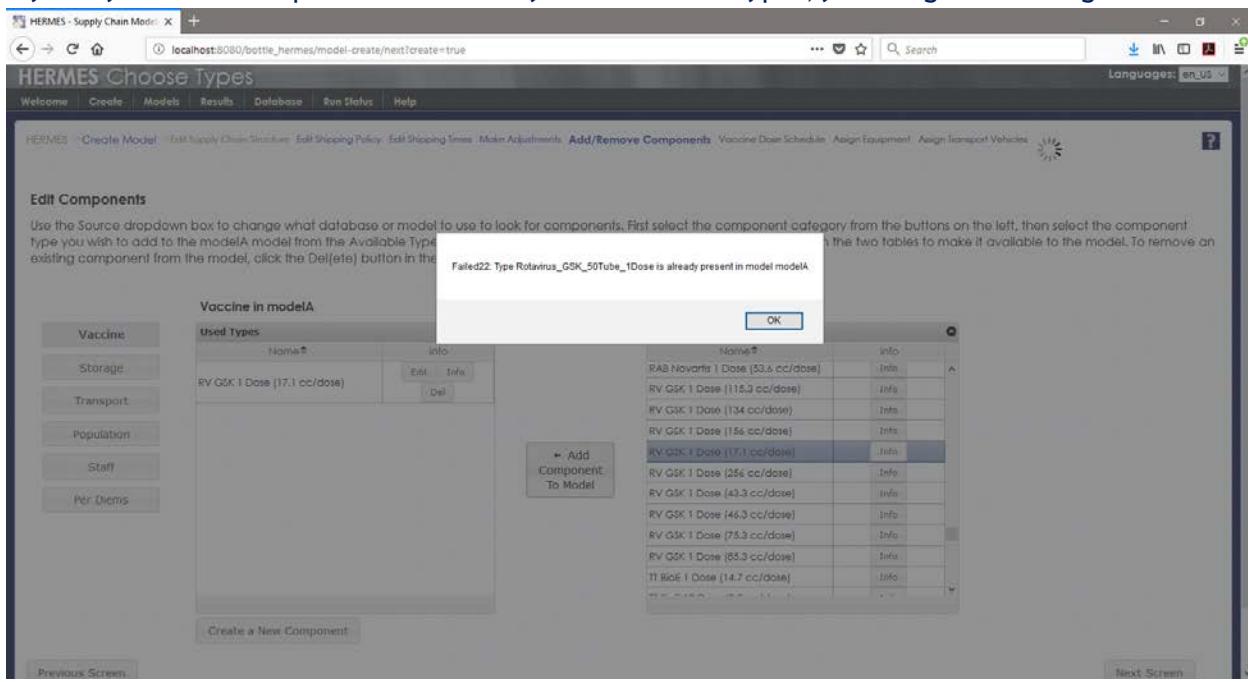
Available sources include the HERMES Database as well as other models in your database. The HERMES Database includes WHO prequalified items where available, as well as examples of commonly used items (see Section 9.2).

Select a component to add from the Source by clicking on it.

 Click **← Add Component To Model** button to add the component to your model. Once you do so and the component type appears in the table on the left, it has been saved to the model.



If you try to add a component that already exists in Used Types, you will get a warning.



To add an item not currently available in any Source, either begin with an item of the same component category in the current model and edit as necessary (as described in Section 3.1.5.3) or create a new component (Section 3.1.5.4).

### 3.1.5.3 Edit a component

Select a component type in the Used Types box.

HERMES Choose Types

Vaccine in modelA

Used Types

Name: RV GSK 1 Dose (17.1 cc/dose)

Edit Info Del

Add Component To Model

SOURCE: HERMES Database

Available Types

Name	Info
RAB Novartis 1 Dose (53.6 cc/dose)	Info
RV GSK 1 Dose (115.0 cc/dose)	Info
RV GSK 1 Dose (134 cc/dose)	Info
RV GSK 1 Dose (156 cc/dose)	Info
RV GSK 1 Dose (17.1 cc/dose)	Info
RV GSK 1 Dose (256 cc/dose)	Info
RV GSK 1 Dose (43.3 cc/dose)	Info
RV GSK 1 Dose (46.0 cc/dose)	Info
RV GSK 1 Dose (75.3 cc/dose)	Info
RV GSK 1 Dose (85.3 cc/dose)	Info
TT BioE 1 Dose (14.7 cc/dose)	Info

Create a New Component

Previous Screen Next Screen

Click the Edit button. A box will appear that allows you to edit your component type.

Edit Components

Used Types

Name: RV GSK 1 Dose (17.1 cc/dose)

Abbreviation: RV

Manufacturer: GSK

Doses per vial: 1

Method of administration: Intramuscular (IM)

Vaccine presentation: Lyophilized + Diluent

Length of time vaccine can be used after opening vial: 0.01 months

Length of time vaccine can be stored at Room Temperature: 0.001 months

Length of time vaccine can be stored at 2-8 C: 36 months

Length of time vaccine can be stored at Below 0 C: 0.002 months

Packed Volume per Dose of Vaccine (mL): 17.1

Packed Volume per Dose of Diluent (mL): 0

Price of Vaccine Per Vial: 0 in 2011 USD - United States Dollar

Notes:

\* indicates a required field

Cancel Save Save As New Component

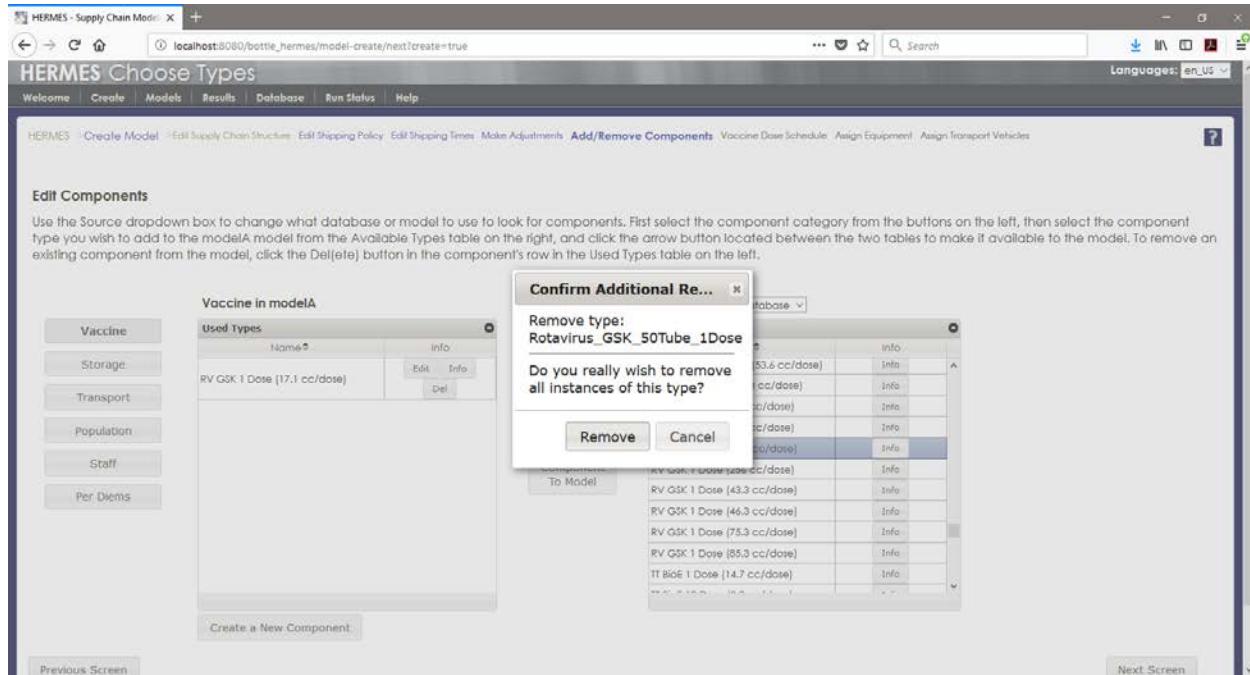
Previous Screen Next Screen

Click Save to keep these changes to the selected component or Save As New Component to save your changes without altering the characteristics of the original component.

### 3.1.5.4 Remove a component

Click Del button next to name of component in Used Types.

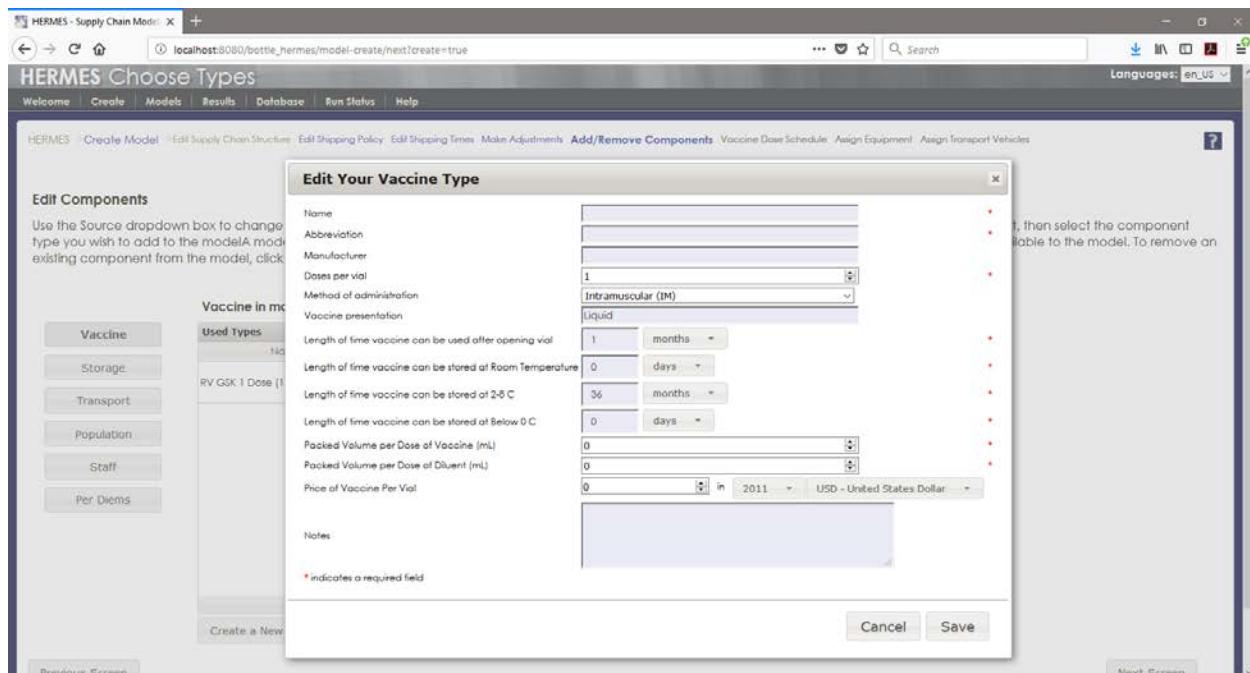
Click Remove button in dialog box to confirm removal. The component will only be removed from your model. It will still be available from its original source.



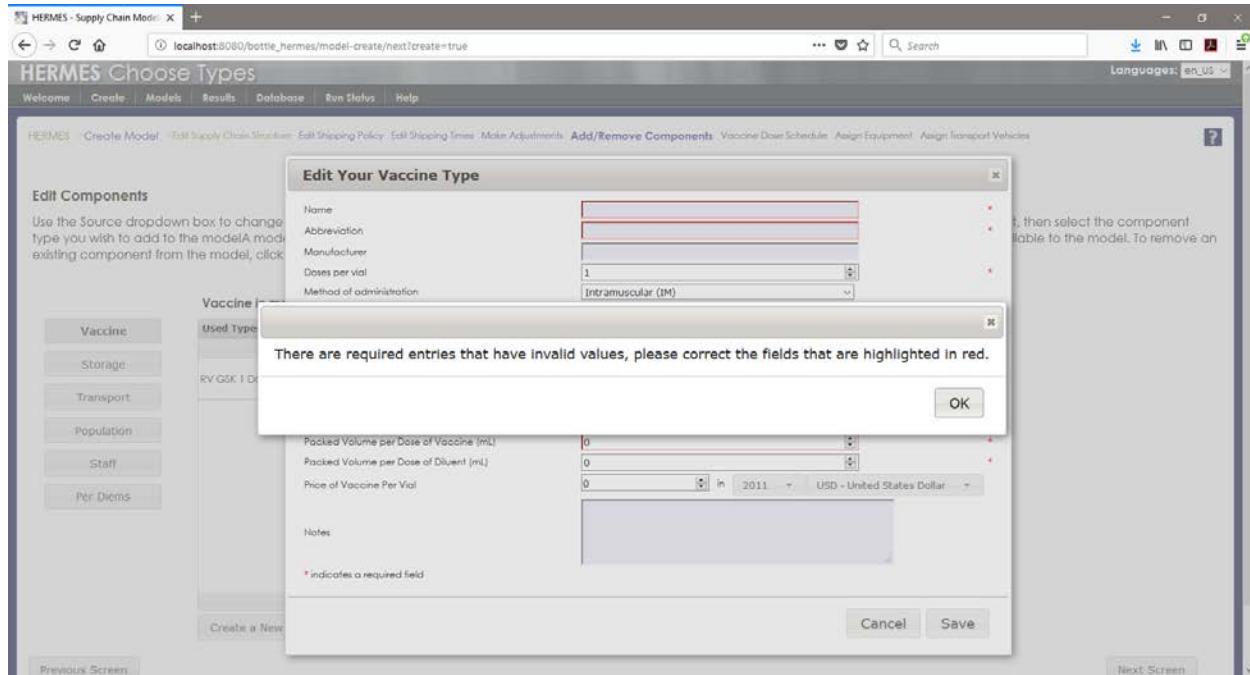
### 3.1.5.5 Create a new component

Click on the button below the Used Types box, Create a New Component.

Similar to editing a component, a dialog box will appear in which you can fill out relevant information for the appropriate component category. Required fields are marked with a red asterisk.



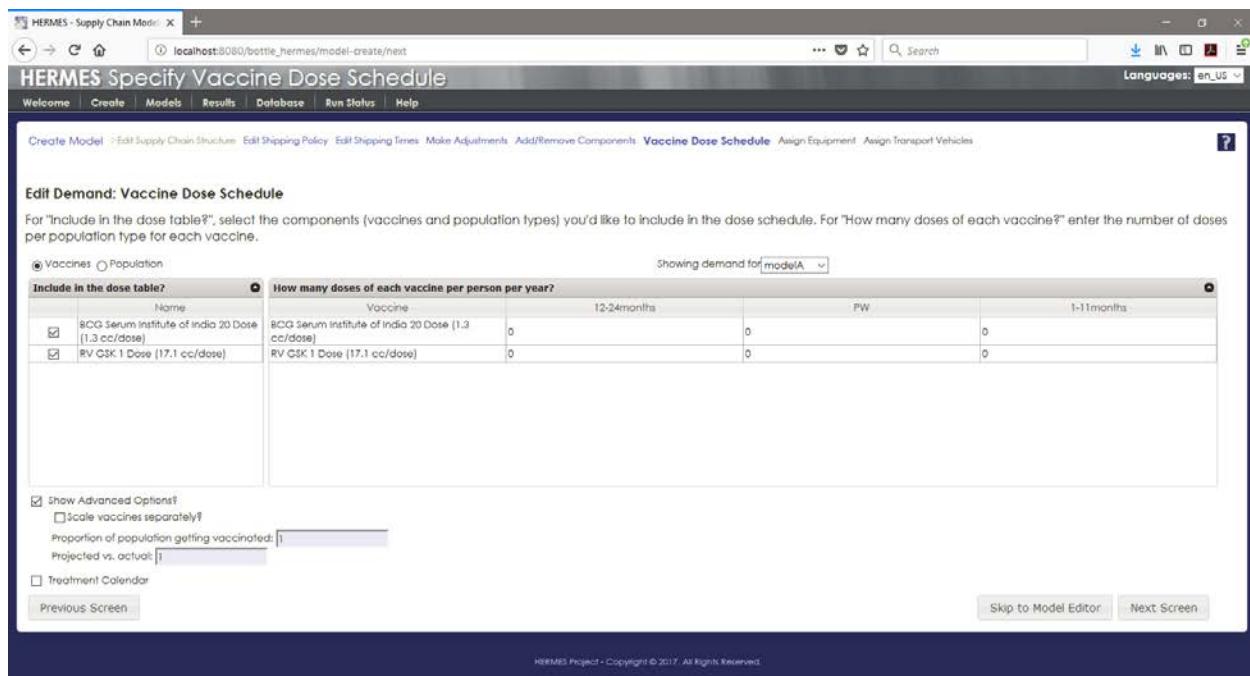
If you try to save the component with an invalid value entered in any of the required fields, a warning will appear asking you to correct any fields highlighted in red.



Once finished editing and or adding components, click Next Screen to access the Vaccine dose schedule.

### 3.1.6 Vaccine dose schedule

In HERMES, demand is determined by the populations served by each location and the vaccine schedule for each population type. Here, you will define the vaccine dose schedule for this model.



The table on the right will be shown with all available vaccines and population categories chosen. If you want to limit what is shown, you can uncheck vaccines or population categories in the “Include in the dose table?” box on the left. Click the radio button for Population above the box to view/choose the population categories. Choices will appear as row and column headers in the “How many doses of each vaccine per person per year” table.

Once the table on the right is configured as you like it, fill out the “How many doses of each vaccine per person per year” table.

You may click a cell to enter the number of doses of the vaccine in that row which will be scheduled for each member of the population type in that column over the course of one simulation.

For example, if including newborns and a BCG vaccine, a user would enter "1" to indicate that each newborn in the model would be scheduled to receive 1 dose of BCG.

You must hit enter after changing the numbers in a row in order to save the changes.

Vaccine	12-24months	PW	1-11months
BCG Serum Institute of India 20 Dose (1.3 cc/dose)	2	1	2
RV GSK 1 Dose (17.1 cc/dose)	1	1	1

Show Advanced Options?  Scale vaccines separately?

Proportion of population getting vaccinated:

Projected vs. actual:

Treatment Calendar  Schedule population types separately?

Which days should clinics be open?  
 days each week: S M T W F S  
 weeks each month: W1 W2 W3 W4  
 months each year: J F M A M J A S O N D

Click check box for Show Advanced Options to scale demand. The proportion of population getting vaccinated is the percentage of all model populations who will arrive for vaccinations in the simulation. The default value is 1, meaning 100% of the populations in the model will present for vaccines at immunization locations during each simulation run.

Entering a value into projected vs. actual further adjusts the expected demand (the size of the population that is expected to arrive for vaccinations, which is taken into account when calculating the amount of each product to order). The expected demand will equal the actual demand, scaled by the factor entered. The default value is 1, meaning the number of people expected to arrive for vaccinations will equal 100% of the people actually arriving.

Under that, click the check box for “Scale vaccines separately?” to specify the proportion of the population getting vaccinated and projected vs. actual factors independently for each specific vaccine. For example, to enter an 85% target coverage for one vaccine and a 90% target coverage for another, a user would edit the proportion of the population getting vaccinated column to "0.85" and "0.9" for the appropriate rows.

Click the check box for “Treatment Calendar” to select which days, weeks, and months the immunizing locations administer vaccines to all population types. In HERMES, all months are considered to have 28 days and therefore only four weeks. Click the check box for “Schedule population types separately?” to fill this out individually for each population type.

### 3.1.7 Assign Equipment

This step assigns quantities of equipment and population to locations by level. Rows in the table list the storage devices and population types that were added to the model in a previous step. Each supply chain level is shown as a column in the table.

Name	Info	Central	Regional	Local
<input checked="" type="checkbox"/> Devices to Store Vaccines at this Level				
CB 20 CF	<a href="#">Info</a>	0	0	0
VC 1.7 CF	<a href="#">Info</a>	0	0	0
<input checked="" type="checkbox"/> Population To Vaccinate at this Level				
12-24months	<a href="#">Info</a>	0	0	0
PW	<a href="#">Info</a>	0	0	0
I-11months	<a href="#">Info</a>	0	0	0

Click the Info button to open a display of available information about the equipment type or population.

Click in a cell to edit the number of devices or people for a typical location at that level, and HERMES will add the specified number of that component to every location at that level. For example, entering "2" for cold rooms at the Region level would assign 2 cold rooms to each location at the Region level, regardless of how many Region level locations exist.

Similarly, populations represent the people who would be vaccinated at each location in a given level. Only enter population numbers for levels that administer vaccinations. A level that solely stores and distributes vaccines should not include any populations here. For example, specifying 100 newborns for the Health Post level would assign 100 newborns to every Health Post. If locations at higher levels in this example do not administer vaccines to newborns, then they

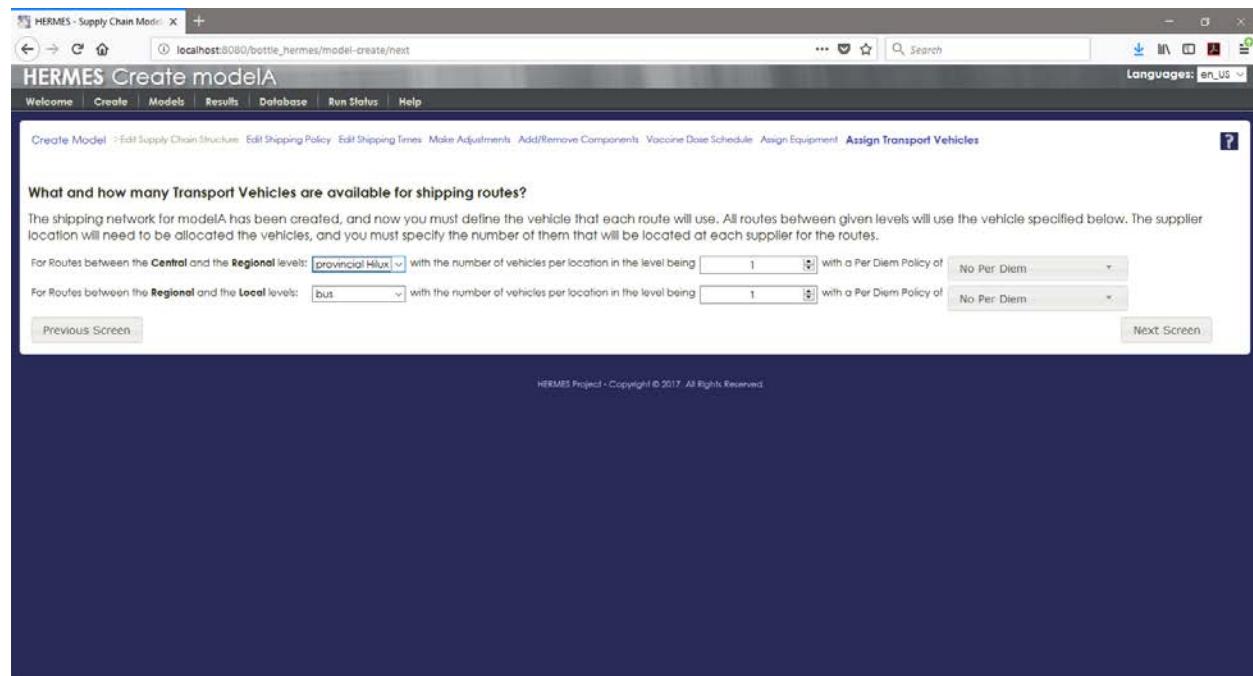
should have 0 newborns assigned here. You can later modify these for specific locations or groups of locations using the Advanced Model Editor (Section 5).

### 3.1.8 Assign Transport Vehicles

This step assigns transport vehicles to routes and locations by level. Specifying the type of vehicle typically used between a pair of levels will assign that vehicle type to all routes between those levels. You can later modify this selection for specific routes using the Advanced Model Editor (Section 5).

In each row, use the dropdown menu to select the type of vehicle typically used for transporting vaccines between the two levels. If the desired vehicle is not found, it must be added to the model in the Add/Remove Components page (Section 3.1.5.2). Then specify how many vehicles exist at each location where such a route would originate.

For example, a system may have 3 Region-level locations that deliver vaccines to 40 District locations, and a typical Region location has 2 cold trucks available for these shipments. In the row "For Routes between the Region and District levels" a user would select the appropriate type of cold truck from the list and enter 2 for the number of vehicles. This would assign 2 cold trucks to each Region location (for a total of 6 cold trucks at the Region level), and these would be used for delivering shipments to the District level. If District level was instead assigned to pick up vaccines from the Region level, then the vehicles selected here would instead reside at the District locations, where each trip would begin.



After completing this step, you will be taken to a page displaying the supply chain network diagram and a list of actions you can next perform with this model (Section 4).

## 3.2 Import

To import an existing HERMES model file into your list of Available Models:

1. On Welcome Page, click “Create or Upload a New Model”  
-or-

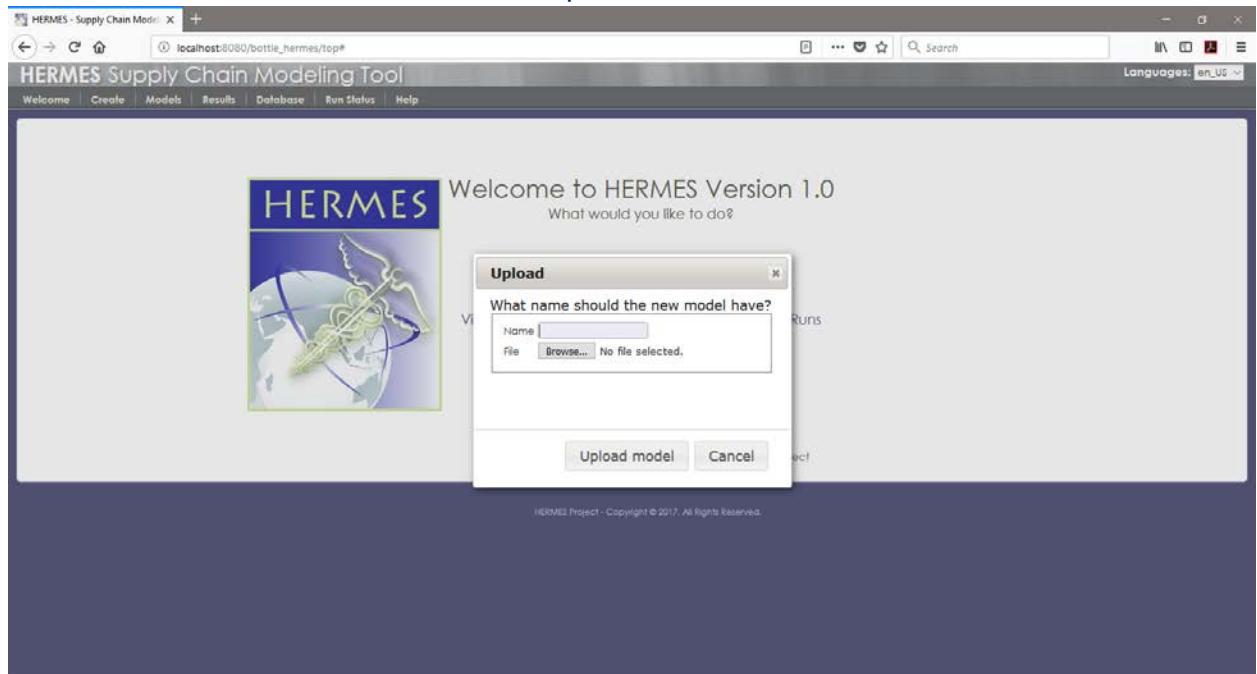
On Main Menu, click “Create”

2. Click on “Upload an Existing Model from a HERMES .H2P File” in the dialogue box

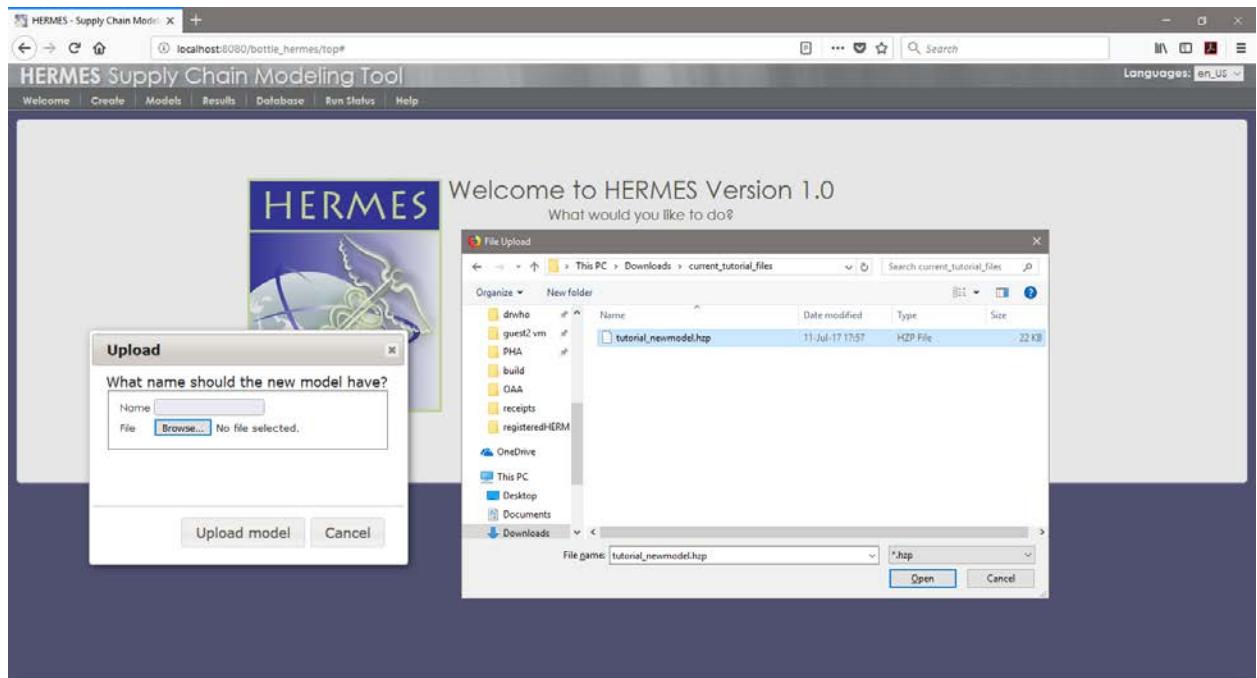


H2P is the extension given for HERMES zip files which include all the information necessary to load a model. You can open them outside of HERMES by changing the file extension to .zip instead of .h2p and then using whatever archive facility you use to open zip files.

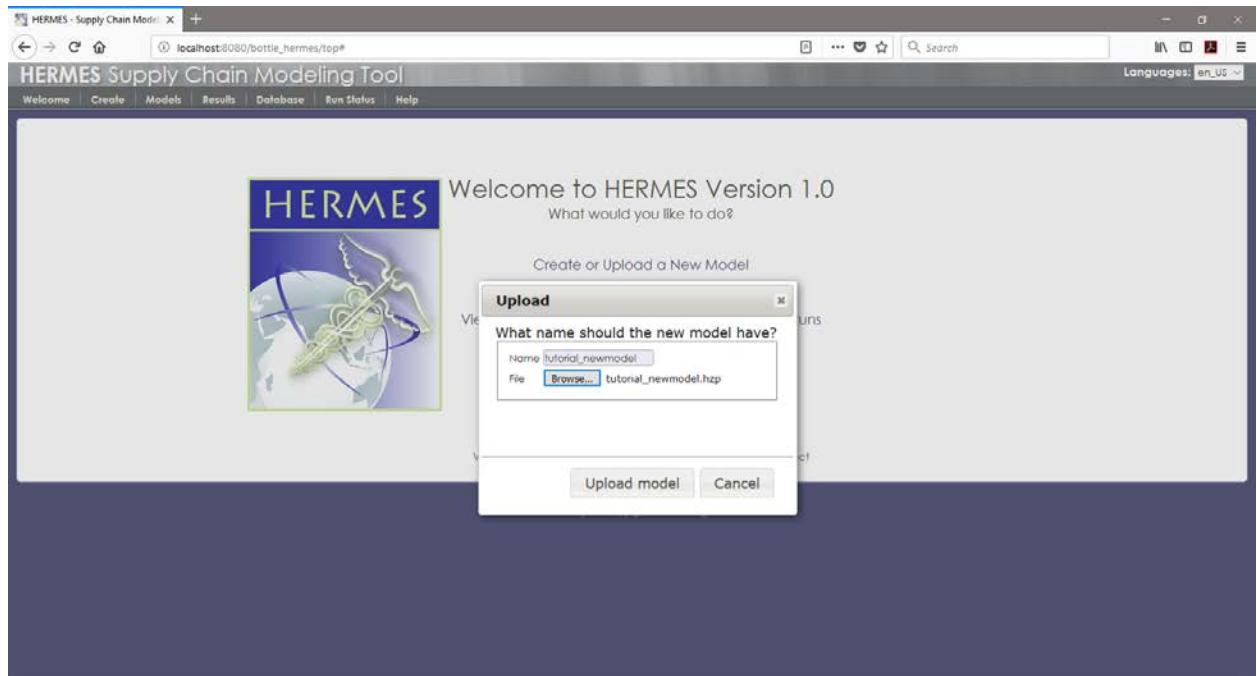
3. Click the browse button to choose a file to upload.



4. Choose an HZP file from the File Upload window. (By default, only HZP files will be displayed.) Either double-click the file name or click the file name and then click the Open button.



5. The model name text box will be automatically filled in with the name from the file but can be edited before uploading the model. The name of the file you selected is now displayed next to the Browse button.



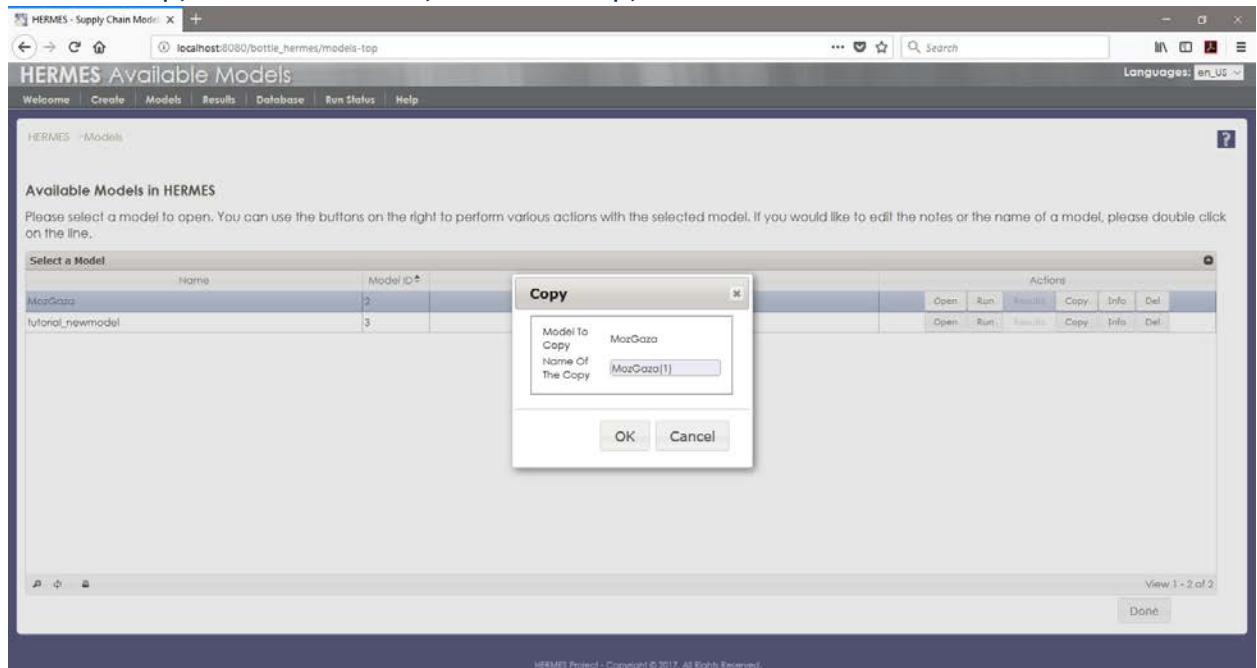
### 3.3 Copy – The Available Models Page

Use the Copy button to add a copy of any model to your list of Available Models. If you wish to edit a model that has already been run, you must first create a copy of the model to edit.

