Guidelines on the use of the GAHI Map Web App: Soil-transmitted helminths and Schistosomiasis

Introduction

The GAHI Map Web App: Soil-transmitted helminths and Schistosomiasis web map application collates our epidemiological data into a single, freely available resource to describe the changing distribution of Soil-transmitted helminths (STH) and schistosomes.

This web map application makes available school and community survey data on the STH and schistosomiasis assembled by the Global Atlas of Helminth Infection. Combined and species-specific prevalence data can be visualised as points at a site-level, as well as aggregated to the second administrative level, typically defined as a district. Also provided are the environmental limits for the distribution of STH,¹ and the predicted proportion of households using improved sanitation and drinking-water source at the district level.²

Users can make maps at regional, national and local levels, filter survey data by characteristics (such as year of survey), tailor the map layouts and print them in different formats.

These distributions provide more than simple cartographic interest. They can be used help tailor intervention strategies towards the dominant intestinal helminth species, and can contribute to investigation of the impact of scaling up of interventions. Analysis of historical infection risk prior to large-scale intervention can help identify factors that may contribute to the persistence of transmission and provide a basis to stratify surveillance activities.

Note: Only data publicly available or data shared by authors without releasing restriction is displayed. We will be releasing more data as authors provide permission.

Functions

Using this web map application, the users will be able to:

- Visualise environmental limits for the distribution of STH at global scale, modelled based on environmental and demographics characteristics¹.


• Display school and community surveys available in the Global Atlas of Helminth Infection database and obtain details for publicly available surveys.

• View combined STH prevalence and highest observed schistosomiasis prevalence for each survey site.

• View site-level species breakdowns for STH, and form of infection (i.e. intestinal and genitourinary) for schistosomiasis.

• Display district-level average prevalence of schistosomiasis and STH for those districts with sufficient data - defined as at least 5 surveys with a minimum of 250 individuals (in total) conducted within a 2-year period.

• Filter surveys according to key characteristics (e.g. location, type of survey, diagnostic method, year) and download the result of the query as a CSV file.

• Display a range of water supply and sanitation coverage indicators by district for sub-Saharan Africa in 2012, based on spatial modelling of population-based household survey data.

• Tailor map layouts and print them in different formats. A mask-out option is available to produce country maps, hiding the surrounding countries. This will help produce comprehensive and readable country maps.

Data

Survey data were identified through structured searches of electronic bibliographic databases (PubMed, EMBASE, MEDLINE) using specified queries; for schistosomiasis, Schistosomiasis OR bilharzia OR Schistosoma mansoni OR Schistosoma haematobium OR Schistosoma intercalatum AND country name; and for STH infection, hookworm OR ascariasis OR trichuriasis OR Necator americanus OR Ancylostoma duodenale OR Ascaris lumbricoides OR Trichuris trichiura OR intestinal parasites OR geohelminths OR soil-transmitted helminths AND country name. This was complemented with manual searches of local archives and libraries and direct contact with researchers.

Estimates of infection prevalence were included according to pre-defined criteria: only cross-sectional prevalence surveys; data were excluded if based on hospital or clinic surveys, post-intervention surveys, or surveys among sub-populations, such as among refugees, prisoners or nomads. No restrictions were placed on sample size or diagnostic method. The longitude and latitude of each survey were determined using a combination of resources including national schools databases, village databases digitised from topographical maps, a range of electronic gazetteers (Geonames, Fuzzy Gazetteer, Google Earth) and contact with authors who used GPS. This methodology is a continuation of work done by Brooker et al.

The prevalence of infection with any STH species (i.e. combined prevalence of STH) was calculated using a simple probabilistic model of combined infection, incorporating a small correction factor to allow for non-independence between species, following the approach

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of de Silva and Hall. The combined prevalence of STH was estimated as $PHAT \div 1.06$ where $PHAT$ is the uncorrected cumulative STH prevalence calculated as

$$PHAT = H + A + T - (HA) - (AT) - (HT) + (HAT).$$

$H$ is the prevalence of hookworm infection, $A$ the prevalence of $A. lumbricoides$ and $T$ the prevalence of $T. trichiura$.

For schistosomiasis, when both intestinal and genitourinary Schistosoma infections are concurrent, the maximum prevalence reported is provided for the site.

**Layers**

The STH and schistosomiasis web map application is a Geographic Information System (GIS) and as such, is formed by several overlapping layers displaying different type of information. In descending order these layers are as follow:

1. **Combined STH prevalence.** Combined STH prevalence from surveys assembled within the Global Atlas of Helminth Infections which are publicly available (i.e. details on survey design, location and outcome data are provided). For data with restrictions (no permission to release major outcomes), only prevalence range and information on data source are provided.

2. **STH species-specific prevalence layers.** Three layers displaying the point prevalence separately for Ascaris, Hookworms and Trichuris.

3. **Maximum SCH prevalence.** Maximum schistosomiasis prevalence by location.

4. **ADM1 boundaries.** Map of first administrative level division (typically a province, region, county).

5. **STH data aggregation (district).** The average combined prevalence of STH was calculated for districts where at least 5 surveys with a minimum of 250 individuals (in total) were conducted within a 2-year period in the past decade. Districts that did not fulfil these criteria but where any survey reported infection in the past decade were classified as having evidence for transmission.

6. **SCH data aggregation (district).** The average prevalence of schistosomiasis was calculated for districts where at least 5 surveys with a minimum of 250 individuals (in total) were conducted within a 2-year period in the past decade. Districts that did not fulfil these criteria but where any survey reported infection in the past decade were classified as having evidence for transmission.

7. **Global country boundaries.**

8. **Environmental limits for STH.** Map of environmental suitability for the occurrence of soil-transmitted helminth infections.