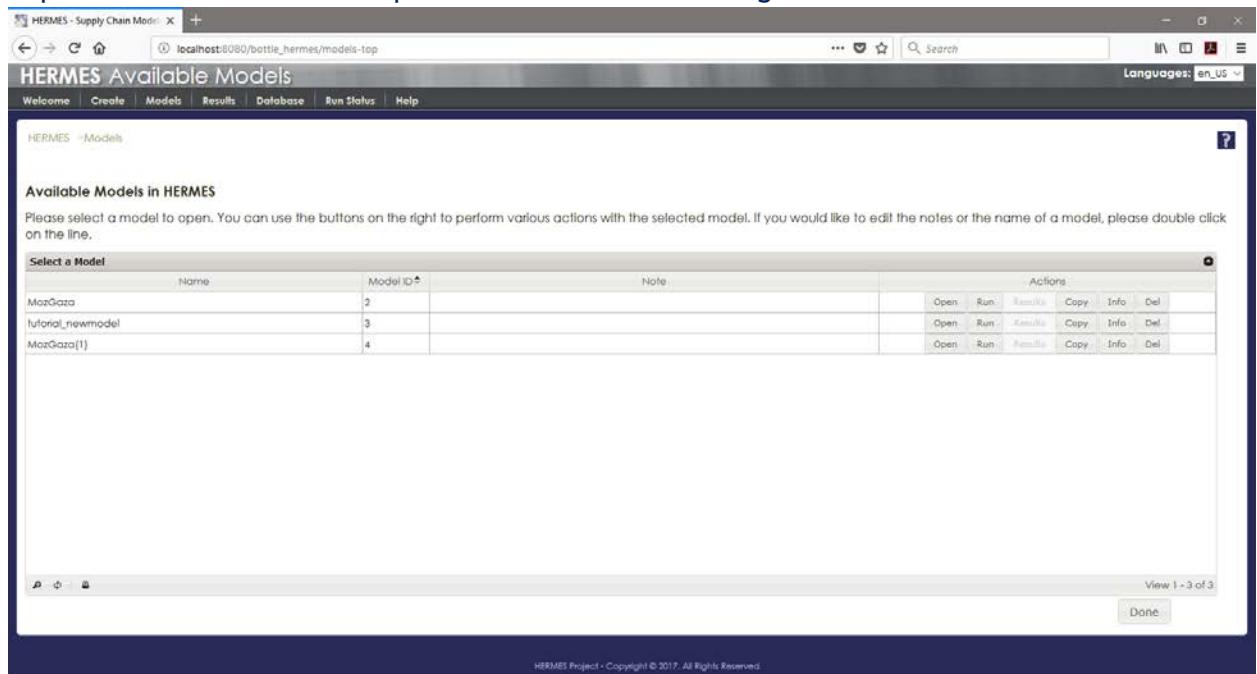
1. Open Available Models page per Section 2.6.

A screenshot of a web browser window titled "HERMES - Supply Chain Model". The URL is "localhost:8080/bottle\_hermes/models-top#". The main content area displays a table titled "Available Models in HERMES". The table has columns for "Name", "Model ID", "Note", and "Actions". Two rows are visible: "MazGaza" (Model ID 2) and "tutorial\_newmodel" (Model ID 3). The "Actions" column for each row contains buttons for "Open", "Run", "Results", "Copy", "Info", and "Del". A modal dialog box titled "Select a Model" is overlaid on the table, covering the second row. This dialog also has columns for "Name", "Model ID", and "Note", with the same data as the table. At the bottom of the dialog are "Actions" buttons for "Open", "Run", "Results", "Copy", "Info", and "Del". The bottom right corner of the dialog shows "Done".

2. Click on “Copy” button of model you want to copy.

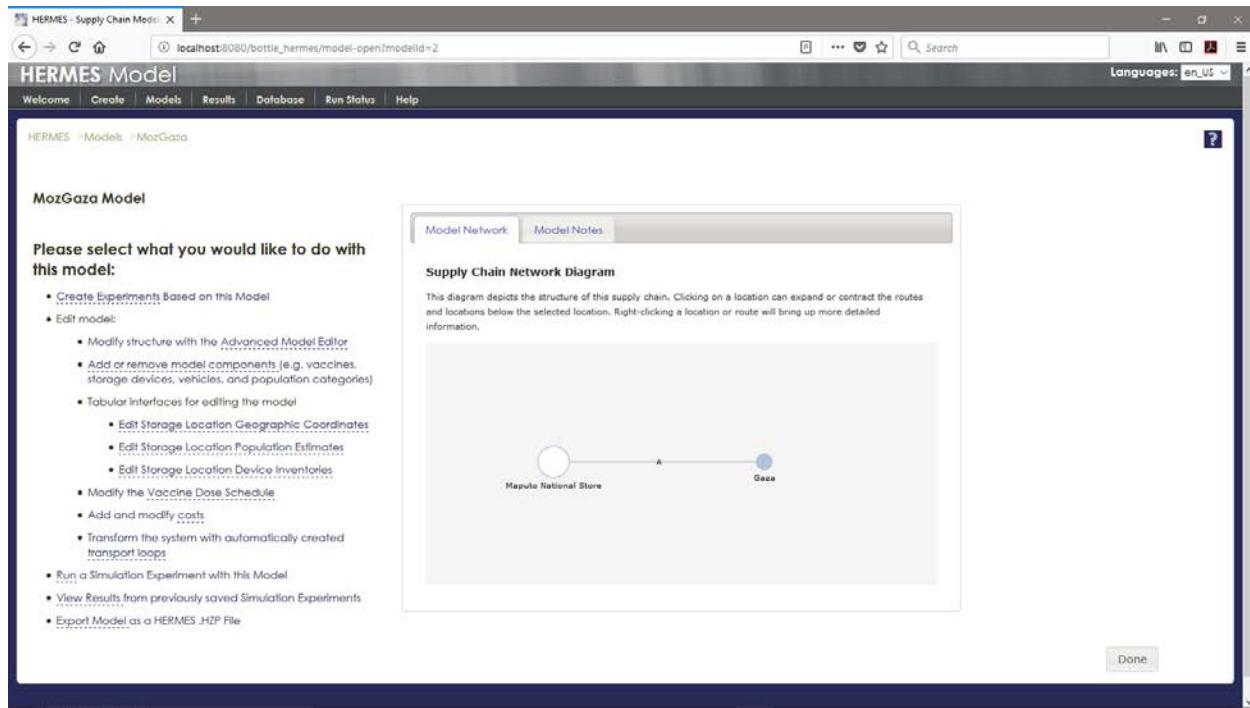


3. Enter a name for the copy that is distinct from the original model. A suggestion is filled in by default. Click “Ok.”
4. After the copy is complete, the model will show up at the bottom of the table. Click on the “Open” button in that row to open the model to make changes.



## 4 Model Manipulation/The Model Page

When you finish creating a model or when you have opened a model from the Available Models page, you are taken to a page that offers you various options for interacting with the chosen model.



These options are:

1. Create Experiments Based on this Model (see HERMES Tutorials PDF for more information on how to run experiments)
2. Edit
  - a. Modify structure with the Advanced Model Editor (Section 5)
  - b. Add or remove model components (Section 4.7)
  - c. Use tabular interfaces for editing storage location information in the model:
    - i. Edit Storage Location Geographic Coordinates (Section 4.1.3)
    - ii. Edit Storage Location Population Estimates (Section 4.1.4)
    - iii. Edit Storage Location Device Inventories (Section 4.1.5)
  - d. Modify the Vaccine Dose Schedule (Section 3.1.6)
  - e. Add and modify costs (Section 4.2)
  - f. Transform the system with automatically created transport loops (Section 4.3)
3. Run a Simulation Experiment with this Model (Section 7)
4. View Results from previously saved Simulation Experiments (Section 8.2)
5. Export Model as a HERMES Zip File (Section 4.4)

Additionally, in the box on the right hand side, you can

6. Explore the supply chain via the supply chain network diagram (Section 4.5)
7. Add notes to the model (Section 4.6)

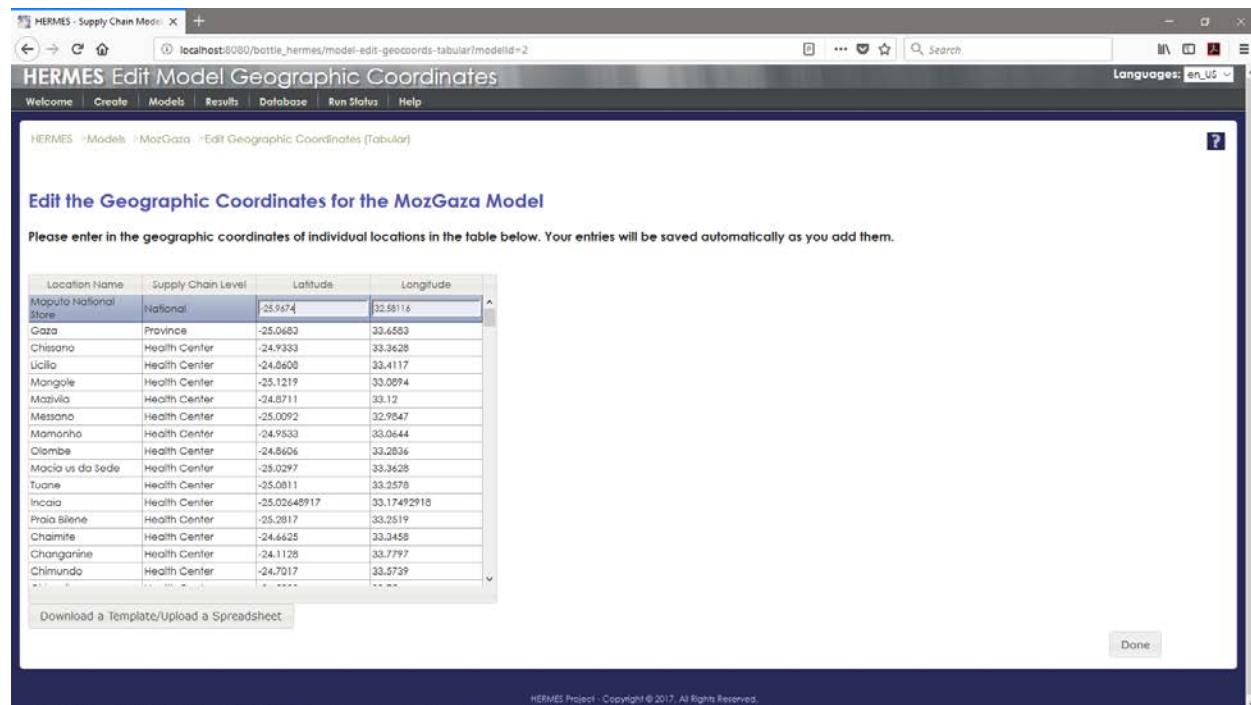
## 4.1 Edit Storage Location Information Using Tabular Interface

Certain storage location information can be more simply entered and updated using the tabular interface. This includes geographic coordinates, population estimates, and device inventories. In each case, you can either manually enter the information directly into the table on the webpage or you can download a template spreadsheet, make the appropriate changes, and then upload the correct information.

The instructions for manually adding and uploading information will use the Geographic Coordinates Page as an example. Screen shots of each of the tabular edit pages as well as page specific information follows.

### 4.1.1 Manually add information

Click on a row to select the row. The cursor will be placed in the first editable field. Editable fields display with light colored backgrounds and can be selected using Tab for the next field or Shift-Tab for the previous one, as well as by using the mouse. A scroll bar is available for quickly moving through the list.



The screenshot shows a web browser window titled "HERMES - Supply Chain Model". The URL is "localhost:8080/bottle\_hermes/model-edit-geocoords-tabular?modelId=2". The main title is "HERMES Edit Model Geographic Coordinates". Below the title is a navigation menu with links: Welcome, Create, Models, Results, Database, Run Status, and Help. A language selection dropdown shows "Languages: en\_US". The main content area is titled "Edit the Geographic Coordinates for the MozGaza Model". It contains a message: "Please enter in the geographic coordinates of individual locations in the table below. Your entries will be saved automatically as you add them." Below this is a table with four columns: Location Name, Supply Chain Level, Latitude, and Longitude. The table lists various locations in Mozambique, such as Maputo National Store, Gaza, Chissano, Lúrio, Mongóla, Matola, Messano, Mamomha, Gilembe, Mocico vs da Sede, Tucane, Incala, Praia Silene, Chaimite, Changanine, and Chimundo. The "Latitude" column for the first row (Maputo National Store) is currently being edited, as indicated by the light blue background color. At the bottom of the table is a button labeled "Download a Template/Upload a Spreadsheet". In the bottom right corner of the page is a "Done" button.

Information is automatically saved when you click on another row to edit or when you click the Done button in the bottom right hand corner.

### 4.1.2 Upload information from spreadsheet

Click on “Download a Template/Upload a Spreadsheet” button to activate spreadsheet dialogue:

The screenshot shows the HERMES - Supply Chain Model interface. The main window title is "HERMES Edit Model Geographic Coordinates". The URL in the address bar is "localhost:8080/bottle\_hermes/model-edit-geocoords-tabular?modelId=2". The main content area displays a table of geographic coordinates for locations in Mozambique. A modal dialog box is overlaid on the screen, containing instructions to upload an Excel file or download a preformatted spreadsheet.

Location Name	Supply Chain Level	Latit
Maputo National Store	National	-25.9574
Gaza	Province	-25.0683
Chissano	Health Center	-24.9333
Licuala	Health Center	-24.8600
Mongole	Health Center	-25.1219
Mozivila	Health Center	-24.8711
Messono	Health Center	-25.0092
Monanha	Health Center	-24.9533
Oiombe	Health Center	-24.8606
Mocio us da Sede	Health Center	-25.0297
Tucane	Health Center	-25.0811
Incala	Health Center	-25.0264591
Prata Silene	Health Center	-25.2017
Chamalte	Health Center	-24.6625
Changanine	Health Center	-24.1128
Chimundo	Health Center	-24.7017

You can upload an Excel file that contains the geographic coordinates of locations in your model.  
Would you like to  
[Download a Preformatted Spreadsheet](#)  
or  
[Upload a Completed Spreadsheet?](#)

#### 4.1.2.1 Download preformatted spreadsheet

In order to upload the geographic information from a spreadsheet, you first need to download the preformatted template.

1. Click on “Download a Preformatted Spreadsheet”
2. From download dialogue box, choose to either open the file with Excel or save it to your hard drive.
3. Click Ok on “Template Download Successful” window

#### 4.1.2.2 Fill out spreadsheet

1. Use Excel to open spreadsheet (most likely saved in your Downloads folder).

The screenshot shows a Microsoft Excel spreadsheet titled "model\_2\_geotemplat.xlsx [Read-Only] - Excel". The "HOME" tab is selected. The spreadsheet contains data for 16 rows, starting with a header row. The columns are labeled A through G. Column A is "HERMES ID", column B is "Location Name", column C is "Supply Chain Level", column D is "Latitude", and column E is "Longitude". Row 4 is highlighted in green, and the cell F4 is selected. The data includes locations like Maputo National Store, Gaza, Chissano, Licio, Mangole, Mazivila, Messano, Mamonho, Olombe, Macia us da Sede, Tuane, Incaia, Praia Bilene, Chaimite, and Changanine, along with their corresponding supply chain levels (National, Province, Health Center) and coordinates.

A	B	C	D	E	F	G
1	HERMES ID	Location Name	Supply Chain Level	Latitude	Longitude	
2	100000	Maputo National Store	National	-25.9674	32.58116	
3	120000	Gaza	Province	-25.0683	33.6583	
4	120101	Chissano	Health Center	-24.9333	33.3628	
5	120102	Licio	Health Center	-24.8608	33.4117	
6	120103	Mangole	Health Center	-25.1219	33.0894	
7	120104	Mazivila	Health Center	-24.8711	33.12	
8	120105	Messano	Health Center	-25.0092	32.9847	
9	120106	Mamonho	Health Center	-24.9533	33.0644	
10	120107	Olombe	Health Center	-24.8606	33.2836	
11	120108	Macia us da Sede	Health Center	-25.0297	33.3628	
12	120109	Tuane	Health Center	-25.0811	33.2578	
13	120110	Incaia	Health Center	-25.02648917	33.17492918	
14	120111	Praia Bilene	Health Center	-25.2817	33.2519	
15	120201	Chaimite	Health Center	-24.6625	33.3458	
16	120202	Changanine	Health Center	-24.1128	33.7797	

2. Enter latitude and longitude information into spreadsheet.  
(See guidelines in Section 4.1.3)
3. Save spreadsheet.

#### 4.1.2.3 Upload spreadsheet

1. Click on “Upload a completed spreadsheet”
2. Click on the “Browse” button on the Upload Geocoordinate Spreadsheet dialogue box to select which file to upload.

3. If you would like to edit location names in your spreadsheet, click the checkbox next to "Would you like to override the Location Names with those in your spreadsheet?"
4. Once you have selected a file, its name will appear next to the Browse button. If the correct name appears, press "Upload XLS" or you can press Browse again to choose a different file.
5. If the file is successfully uploaded, a message box will appear telling you the spreadsheet update was successful. Press OK to return to the Geographic Coordinates page.
6. If the file does not successfully load, you will get an error message. Check the format of latitudes and longitudes in your Excel file to make sure they agree with the guidelines in Section 4.1.3.

When you have finished using the Geographic Coordinates page, press Done button in bottom right corner to return to the Model page.

#### **4.1.3 Edit Storage Location Geographic Coordinates**

This page allows you to edit the latitude and longitude for each storage location in the model.

**HERMES Edit Model Geographic Coordinates**

HerMES > Models > MozGaza > Edit Geographic Coordinates (Tabular)

**Edit the Geographic Coordinates for the MozGaza Model**

Please enter in the geographic coordinates of individual locations in the table below. Your entries will be saved automatically as you add them.

Location Name	Supply Chain Level	Latitude	Longitude
Maputo National Store	National	-25.9674	32.58116
Gaza	Province	-25.0683	33.6583
Chissano	Health Center	-24.9333	33.3628
Liculilo	Health Center	-24.0608	33.4117
Mongole	Health Center	-25.1219	33.0594
Mozivila	Health Center	-24.8711	33.12
Messono	Health Center	-25.0092	32.9547
Mononha	Health Center	-24.9533	33.0644
Oiombe	Health Center	-24.8606	33.2836
Moçambique da Sede	Health Center	-25.0297	33.3628
Tucane	Health Center	-25.0811	33.2578
Incala	Health Center	-25.02648917	33.17492918
Prata Silene	Health Center	-25.2817	33.2519
Chamite	Health Center	-24.6625	33.3458
Changanine	Health Center	-24.1128	33.7797
Chimundo	Health Center	-24.7017	33.5739

Download a Template/Upload a Spreadsheet

Done

*Guidelines for entering latitude and longitude:*

The model expects signed degrees format (DDD.dddd).

South latitudes and West longitudes should be preceded by a minus sign, so latitudes range from -90 to 90 and longitudes range from -180 to 180.

#### 4.1.4 Edit Storage Location Population Estimates

This page allows you to edit the numbers for each population type in each location.

**HERMES - Supply Chain Model**

localhost:8080/bottle\_hermes/model-edit-population-tabular?modelId=2

**HERMES Edit Model Population Demand Estimates**

Welcome Create Models Results Database Run Status Help

HERMES > Models > MozGaza > Edit Population Counts (Tabular)

**Edit the Population Estimates for the MozGaza Model**

Please enter in the population estimates for the number individuals of each type to be vaccinated during a year at individual locations in the table below. Your entries will be saved automatically as you add them.

Location Name	Supply Chain Level	Attached Demand#	Newborn	1-11 months	12-24months	10years	PW
Maputo National Store	National	0	0	0	0	0	0
Gaza	Province	0	0	0	0	0	0
Chissano	Health Center	0	0	0	0	0	0
Licula	Health Center	687	670	644	363	859	
Mangole	Health Center	110	107	103	56	137	
Matavila	Health Center	0	0	0	0	0	0
Messana	Health Center	0	0	0	0	0	0
Memomha	Health Center	169	166	159	90	212	
Clombe	Health Center	429	418	402	227	536	
Mocico da Sede	Health Center	1802	1757	1689	954	2253	
Tutane	Health Center	0	0	0	0	0	0
Inhala	Health Center	560	546	525	296	700	
Prainha	Health Center	0	0	0	0	0	0
Chaimite	Health Center	0	0	0	0	0	0
Changane	Health Center	412	402	386	218	515	
Chimundo	Health Center	417	407	391	221	522	
Chipodja	Health Center	0	0	0	0	0	0

Download a Template/Upload a Spreadsheet

Done

#### 4.1.5 Edit Storage Location Device Inventories

This page allows you to edit the types and numbers of storage devices available at each storage location.

**HERMES - Supply Chain Model**

localhost:8080/bottle\_hermes/model-edit-store-inventory-tabular?modelId=2

**HERMES Edit Model Population Demand Estimates**

Welcome Create Models Results Database Run Status Help

HERMES > Models > MozGaza > Edit Population Counts (Tabular)

**Edit the Storage Devices at Each Location in the MozGaza Model**

Please enter in the inventory of storage devices that are to be present at each location in the model. You can change the number of existing devices by clicking on the number and editing. To remove a device, set its number to zero. Finally, if you would like to add a storage device to a location, click the 'Add Storage Device' button and select the device from the dropdown menu.

Location Name	Supply Chain Level	Inventory																		
Maputo National Store	National	<table border="1"> <tr><td>National WIFR 2</td><td>1</td></tr> <tr><td>National WICR 4</td><td>1</td></tr> <tr><td>National WICR 5</td><td>1</td></tr> <tr><td>National WIFR 1</td><td>1</td></tr> <tr><td>National WICR 1</td><td>1</td></tr> <tr><td>National WICR 2</td><td>1</td></tr> <tr><td>National WICR 3</td><td>1</td></tr> <tr><td>TCW 3000 AC National</td><td>3</td></tr> <tr><td>Add Storage Device</td><td></td></tr> </table>	National WIFR 2	1	National WICR 4	1	National WICR 5	1	National WIFR 1	1	National WICR 1	1	National WICR 2	1	National WICR 3	1	TCW 3000 AC National	3	Add Storage Device	
National WIFR 2	1																			
National WICR 4	1																			
National WICR 5	1																			
National WIFR 1	1																			
National WICR 1	1																			
National WICR 2	1																			
National WICR 3	1																			
TCW 3000 AC National	3																			
Add Storage Device																				
Gaza	Province	<table border="1"> <tr><td>S8 302</td><td>2</td></tr> <tr><td>TC 883</td><td>1</td></tr> <tr><td>MC 304</td><td>1</td></tr> <tr><td>MC 214</td><td>1</td></tr> <tr><td>TCW 3000 AC</td><td>5</td></tr> <tr><td>Add Storage Device</td><td></td></tr> </table>	S8 302	2	TC 883	1	MC 304	1	MC 214	1	TCW 3000 AC	5	Add Storage Device							
S8 302	2																			
TC 883	1																			
MC 304	1																			
MC 214	1																			
TCW 3000 AC	5																			
Add Storage Device																				
Placencia	Health Center	<table border="1"> <tr><td>RCW 50 EQ/CF</td><td>1</td></tr> </table>	RCW 50 EQ/CF	1																
RCW 50 EQ/CF	1																			

Done

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#### 4.1.5.1 Change number of devices

Click on a device to activate the editing window and change the number of devices.

The screenshot shows the HERMES software interface for editing population counts. The main title is "HERMES Edit Model Population Demand Estimates". Below it, the path is "HERMES > Models > MozGaza > Edit Population Counts (Tabular)". The main content area is titled "Edit the Storage Devices at Each Location in the MozGaza Model". It contains a table with columns "Location Name", "Supply Chain Level", and "Inventory". The table lists various storage devices and their current counts. In the "Maputo National Store" row, the "National WICR 4" device has its count changed from 1 to 0. A tooltip message above the table reads: "Please enter in the inventory of storage devices that are to be present at each location in the model. You can change the number of existing devices by clicking on the number and editing. To remove a device, set its number to zero. Finally, if you would like to add a storage device to a location, click the 'Add Storage Device' button and select the device from the dropdown menu." At the bottom right of the interface is a "Done" button.

#### 4.1.5.2 Remove a device

Click on a device to activate the editing window and change the number of devices to zero. Click OK to confirm removing device from that location.

This screenshot shows the same interface as the previous one, but with a confirmation dialog box overlaid. The dialog box asks "Are you sure you would like to remove National WICR 4 from this location?" with "OK" and "Cancel" buttons. The background table shows the storage device inventory with the "National WICR 4" entry now having a value of 0. The rest of the interface remains the same, including the "Done" button at the bottom right.

#### 4.1.5.3 Add a new type of storage device

Click on Add Storage Device. This will activate a dropdown box which you can scroll through to see all devices which are available to add. Hovering over a device type will pop up a window with information about the device.

The screenshot shows the HERMES software interface with the title "HERMES Edit Model Population Demand Estimates". The main area displays a table of storage devices across different locations and supply chain levels. A tooltip is open over the "RCW 42 EK/CF" entry in the "Gaza" row, showing its details:

Name	RCW 42 EK/CF
Make	Dometic/Electrolux
Model	RCW 42 EK/CF
Year	1982
Yearlink	
Net Volume for 2-8C Storage (L)	18.2
Capital Cost of Device	1793.0 in 2012 USD
Usable Lifetime of the Device	8.53
Type of Energy Used	Electric with option for Kerosene
Rate of Energy Usage	1.6 kWh/day
Hold Days with No Power	0.521

Click on the device you wish to choose, then type how many are in inventory into the dialog box and click Ok to confirm adding the device.

The screenshot shows the same interface as the previous one, but with a confirmation dialog box overlaid. The dialog box is titled "Confirming adding st..." and contains the question "How many RCW 42 EK/CF storage devices would you like to add?". A dropdown menu shows the value "1" selected. There are "OK" and "Cancel" buttons at the bottom of the dialog.

## 4.2 Add and modify costs

This page is the starting point for preparing your model to produce detailed cost estimates. If you ask a model to produce cost estimates when it does not have all the information needed to do so, the run will fail.

The screenshot shows the 'HERMES Costs' interface. At the top, there are dropdown menus for 'Showing Costs for' (set to 'MozGaza'), 'Base Currency' (set to 'USD'), 'Base Year' (set to '2014'), 'Inflation Rate' (set to '2'), 'Storage Maintenance' (set to '5'), and 'Vehicle Maintenance' (set to '15'). A checkbox 'Enable microcosting for this model?' is checked. Below these settings, there is a section titled 'Cost Components' with buttons for 'Fuel and Power' (Continue), 'Storage Equipment' (Revisit), 'Vehicles' (Revisit), 'Salaries' (Revisit), 'Per Diem' (Revisit), and 'Buildings' (Revisit). There is also a button 'Calculate vaccine costs?' with a checkbox next to it, and a 'Vaccines' button with a 'Continue' link. On the right side of the interface, there is a 'Check Completeness' button and a 'Done' button at the bottom right. The footer of the page reads 'HERMES Project - Copyright © 2017. All Rights Reserved.'

### 4.2.1 Select model

The model can be selected from the dropdown box at the top of the page labeled **Showing Costs for**. Only models that can safely be changed will be shown here; a model with results cannot be changed because the results would be invalidated. If a model already has results, you will need to either make a copy (Section 3.3) or delete the results (Section 8.3) before the model will be available for selection.

- Un-checking the **Enable microcosting for this model?** checkbox will turn off cost calculations for your model so that it can be run with incomplete cost information.
- **Base Currency** and **Base Year** specify the currency and year in which all costing output will be represented. Any costs or prices in other currencies or years will be converted to the given year as HERMES runs.

- **Inflation Rate** is just the year-over-year rate of inflation for your model. When HERMES converts costs with different base years, this inflation rate is used. This is automatically set at XX but can be adjusted by clicking on the box.
- **Storage Maintenance** gives the maintenance cost for each item of storage (refrigerators, for example) as a percentage of initial purchase cost of the item. The same value applies to solar panels. This is automatically set at industry standard (??) but can be adjusted.
- **Vehicle Maintenance** gives the maintenance cost for each vehicle as a percentage of its fuel cost. For example, in a cost calculation where a given truck burned 100 liters of gasoline at 2 USD per liter, the total fuel cost for the truck would be 200 USD and a maintenance percentage of 5% would indicate an additional 10 USD for vehicle maintenance. This can be adjusted.
- Vaccine purchase costs are normally excluded from cost calculations, but they can be included by selecting the **Calculate vaccine costs?** checkbox. If this option is set, the model will need to have complete costing information for its vaccines.

#### 4.2.2 Check Completeness

Use this button to produce a list of missing model information, if any.

#### 4.2.3 Cost Components

Each button in this section leads to a screen where you can specify the costs associated with the labeling category. The button label describes the completeness of the associated category:

- ‘Begin’ if the category has not been examined for costing,
- ‘Continue’ for a category that is still missing information, and
- ‘Revisit’ when all necessary information has been specified.

##### 4.2.3.1 Fuel and Power

The screenshot shows a web-based application window titled "HERMES - Supply Chain Model". The URL in the address bar is "localhost:8080/bottle\_hermes/cost-edit-fuel". The main title is "HERMES Fuel Costs". Below it, a breadcrumb navigation shows: HERMES > Models > MozGaza > Costs > Fuel. A sub-header says "Showing fuel costs for MozGaza". The main content is a table with columns "Commodity", "Price", and "Per". The table rows are:

Commodity	Price	Per
LPG gas	0.00	USD Kg
Kerosene	0.00	USD Liter
Gasoline	1.29	USD Liter
Diesel	0.00	USD Liter
Electric Mains	0.10	USD Kilowatt Hour
Solar Power	0.00	USD Installed Kilowatt
Ice	0.00	USD Freeze One Liter of Ice
Solar Panel Amortization	10	Years

A "Done" button is visible at the bottom right of the form. At the very bottom of the page, a footer note reads "HERMES Project - Copyright © 2017. All Rights Reserved."

#### 4.2.3.2 Storage Equipment

The screenshot shows the HERMES Storage Device Costs interface. The title bar reads "HERMES Storage Device Costs". The main content area displays a table titled "Cold Storage Costs" showing storage costs for MozGaza. The table includes columns for Name, Base Cost, Currency, Base Cost Year, Years to Amortize, Ongoing, Units, Of, and Details. There are several sections of data, each with a collapse/expand icon:

- ColdBox - 3 Item(s)**: Contains entries for CB 18.7L, CB 20 CF, and CB RCB 444LA.
- ColdRoom - 7 Item(s)**: Contains entries for National WiCR 1 through National WiCR 7.
- Freezer - 2 Item(s)**: Contains entries for SB 302 and TC 883.
- IceLinedRefrigerator - 1 Item(s)**: Contains an entry for MK 304.
- IceLinedRefrigeratorFreezer - 5 Item(s)**: Contains entries for ME 214, ME 215, ME 216, ME 217, and ME 218.

At the bottom right of the table, there is a "Done" button. The footer of the page reads "HERMES Project - Copyright © 2017. All Rights Reserved."

#### 4.2.3.3 Vehicles

The screenshot shows the HERMES Vehicle Costs interface. The title bar reads "HERMES Vehicle Costs". The main content area displays a table titled "Vehicle Costs" showing vehicle costs for MozGaza. The table includes columns for Name, Base Cost, Currency, Base Cost Year, Km To Amortize, Fuel Consumption, Units, Of, and Details. There are several sections of data, each with a collapse/expand icon:

- weekly C8 pickup**
- provincial Hilux**
- bus**
- national cold truck**
- motorbike**
- mobile brigade truck**
- district truck**
- walk**

At the bottom right of the table, there is a "Done" button. The footer of the page reads "HERMES Project - Copyright © 2017. All Rights Reserved."

#### 4.2.3.4 Salaries

The screenshot shows a web-based application interface for managing staff costs. The title bar reads "HERMES - Supply Chain Model" and the URL is "localhost:8080/bottle\_hermes/cost-edit-salary". The main content area is titled "HERMES Staff Costs" and shows a table of staff costs for "MozGaza". The table columns include Name, Base Salary, Currency, Base Salary Year, Fraction EPI, and Details (with Edit, Info, and Del buttons). The table lists various staff roles such as District Driver, District EPI Manager, Health worker, National EPI Administrative Officer, and Provincial Driver, along with their respective salaries and details.

Name	Base Salary	Currency	Base Salary Year	Fraction EPI	Details
District Driver no DLS	1,284.00	USD	2014	0.1	Edit Info Del
District EPI Manager no DLS	4,977.00	USD	2014	0.4	Edit Info Del
District EPI Manager with DLS	4,977.00	USD	2014	0.08	Edit Info Del
District Medical Officer no DLS	11,542.00	USD	2014	0.05	Edit Info Del
District Medical Officer with DLS	11,562.00	USD	2014	0.01	Edit Info Del
Health worker no DLS	2,574.00	USD	2014	0.2	Edit Info Del
Health worker with DLS	2,574.00	USD	2014	0.01	Edit Info Del
National EPI Administrative Officer	3,282.00	USD	2014	0.01	Edit Info Del
National EPI Data Manager	8,845.00	USD	2014	0.02	Edit Info Del
National EPI Logistic Officer	3,606.00	USD	2014	0.05	Edit Info Del
National EPI Logistics Officer	8,845.00	USD	2014	0.06	Edit Info Del
National EPI Manager	10,882.00	USD	2014	0.01	Edit Info Del
"National EPI Officer-Training, Planning, M&E"	8,845.00	USD	2014	0.03	Edit Info Del
National EPI Service Delivery Officer	8,845.00	USD	2014	0.02	Edit Info Del
"National EPI Vaccine, Supply & Quality Officer"	3,282.00	USD	2014	0.06	Edit Info Del
National Secretary	3,330.00	USD	2014	0.01	Edit Info Del
Prov Cold Chain Maintenance Tech	5,688.00	USD	2014	1	Edit Info Del
Prov Driver	1,623.00	USD	2014	1	Edit Info Del

#### 4.2.3.5 Per Diem

The screenshot shows a web-based application interface for managing per diem rates. The title bar reads "HERMES - Supply Chain Model" and the URL is "localhost:8080/bottle\_hermes/cost-edit-perdiem". The main content area is titled "HERMES Per Diem Rates" and shows a table of per diem rates for "MozGaza". The table columns include Name, Base Amount, Currency, Base Amount Year, Must Be Overnight?, Count First Day?, Min Km Home, and Details (with Edit, Info, and Del buttons). The table lists categories like District, Outreach, Province, and No Per Diem, along with their respective base amounts and details. Below the table, there is a section titled "Route Per Diem Rules" which lists route names, suppliers, and per diem types. A checkbox "Mark all unassigned routes as having no per diem?" is present, with a "Yes" button next to it.

Name	Base Amount	Currency	Base Amount Year	Must Be Overnight?	Count First Day?	Min Km Home	Details
District	36.29	USD	2014	false	true	0	Edit Info Del
Outreach	5.65	USD	2014	false	true	0	Edit Info Del
Province	84.68	USD	2014	false	true	0	Edit Info Del
No Per Diem	0.00	USD	2014	false	false	0	Edit Info Del
No Per Diem	0.00	USD	2012	false	false	0	Edit Info Del

View 1 - 5 of 5

Route Per Diem Rules

Route Name	Supplier	Per Diem Type	Details
■ District - 24 Item(s)			
■ Health Center - 78 Item(s)			
■ National - 1 Item(s)			
■ Province - 4 Item(s)			

View 1 - 107 of 107

Click the plus sign next to the level name in the lower table to display the per diem rules assigned to each route at that level.

The screenshot shows the HERMES Per Diem Rates interface. At the top, there's a navigation bar with links like 'Welcome', 'Create', 'Models', 'Results', 'Database', 'Run Status', and 'Help'. Below the navigation is a sub-navigation bar: 'HERMES > Models > MozGaza > Costs > Per Diem Rates'. The main content area has a title 'Showing per diem costs for MozGaza' and a table titled 'Per Diem Rates'. The table columns are: Name, Base Amount, Currency, Base Amount Year, Must Be Overnight?, Count First Day?, Min Km Home, and Details. Data rows include: District (Base Amount: 36.29, Currency: USD, Year: 2014, Overnight: false, Count First Day: true, Min Km Home: 0), Outreach (Base Amount: 5.65, Currency: USD, Year: 2014, Overnight: false, Count First Day: true, Min Km Home: 0), Province (Base Amount: 84.68, Currency: USD, Year: 2014, Overnight: false, Count First Day: true, Min Km Home: 0), No Per Diem (Base Amount: 0.00, Currency: USD, Year: 2014, Overnight: false, Count First Day: false, Min Km Home: 0), and another row for No Per Diem (Base Amount: 0.00, Currency: USD, Year: 2012, Overnight: false, Count First Day: false, Min Km Home: 0). A message at the bottom left says 'Mark all unassigned routes as having no per diem? Yes'. On the right, there's a 'View 1 - 5 of 5' link and a 'Done' button.

#### 4.2.3.6 Buildings

The building costs page will open with each level listed and the number of buildings associated.

The screenshot shows the HERMES Building Costs interface. At the top, there's a navigation bar with links like 'Welcome', 'Create', 'Models', 'Results', 'Database', 'Run Status', and 'Help'. Below the navigation is a sub-navigation bar: 'HERMES > Models > MozGaza > Costs > Building Costs'. The main content area has a title 'Showing building costs for MozGaza' and a table titled 'Building Costs'. The table columns are: ID, Store Name, Level, Cost Per Year, Cost Currency, Cost Base Year, and Details. A message at the bottom left says 'Mark all unassigned locations as having zero building cost per year? Yes'. On the right, there's a 'View 1 - 257 of 257' link and a 'Done' button.

To see the buildings associated with a level, click the plus sign next to the name.

The screenshot shows a web-based application window titled "HERMES - Supply Chain Model". The URL in the address bar is "localhost:8080/bottle\_hermes/cost-edit-building". The main title is "HERMES Building Costs". Below it is a navigation menu with links: Welcome, Create, Models, Results, Database, Run Status, and Help. A language selection dropdown shows "Languages: en\_US". The main content area is titled "Showing building costs for MozGaza". It contains a table with the following columns: ID, Store Name, Level, Cost Per Year, Cost Currency, Cost Base Year, and Details. The table has several sections and rows:

- National - 1 Item(s)**: 100000, Maputo National Store, National, 775.00, USD, 2014
- Province - 2 Item(s)**: 130000, Other Province Stores, Province, 0.00, USD, 2014
- 120000, Gaza, Province, 103.00, USD, 2014
- District - 4 Item(s)**: 120300, Chicualacuala Distrito, District, 103.00, USD, 2014
- 120400, Chigubo Distrito, District, 103.00, USD, 2014
- 120800, Mabalane Distrito, District, 103.00, USD, 2014
- 121000, Massangena Distrito, District, 103.00, USD, 2014
- Health Center - 177 Item(s)**
- Outreach - 73 Item(s)**

At the bottom left of the table, there is a button labeled "Yes" next to the text "Mark all unassigned locations as having zero building cost per year?". At the bottom right, there is a "Done" button and a status message "View 1 - 257 of 257".

#### 4.2.3.7 Calculate vaccine costs? checkbox

Vaccine purchase costs are normally excluded from cost calculations, but they can be included by selecting the **Calculate vaccine costs?** checkbox. If this option is set, the model will need to have complete costing information for its vaccines.

#### 4.2.3.8 Vaccines

The screenshot shows the HERMES Vaccine Costs interface. At the top, there's a navigation bar with links for Welcome, Create, Models, Results, Database, Run Status, and Help. Below the navigation is a breadcrumb trail: HERMES > Models > MozGaza > Costs > Vaccines. A search bar is at the top right. The main content area is titled "Vaccine Costs" and displays a table with the following data:

Name	Cost Per Vial	Currency	Base Cost Year	Details
BCG Serum Institute of India 20 Dose (1.3 cc/dose)		USD		<a href="#">Edit</a> <a href="#">Info</a> <a href="#">Delete</a>
DTP-HepB-Hib Serum Institute of India 10 Dose (2.6 cc/dose)		USD		<a href="#">Edit</a> <a href="#">Info</a> <a href="#">Delete</a>
M Serum Institute of India 10 Dose (2.61 cc/dose)		USD		<a href="#">Edit</a> <a href="#">Info</a> <a href="#">Delete</a>
OPV WHO 10 Dose (2 cc/dose)		USD		<a href="#">Edit</a> <a href="#">Info</a> <a href="#">Delete</a>
PCV10 GSK 2 Dose (4.8 cc/dose)		USD		<a href="#">Edit</a> <a href="#">Info</a> <a href="#">Delete</a>
TT Serum Institute of India 10 Dose (2.61 cc/dose)		USD		<a href="#">Edit</a> <a href="#">Info</a> <a href="#">Delete</a>

At the bottom right of the table area, there are buttons for "View 1 - 6 of 6" and "Done".

This model has no costs associated with its vaccines. Click Edit on a vaccine row to bring up the dialog box for editing. Click Save to enter values into model without closing the dialog box. You can use the arrows to navigate between the vaccines; the selected vaccine will be highlighted dark blue in the table. Click Done to exit the dialog box (will not save any values that are entered).

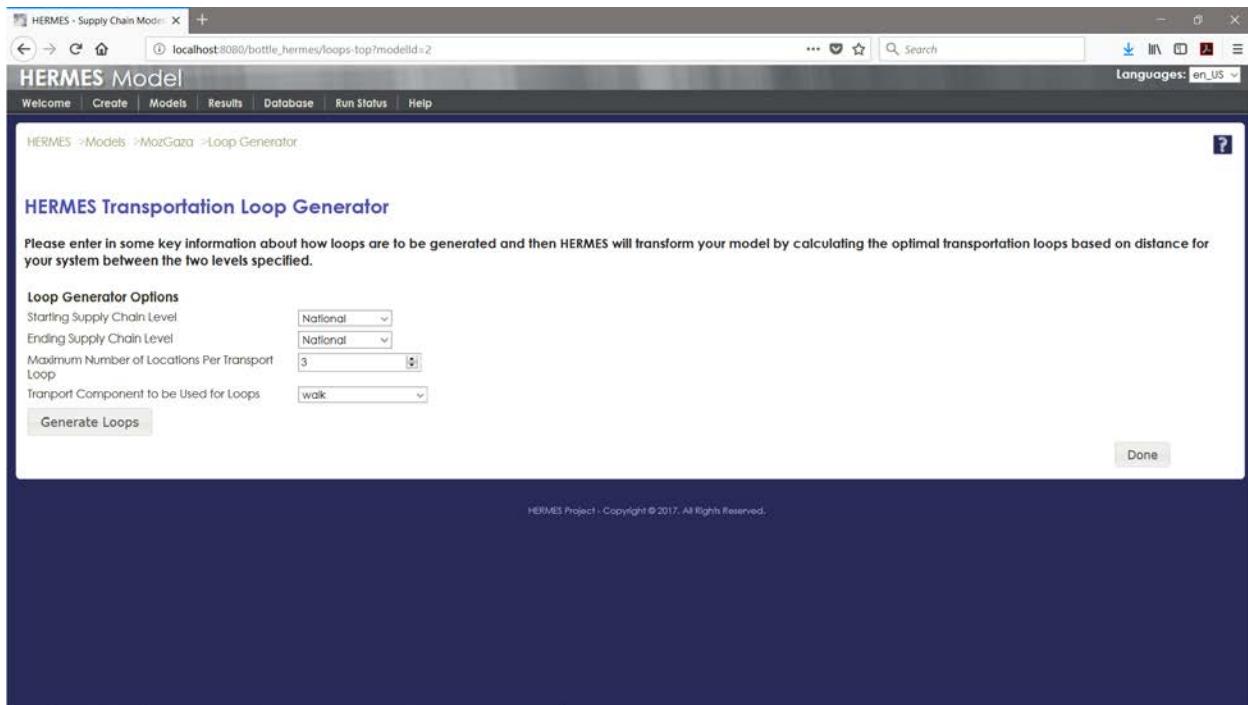
The screenshot shows the same interface as above, but with a modal dialog box open over the "BCG - 1 Item(s)" row. The dialog is titled "Edit Cost Information for BCG Serum Institute of India 20 Dose (1.3 cc/dose)". It contains three input fields: "Cost Per Vial" (with a value of "1.3"), "Currency" (set to "USD"), and "Base Cost Year" (set to "2017"). At the bottom of the dialog are "Save" and "Done" buttons.

## 4.3 Transform the system with automatically created transport loops

The HERMES Transportation Loop Generator calculates optimal transportation loops for locations in a model.

This feature is under development and currently only supports loops between two adjacent supply chain levels. The loop generator requires an internet connection.

After clicking on “Transform the system with automatically created transport loops,” the following page should appear:



### 4.3.1 Starting and Ending Supply Chain Levels

Select adjacent levels (displayed on lines next to each other). If you want to use starting and ending levels that are not adjacent, you will have to delete the intervening levels in the model first. See the [HERMES Tutorials PDF](#) for the tutorial called [Removing a Level from the Supply Chain](#) for more information on how to proceed.

### 4.3.2 Maximum Number of Locations Per Transport Loop

Set this number to limit how many locations will be visited in one loop before returning to the supplier.

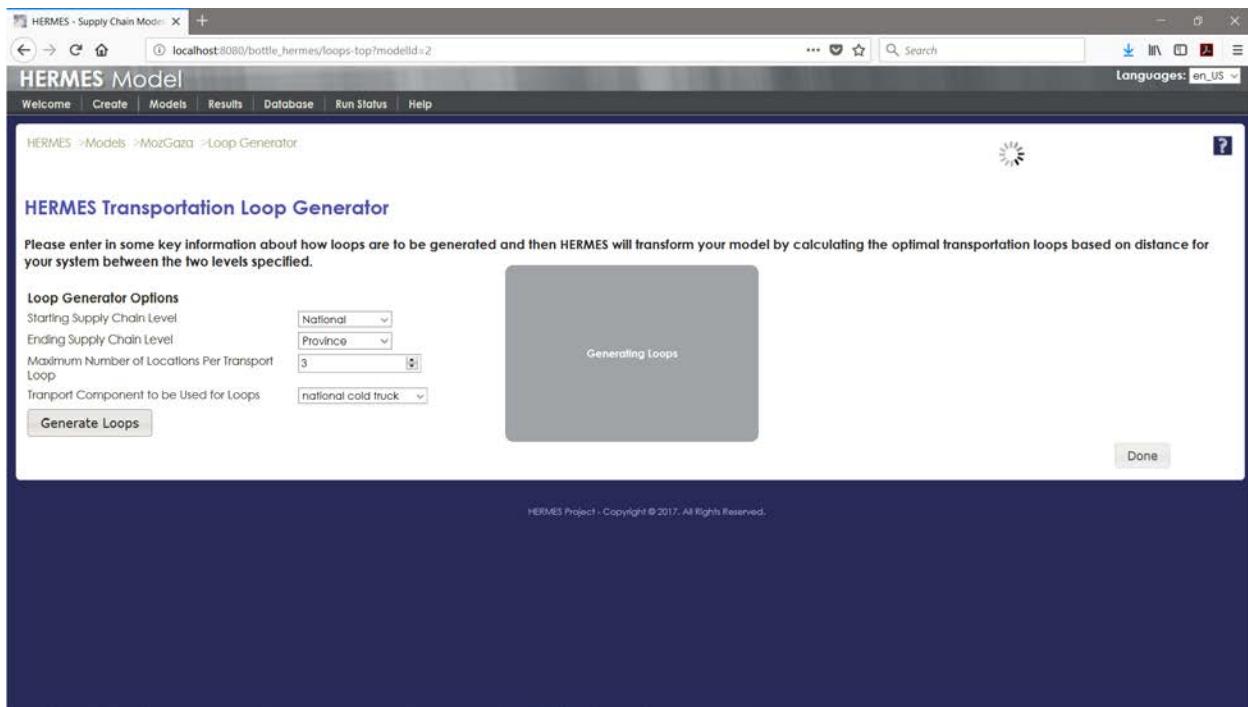
### 4.3.3 Transport Component to be Used for Loops

Choose the method of transportation that will be used to calculate loop functionality. All transportation components in the model are available.

#### 4.3.4 Click “Generate Loops”

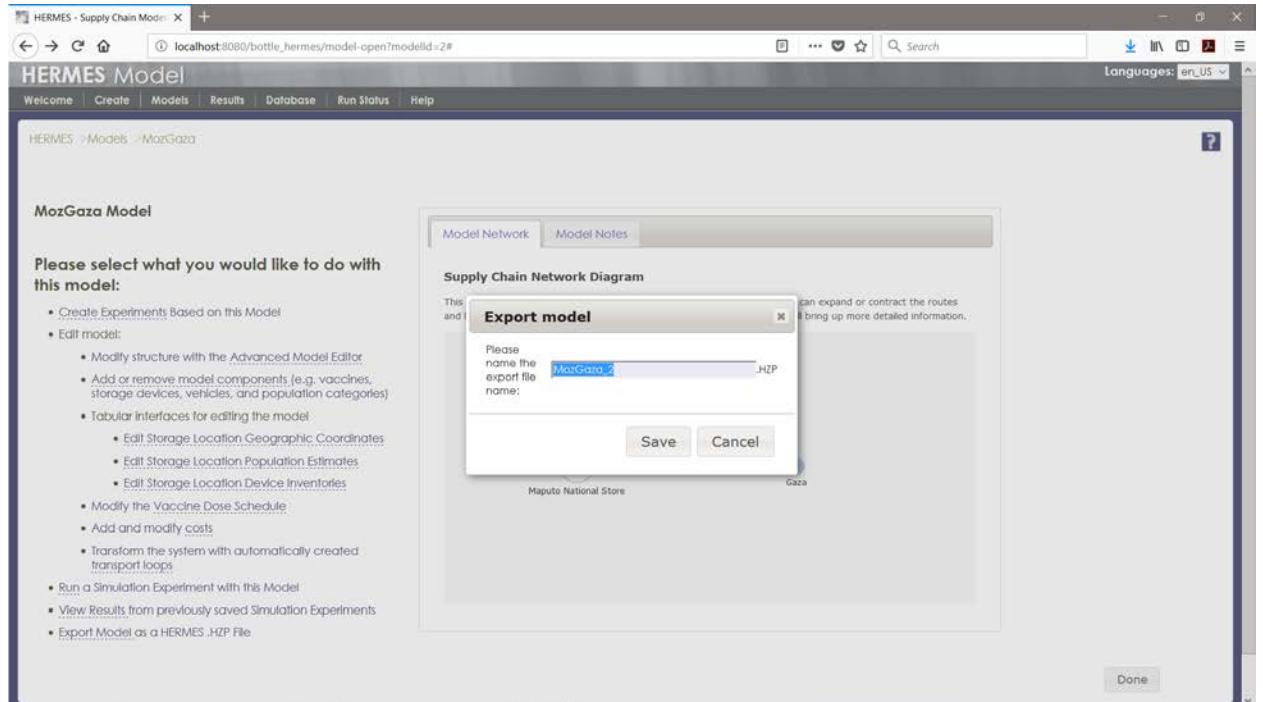
“Generate Loops” button is at bottom left under the drop down menus. “Done” button on bottom right will not generate loops but will return you to the Available Models page.

This requires an internet connection to complete and may take some time depending on the number of locations in the model, during which a “Generating Loops” message will appear.

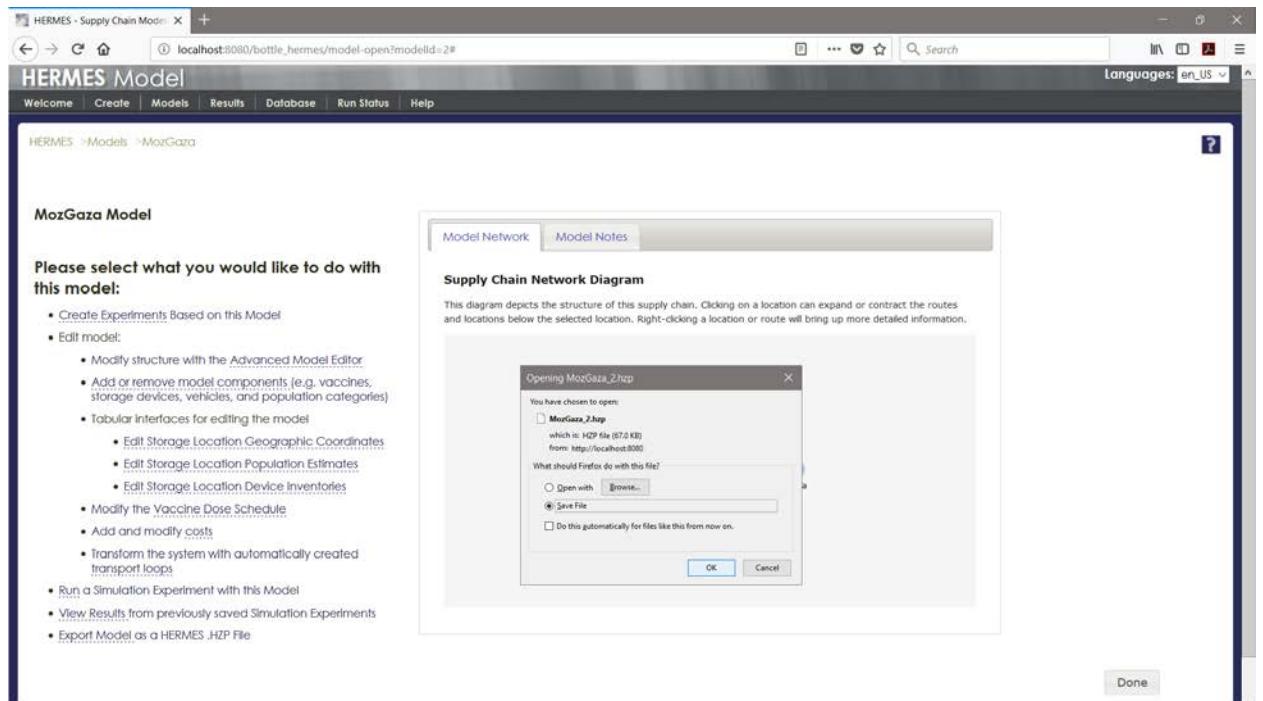


## 4.4 Export Model as a HERMES Zip File

1. Open the Model page (Section 2.6).
2. Click “Export Model as a HERMES Zip File”
3. In the dialogue box that appears, the filename will be automatically entered as the model name and a differentiating number. Edit this if you want and then click “Save.”



- Choose Save File from download dialogue box and then click the OK button. The file will be saved to your Downloads folder or wherever you have told your operating system to save downloaded files.

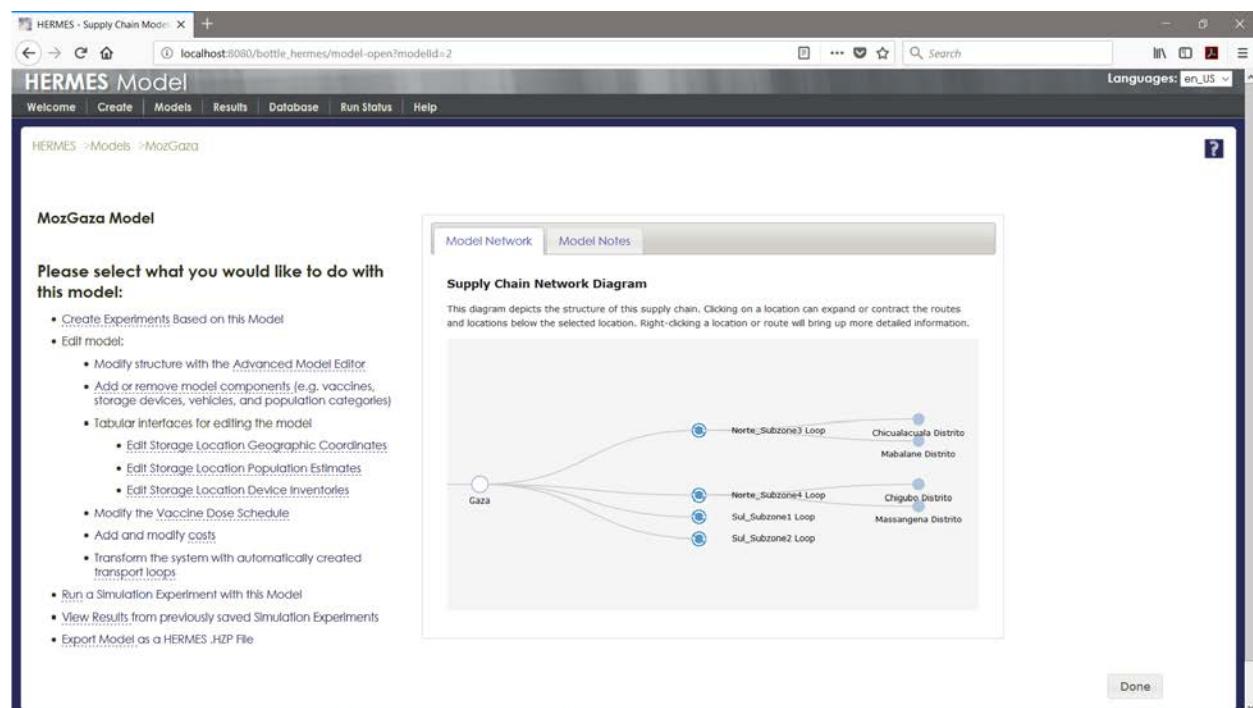


## 4.5 Explore the supply chain via the supply chain network diagram

The dynamic diagram on the right allows you to explore the structure of the model.

### 4.5.1 Open and Close Locations

Left-click on a circle to expand the diagram and see which locations it supplies. Left-click again to collapse the network below that point.



A white circle indicates that the location has already been expanded (see Chicualacuala Distrito below) or that the location does not supply any others (see Chidulo below).

A solid blue circle means that the location can be expanded to show the levels below it in the supply chain.

Transport loops (where several locations are supplied before returning to the route origin) are shown by solid blue circles with white arrows.

HERMES - Supply Chain Model x +

localhost:8080/bottle\_hermes/model-open?modelId=2

... Search Languages: en\_US

## HERMES Model

- Welcome
- Create
- Models
- Results
- Database
- Run Status
- Help

HERMES > Models > MozGaza

### MozGaza Model

Please select what you would like to do with this model:

- Create Experiments Based on this Model
- Edit model:
  - Modify structure with the Advanced Model Editor
  - Add or remove model components (e.g. vaccines, storage devices, vehicles, and population categories)
  - Tabular Interfaces for editing the model
    - Edit Storage Location Geographic Coordinates
    - Edit Storage Location Population Estimates
    - Edit Storage Location Device Inventories
  - Modify the Vaccine Dose Schedule
  - Add and modify costs
  - Transform the system with automatically created transport loops
- Run a Simulation Experiment with this Model
- View Results from previously saved Simulation Experiments
- Export Model as a HERMES .HZP File

Model Network Model Notes

#### Supply Chain Network Diagram

This diagram depicts the structure of this supply chain. Clicking on a location can expand or contract the routes and locations below the selected location. Right-clicking a location or route will bring up more detailed information.

Done

#### 4.5.2 Obtain Item Information

Right-click on a location (circle) or a route (line) or a loop (circle with white arrows inside) to obtain more detailed information about the item.

Location info (after right clicking on Chicualacuala Distrito)

HERMES - Supply Chain Model x +

localhost:8080/bottle\_hermes/model-open?modelId=2

... Search Languages: en\_US

## HERMES Model

- Welcome
- Create
- Models
- Results
- Database
- Run Status
- Help

HERMES > Models > MozGaza

### MozGaza Model

Please select what you would like to do with this model:

- Create Experiments Based on this Model
- Edit model:
  - Modify structure with the Advanced Model Editor
  - Add or remove model components (e.g. vaccines, storage devices, vehicles, and population categories)
  - Tabular Interfaces for editing the model
    - Edit Storage Location Geographic Coordinates
    - Edit Storage Location Population Estimates
    - Edit Storage Location Device Inventories
  - Modify the Vaccine Dose Schedule
  - Add and modify costs
  - Transform the system with automatically created transport loops
- Run a Simulation Experiment with this Model
- View Results from previously saved Simulation Experiments
- Export Model as a HERMES .HZP File

Model Network Model Notes

#### Supply Chain Network Diagram

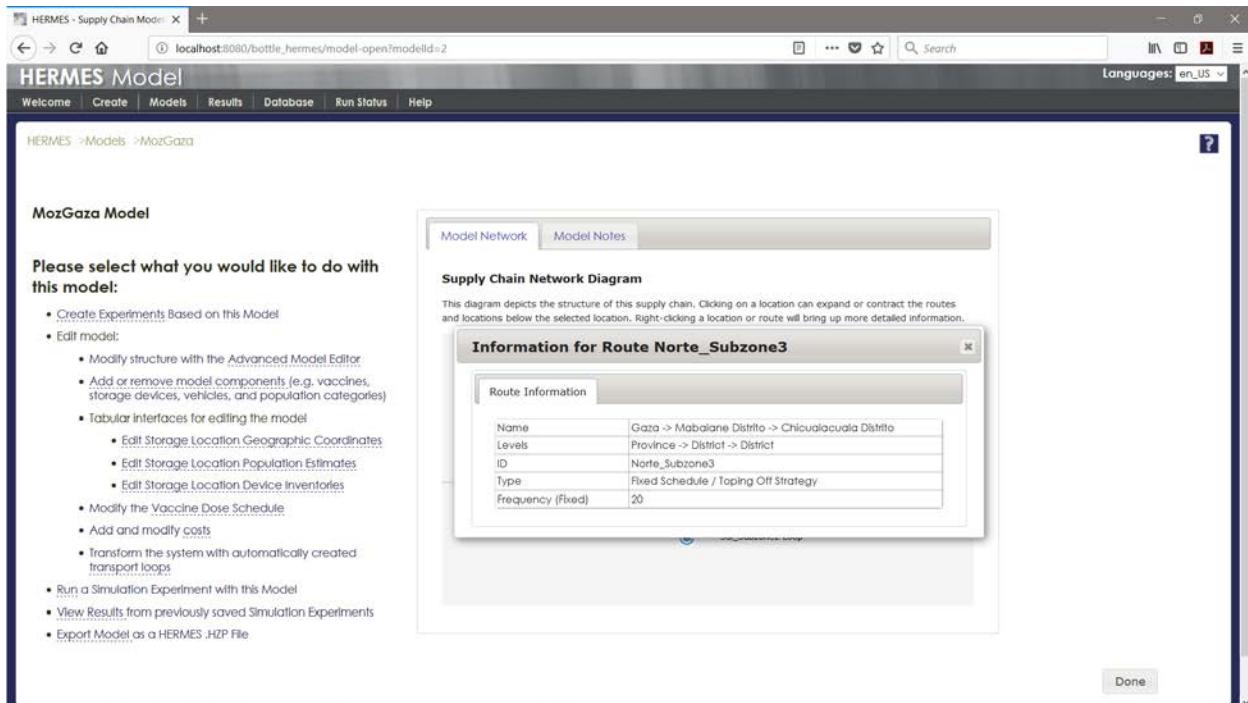
This diagram depicts the structure of this supply chain. Clicking on a location can expand or contract the routes and locations below the selected location. Right-clicking a location or route will bring up more detailed information.

Information for Location Chicualacuala Distrito(120300)

General Info	Population Information	Storage Devices	Transport Devices
Name	Chicualacuala Distrito		
ID	120300		
Level	District		
Latitude	-22.0775		
Longitude	31.6783		

Done

## Route/Loop info (after right clicking on Norte\_Subzone3 loop)



### 4.5.3 Navigate diagram

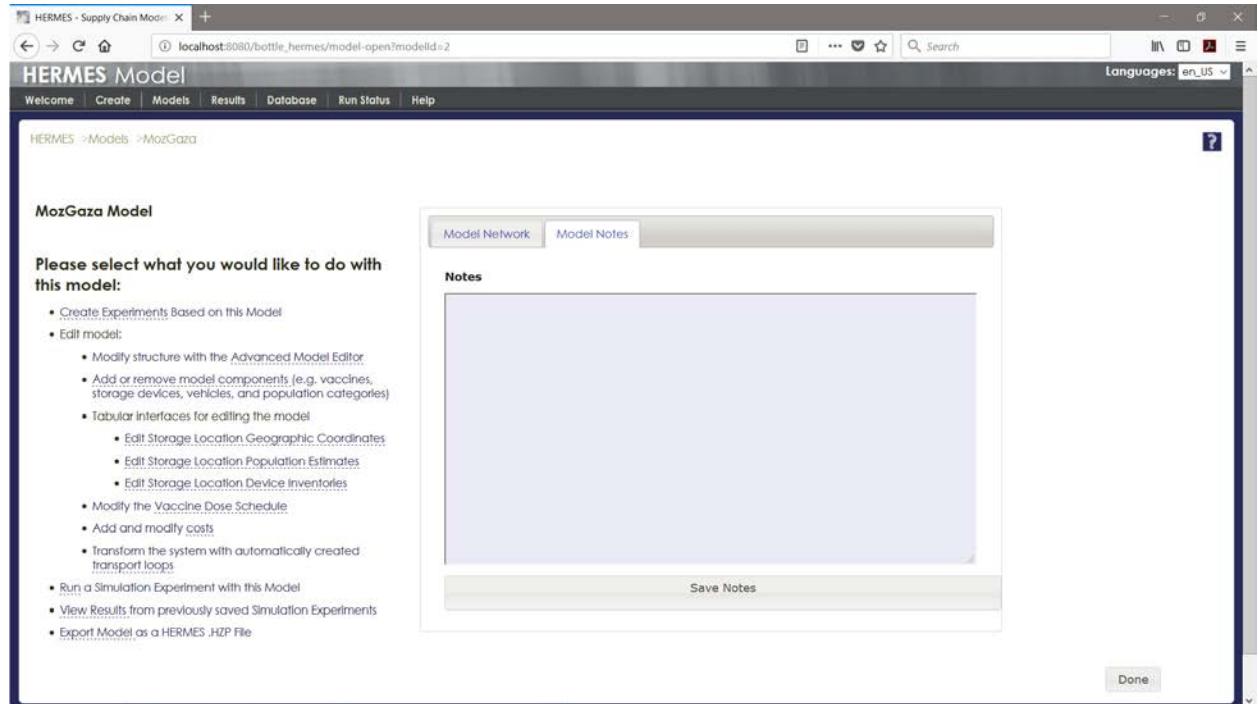
If you are unable to see a part of the supply chain network, click and hold on any blank space in the diagram and drag to reposition the network until the section you are interested in is available.

Zoom in and out using the scrollwheel on a mouse or zooming gestures on a trackpad while within the diagram.

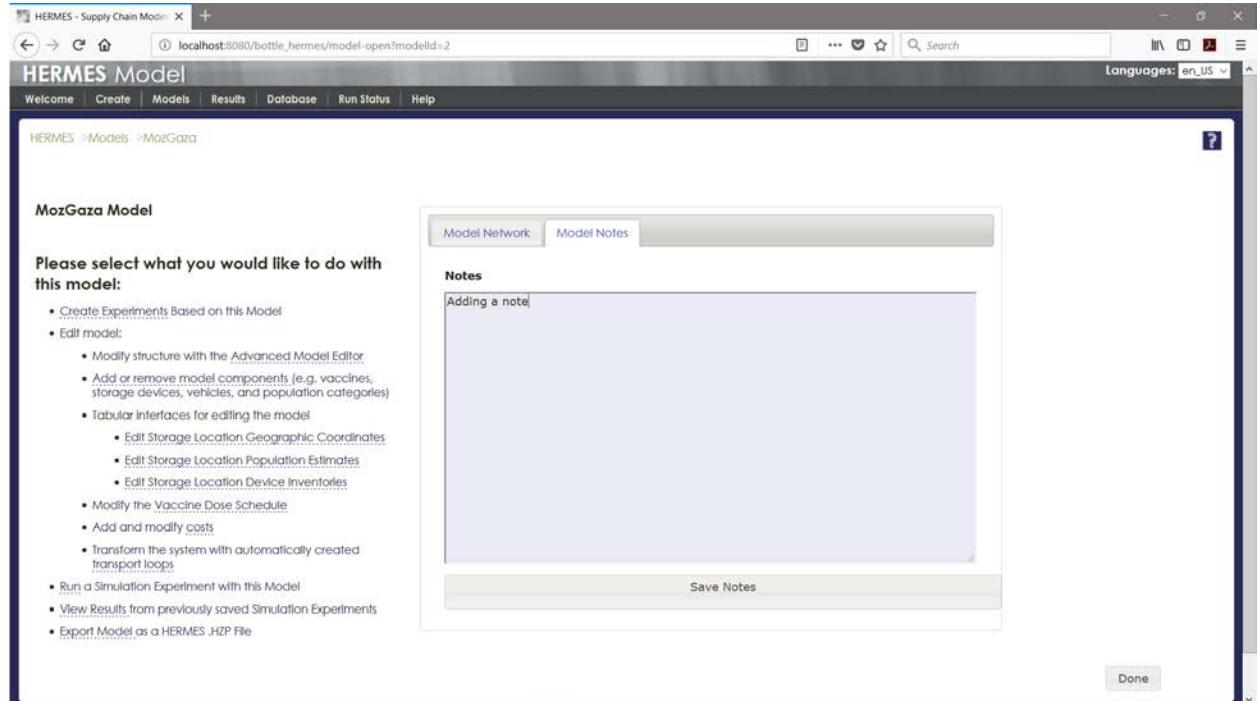
## 4.6 Add notes to the model

These notes will be visible in the Notes column of the Available Models page.

1. Click on Model Notes tab next to Model Network in window to right.



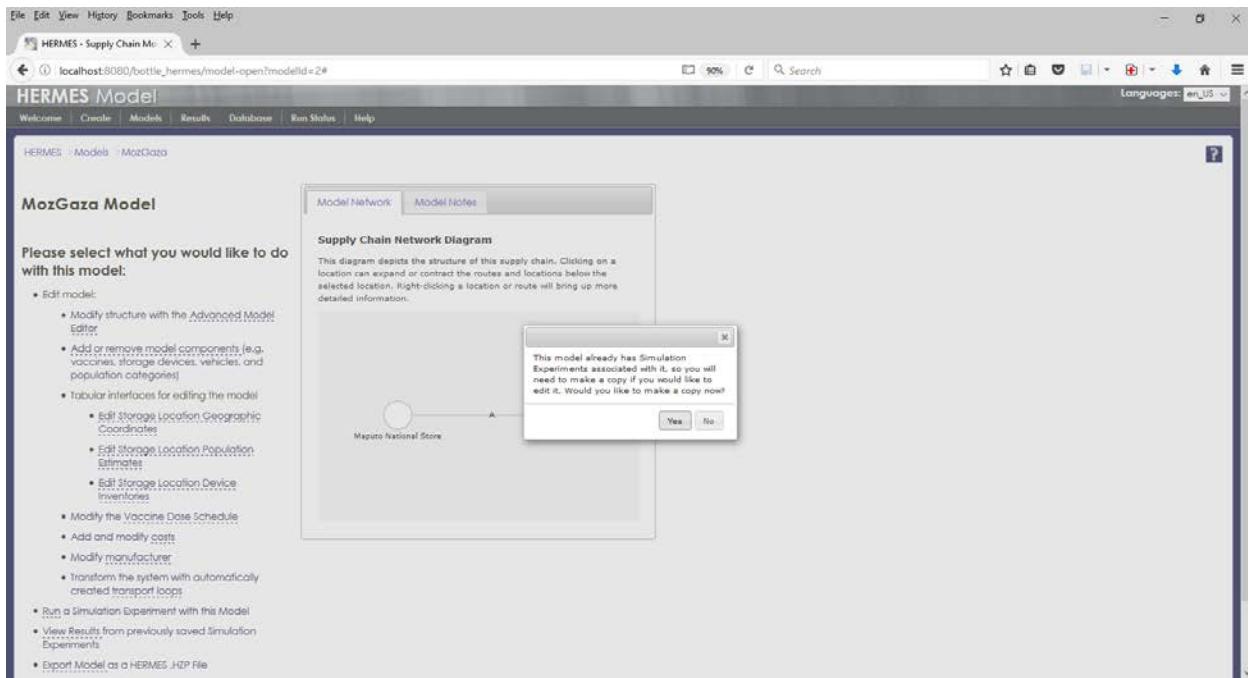
2. Type any notes you wish to make in the blue window labeled Notes.



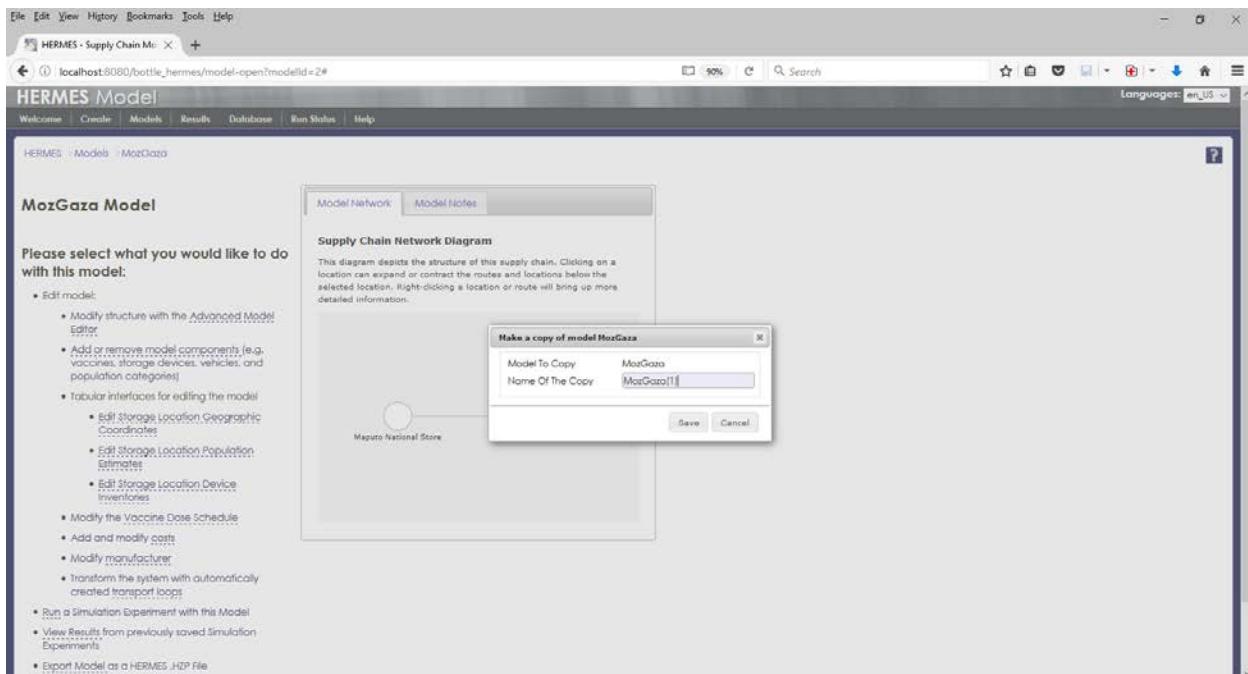
3. Click "Save Notes" at bottom of window.

## 4.7 Add or Remove Model Components

Review Section 3.1.5 for details on making changes to model components. If you try to make component changes to a model for which you have already run simulations, you will get a window warning you of this and asking if you want to make a copy. Either agree to make a copy and proceed to make model changes from there or cancel and choose another model &/or action.



If you choose Yes, you will be asked for a name for the copy.

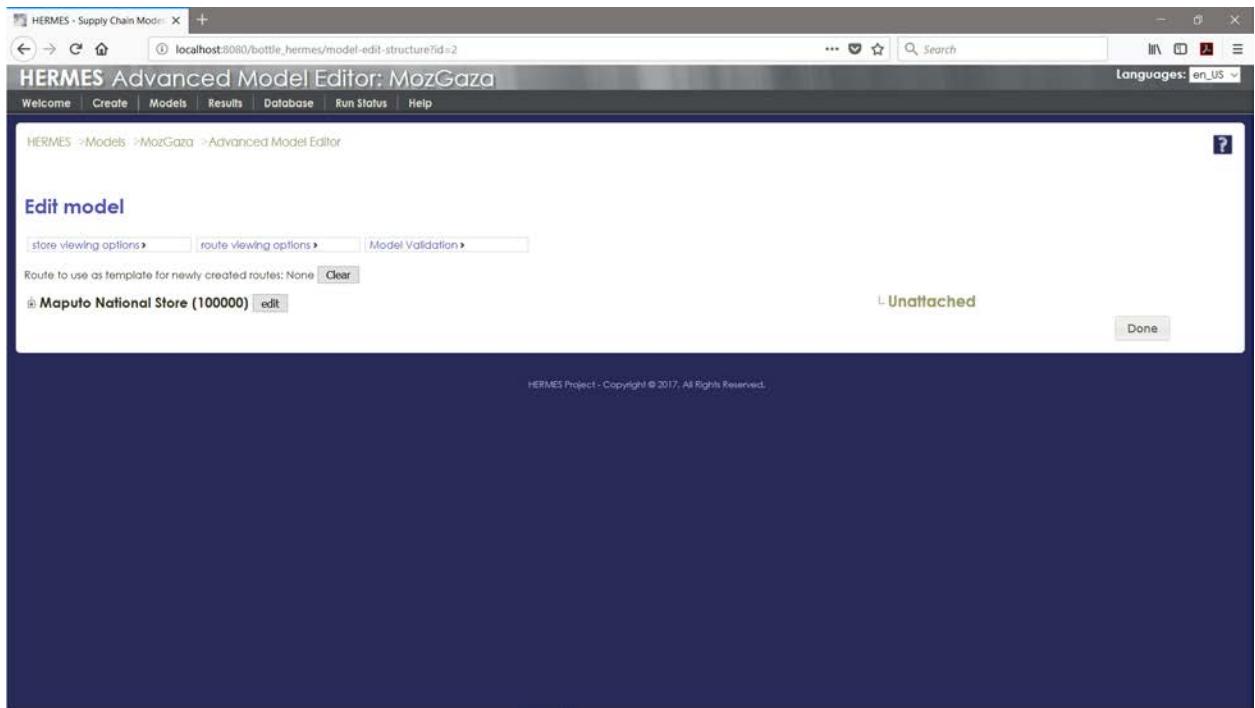


After clicking Save, the new copy will be opened up on the same page for you to work with. It will also be available from the Models page.

## 5 Advanced Model Editor

### 5.1 Open the Advanced Model Editor Page

1. Open the Model page (Section 2.6).
2. Click on “Modify Structure with the Advanced Model Editor.” You should see the following.

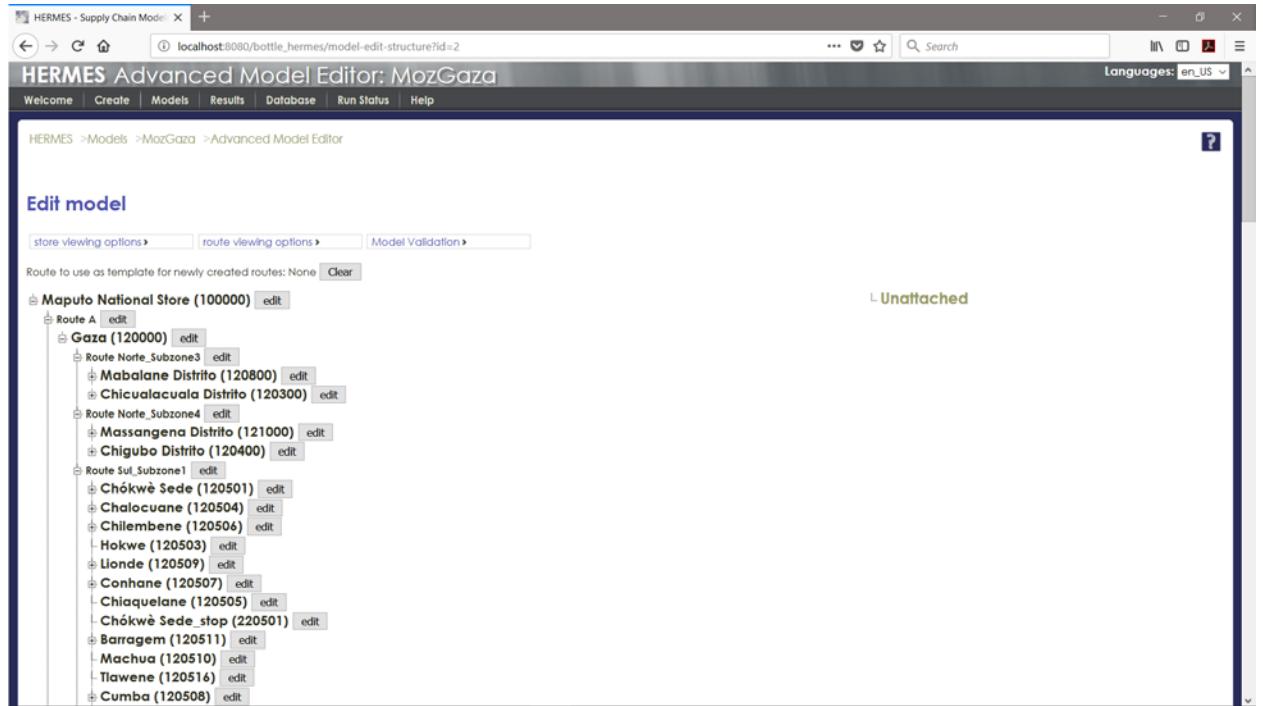


### 5.2 Using the Editor

The Advanced Model Editor offers quick access to modify specific stores and routes.

#### 5.2.1 Navigating the Editor

1. Click the "+" next to any location to view the routes and locations directly below it. The image below is after clicking first on the "+" next to Maputo National Store and then on the one next to Gaza.



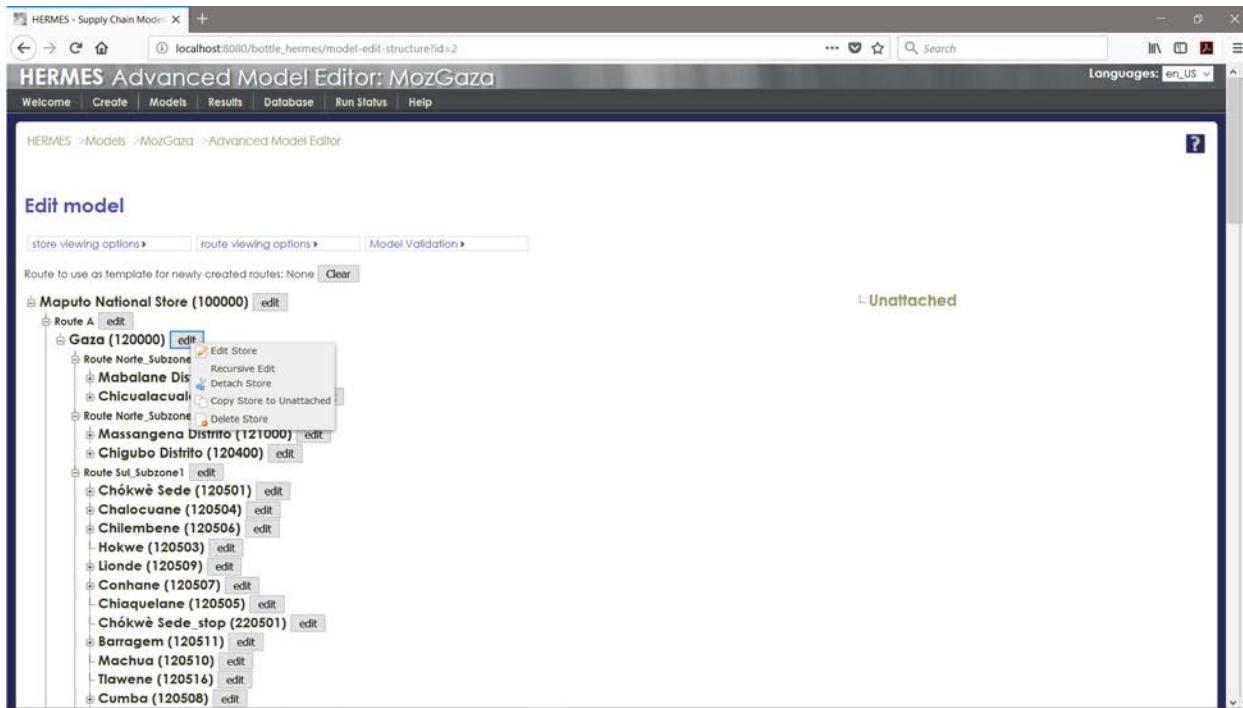
If there are many subsidiary locations, the page may take a few seconds to refresh.

2. Click the "-" next to a location to collapse all routes and locations directly below it.

### 5.2.2 Using the edit buttons

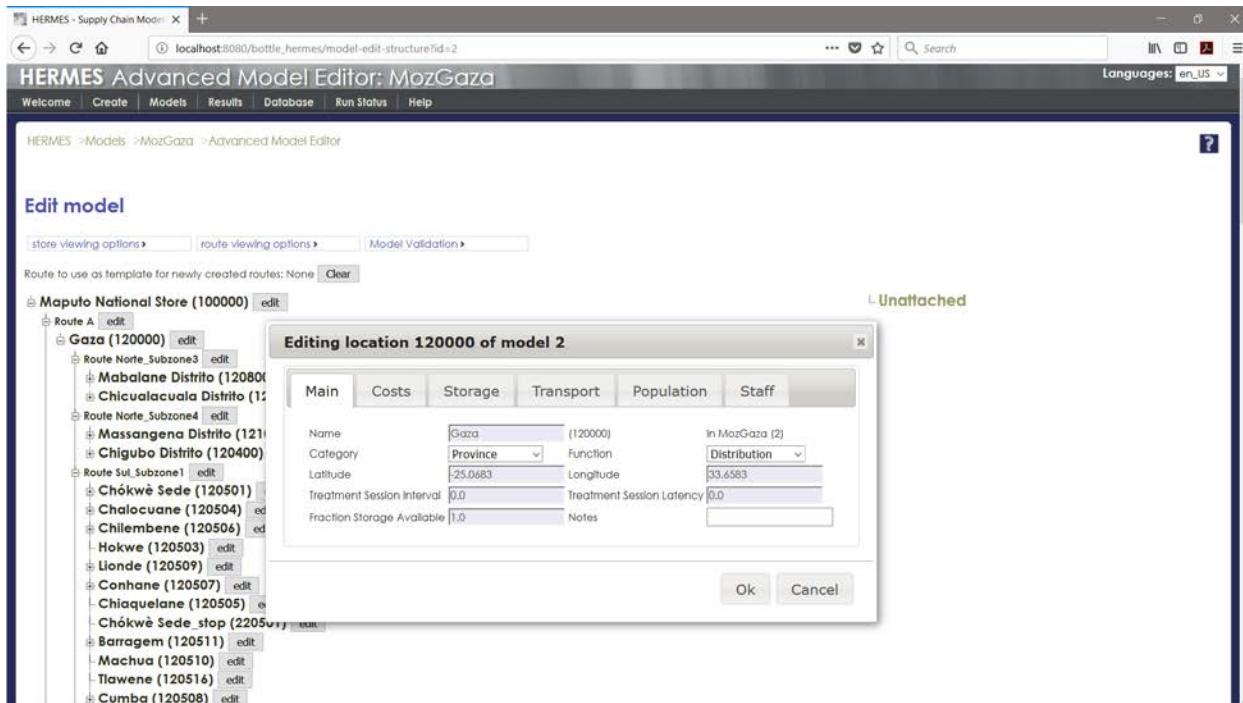
The "edit" buttons located to the right of each store location and route allow you to manipulate the store or route as a unit.

### 5.2.2.1 Edit button options for store locations



#### 5.2.2.1.1 Edit Store

Choosing Edit Store allows you to edit all the information associated with that store, organized by tabs for the following categories: main, costs, storage, transport, population, and staff.



Click on each tab to access the editable information for that location.

When finished, click "Ok" to save changes or "Cancel" to discard them.

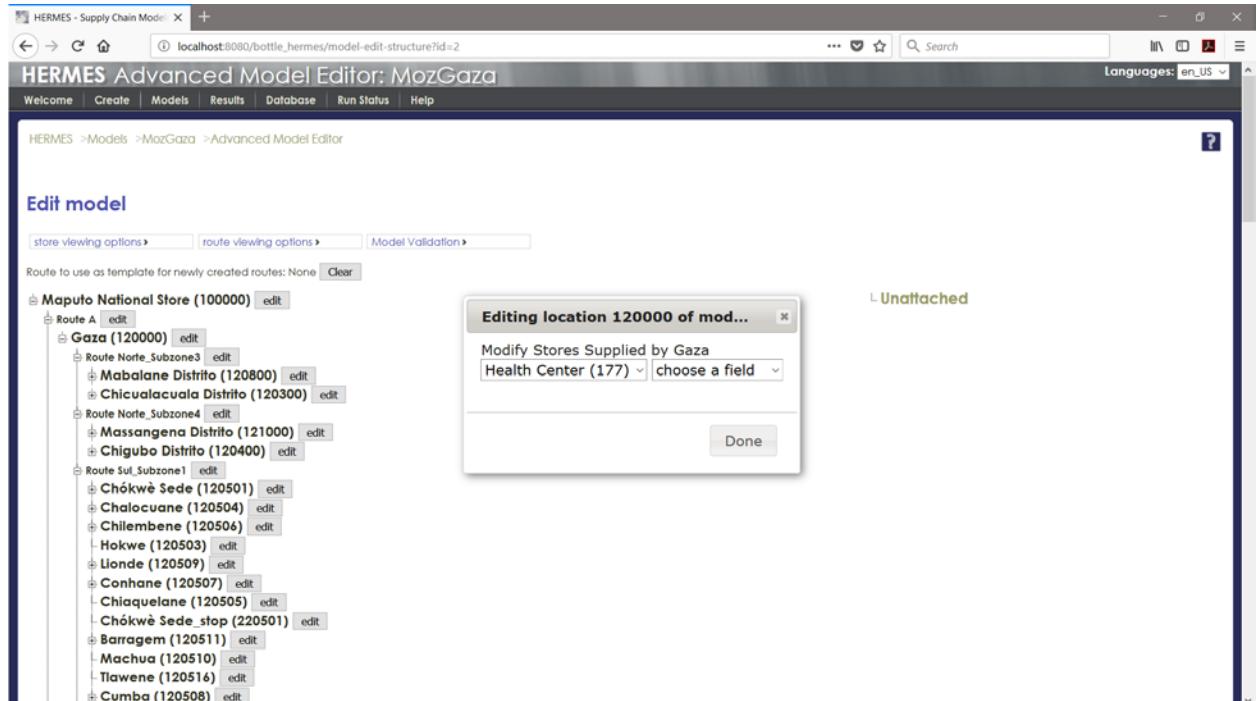
#### 5.2.2.1.2 Recursive Edit

Recursive edits apply to all locations at a specified level below a selected location in the network.

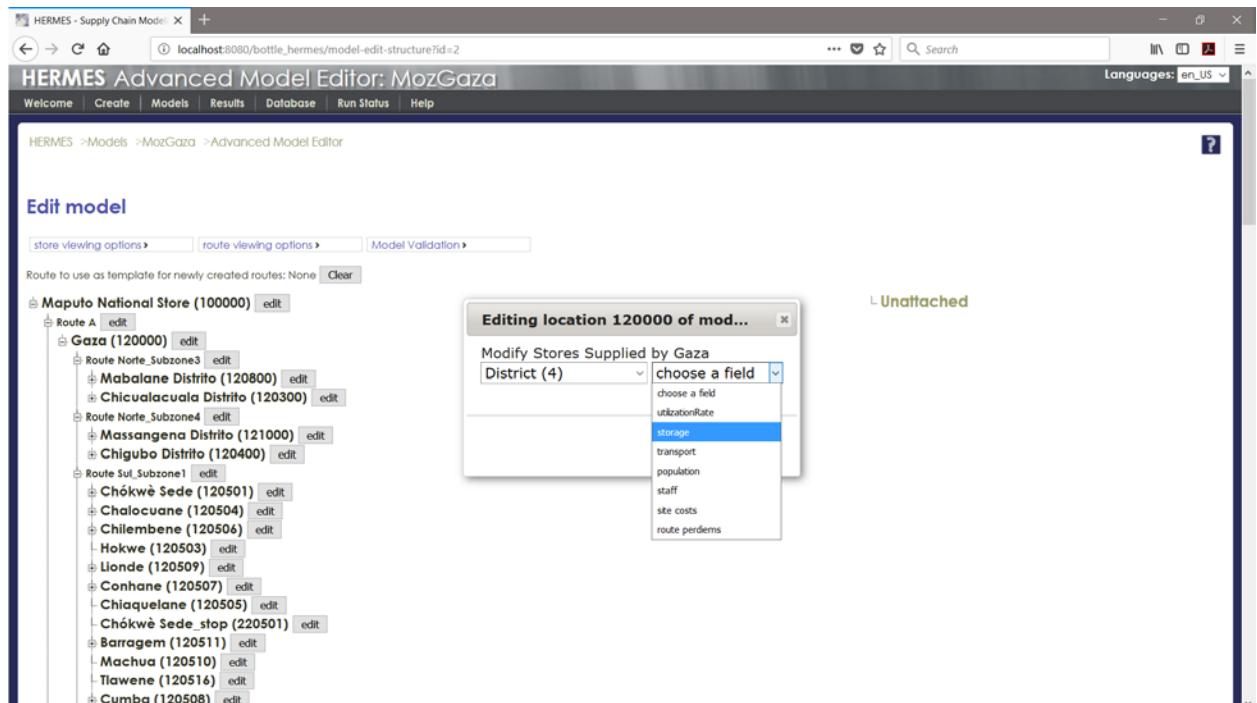
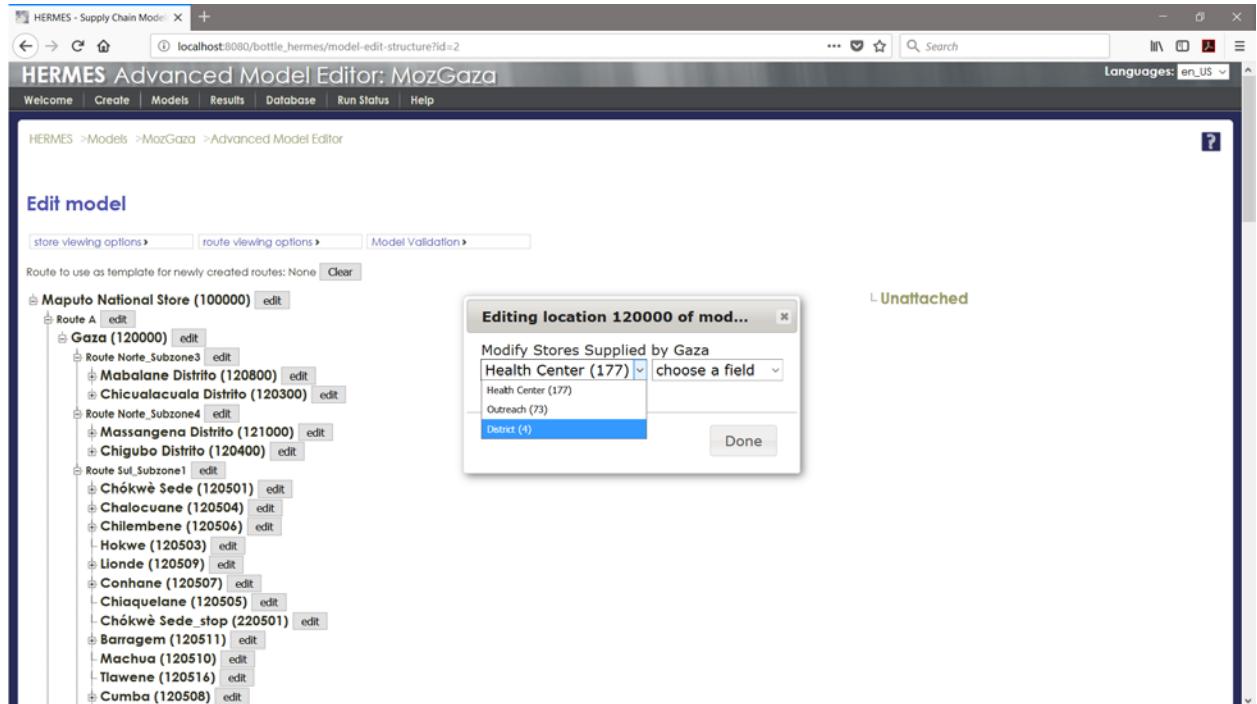
Click "edit" next to a location and select "Recursive Edit." In the dialog that appears, select the level of stores which will be edited and the field that will be edited. The types of actions that you can perform are Add, Scale (round up), Scale (round down), Replace with, and Clear All.

For example, to add one fridge to each District store in the Gaza Region:

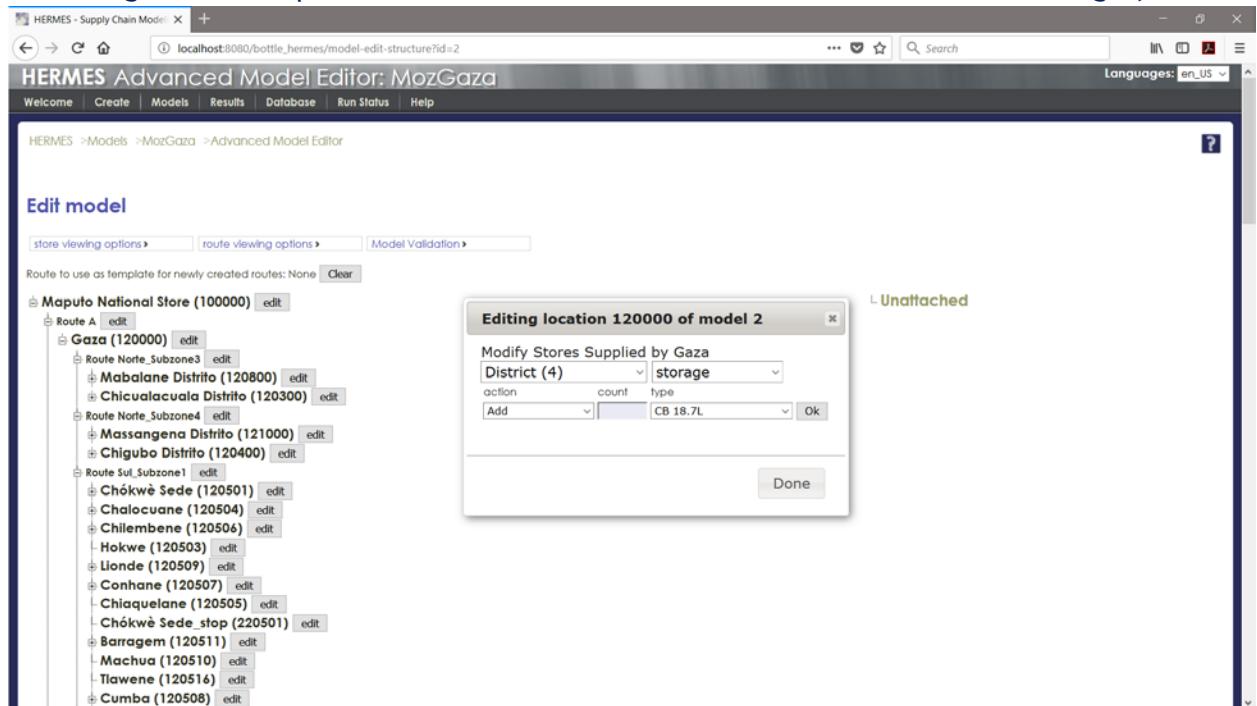
1. Click "edit" next to Gaza and select "Recursive Edit."



2. Choose “District” from the left dropdown box and “storage” from the right.



3. The dialogue box will update with the editable fields and actions available to that category.



4. Select “Add” from action dropdown list, type 1 in the count entry box to indicate 1 new fridge per location, and then select the type of fridge that will be added.  
 5. Click “Ok” (not “Done”) to process the edit.

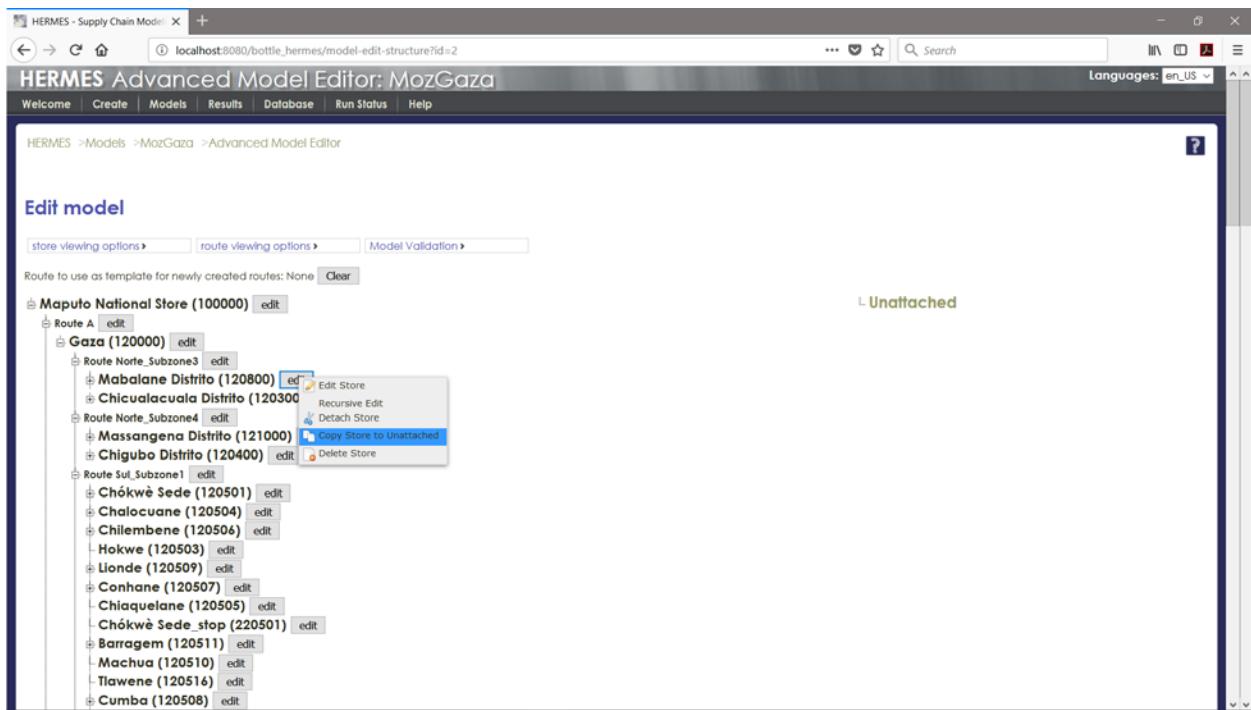
#### 5.2.2.1.3 Detach Store

Choose “detach store” to **move** the location to the Unattached area. Once moved, it will not be part of the model unless it is reattached.

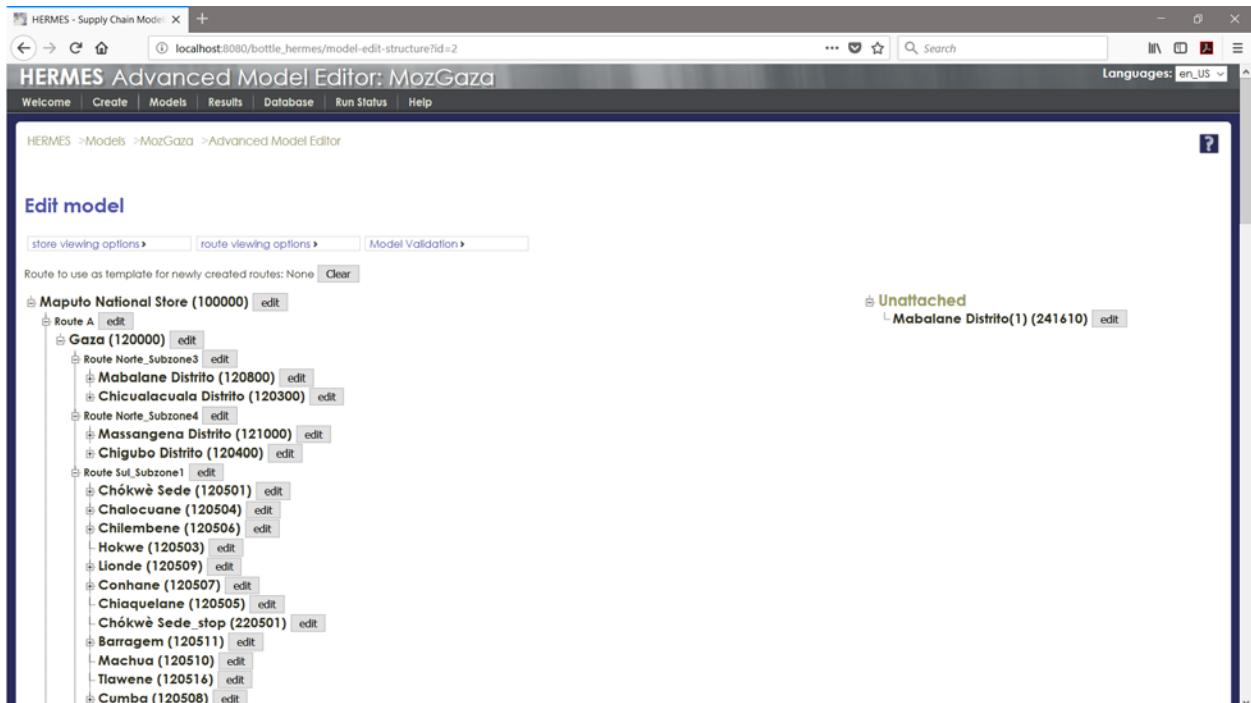
This action can also be performed by dragging the location to the area on the right of the screen labeled “Unattached.”

#### 5.2.2.1.4 Copy Store to Unattached

Choose “copy store” to **copy** the location to the Unattached area. The original location is still included in the model, so you can alter the copy before choosing where or whether to reattach a new location.



In the picture below, you can see that Mabalane Distrito is still in the hierarchy on the left, while Mabalane Distrito (1) is available on the Unattached side. Subsequent copies would be labeled (2), (3), etc.

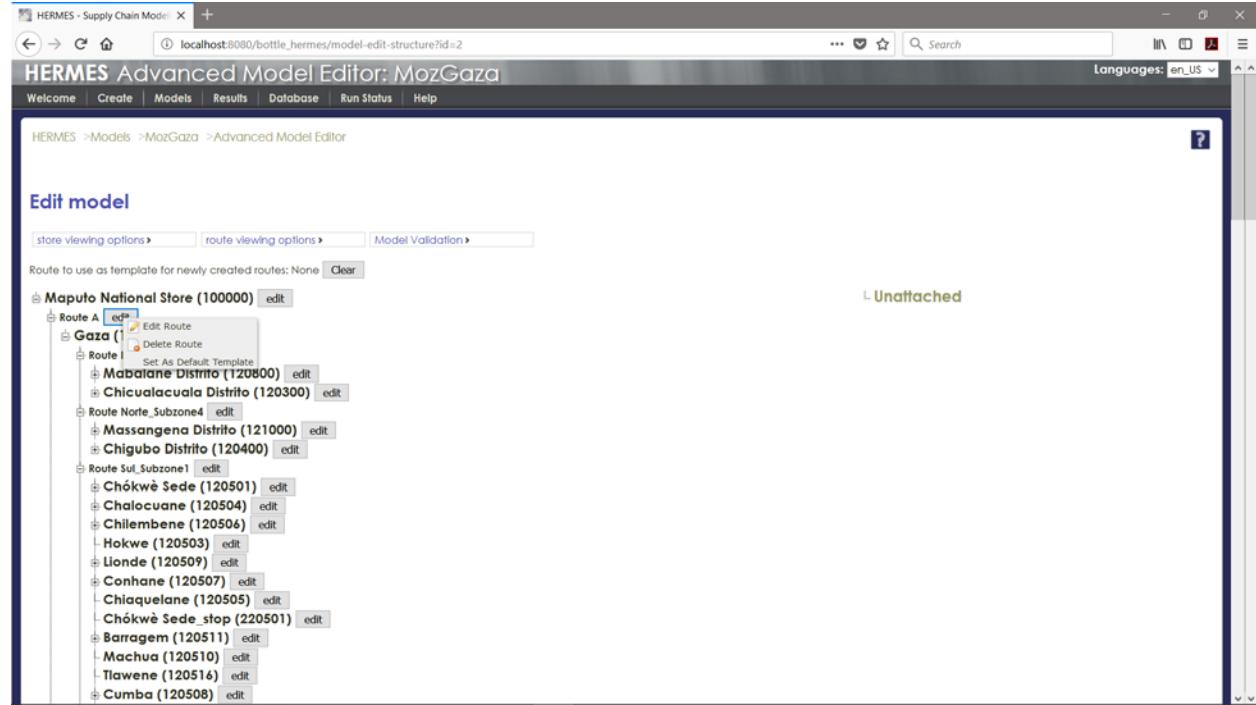


#### 5.2.2.1.5 Delete Store

Use “Delete Store” to remove store from the model. Deleting a location will also remove all locations that are supplied by the deleted location. **This action is irreversible.** If you are unsure

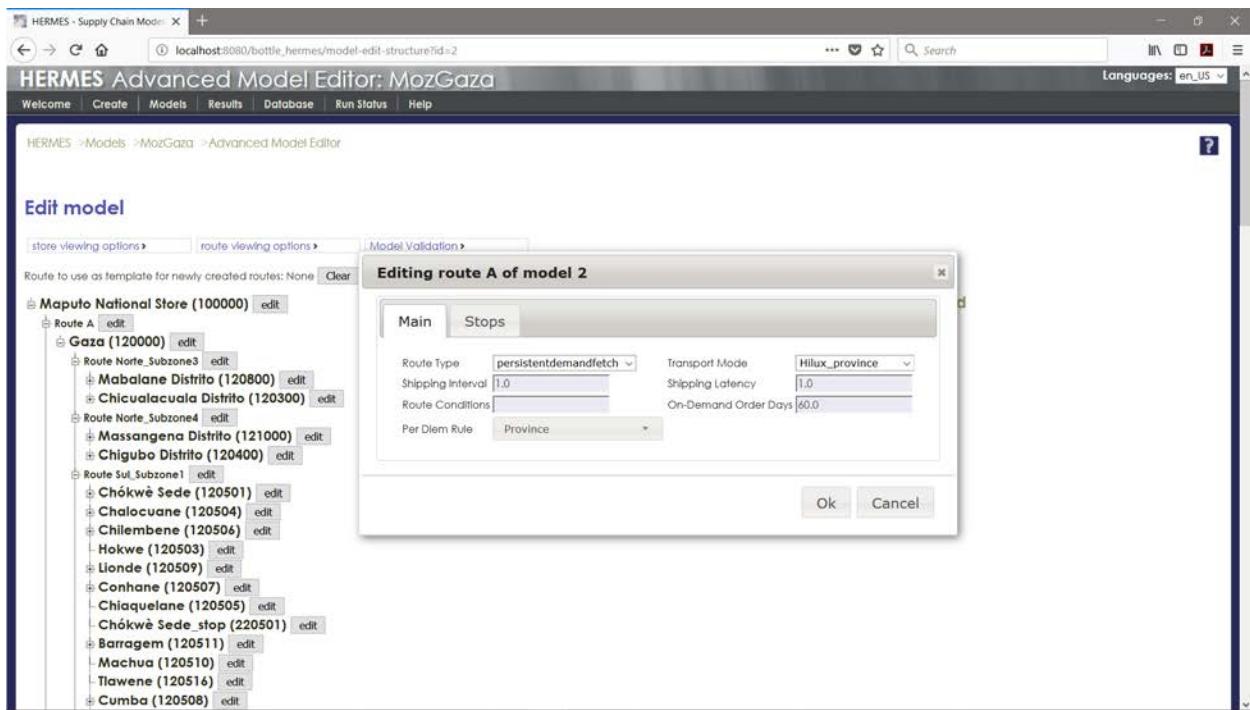
whether you want to completely remove the location from the model, it is recommended that you first detach the store (Section 5.2.2.1.3) and delete it from there once you are sure none of its information is required.

### 5.2.2.2 “Edit” button options for routes



#### 5.2.2.2.1 Edit Route

Choosing Edit Route allows you to edit all the information associated with that route, with a main tab as well as a tab for stops.



HERMES has six basic route types defined by three parameters: how frequently shipments occur, how order quantities are determined, and whether vaccines are shipped from the supplier or picked up by the recipient. These three parameters are described in Section 3.1.2, and the six resulting route types are displayed in the table below.

Route Type	Shipping Schedule	Shipping Quantity	Delivery vs. Pick Up
<b>Basic Routes</b>			
<b>push</b>	fixed	fixed	supplier delivers
<b>schedfetch</b>	fixed	fixed	recipient picks up
<b>varpush</b>	fixed	variable (based on demand)	supplier delivers
<b>schedvarfetch</b>	fixed	variable (based on demand)	recipient picks up
<b>pull</b>	variable (extra trips as needed)	variable (based on demand)	supplier delivers
<b>demandfetch</b>	variable (extra trips as needed)	variable (based on demand)	recipient picks up
<b>Special Cases</b>			
<b>persistentpull</b>	unlimited	variable	supplier delivers
<b>persistentdemandfetch</b>	unlimited	variable	recipient picks up
<b>askingpush</b>	fixed	variable (based on demand)	supplier delivers
<b>dropandcollect</b>	fixed	variable	supplier delivers

		(based on demand)	
<b>attached</b>	N/A	N/A	N/A

A route of type **push** or **schedfetch** will attempt to ship the same quantities of vaccines in each shipment (the amount may be less if the supplying location has insufficient stock or if supply chain bottlenecks prevent the full amount from being delivered). In all other HERMES route types, the quantities of vaccines sent in each shipment is based on anticipated demand (this policy is more common).

Shipments on **push**, **schedfetch**, **varpush**, and **schedvarfetch** routes occur at fixed intervals, as defined by the Shipping Interval (the number of days between each shipment), regardless of stock levels at the receiving location (or locations, in the case of distribution loops that deliver vaccines to more than one recipient before the vehicle returns to the supplier). Because HERMES assumes 28-day months, the Shipping Interval on a fixed-schedule route would be 28 for monthly shipments, 84 for quarterly shipments, or 14 for shipments occurring twice per month, for example.

**Pull** or **demandfetch** routes allow extra shipments to take place as needed, with some limit to how often trips can occur. An extra trip is needed when stock levels for any vaccine at the receiving location fall below the level of buffer stock prescribed by program policies. The Shipping Interval sets the limit for how often shipments can take place on routes with a variable shipping schedule, representing the minimum number of days between trips (a shipping interval of 1 would allow trips to occur as often as once daily). The On-Demand Order Days indicate the number of days each shipment is intended to supply. For example, if shipping policies instituted monthly trips but shipments can occur as often as once per week when needed, the Shipping Interval would be 7 and the On-Demand Order Days would be 28.

The supplying location delivers vaccines to the receiving location(s) in **push**, **varpush**, and **pull** routes. The receiving location picks up its vaccines from the supplier in **schedfetch**, **schedvarfetch**, and **demandfetch** routes. The mode of transportation indicated under Transport Mode must exist at the location that either delivers or picks up the vaccines (edit a store to add or change a mode of transportation available at a given location, per Section 5.2.2.1.1).

Special cases include **persistentpull** and **persistentdemandfetch** routes, which are similar to pull and demandfetch routes, respectively. However, persistentpull and persistentdemandfetch routes are not limited in how frequently shipments can occur (i.e. these routes are not governed by the Shipping Interval). This will allow multiple shipments to occur on a single route in a single day, if needed.

**Askingpush** simulates an informed push route, in which a vehicle is loaded with vaccines to full capacity at the supplier (if sufficient stock exists), and the quantities of vaccines needed at the receiving location(s) are determined when the vehicle arrives.

**Dropandcollect** routes are typically used to model outreach vaccination sessions. In a dropandcollect route, the supplier sends vaccines to an immunization session, after which the remaining vials are returned to the supplier. In the Stops tab, the Hours to Next Stop for the

return leg of the trip should include the time needed for the vaccination session to occur. For example, if a health facility sends vaccines to a 6-hour outreach session occurring 1 hour away, then the Hours to Next Stop for the final leg of the trip should be 7 hours.

**Attached** routes are for locations that share storage equipment. The supplier is the location with cold storage, and the receiving location stores vaccines in the same devices. For example, a health facility may be co-located with its district-level supplier and use vaccines stored in the district warehouse's refrigerators and freezers. Other parameters (such as Shipping Interval, Truck Type, KM to Next Stop) do not apply to attached routes.

For any route, click on each tab to access the editable information. On the Stops tab, only Hours to Next Stop and KM to Next Stop are available for editing.

When finished, click "Ok" to save changes or "Cancel" to discard them.

#### 5.2.2.2 Delete Route

Use "Delete Route" to remove a route from the model. Deleting a route will move all locations on that route to the Unattached area. **This action is irreversible.**

#### 5.2.2.3 Set as Default Template

Choosing "Set as Default Template" will cause the model to use the details for the selected route when creating any new routes.

### 5.2.3 Using the viewing options

The dropdown store and route viewing options located near the top of the page allow you to choose specific attributes to be displayed and/or edited for all stores or routes in the model.

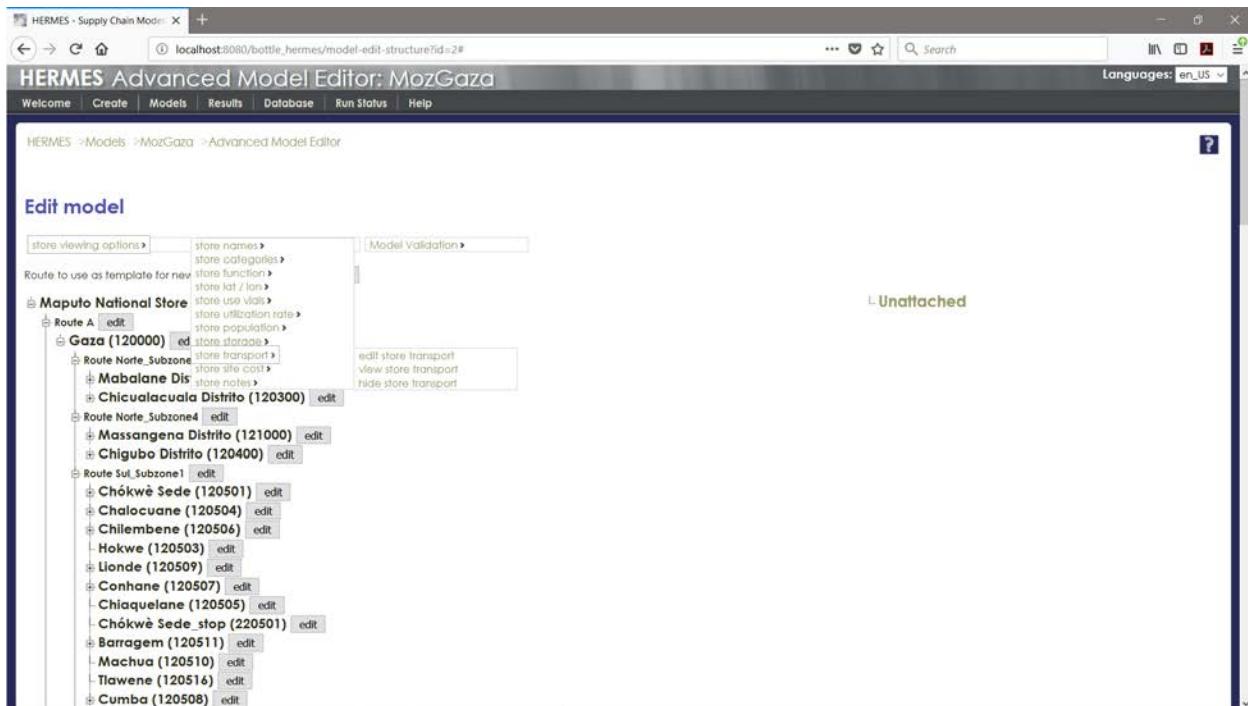
#### 5.2.3.1 Store viewing options

The screenshot shows the HERMES Advanced Model Editor interface. The title bar reads "HERMES Advanced Model Editor: MozGaza". The main window is titled "Edit model". On the left, there is a tree view of locations and routes under "Maputu National Stores". A context menu is open over the "Route A" node, listing options such as "edit", "store names", "store categories", "store functions", "store lat / lon", "store use visits", "store utilization rate", "store population", "store storage", "store transport", "store site cost", "store notes", and "Chicualacuala Distrito (120300) edit". To the right of the tree view, there is a list of locations grouped under "Unattached", including "Hokwe (120503)", "Lionde (120509)", "Conhane (120507)", "Chiaquelane (120505)", "Chókwé Sede\_stop (220501)", "Barragem (120511)", "Machua (120510)", "Tlawene (120516)", and "Cumba (120508)".

The different store viewing options available are:

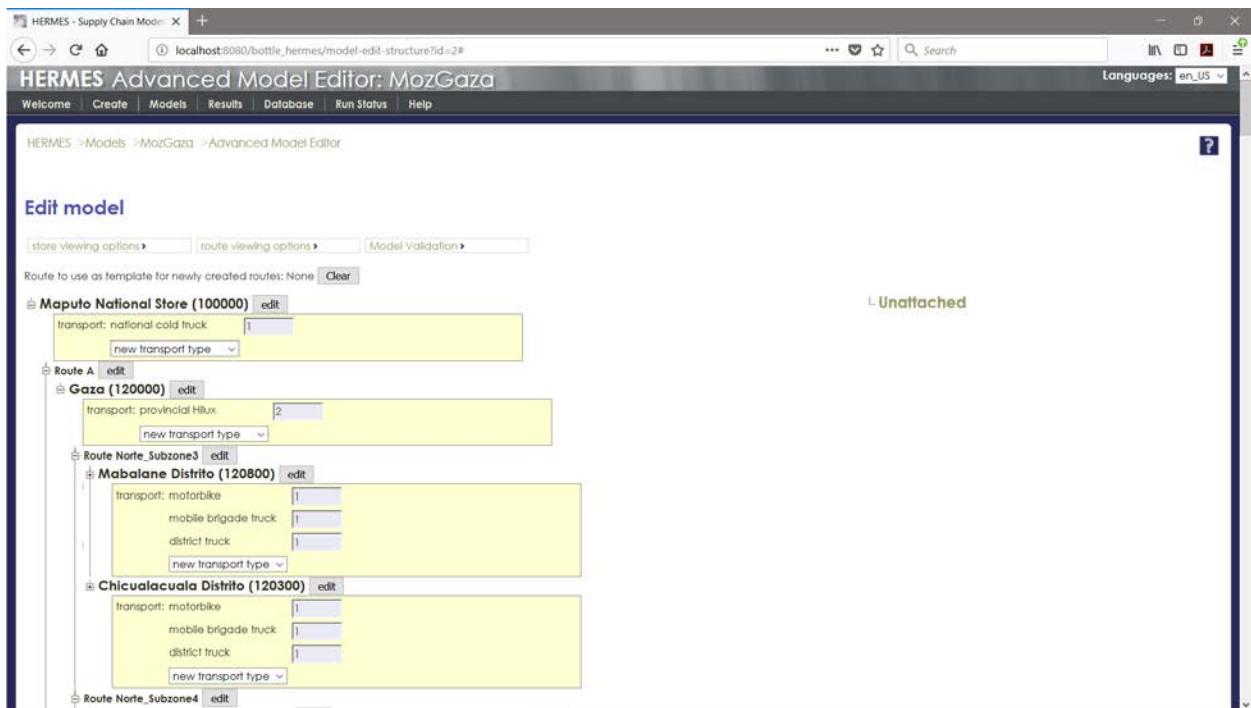
- store names
- store categories
- store lat/lon (store latitude/longitude)
- store use vials
- store utilization rate
- store population
- store storage
- store transport
- store site cost
- store notes

Whichever of the above options is chosen, a further menu will pop up offering you the ability to edit, view, or hide the category.



#### 5.2.3.1.1 Edit [category]

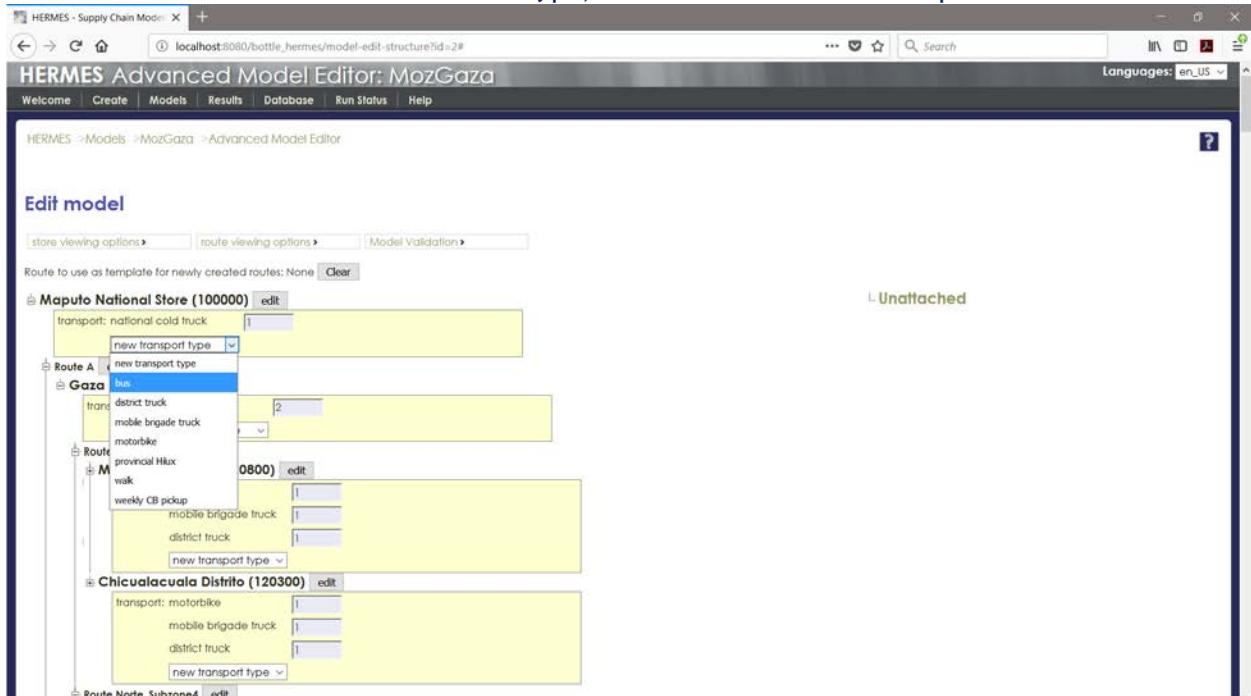
When edit is chosen, as for example below where category equals “store transport,” the model expands to show all editable information associated with that category **for every store in the model**, in this case types and numbers of vehicles.



Change the numbers of vehicles by altering the number in the entry box.

Delete the vehicle type by changing the number to zero.

The “new transport type” dropdown box contains any vehicle types that are included in the model but not at that location. To add a vehicle type, first choose it from the dropdown box.



After adding the transport type, adjust the number in the entry box to reflect how many are at the

location.

The screenshot shows the HERMES Advanced Model Editor interface. The main window title is "HERMES Advanced Model Editor: MozGaza". The left sidebar shows a navigation path: "HERMES > Models > MozGaza > Advanced Model Editor". The main area is titled "Edit model". It displays a hierarchical tree structure of locations and their associated transport types. A yellow box highlights the "add" button next to the "new transport type" dropdown for the Gaza location. Other locations shown include Maputo National Store (100000), Route A, Route Norte\_Subzone3, Mabalane Distrito (120800), Chicualacuala Distrito (120300), and Route Norte\_Subzone4. Each location has a "transport" section with various options like national cold truck, provincial Hilux, motorbike, mobile brigade truck, and district truck. A "Route Validation" section is visible at the top right.

Click “add” to complete adding the transport type.

#### 5.2.3.1.2 View [category]

Similarly to “Edit [category],” “View [category]” displays all information associated with the category for every location in the model but without any means of interacting with that information.

The screenshot shows the HERMES Advanced Model Editor interface, similar to the previous one but with different transport type counts displayed. The main window title is "HERMES Advanced Model Editor: MozGaza". The left sidebar shows a navigation path: "HERMES > Models > MozGaza > Advanced Model Editor". The main area is titled "Edit model". The hierarchical tree structure of locations and their associated transport types is identical to the previous screenshot. However, the transport type counts are now explicitly shown next to each transport type entry. For example, under the Gaza location, there are three entries: "transport: provincial Hilux 2", "transport: motorbike 1", and "transport: mobile brigade truck 1". Similar counts are shown for other locations like Mabalane Distrito (120800) and Chicualacuala Distrito (120300). The "Route Validation" section is visible at the top right.

### 5.2.3.1.3 Hide [category]

Choose “Hide [category]” to make the information associated with that category disappear.

#### 5.2.3.1.3.1 Example

MozGaza model with store names and store categories chosen for editing:

The screenshot shows the HERMES Advanced Model Editor interface. The main window title is "Edit model". At the top, there are three tabs: "store viewing options", "route viewing options", and "Model Validation". Below these tabs, there is a button labeled "Route to use as template for newly created routes: None" with a "Clear" button. The main content area displays a hierarchical tree structure of locations. The root node is "Maputo National Store (100000)". It has a child node "Route A". Under "Route A", there are several nodes: "Gaza (120000)", "Mabalane Distrito (120800)", "Chicualacuala Distrito (120300)", "Route Norte\_Subzone3", "Route Norte\_Subzone4", "Massangena Distrito (121000)", and "Chigubo Distrito (120400)". Each node has an "edit" button next to its name. The nodes for "Maputo National Store (100000)", "Gaza (120000)", and all the district nodes under "Route A" are highlighted with a yellow background, indicating they have been selected for viewing options. To the right of the tree, there is a status bar with the text "Unattached".

After selecting store viewing options -> store names -> hide store names

This screenshot shows the same HERMES Advanced Model Editor interface as the previous one, but with different selection highlights. The nodes for "Maputo National Store (100000)", "Gaza (120000)", and the districts under "Route A" are no longer highlighted with a yellow background. Only the "Route Norte\_Subzone3" and "Route Norte\_Subzone4" nodes under "Route A" remain highlighted in yellow, indicating they are still selected for viewing options. The rest of the nodes are now white, suggesting they have been unselected or hidden. The status bar on the right still shows "Unattached".

### 5.2.3.2 Route viewing options

The available route viewing options are:

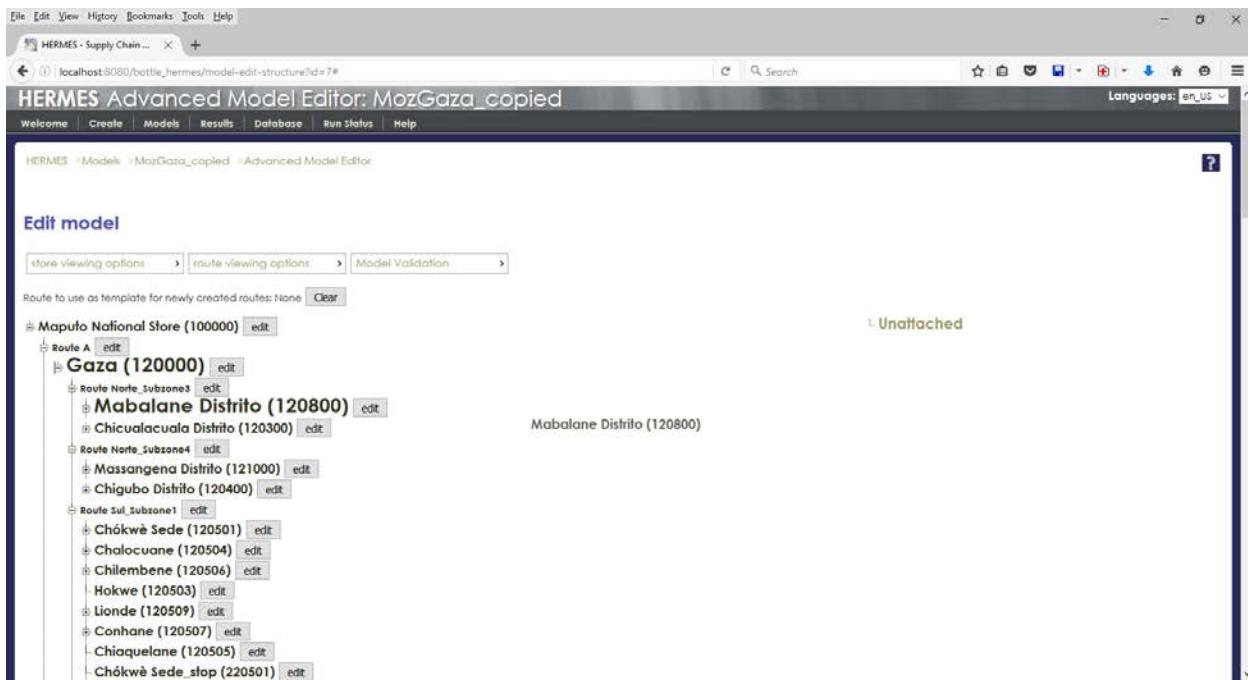
- route names
- route types
- transit hours
- distances
- order amounts
- truck type
- route timings
- per diem policy
- route conditions

Similarly to storage viewing options, you can choose to edit, view or hide any of the above categories. See Section 5.2.3.1.1 and below.

## 5.3 Locations

### 5.3.1 Moving locations in the network

Click and drag a location to change its position in the network. The location name will enlarge to show that it is selected. When the location name is dragged around the screen, a will be displayed in front of the name until it is in a place it can be dropped.



### 5.3.1.1 Change supplier

Any recipient locations below the moving location will continue to be supplied by that location after it is moved.

5.3.1.1.1 Select the location.

5.3.1.1.2 Drag the location onto the desired supplier name and release.

### 5.3.1.2 Move location to an existing route

Adding a location to an existing route with one location will convert a point-to-point route into a delivery loop.

5.3.1.2.1 Select the location.

5.3.1.2.2 Drag the location onto the desired route name and release.

5.3.1.2.3 Drag locations within a route to change the order they are supplied in the delivery loop.

If a route type does not support multiple locations, an error message will tell you “Destination route type only supports one client store.” Edit the route type (Section 5.2.2.2.1) and try again.

### 5.3.2 Unattached locations

On the right of the page is a space labeled “Unattached.” This is a staging area for locations that are temporarily detached from the network.

Some changes to the network, for example deleting a route that has locations associated with it, will automatically result in locations becoming unattached.

### **5.3.2.1 Detach location**

Location can be detached either by dragging and dropping or by using the edit button associated with the location.

#### **5.3.2.1.1 Drag and drop**

##### **5.3.2.1.1.1 Select location**

##### **5.3.2.1.1.2 Drag it onto the space labeled "Unattached."**

#### **5.3.2.1.2 "Edit" button**

##### **5.3.2.1.2.1 Click "edit" button next to a location.**

##### **5.3.2.1.2.2 Select "Detach Store."**

### **5.3.2.2 Reattach location**

Unattached locations are removed from the supply chain network and must be added again if they are to remain in the model.

#### **5.3.2.2.1 Select location from area labeled "Unattached."**

#### **5.3.2.2.2 Drag to desired new location.**

### **5.3.3 Add a new location**

#### **5.3.3.1 Find a similar location in the network and copy**

##### **5.3.3.1.1 Click the "edit" button next to a location with similar features as the one you want to add.**

##### **5.3.3.1.2 Select "Copy Store to Unattached" to make a copy of that store appear in the "Unattached" area.**

#### **5.3.3.2 Edit the copy as needed**

#### **5.3.3.3 Drag the edited location from "Unattached" to its new position in the network.**

### **5.3.4 Delete a Location**

#### **5.3.4.1 Single location**

##### **5.3.4.1.1 Select location**

##### **5.3.4.1.2 Click "Edit" button to the right.**

##### **5.3.4.1.3 Click "Delete Store."**

#### **5.3.4.2 Location that supplies other locations**

If you want to delete a location and all its dependent locations, follow the instructions in Section 5.3.4.1 for that location. Otherwise

- 5.3.4.2.1 Detach location (Section 5.3.2.1)
- 5.3.4.2.2 Select dependent location(s) that you want to keep and reattach to model in desired place(s) using drag and drop (Section 5.3.2.2).
- 5.3.4.2.3 Click “Edit” button next to location in “Unattached” section.
- 5.3.4.2.4 Click “Delete Store.”

## 5.4 Routes

### 5.4.1 Add a route

Actions such as adding a new location will automatically create a new route between that location and its supplier. If a default route is specified (Section 5.4.2), the new route will be assigned the same policies as the default route. If a default route is not specified, the route is based on a previous route from the supplier.

### 5.4.2 Specify a default route

Before generating new routes, one existing route can be specified as a template for newly created routes to copy. If a template is specified, new routes will be assigned the same shipping policies, vehicle type, and per diem policy as the template route. The selected route is displayed below the store and route viewing dropdown boxes and above the supply chain network.

#### 5.4.2.1 Set a default route

- 5.4.2.1.1 Click the "edit" button next to the route.
- 5.4.2.1.2 Select "set as default template."

#### 5.4.2.2 Change default route

- 5.4.2.2.1 HERMES uses the last route set as default. To change the default, simply select a new desired route and set as default as in Section 5.4.2.1

#### 5.4.2.3 Clear default route

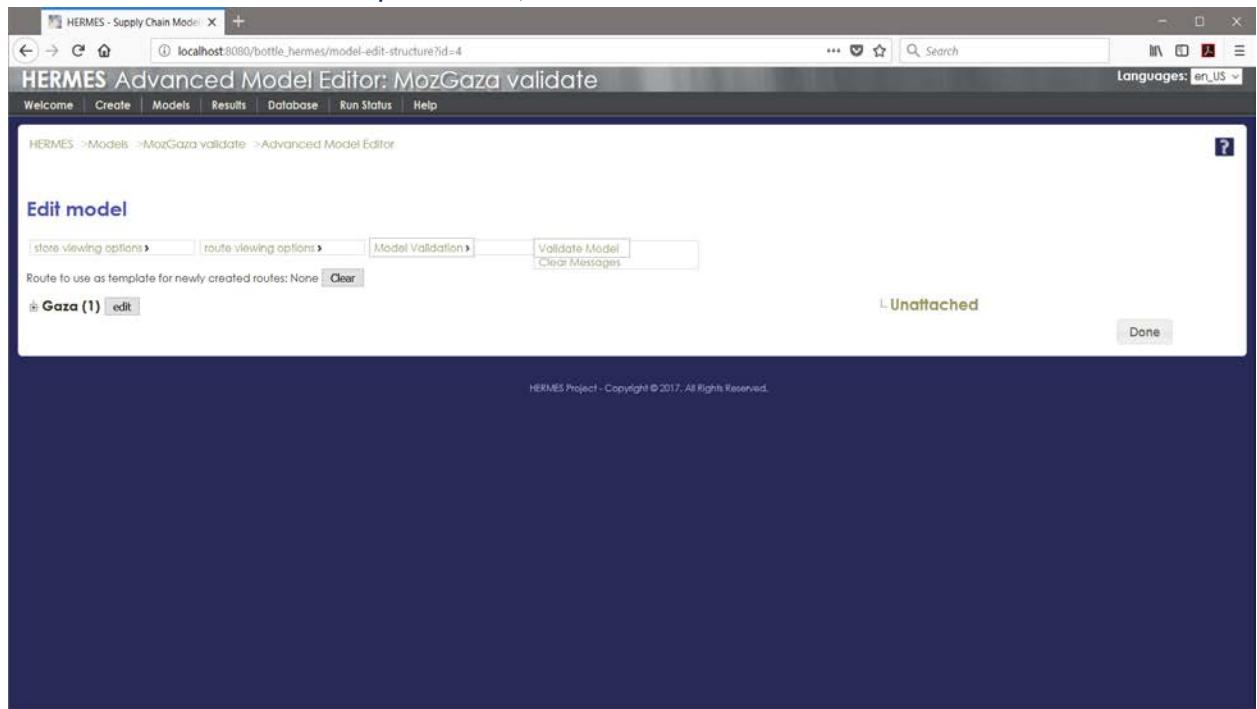
- 5.4.2.3.1 Click "Clear" next to the currently selected route displayed above the supply chain network.

## 5.5 Model Validation

The Advanced Model Editor allows you to manually trigger a check of the validity of the model you have created to make sure you have included all necessary information. The validator will list all issues under the relevant locations and routes or in a scrollable window if supply chain network is not fully expanded. See Section 6 for more information on model validation.

### 5.5.1 Validate model

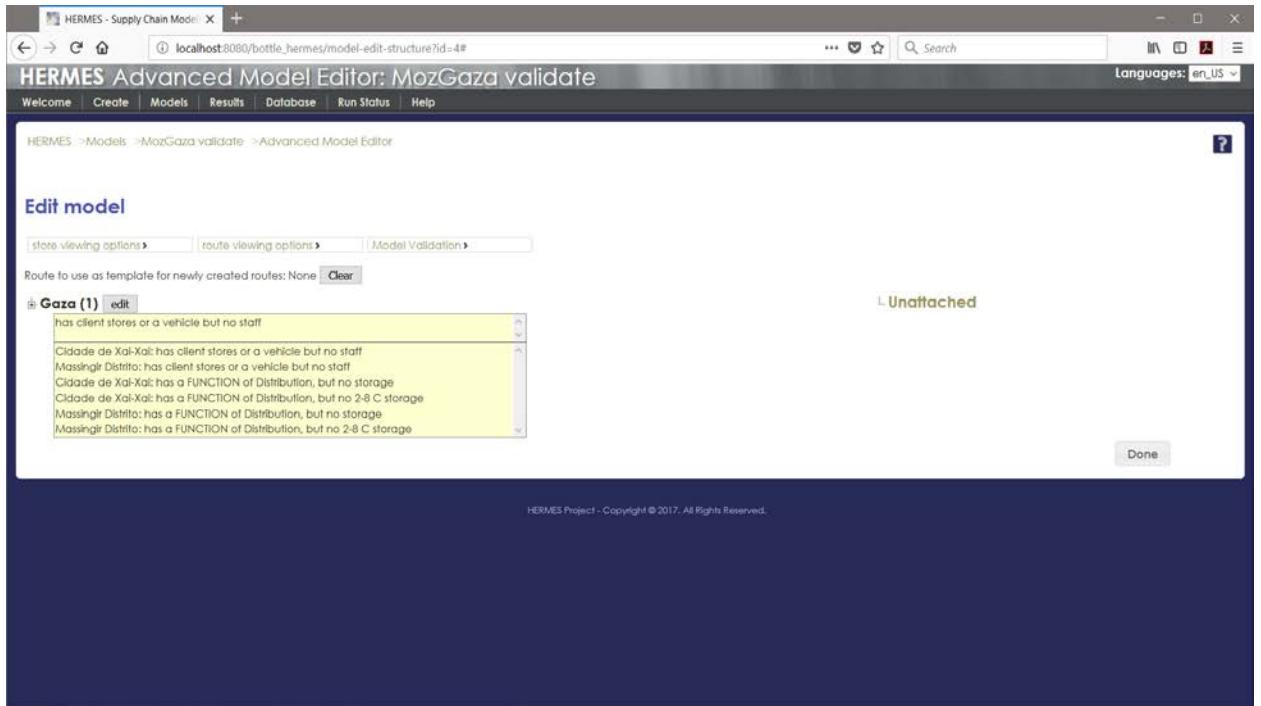
1. Select "Model Validation" dropdown box, then select "Validate Model."



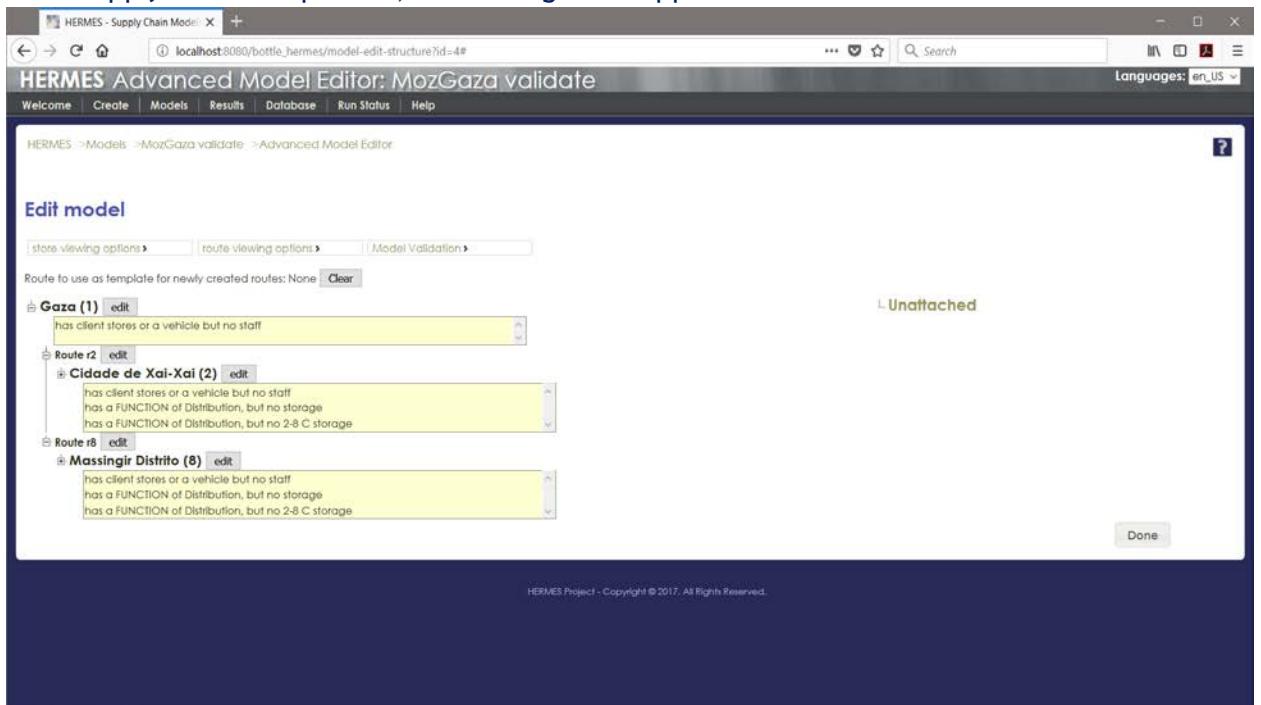
2. Review validation results.

If there are no issues, the page will remain the same.

If there are issues and the supply chain network is unexpanded, all issues will be displayed just below the top level.

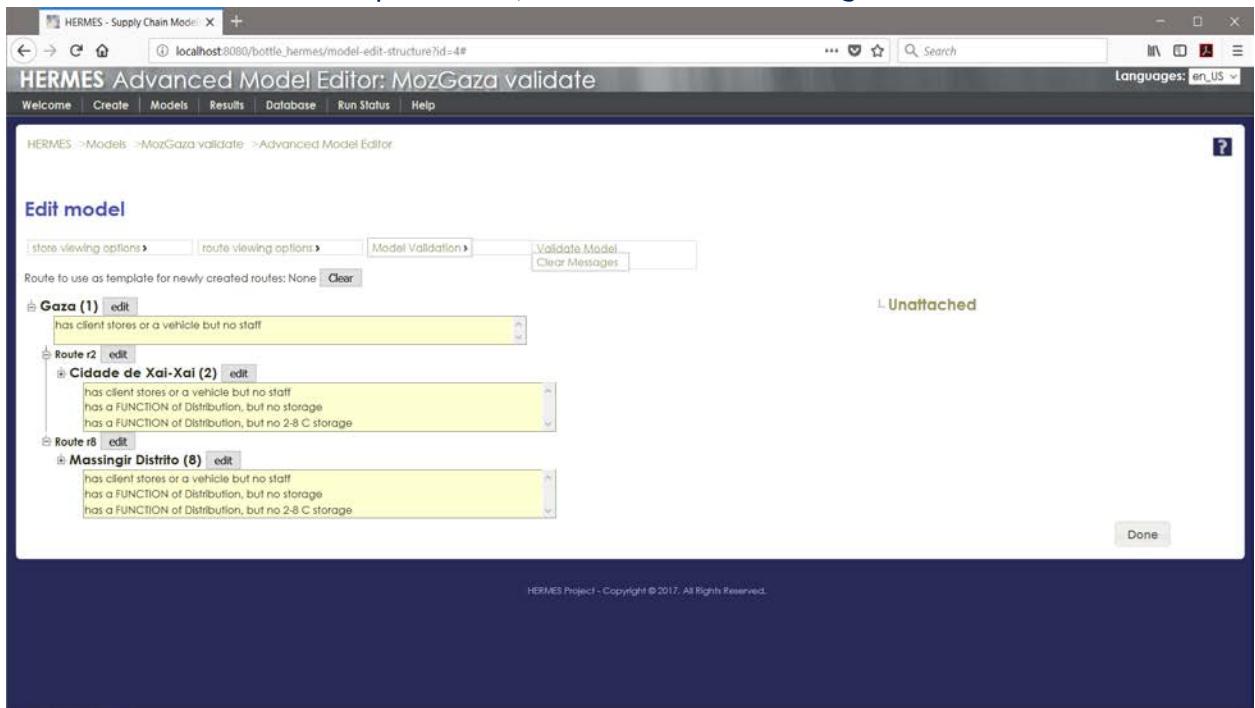


If the supply chain is expanded, the messages will appear below the correct locations

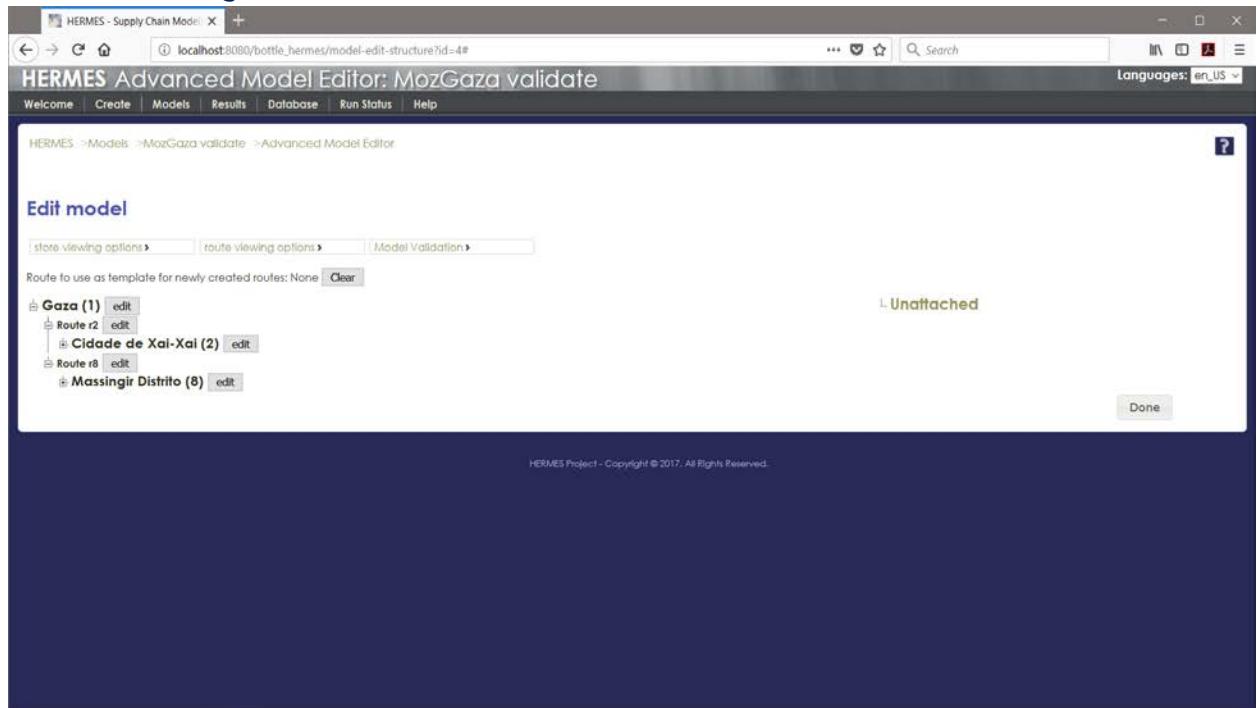


### 5.5.2 Clear validation information

1. Select "Model Validation" dropdown box, then select "Clear Messages."



- The supply chain will then be displayed at the same level of expansion but without the validation messages.



## 6 Model Validation

### 6.1 Overview

The HERMES program checks the model for structural errors and reports different levels of warnings to the user. "Fatal Errors" will likely cause the run to fail before the simulation is complete, thus returning no results. "Warnings" indicate items that may be erroneous but would most likely not cause the run to fail; however, these items may lead to erroneous results if they reflect actual errors in the model.

### 6.2 Automatic Validation

HERMES automatically performs model validation whenever a run is submitted. A dialogue box displays any errors that are found (or a message stating there were no errors). If errors are found, you may go directly from the dialogue box to the Advanced Model Editor to address the issues, or you may proceed with trying to run the simulation.

See Section 7.3.4 for screenshots of the validation window with and without errors.

### 6.3 Manual Validation

If you want to check the validity of your model at any point, you can trigger the model validation process from the Advanced Model Editor. See Section 5.5.

# 7 Running Simulations

## 7.1 Computational requirements

### 7.1.1 Time per run

The amount of time per run depends on the size and complexity of the model and the number of simulations requested. A small model may complete each simulation within a minute, while more complex ones might take an hour or more.

### 7.1.2 Memory

HERMES can use up to 4GB of RAM during a run. Having less memory in your machine will cause the run to stall.

## 7.2 Experiment guidelines

While running a HERMES simulation model can provide valuable insight into the performance and costs of a system, even greater insight may be gained by performing experiments to assess the potential impact of changes to a system (e.g. altering supply chain structure, operations, resources, or setting). Modeling provides the ability to study the effects of these changes for only a fraction of the time and resources necessary to implement them in a real-world system on a trial-and-error basis.

### 7.2.1 Defining questions to explore

The question or questions you hope to answer with the modeling should be well defined before you begin to model and test scenarios. A well-defined question can help identify the appropriate scenarios to run in order to thoroughly address the question at hand without producing an unnecessarily large volume of results to analyze.

#### 7.2.1.1 Example topics HERMES can address

HERMES can help decision makers explore questions around:

- Introducing new vaccines and technology (e.g. vaccines, storage, vehicles)
- Monitoring the health and status of the supply chain (e.g. augment imperfect surveillance of the immunization program)
- Altering characteristics of vaccines and other technologies (e.g. vaccine vial size, vaccine thermostability, cold device capacity)
- Changing configuration and operations of the supply chain (e.g. storage, shipping frequency, personnel, ordering policy)
- Differing conditions/circumstances (e.g. power outages, delays, inclement weather, limited access)
- Investing or allocating of resources (e.g. adding refrigerators vs. increasing transport frequency)
- Optimizing vaccine delivery (e.g. minimize cost, cost per outcome, maximize immunizations)

#### 7.2.1.2 Considerations when defining modeling questions

The specific setting and conditions in which you wish to explore a modeling question should be well defined. For example, if exploring the impact of introducing a new vaccine to a system, you

must decide whether to simulate the vaccine introduction in a model of the system as it currently exists or in some variation of the current system (e.g. the current supply chain with the population projected to a future year or with new cold chain equipment added). You may also choose to compare the relative impact of introducing different presentations of the new vaccine to a system, or you may compare the effects of introducing the new vaccine into different variations of a system (i.e. before and after making a change to the supply chain).

The outcomes of interest must also be clearly identified. The impact of a change to a vaccine supply chain can be measured using a variety of metrics, including the number and severity of system bottlenecks, the availability of vaccines when and where they are needed, open and closed vial wastage, supply chain logistics costs, and the supply chain logistics cost per administered vaccine dose. Experiments often entail studying the impact of a change on multiple outcomes in order to obtain a more complete picture (e.g. measuring demand fulfillment in terms of vaccine availability and evaluating costs in terms of the logistics cost per dose administered).

### **7.2.2 Identifying scenarios to compare**

Based on the modeling question defined, the scenarios to run must be identified. An experiment involves running multiple HERMES simulation models representing variations on a system. These scenarios can generally be separated into a baseline scenario and one or more experimental scenarios.

#### **7.2.2.1 Baseline**

The baseline scenario provides a basis for comparison with each experimental scenario. To measure the impact of a vaccine introduction, for example, you would need to run a baseline model without the new vaccine, in order to determine what changes when the vaccine is introduced. Essentially, the baseline scenario represents the system without the change that is being explored, but should in all other ways be comparable to the experimental scenarios with which it will be compared. If exploring the impact of a new vaccine introduction using an experimental scenario that includes the new vaccine along with the population projected to a future year, then the baseline scenario should also model the population projected to the same year.

#### **7.2.2.2 Experimental scenarios**

Experimental scenarios represent the altered systems to compare to the baseline scenario. An experiment may include multiple experimental scenarios that are also compared to one another. For example, if assessing the impact of introducing a new vaccine in either a one-dose or five-dose vial presentation, one experimental scenario would introduce the vaccine in a one-dose vial while the other would introduce the five-dose vial. These would each be compared to a baseline scenario without the new vaccine introduced, to measure the impact each new presentation would have on the system. The two experimental scenarios would also be compared to each other, to determine which presentation of the new vaccine has a greater impact.

### **7.2.3 Comparing results**

The results of modeling experiments can help inform decision making by revealing the relative costs, benefits, and even unintended consequences of various changes. You can compare the results for the baseline scenario and any experimental scenarios by running the scenarios as described in the following section and viewing results for the scenarios as shown in Section 8.2.1.

## 7.3 Setting up and starting a run

### 7.3.1 Open the Run A Model Simulation page

On the Model page, click the bullet labeled “Run a Simulation Experiment with this Model”

-or-

On Available Models page, click “Run” button in the model’s row.

Both methods should bring you to the following page, which displays the minimal parameters that need to be entered in order to run a simulation. This is the first step in running a HERMES model. Once you have finished this short set of pages, the execution of your model will begin. If you leave this sequence of screens too early, your model will not begin running, but you will be able to return to the sequence where you left off by selecting Run again.

The screenshot shows a web browser window with the title 'HERMES - Supply Chain Model'. The URL in the address bar is 'localhost:8080/bottle\_hermes/model-run?modelId=2'. The main content area is titled 'HERMES Run A Model Simulation'. Below it, a sub-section says 'HERMES ->Models ->Run Simulation'. The form is titled 'Running a HERMES Model'. It has two input fields: 'What name should be given to this set of results?' (empty) and 'How many stochastic (random) runs would you like to average the results over?' (set to 4). Under 'Run Parameters for model MozGaza', there are four input fields: 'Number of Simulation Days' (240), 'Number of Shipments from the Manufacturer per Year' (4), 'Factor for Buffer Stock from the Manufacturer' (2), and 'Sets the default buffer stock for the whole model' (0.25). At the bottom right are 'Show Advanced Options' and 'Submit' buttons. The footer of the page reads 'HERMES Project - Copyright © 2017. All Rights Reserved.'

### 7.3.2 Fill out HERMES model parameters

Here you will enter a name for results and specify the number of times you wish to run the model when generating this set of results. To better capture the day-to-day variation that occurs in the real world, HERMES models are stochastic (unless otherwise specified in the parameters). This means each run will generate somewhat different results. For example, daily demand at an immunizing location is not uniform -- rather, some days will see more patients than others at any given location. Thus, HERMES stochastically generates daily demand as a Poisson distribution.

#### 7.3.2.1 Enter a name for the results

A model can be run many times with different run parameters, so the results for each run need to be given a distinct name.

### 7.3.2.2 Enter number of simulations to run and average the results over

To obtain results that are representative of the model, taking the average of multiple runs is recommended. Each model is different, but a good rule of thumb is to use the average of 10 runs for results that will not vary significantly due to stochasticity alone.

### 7.3.3 Enter model-specific parameters

These parameters are initially populated by information in the model or by defaults and can be altered to further fine-tune the simulation.

#### 7.3.3.1 Enter Basic Options

Four basic run parameters are displayed to allow editing of the simulation length, shipments from the manufacturer, and buffer stock.

The screenshot shows a web-based application window titled "HERMES - Supply Chain Model". The URL in the address bar is "localhost:8080/bottle\_hermes/model-run?modelId=2". The main title is "HERMES Run A Model Simulation". Below it, a navigation menu includes "Welcome", "Create", "Models", "Results", "Database", "Run Status", and "Help". The main content area is titled "Running a HERMES Model". It contains two input fields: "What name should be given to this set of results?" with the value "MG\_2017-10-11" and "How many stochastic (random) runs would you like to average the results over?" with the value "5". Below these are "Run Parameters for model MozGaza" with four numerical inputs: "Number of Simulation Days" (240), "Number of Shipments from the Manufacturer per Year" (4), "Factor for Buffer Stock from the Manufacturer" (2), and "Sets the default buffer stock for the whole model" (0.25). At the bottom right are "Show Advanced Options" and "Submit" buttons. A small note at the bottom center says "HERMES Project - Copyright © 2017, All Rights Reserved."

The number of simulation days specifies the time period that each run will simulate. Because each simulated month in HERMES is 4 weeks long, one year is equal to 336 days.

The number of shipments from the manufacturer per year indicates the annual number of times the location at the highest level receives vaccines. For example, if vaccines enter the supply chain via quarterly deliveries to the top level, then 4 would be entered here.

The factor for buffer stock from the manufacturer specifies how shipments to the top level are calculated. Typically, orders are calculated based on expected vaccine demand and open vial wastage and then inflated by a factor to allow for additional buffer stock. A value of 1.25 in this field would indicate a 25% buffer stock policy, in which the location at the top level will receive 25% more vaccines than the amount expected to be necessary (if adequate storage capacity exists at that location as calculated by the HERMES model). The default factor for buffer stock from the manufacturer is set to 1 and the default buffer stock for the whole model is 0.25.

### 7.3.3.2 Enter Advanced Options

1. Click “Show Advanced Options” button to display further options

The screenshot shows the HERMES - Supply Chain Model software interface. The title bar reads "HERMES - Supply Chain Model". The main window is titled "HERMES Run A Model Simulation" and displays the "Run Parameters for model MozGaza" configuration screen. The screen includes fields for result naming ("What name should be given to this set of results? MG\_2017-10-11") and averaging ("How many stochastic (random) runs would you like to average the results over? 5"). Below these, there are numerous parameters listed with their current values:

Parameter	Value
Number of Simulation Days	240
Number of Shipments from the Manufacturer per Year	4
Factor for Buffer Stock from the Manufacturer	2
Sets the default buffer stock for the whole model	0.25
Compliance with MVPD	1
Institute Multi-dose Vial Policy?	true
Startup Latency for the Factory	1
Number of Burn-In Days	40
Random Number Seed	
Wastage Estimation Latency	50
Global Frequency of Delay in Picking Up Shipments	
Global Magnitude of Delay in Picking Up Shipments	
STDev for Normal Distribution of Delay in Picking Up Vaccines	
Recalculation Order After a Pickup Delay (Pull Shipments Only)	false
Frequency of Delay in Delivery	
Global Magnitude of Delay in Delivery	

The screenshot shows a configuration interface for the HERMES - Supply Chain Model. The URL in the address bar is `localhost:8080/bottle_hermes/model-run?modelId=2`. The interface contains numerous input fields for different parameters:

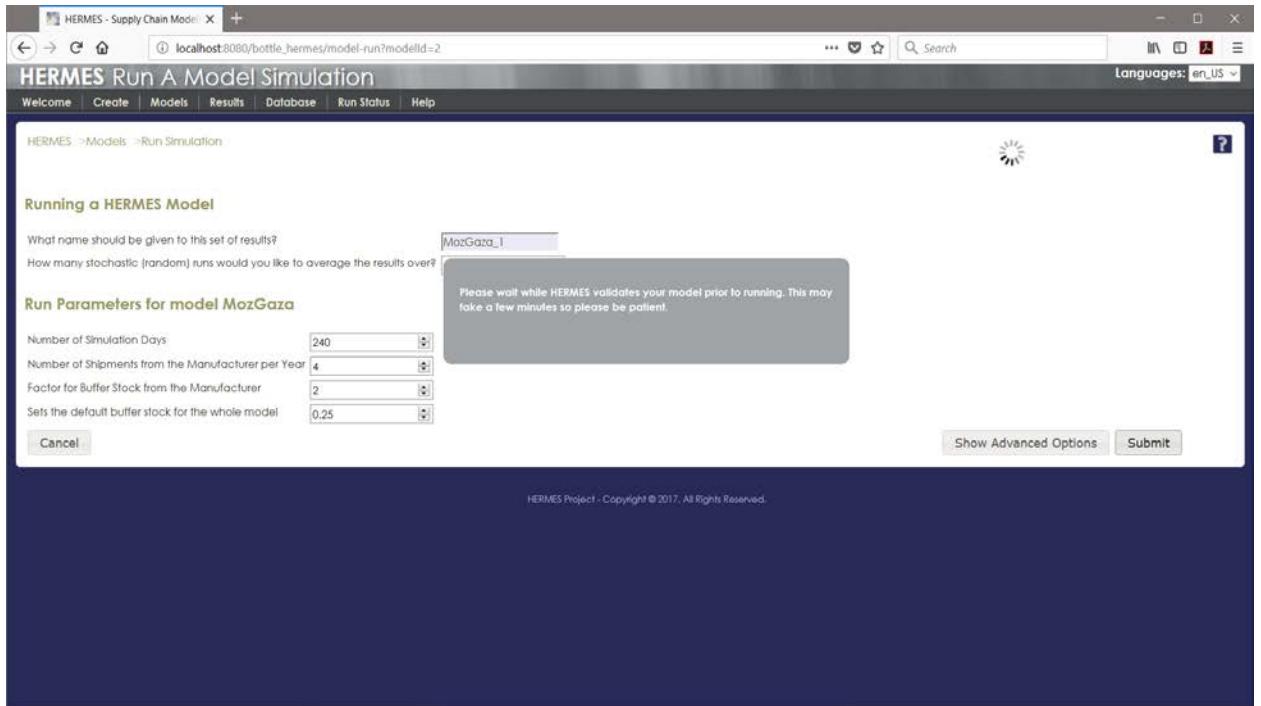
- Global Frequency for Power Outages Per Year
- Global Duration Days for Power Outages
- STDev for Normal Distribution for Power Outages
- Percent Chance of Warehouse Experiencing Power Outage within its Cluster
- Power Outage Cluster ID
- Interval in which to Monitor the Stock at Warehouses: 0.1
- Threshold for Monitoring Overstocking at Warehouses: 0.99
- Discard Unused Vaccine at End of Session: false
- Base Currency Type: USD
- Base Currency Year: 2014
- Inflation rate: 0.02
- Fraction of vehicle fuel cost to allocate for maintenance: 0.15
- Fraction of storage unit base cost for annual maintenance: 0.05
- Base price of LP gas: 0
- Base price of kerosene: 0
- Base price of gasoline: 1.29
- Base price of diesel: 0
- Base price of electricity: 0.1
- Base price of solar panels: 0
- Amortization lifetime of solar panels: 10
- Base price to freeze one liter of ice: 0
- Calculate Vaccine Purchase Costs When Doing Microcosting: false
- Vaccines Types for Campaigns
- Fraction of Breakage in Storage by Level: 0.0
- Fraction of Breakage in Transit by Level: 0.0
- Update Thresholds for Ordering with OVW Automatically: true

At the bottom right are two buttons: "Show Basic Options" and "Submit".

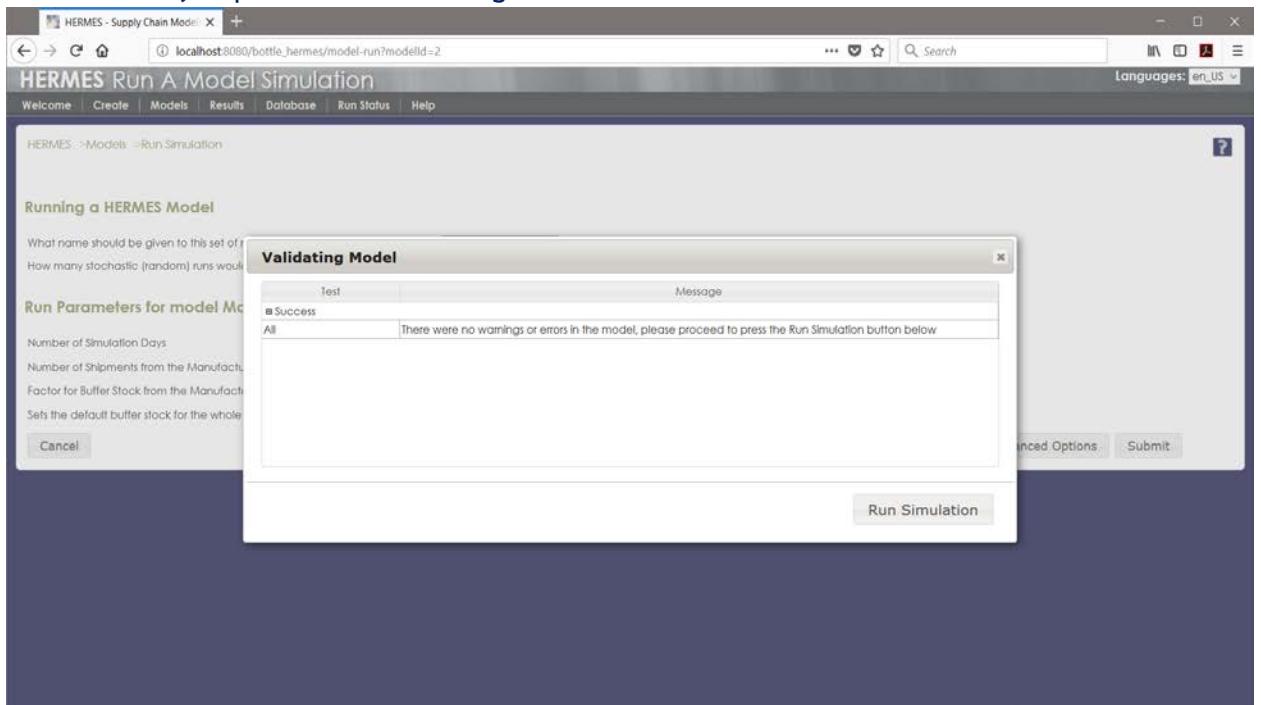
2. Enter any changes to information.
3. To return to Basic Options view, click “Show Basic Options” button at bottom right of page.

#### **7.3.4 Click “Submit” button to start run.**

1. A dialogue box will come up asking you to wait while model is being validated (see Section 6)



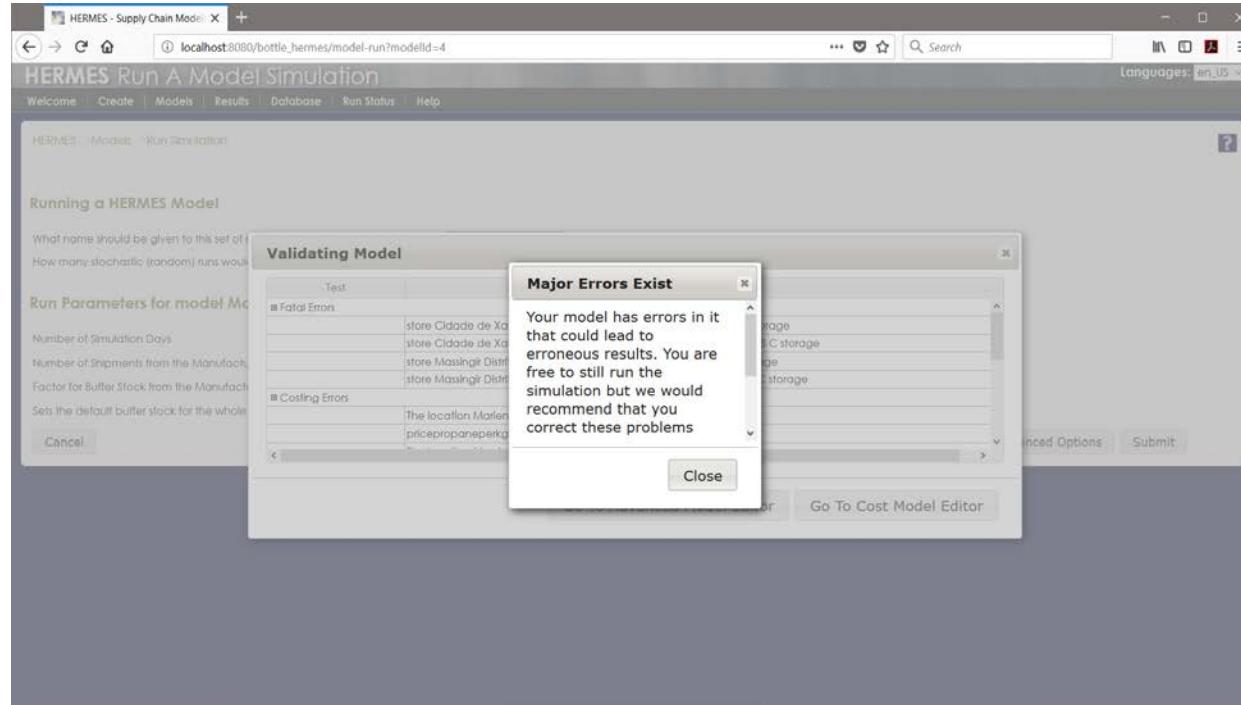
2. If there are no errors, the Validating Model window will appear with a message letting you know it is okay to proceed with running the simulation.



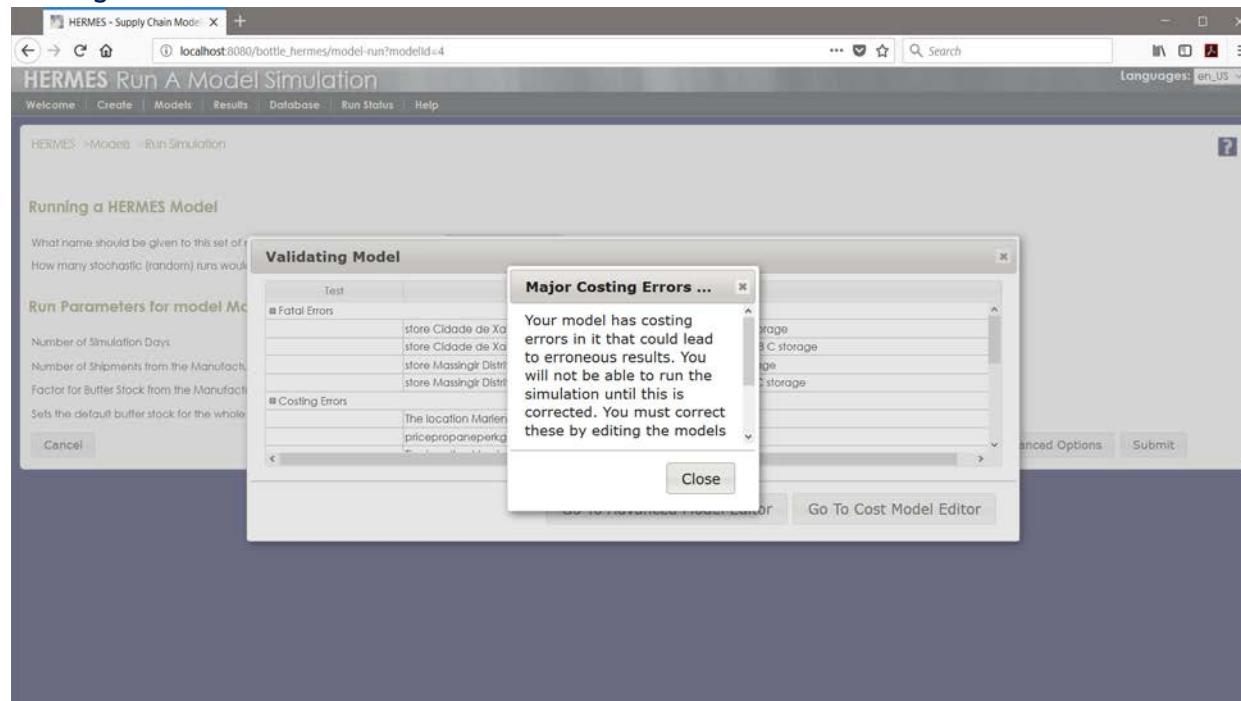
Click on the “Run Simulation” button to start the simulation.

3. If there are errors in your model, two or three messages may appear.

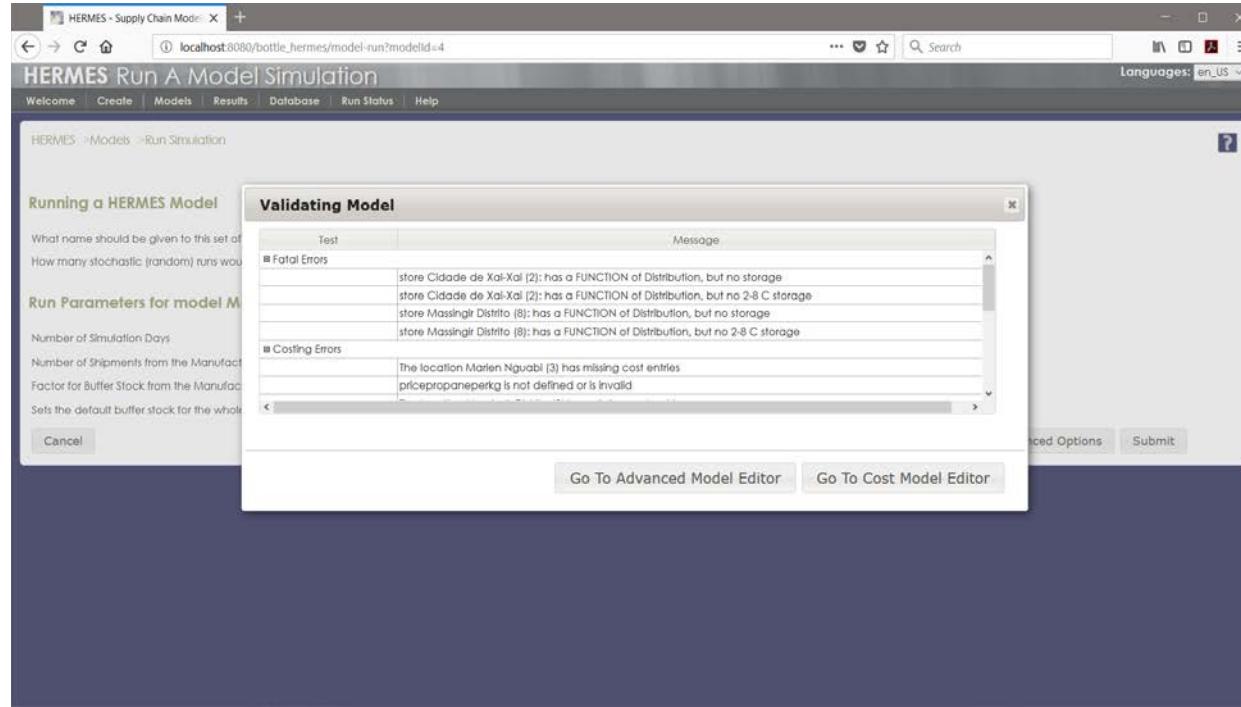
- a. The first message references errors in the model itself. Click the “Close” button to move to the next message.



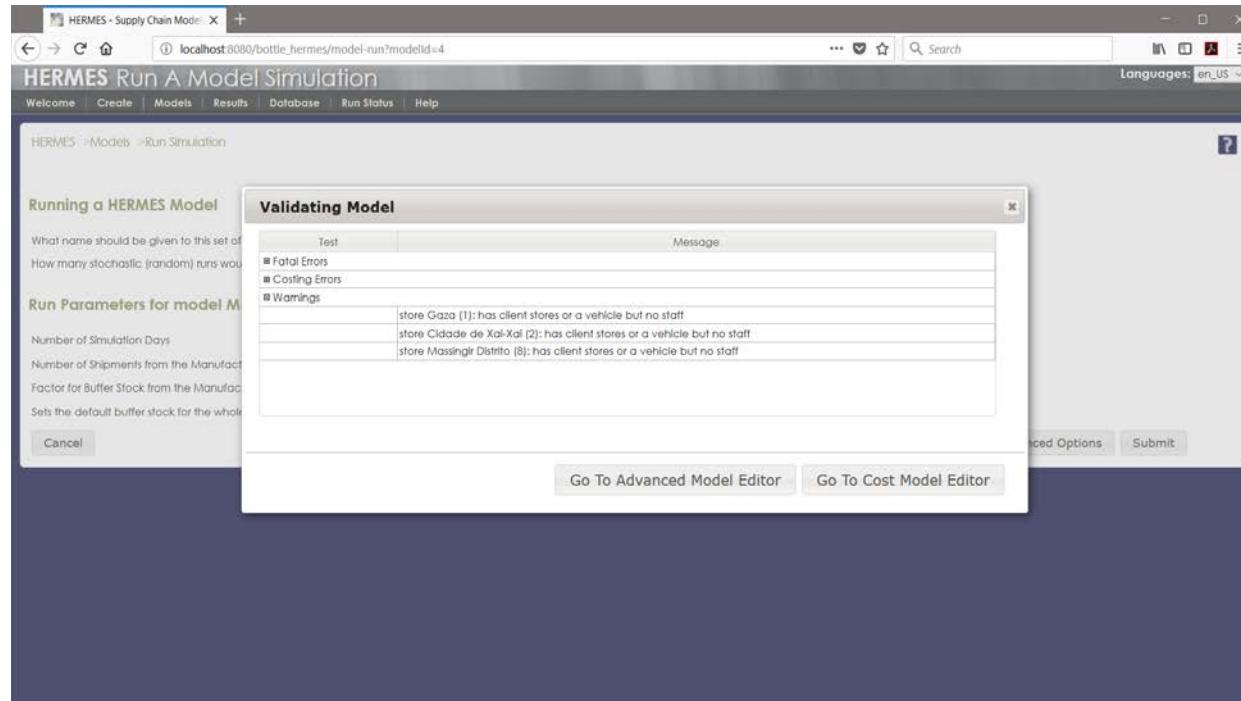
- b. The second message references errors in costing (if they exist and if you have enabled costing for the model). Click the “Close” button to move to the next message.



- c. The Validating Model window lists all Fatal Errors, Costing Errors, and Warnings caused by the model validation.



You can scroll through the errors and warning using the scroll bar. You can also use the +/- next to Fatal Errors, Costing Errors, and Warnings to expand or collapse those lists.



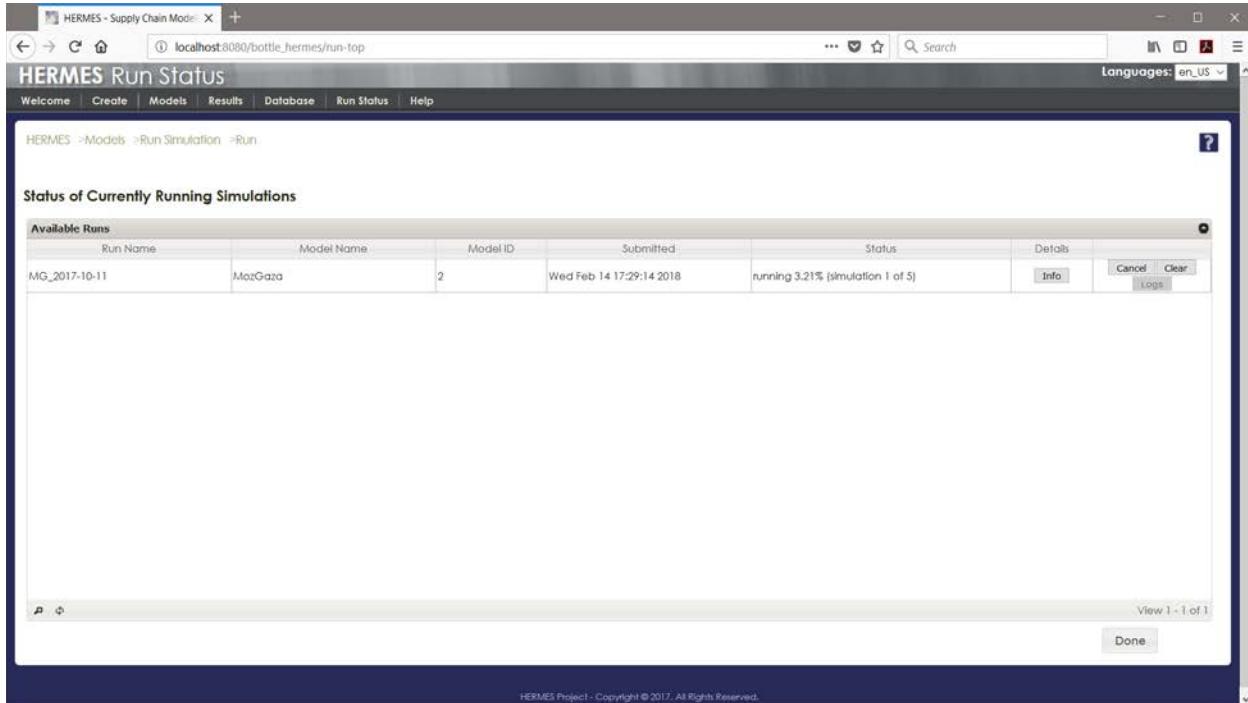
If there are fatal errors, the simulation most likely will not run, but you can try by

pressing the “Run Simulation” button. Otherwise, click “Go To Advanced Model Editor” to correct the listed errors.

## 7.4 Checking Run Status

### 7.4.1 The Run Status page

After you successfully start a simulation run, HERMES opens the Run Status page. You can also open this page by clicking “Run Status” in the main menu.



The screenshot shows a web browser window for the HERMES Supply Chain Modeler. The address bar indicates the URL is `localhost:8080/bottle_hermes/run-top`. The title bar says "HERMES Run Status". The main content area displays the "Status of Currently Running Simulations" table. The table has columns: Run Name, Model Name, Model ID, Submitted, Status, and Details. There is one row visible: MG\_2017-10-11, MozGaza, 2, Wed Feb 14 17:29:14 2018, running 3.21% (simulation 1 of 5), and a "Details" button. At the bottom of the table, there are "Info", "Cancel", and "Clear" buttons. A "Done" button is located at the bottom right of the page. The footer of the page reads "HERMES Project - Copyright © 2017. All Rights Reserved."

Status of Currently Running Simulations					
Available Runs					
Run Name	Model Name	Model ID	Submitted	Status	Details
MG_2017-10-11	MozGaza	2	Wed Feb 14 17:29:14 2018	running 3.21% (simulation 1 of 5)	<button>Info</button> <button>Cancel</button> <button>Clear</button>

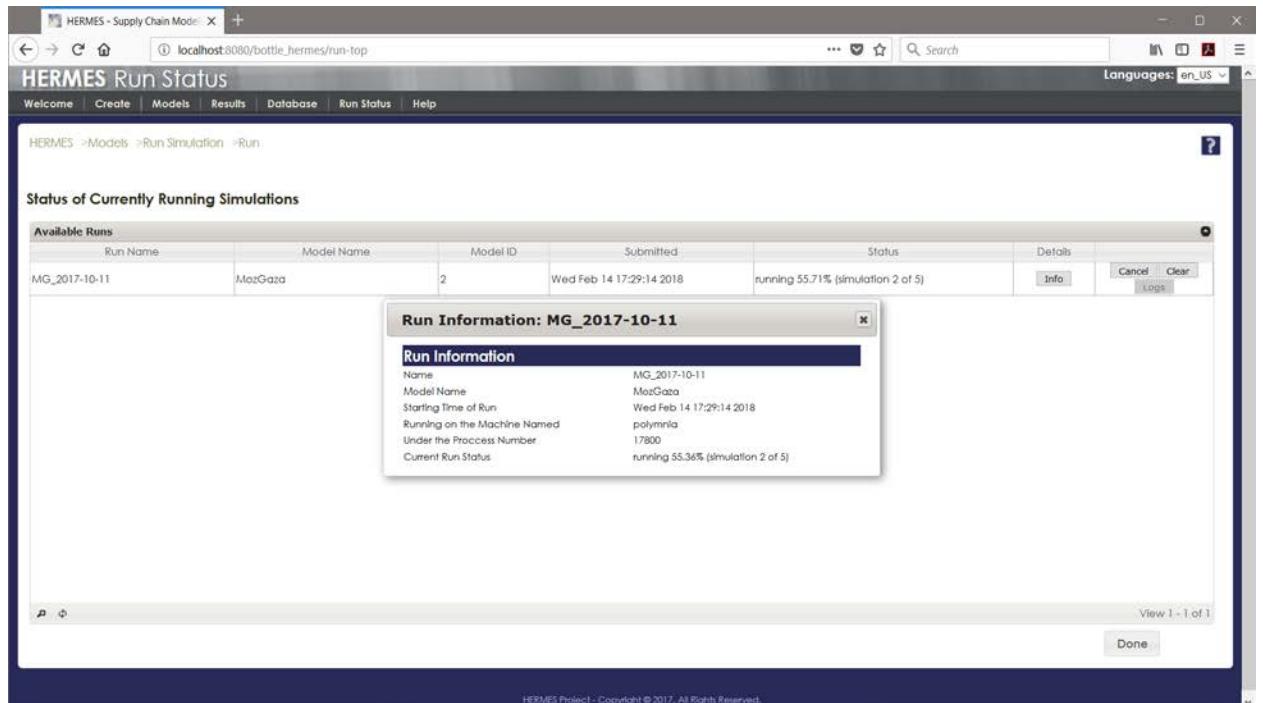
The Available Runs table displays the status of all runs begun during the current session.

The Status column will update periodically to display the progress of an ongoing run. You can continue to modify other models while a model is running.

For each currently running simulation, the table shows:

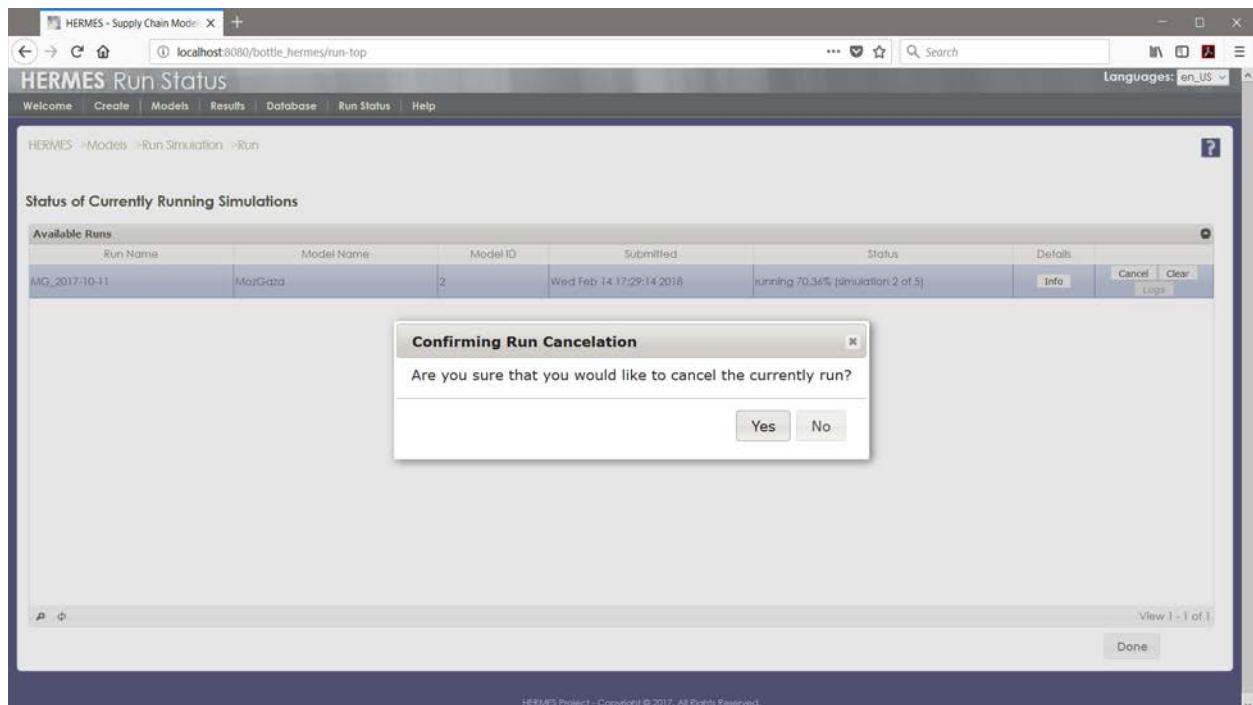
- run name
- model name
- model id
- date and time submitted
- status – running status (running, completed, failed), percentage complete of simulation repeat running out of total simulations requested

- details (obtained by clicking “Info” button)



## 7.4.2 Cancel a run

To cancel a run, click the “Cancel” button of the run that you want to cancel.



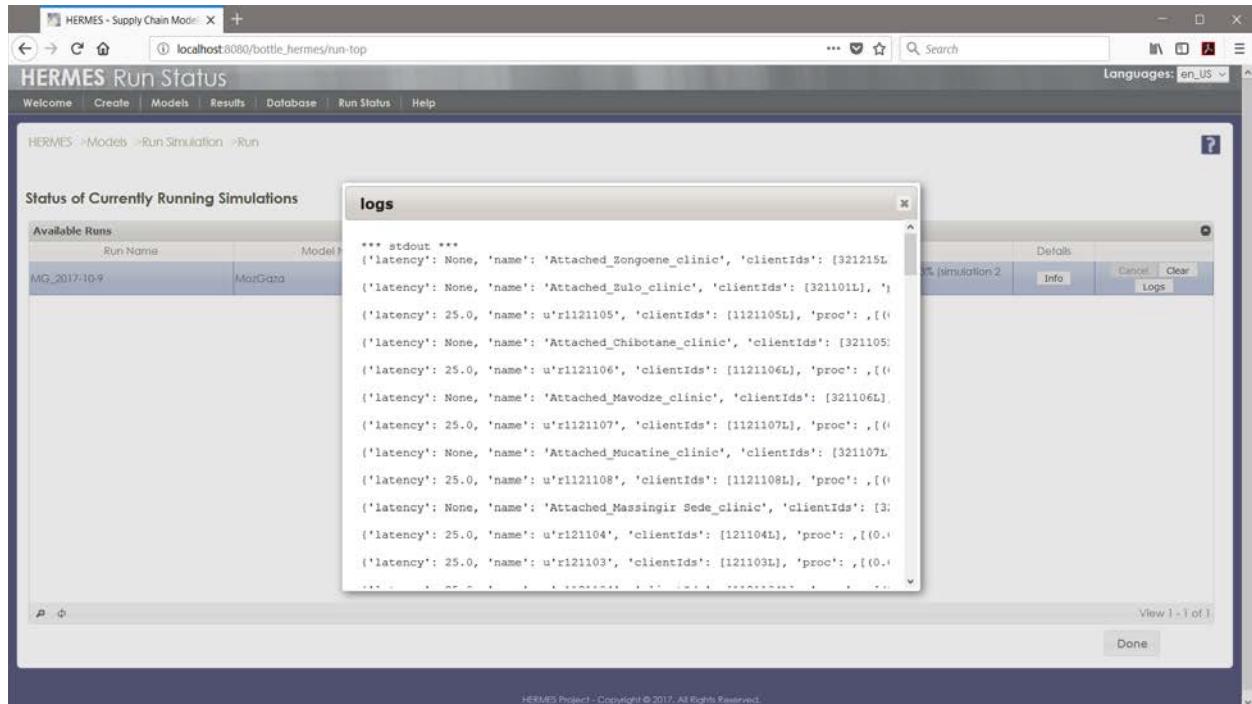
Then click “Yes” to cancel the run or “No” to let it continue.

#### 7.4.3 Clear a run

The “Clear” button will remove the run info from the list of available runs. This does not affect the results.

#### 7.4.4 Logs

Once a run has finished, you can display the output log of the simulation by clicking the “Logs” button. This can be useful if the run did not complete successfully or as you expected. The button will be greyed out and unavailable until the run is done.



## 8 Results

### 8.1 Open Results Page

On Welcome Page, click “View and Compare Results from Previous Model Runs”

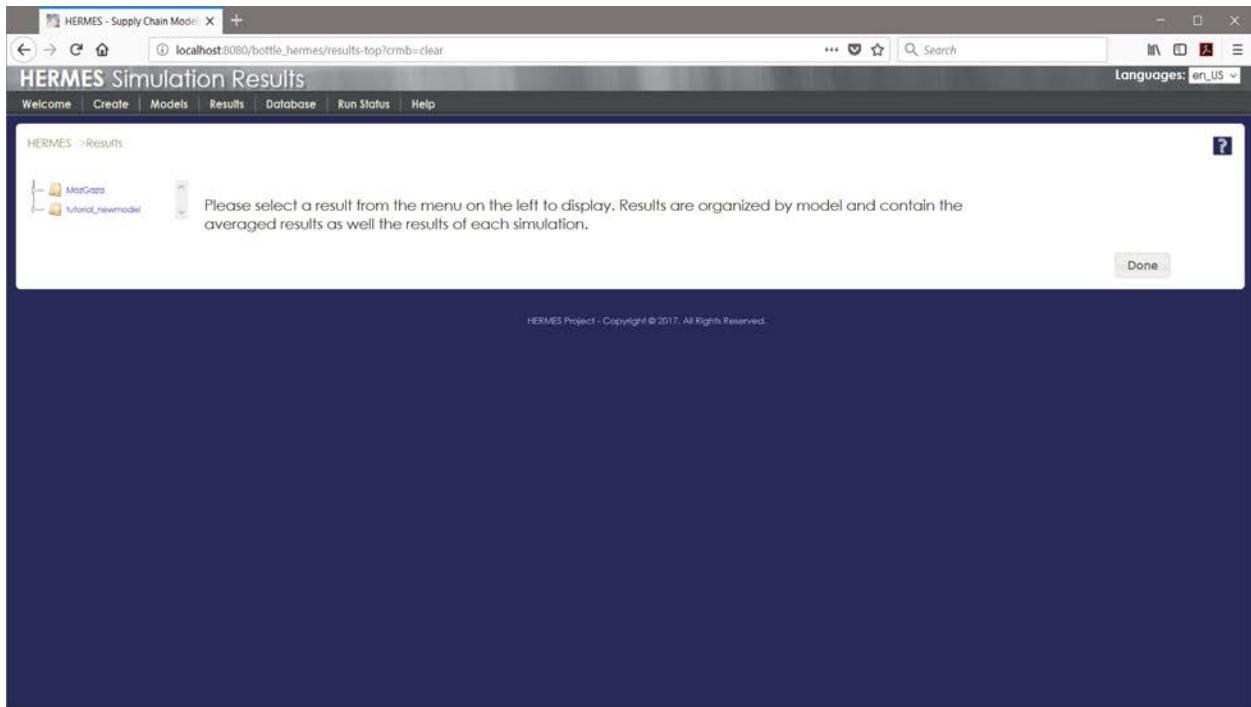
-or-

On Main Menu, click “Results”

-or-

On Available Models page, click “Results” button of model for which you wish to look at results.

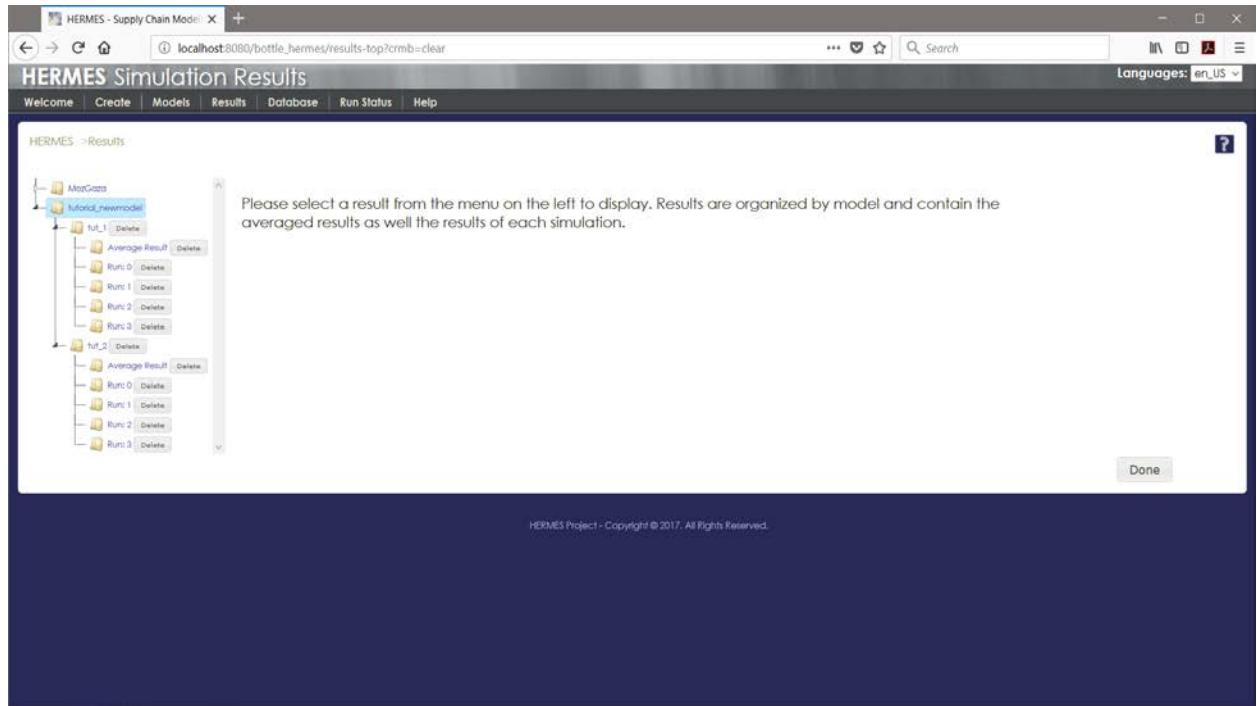
In all cases, you will get a window that has an expandable list of results organized by model name.



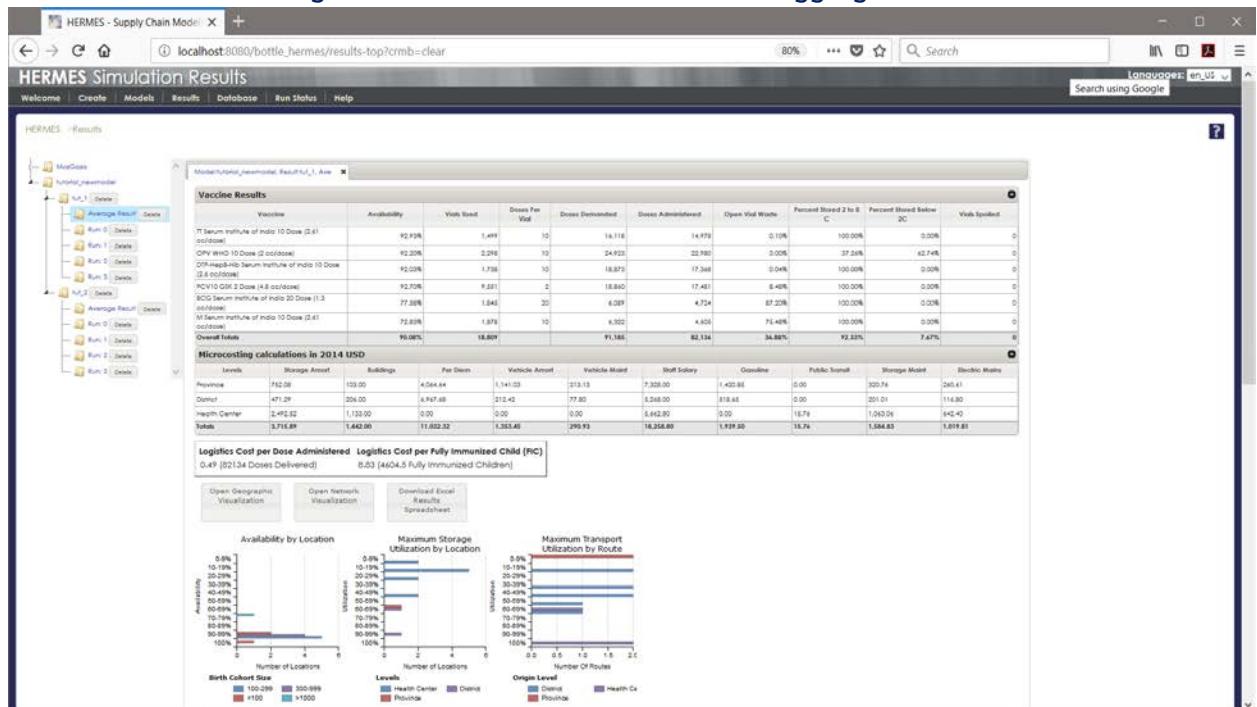
## 8.2 View Results

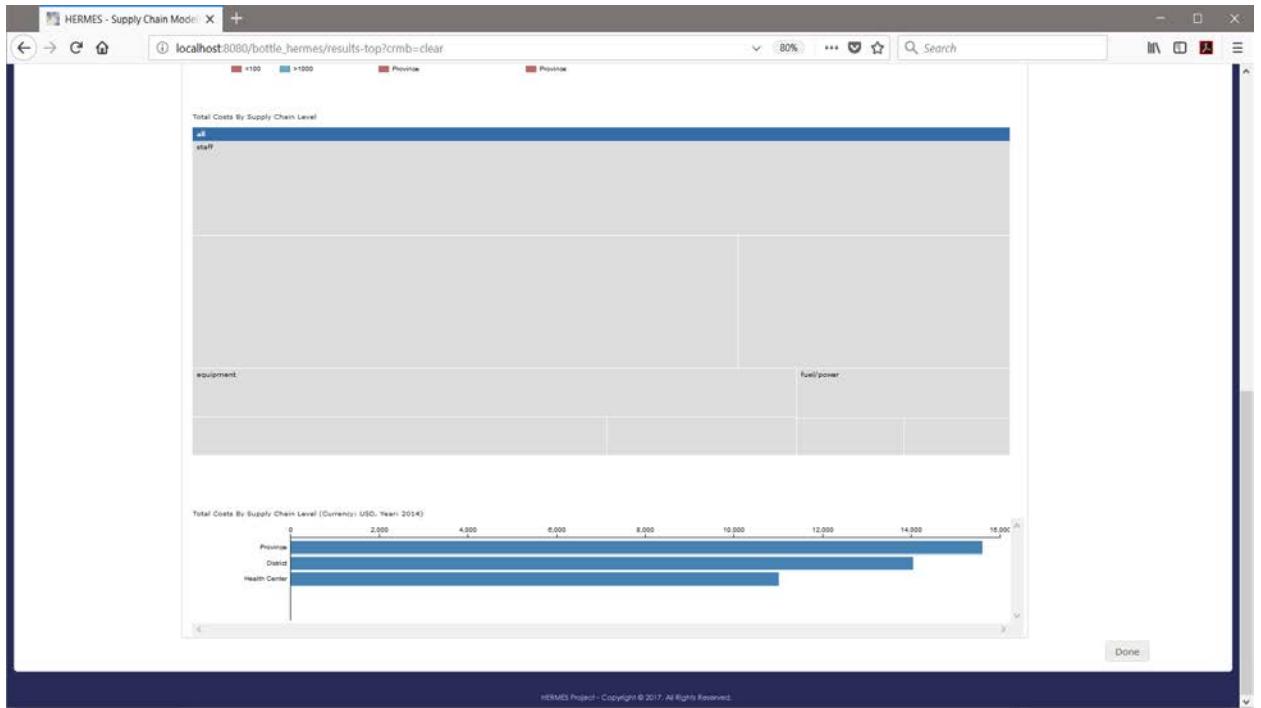
### 8.2.1 Open Results

1. Click on model name for which you wish to view results. This will expand to show you the list of all results calculated for that model.

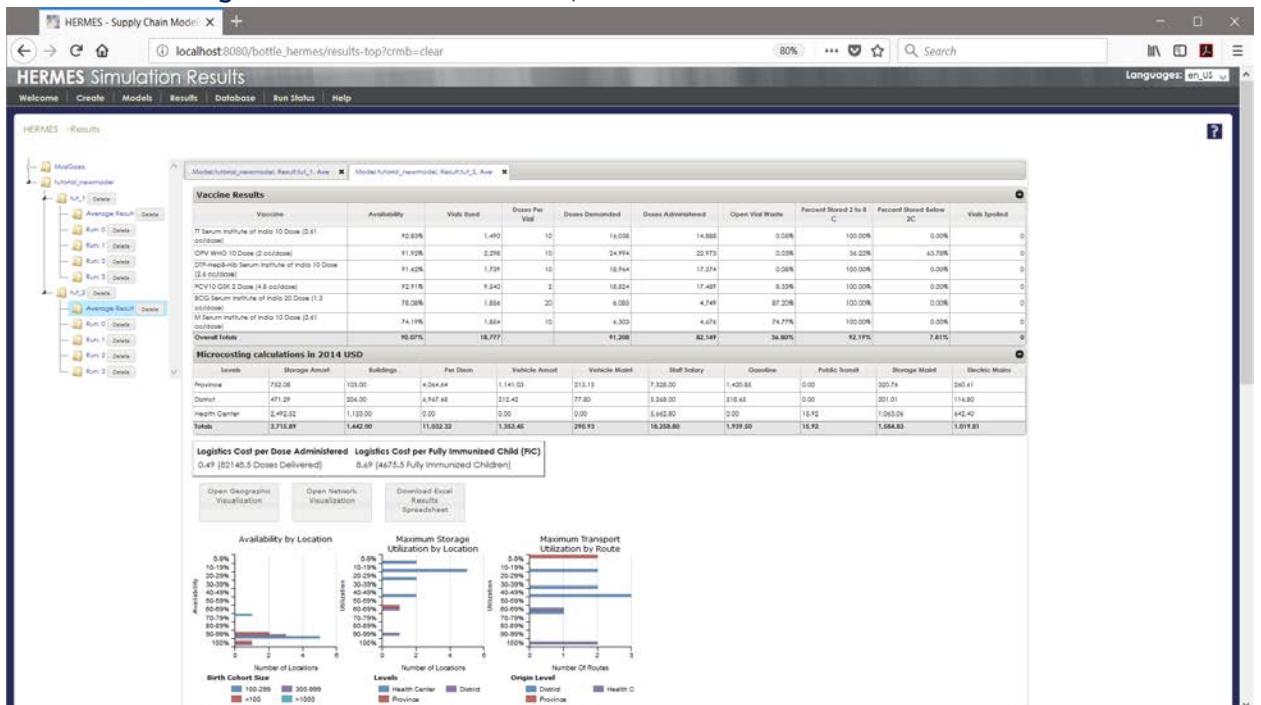


2. Each set of results is broken down into the results for each run and an average result. Clicking on the results name will expand or close the results included in that run. If an average result is not included, at least one of the runs didn't finish or there was some other error.
3. Click on Run:# or Average Result to view either individual or aggregated results.





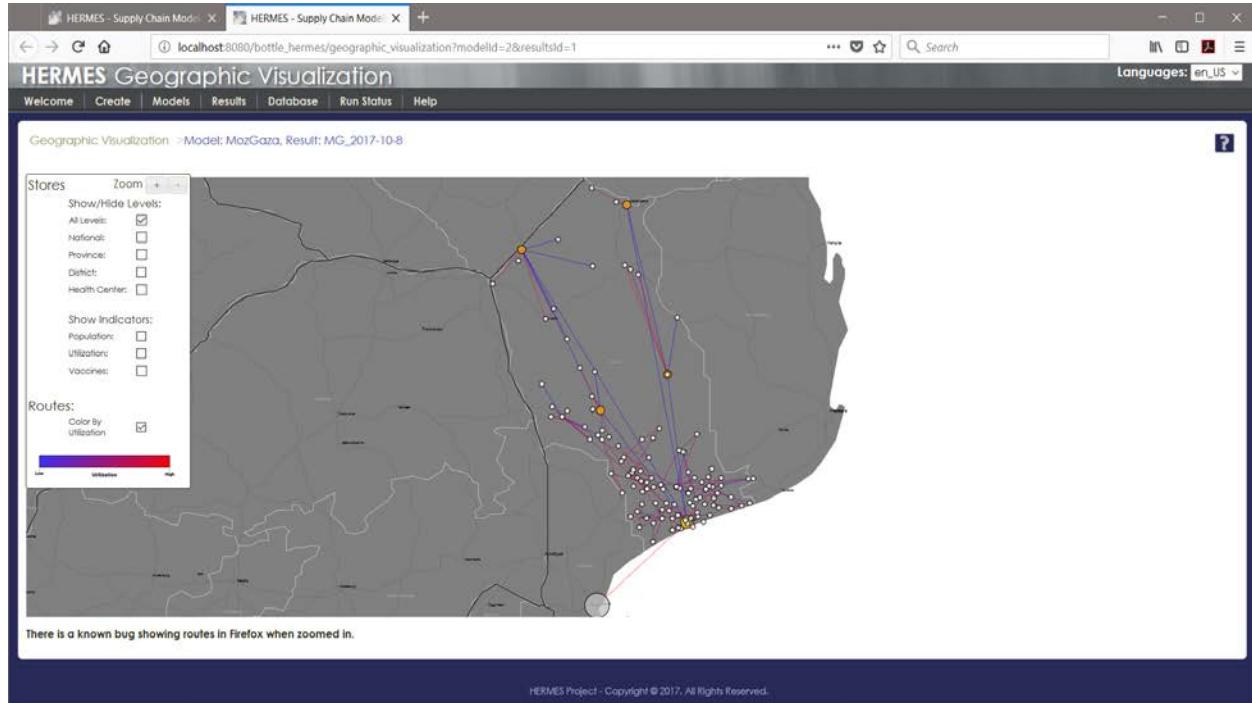
4. You can have more than one set of results open at a time. Results will appear as tabs in the window on the right. To close a set of results, click the x in the tab with its name.



## 8.2.2 Open Geographic Visualization

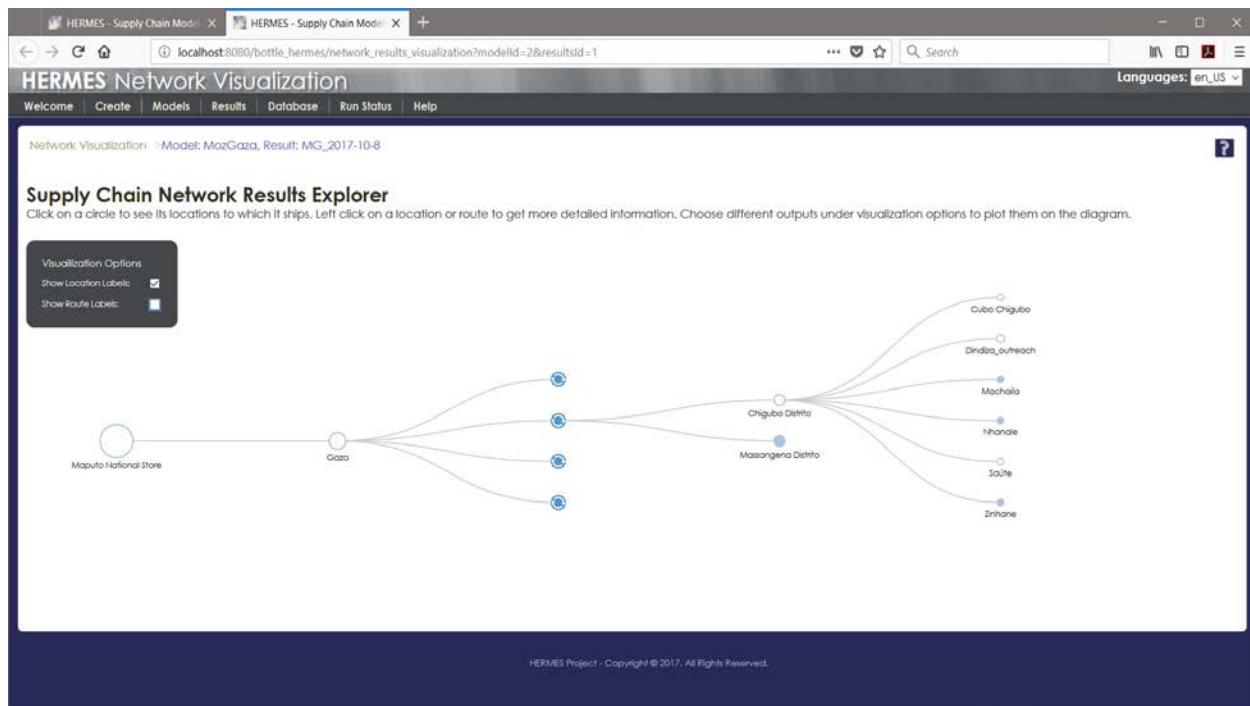
Click “Open Geographic Visualization” button below tables to open a map of the supply chain network visualized against a map in a new tab. This is only available if latitudes and longitudes are

supplied for each location. The map has a control section that allows you to zoom in or out of the map, show and hide various levels of the supply chain, or color routes and locations to indicate various utilization levels.



### 8.2.3 Open Network Visualization

Click “Open Network Visualization” button below spreadsheet to open a map of the supply chain network in a new window. This is the same map as is shown on the main model page, with the same interactions as described in Section 4.5. It also has a control section to show or hide location or route names.



## 8.3 Delete Results

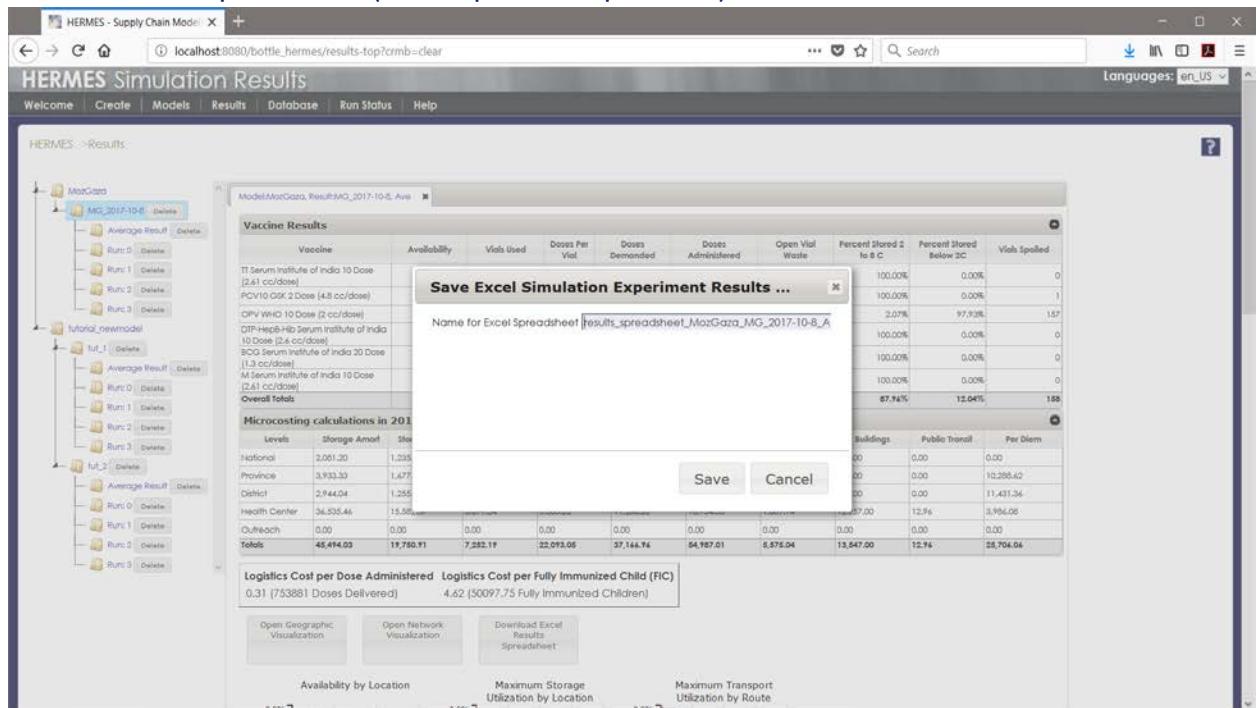
**Click the “Delete” button next to results you want to delete. Click “Yes” to delete results.**

If you click the “Delete” button next to the name of the run instead of the individual run number or average, you will be asked if you want to delete the entire group of results. Click “Yes” to delete all results.

The screenshot shows the HERMES - Supply Chain Model application running at [localhost:8090/bottle\\_hermes/results-top?crmb=clear](http://localhost:8090/bottle_hermes/results-top?crmb=clear). The main window displays "HERMES Simulation Results" with a "Vaccine Results" table. A confirmation dialog box is overlaid on the table, asking "Are you sure that you would like to delete this entire group of results?" with "Yes" and "No" buttons. Below the table, there's a section for "Microcosting calculations in 2014 USD" and "Logistics Cost per Dose Administered". At the bottom, there are links for "Open Geographic Visualization", "Open Network Visualization", "Download Excel Results Spreadsheet", and three summary metrics: "Availability by Location", "Maximum Storage Utilization by Location", and "Maximum Transport Utilization by Route".

## 8.4 Export Results

1. View results per Section 8.2.
2. Click “Download Excel Results Spreadsheet” button below spreadsheet.
3. Enter name for spreadsheet (or accept default provided) and click “Save.”



4. Choose Open or Save File from the download dialogue box.

## 8.5 Understanding Results

### 8.5.1 The Vaccine Results Table

The Vaccine Results table lists statistics for each vaccine in the dose schedule, as well as overall statistics for all vaccines combined.

#### 8.5.1.1 Doses Demanded

Doses Demanded indicates the number of doses of each vaccine that was needed at immunizing locations in order to administer the required vaccines to all people who arrived for vaccinations.

#### 8.5.1.2 Doses Administered

Doses Administered indicates the number of doses that were given to people arriving for vaccinations. This number may be lower than Doses Demanded if supply chain bottlenecks or ordering policies prevented the necessary vaccines from getting where they were needed, when they were needed.

#### 8.5.1.3 Availability

Availability expresses the Doses Administered as a percentage of the Doses Demanded.

#### 8.5.1.4 Open Vial Waste

Open Vial Waste is the number of doses discarded from opened vials, as a percentage of all doses in vials that were opened. Doses must be discarded from opened vials depending on the type of vaccine (lyophilized or liquid, for example) and the immunization program policies (some

programs mandate discarding all opened vials at the end of every session, while others may allow some types of opened vials to be used in future sessions).

### **8.5.2 Histograms**

Histograms display the distribution of overall vaccine availability, maximum storage utilization, and maximum transport utilization across locations.

#### **8.5.2.1 Maximum Storage Utilization**

Maximum Storage Utilization indicates the maximum storage capacity needed at a location during the simulation, as a percentage of the actual capacity available at that location.

#### **8.5.2.2 Maximum Transport Utilization**

Maximum Transport Utilization indicates the maximum transport capacity needed for a route during the simulation, as a percentage of the actual capacity available on that route.

### **8.5.3 Microcosting Results**

#### **8.5.3.1 Microcosting Table**

Microcosting results are first displayed in a table which lists costs accrued at each supply chain level during the simulation, as well as the total for all levels. The table heading states the year and currency in which all cost results are reported.

#### **8.5.3.2 Interactive Treemap**

An interactive zoomable treemap allows for quick visualization of the major cost driving categories and the relative cost of each level, location, and route. The treemap displays boxes labeled with categories of costs, with the relative size of each box representing the relative share of costs attributed to that category. Clicking any box will "zoom in" the treemap to the selected category, now further broken down into subcategories. To zoom out to the previous level of costs, click on the blue bar at the top of the treemap, which displays a label of the current category.

#### **8.5.3.3 Interactive Bar Chart**

An interactive Costs Bar Chart initially displays total costs by level. Clicking any level will regenerate the bar graph to show the costs accrued at each location and route at the selected level. Clicking any location or route will display the costs by category at that location or route. Return to the previous view by clicking in any empty white space in the chart.

### **8.5.4 Results Spreadsheet**

The Excel spreadsheet that is downloadable per Section 8.4 contains several sheets of information about the model. The first page is an overall model summary, followed by a level-wise device inventory, store locations with cost breakdowns, route information with cost breakdowns, and then listings of storage devices, vehicles and vaccines.

The screenshot shows a Microsoft Excel spreadsheet titled "MozGaza". The spreadsheet contains several data tables and formulas. At the top, there is a ribbon with tabs like FILE, HOME, INSERT, PAGE LAYOUT, FORMULAS, DATA, REVIEW, VIEW, DEVELOPER, ACROBAT, POWERPIVOT, and TEAM. The main content includes:

- Overall System Statistics**: A table with columns for Facility, Total, Vaccinating, Average Peak Storage Utilization, and Total Volume Delivered (L).
- Vaccine Statistics**: A table with columns for Vaccine, Availability, Doses Needed, Doses Received, Open Vial Waste, Vials Opened, Vials Procured, Vials Spoiled, % Stored 2 to 8°C, and % Stored Below 2°C.
- Population Statistics**: A table with columns for Age Group, Total, Average, District Minimum, District Maximum, Health Center Minimum, Health Center Maximum, and Outreach Minimum, Maximum.
- Model Summary**: A row showing summary statistics for the model.

## 9 Help

### 9.1 Tutorials

The complete file for the HERMES tutorials can be found here. You can also locate each section of the tutorials individually by clicking on the titles broken out below:

- [\*\*9.1.1 Creating a New Vaccine Supply Chain Model\*\*](#)
- [\*\*9.1.2 Running Your New Model and Viewing Results\*\*](#)
- [\*\*9.1.3 Introducing or Changing Vaccines\*\*](#)
- [\*\*9.1.4 Adding, Removing and Changing Storage Devices\*\*](#)
- [\*\*9.1.5 Removing a Level from the Supply Chain\*\*](#)
- [\*\*9.1.6 Modifying Transport Characteristics by Level\*\*](#)
- [\*\*9.1.7 Introducing Transport Loops\*\*](#)

### 9.2 Database Exploration/The Databases Page

View components in the HERMES Database and your available models.

#### 9.2.1 Open the Databases Page

On Welcome Page, click “View Databases”

-OR-

On Main Menu, click “Databases”

By default, the vaccine component is selected.

The screenshot shows the HERMES Database Types interface. At the top, there's a navigation bar with links for Welcome, Create, Models, Results, Database, Run Status, and Help. The language is set to en\_US. Below the navigation is a breadcrumb trail: HERMES >Vaccines. A search bar is present at the top right. The main content area is titled "Explore the HERMES Databases" and has tabs for Vaccines, Transport, Storage, Population, Per Diems, and Staff. Under the Vaccines tab, it says "Showing vaccine types for HERMES Database" and "Grouping subgrids by Abbreviation". A table lists "Available Vaccine Types" with columns for Name and Count. The table includes rows for BCG, dT, DTP, DTP-HepB, DTP-HepB-Hib, DTP-Hib, HINI, HepA, HepB, Hib, HPV, inf, IPV, and JE. The count for each type is listed to the right. At the bottom right of the table, it says "View 1 - 30 of 30". A "Done" button is located at the bottom right of the main content area.

## 9.2.2 Using the Databases Page

### 9.2.2.1 Choose component category

The different component categories in the databases are available as buttons at the top of the page: vaccines, transport equipment, storage equipment, population types, per diem policies, and staff types.

#### 9.2.2.1.1 Vaccines

By default, vaccines are grouped by antigen abbreviation. Only when the vaccines component category is selected is there a second dropdown menu to allow grouping them by presentation or manufacturer instead.

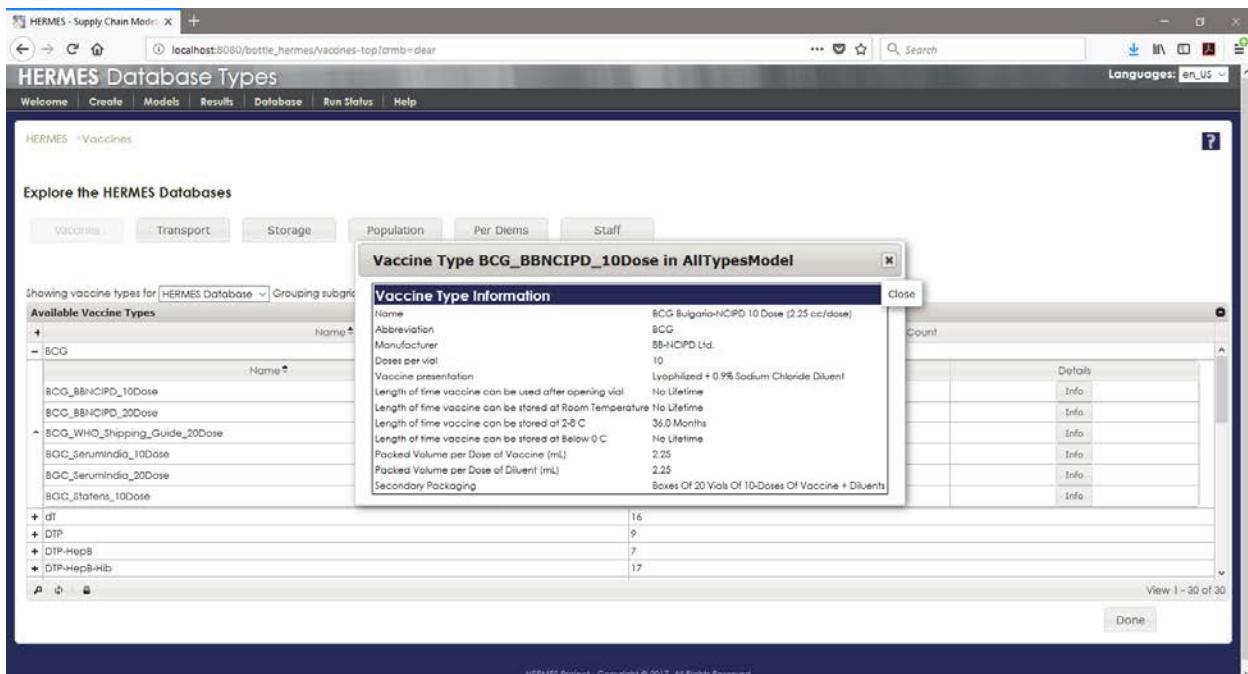
The screenshot shows the HERMES Database Types interface. At the top, there's a navigation bar with links for Welcome, Create, Models, Results, Database, Run Status, and Help. Below the navigation bar, the title "HERMES Database Types" is displayed. Underneath the title, a breadcrumb trail shows "HERMES >Vaccines". A search bar and a language selection dropdown ("Languages: en\_US") are also present.

The main content area is titled "Explore the HERMES Databases" and features a tab bar with "VACCINES" selected, along with Transport, Storage, Population, Per Items, and Staff tabs. Below the tabs, a table displays "Available Vaccine Types" grouped by "Abbreviation". The table has columns for Name, Vaccine presentation, Manufacturer, and Count. The "Name" column is sorted in ascending order. The "Count" column shows the number of items under each category. The table includes expandable categories like BCG, dT, DTP, etc., indicated by plus signs (+) before their names.

Click the "+" to expand any category and view individual items. Click the "-" to collapse the category.

This screenshot shows the same interface as the previous one, but the BCG category has been expanded. The expanded table now includes additional columns: DisplayName and Details. The DisplayName column provides a detailed description of each BCG item, such as "BCG Bulgaria-NCIPD 10 Dose (2.25 cc/dose)". The Details column contains an "Info" button for each item. The "Name" column is still sorted by ascending order.

Click the "Info" button to view available details for an item.



The HERMES Database lists WHO prequalified vaccines by antigen, followed by manufacturer and primary container size (doses per vial). Vaccines with WHO listed as the manufacturer indicate WHO International Shipping Guidelines. These guidelines indicate the maximum recommended packaged volume per dose for various types of vaccines, and these can be used when the actual manufacturer supplying vaccines is not known.

#### 9.2.2.1.2 Transport

The HERMES Database includes commonly used vehicle types. These examples include a refrigerated truck, which has a net cold storage capacity. Other vehicles that lack refrigeration include cold boxes and vaccine carriers.

The screenshot shows the HERMES Database Types interface with the URL [localhost:8080/bottle\\_hermes/truck-top](http://localhost:8080/bottle_hermes/truck-top). The main title is "HERMES Database Types". Below it, the path is "Vaccines >Transport". A navigation bar includes "Vaccines", "Transport", "Storage", "Population", "PerDiems", and "Staff". The main content area displays a table titled "Available Transport Types" with columns "Name", "DisplayName", and "Details". The table lists the following items:

Name	DisplayName	Details
Std_DoubleCabTruck	Double cab truck 4 large C8	Info
Std_SingleCabTruck	Single cab truck 8 large C8	Info
Std_bus	Public transportation	Info
Std_coldtruck	Cold truck 3570L	Info
Std_motorbike	Motorbike I VC	Info
Std_walk	Person walking	Info

At the bottom right of the content area, there are buttons for "View 1 - 6 of 6" and "Done".

### 9.2.2.1.3 Storage

The HERMES Database includes WHO prequalified storage equipment, as well as commonly used devices. WHO prequalified equipment is listed by model, with a prefix of "CB" for cold boxes and "VC" for vaccine carriers. Commonly used devices include a 30 cubic meter walk-in cold room and a freezer room of the same size. Devices are organized by types; categories can be expanded and collapsed using the "+" and "-" next to the label.

The screenshot shows the HERMES Database Types interface with the URL [localhost:8080/bottle\\_hermes/fridge-top](http://localhost:8080/bottle_hermes/fridge-top). The main title is "HERMES Database Types". Below it, the path is "Vaccines >Transport >Cold Storage". A navigation bar includes "Vaccines", "Transport", "Storage", "Population", "PerDiems", and "Staff". The main content area displays a table titled "Available Cold Storage Types" with columns "Name", "DisplayName", and "Details". The table lists the following items, with some entries expanded to show sub-items:

Name	DisplayName	Details
■ ColdBox - 5 item(s)		
■ ColdRoom - 2 item(s)		
Std_ColdRoomFreezer_U	Freezer room 30m3	Info
Std_ColdRoomFridge_U	Cold room 30m3	Info
■ Freezer - 6 item(s)		
■ IceLinedRefrigerator - 5 item(s)		
■ IceLinedRefrigeratorFreezer - 7 item(s)		
■ Refrigerator - 1 item(s)		
■ RefrigeratorFreezer - 28 item(s)		
■ VaccineCarrier - 6 item(s)		

At the bottom right of the content area, there are buttons for "View 1 - 60 of 60" and "Done".

#### 9.2.2.1.4 Population

The HERMES Database includes commonly used population groups, typically based on age.

A screenshot of a web-based application titled "HERMES - Supply Chain Model". The URL is "localhost:8080/bottle\_hermes/people-top". The interface has a top navigation bar with links: Welcome, Create, Models, Results, Database, Run Status, Help, and Languages (set to en\_US). Below the navigation is a breadcrumb trail: HERMES > Vaccines > Transport > Cold Storage > Population. A horizontal menu bar below the breadcrumb includes tabs: Vaccines, Transport, Storage, Population, PerDiems, and Staff. The main content area is titled "Showing population types for HERMES Database". A table titled "Available Population Types" lists the following data:

Name	DisplayName	Details
0to1Year	Children Below 1 Years of Age	Info
1to2Year	Children Ages 1 to 2 Years Old	Info
2to3Year	Children Ages 2 to 3 Years Old	Info
3to4Year	Children Ages 3 to 4 Years Old	Info
4to14Year	Children Ages 4 to 14 Years Old	Info
Newborn	Newborn Children	Info
Pregnant	Pregnant Women	Info
Women_CBA	Women of Childbearing Age	Info

At the bottom right of the content area are buttons for "View 1 - 8 of 8" and "Done". The footer of the page says "HERMES Project - Copyright © 2017. All Rights Reserved."

#### 9.2.2.1.5 Per diems

The HERMES Database includes one example per diem rule for routes, which specifies that no per diem be paid for trips that occur.

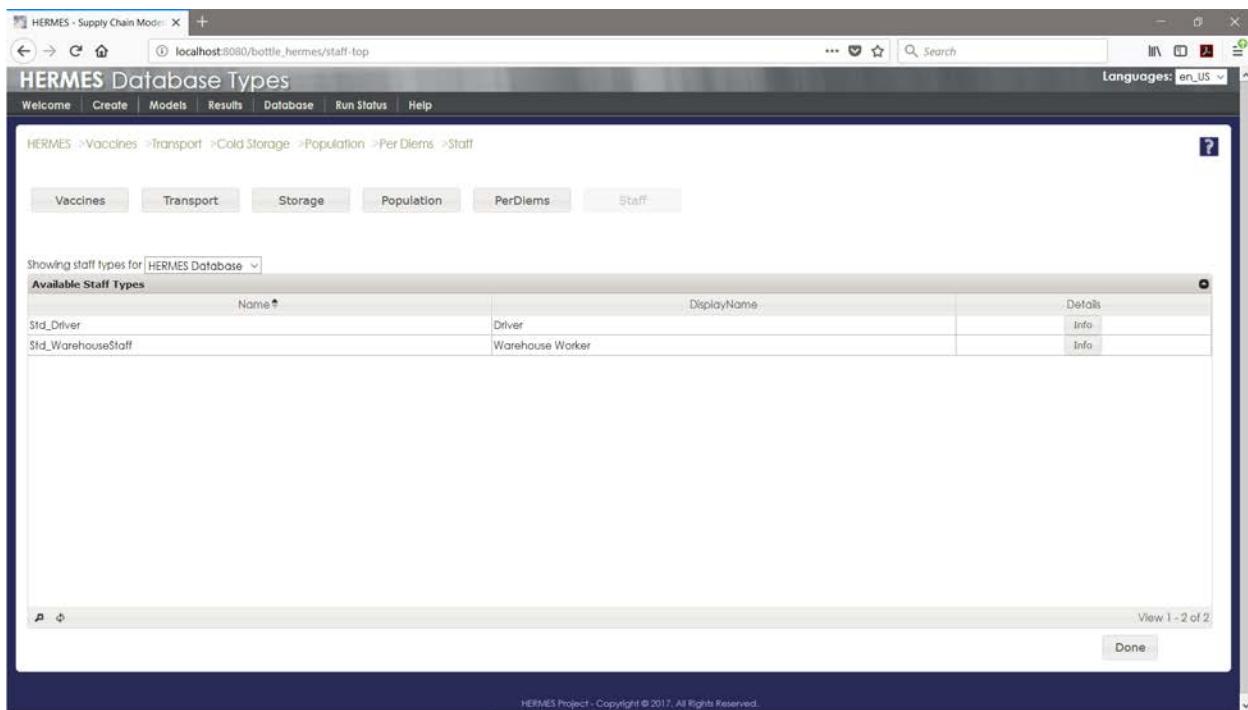
A screenshot of the same web-based application as the previous image. The URL is "localhost:8080/bottle\_hermes/perdiem-top". The interface and navigation are identical. The main content area is titled "Showing PerDiem types for HERMES Database". A table titled "Available PerDiem Types" lists the following data:

Name	DisplayName	Details
Std_Per_Diem_None	No Per Diem	Info

At the bottom right of the content area are buttons for "View 1 - 1 of 1" and "Done". The footer of the page says "HERMES Project - Copyright © 2017. All Rights Reserved."

### 9.2.2.1.6 Staff

The HERMES Database includes examples of commonly used staff types.



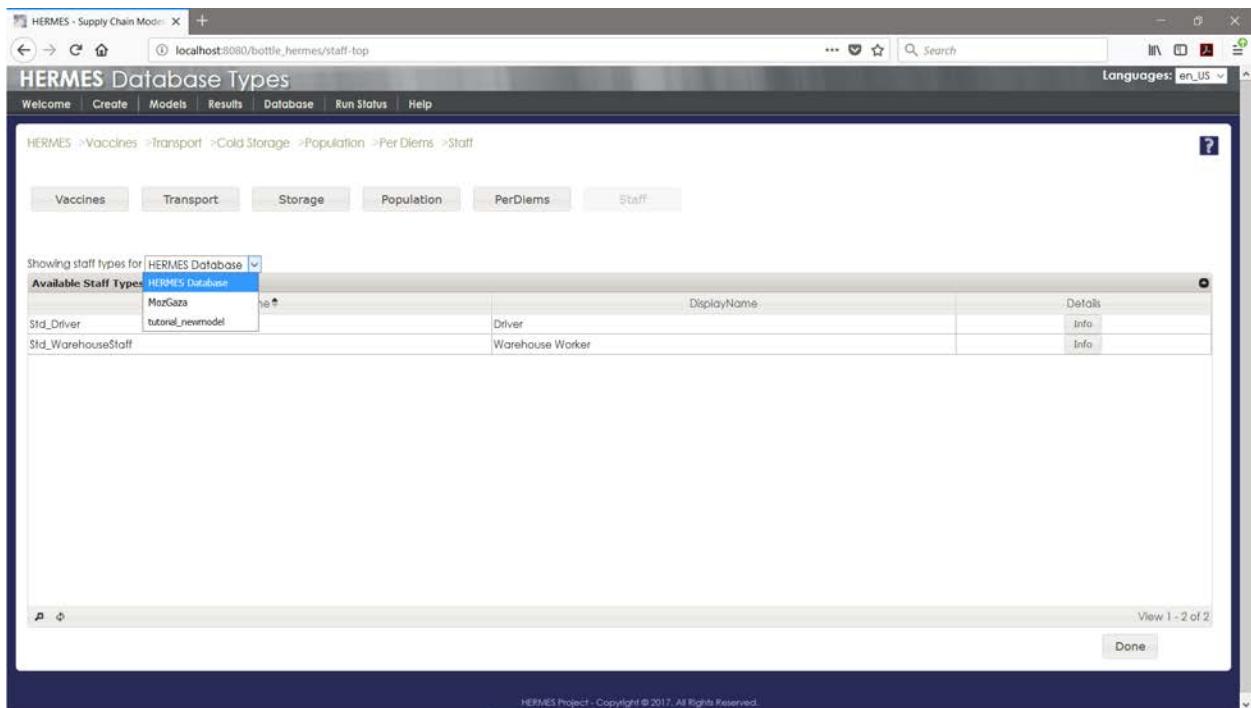
The screenshot shows a web-based application window titled "HERMES - Supply Chain Modeler". The address bar indicates the URL is "localhost:8080/bottle\_hermes/staff-top". The main title is "HERMES Database Types". Below the title, there's a navigation menu with links: Welcome, Create, Models, Results, Database, Run Status, and Help. A language selection dropdown shows "Languages: en\_US". The main content area displays a breadcrumb trail: HERMES > Vaccines > Transport > Cold Storage > Population > Per Items > Staff. Below the breadcrumb, there are several component category buttons: Vaccines, Transport, Storage, Population, Per Items, and Staff. A dropdown menu labeled "Showing staff types for HERMES Database" is open, showing two entries: "Std\_Driver" and "Std\_WarehouseStaff". Each entry has columns for "Name", "DisplayName", and "Details". The "Name" column contains "Std\_Driver" and "Std\_WarehouseStaff". The "DisplayName" column contains "Driver" and "Warehouse Worker". The "Details" column contains two "Info" buttons. At the bottom of the page, there's a footer with the text "HERMES Project - Copyright © 2017. All Rights Reserved." and a "Done" button.

### 9.2.2 Available databases

Under the component category buttons is a drop down menu allowing you to choose which database info you want to view.

The HERMES database includes WHO prequalified items where available, as well as examples of commonly used items.

Also available are the databases associated with any models you have saved.



## 9.3 Quick Help

There is a question mark on the top corner of each page which when clicked will offer help specific to that page.

## 9.4 Online Help

This documentation is also available from the Help tab of the Main Menu.

## 10 Glossary

### Supply Chain Basics

#### Supply Chain

The term for a system of processes through which product is moved from a manufacturer to the user.

#### Push

Alternately called an allocation system. In this type of system, the person who issues the supplies (e.g. the higher level) calculates the quantities sent through to the next level. Quantities can either be fixed in size or variable with regards to the demand (referred to in HERMES as "varpush").

#### Pull

Alternately called a requisition system. In this type of system, the location which receives the supplies (at the lower level) calculates the quantities that are required at their level. Quantities are usually variable, as these systems request whatever stock is needed.

#### Cold Chain

The supply chain when it utilizes cold devices, such as refrigerators, freezers, and vaccine carriers, as well as cold vehicles (e.g. cold trucks). Important in the vaccine supply chain because vaccine efficacy is maintained only when vaccines are kept in the cold chain.

#### Leaf Nodes

Alternatively called service delivery points or SDPs. According to the [USAID Logistics Handbook](#), it is defined as "any facility where users receive supplies related to health services". These locations are usually hospitals and health centers, but may also include mobile units, community-based distributors, laboratories, and health posts.

#### Supply Chain Levels

The administrative depots where products are usually kept and vaccine is transferred to and from.

Common levels include the National or Central store, Regional or Provincial stores, District or State stores, and the service delivery points (i.e. health centers).

#### Point-to-Point Shipments

A type of shipping route in which a vehicle delivers or picks up just enough vaccine for one location.

#### Transport Loop

**A type of shipping route in which a vehicle travels to multiple destinations before returning to its point of origin.**

### Vaccine Supply Chain Terminology

#### EPI

Expanded Program on Immunization. A program started by the World Health Organization in 1974, with the goal of making vaccines for childhood diseases available to children throughout the world.

this is the program that dictates the specific vaccines, ages and doses per child for each specific country.

## **NVI**

New Vaccine Introduction. The catch-all term for the introduction of new vaccines into the standard EPI regimen.

## **Stockout**

The term for when a location runs out of a particular product's stock. Can either be a partial stockout (a stockout for a particular product) or a full stockout (when the location has run out of all of a products' stock).

## **Supply Ratio (Vaccine Availability)**

Defined as the number of treated individuals divided by the total number of individuals who are available to vaccinate. Analogous to prevalence, which is a measure in public health. When applied specifically to vaccines, it can be denoted as vaccine availability.

## **Open Vial Waste**

Occurs when vials are opened but not all the doses are completely consumed before the vaccine vial expires. This process has been detailed by a previously published VMI file and the WHO's [Multidose Vial Policy](#).

## **Baseline Scenario**

The supply chain as it currently stands, with no population, storage, transportation or policy modifications.

## **4x4 Truck**

Refers in this case to a pick-up truck, not an all-terrain vehicle (ATV). The space available for vaccines varies based on the specifications for the country-specific truck, as well as if it is a single-cab or a double-cab truck.

## **Vaccine Carrier**

A type of cold box carried to the leaf nodes of a supply chain, often by motorcycle or public transport.

## **Probability Distributions**

### **Stochastic Model**

Alternately called a probabilistic model. The outputs of the model will vary slightly each time, as the model is based on the selection of a random number.

### **Stochasticity**

Refers to a process which uses a random variable and/or uses a random sampling procedure which, over time and many trials, can approximate a certain outcome (opposed to a deterministic process, which parameterizes a variable into a discrete unit, which is subsequently used to create a certain outcome).

## **Poisson Distribution**

The distribution from which the number of patients arriving at a clinic per vaccination session, and any other process involving a random number selection, is based. It is a discrete statistical distribution which expresses the probability of a given number of events occurring in a fixed interval of time and/or space if these events occur with a known average rate and independently of the time since the last event. It is usually based on the Poisson law of small numbers. This distribution is characterized by the parameters: mean =  $\lambda$  and standard deviation =  $\sqrt{\lambda}$ .

## **11 Index**