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9. **Safe drinking water.** Maps show the predicted proportion of households with access to an improved drinking-water source. This is defined as one that is protected from outside faecal contamination: piped water, standpipes, tubewells, borewells, protected dug wells, protected springs and rainwater.

10. **Adequate sanitation.** Maps show the predicted proportion of households with access to an improved sanitation facility. This is defined as one that hygienically separates excreta from human contact: flush toilets, piped sewer systems, septic tanks, ventilated improved pit latrines, pit latrines with a slab and composting toilets. This metric includes households that share access to an improved facility.

11. **Open defecation.** Maps show the predicted proportion of households who report habitually defecating in the open, and have no access to an improved or unimproved sanitation facility.

Finally, a **Country layer** has been provided to hide those countries which the user does not want to be displayed in their map layouts. It must be used along with the **Masking out by country** widget (see below).

**Web Map Interface**

When the STH/SCH web map app is first opened, we are provided with a global view of the prevalence surveys available at the GAHI site (point layer) and in background the environmental suitability for the occurrence of STH infections. The latter covers all those countries which are considered endemic for STH.
Placing the mouse cursor on any feature in the map will bring up a pop-up window with the information linked to this feature. This is applicable to the endemicity layers (both country and implementation unit layers) and community survey layers (both restricted and non-restricted surveys).

**Widgets: tools to help customise your map**

The STH/SCH web map app has been provided with some widgets - or tools - to allow the user to customise their maps:

- navigate across the map
- tailor custom map layouts
- query and filter prevalence data by survey characteristics
- select data by country
- download data.

Widgets have been numbered in the above screenshot, and details on each one are provided below.

**1. Navigation bar**

This left corner panel allows you to:

- **Interactive zoom** controls in the map display. Click the plus or minus button to zoom in or out on the map. The “house” button is used to go back to default extent

- **My location**, allows the network to detect your physical location and zoom the map to it. The location can be highlighted if necessary. The widget takes advantage of HTML geolocation. When the app runs on desktops, it uses the browser on the network to detect the location.
2. Legend

The Legend widget displays labels and symbols for layers in the map. This automatically updates when the visibility of a layer changes. When no operational layers are rendered in the map, the Legend widget is blank.

Basemaps are not shown in the Legend widget by default. The order in which layers appear in the Legend widget corresponds to the layer order in the map.

3. Layer list

The Layer List widget provides a list of operational layers and their symbols, and allows you to turn individual layers on and off. Each layer in the list has a check box that allows you to easily control its visibility. Layers having expansion arrows indicate that they contain sublayers or subtypes.

The order in which layers appear in this widget corresponds to the layer order in the map.

This widget provides functionality allowing you, for example, to change the order of layers in the map or to set a specific transparency for the layer.

4. Survey selection by country

This widget allows you to limit the visibility of STH/SCH prevalence surveys by country. Only the community surveys from a selected country will be visible in the map.

Country list is provided in a drop-down menu, or you can choose to type the country name. After making your choice, click on Apply button, and only those surveys conducted in the selected country will be displayed. Selection is done from both the restricted and downloadable layers.
If you want this selection to persist after widget is closed, tick on the corresponding option available under the 🌟 icon, at the right top corner. You can also choose to save the selection settings, which can be used later.

Click **Reset** to undo the selection.

### 5. Basemap Gallery

This widget presents a gallery of basemaps and allows you to select one from the gallery as the application's basemap.

The global topographic map is set by default, but you can choose among a variety of base map.

![Basemap Gallery](image)

### 6. Attribute tables

The Attribute Table widget displays a tabular view of community survey layer attributes. It displays at the bottom of your web application and can be opened, resized, or closed.

![Attribute Table](image)

You can turn on and off the attribute table, clicking on the widget icon at the left bottom corner of the web map application or going to the Layer list menu and click **Open Attribute Table** option.
Under **Options**, you can define a filter expression based on table fields to query records which fulfil your criteria.

You can also download the entire list of prevalence data and details of surveys, or only those records resulting from a specific query task using the **Export All to CSV** option.

Upon having run a query task the options **Show Selected Records** and **Show Related Records** will be enabled. The second option does not trigger any action in this web map app as only applies to relational tables.

Clicking the + icon on the right side of the Attribute Table panel opens the field visibility window. Check or uncheck the fields to set them to visible or invisible in the table.

### 7. Show Map Overview

The Overview Map widget displays the current extent of the map within the context of a larger area and updates whenever the map extent changes. The current extent of the map is represented in the overview map as a grey rectangle that can be dragged to modify the extent of the current view. You can expand or fold the widget. When the widget is expanded, you can also maximize or minimize it.
8. About

A brief explanation of the purpose of the Global Atlas of Lymphatic Filariasis is provided together with some helpful references for some of the data provided in the web map app.

9. Printer

The Print widget connects the web application with a printing service to allow the current map to print.

The Default Layout controls the pre-selected layout in the list of options on the Print widget. Default options available on the ArcGIS Online service are as follows:

- A3 Landscape; A3 Portrait
- A4 Landscape; A4 Portrait
- Letter ANSI A Landscape
- Letter ANSI A Portrait
- Tabloid ANSI B Landscape
- Tabloid ANSI B Portrait
- MAP_ONLY

The Default Format controls the pre-selected format in the list of options on the Print widget. Options are:

- PDF (georeferenced)
- PNG32
- PNG8
- JPG
- GIF
- EPS
- SVG
- SVGZ
Click **Advanced** to open a menu with advanced print options.

The **Map scale/extent** section defines the method that the print service should use to calculate the printed extent of the map. Preserving **map scale** may cause the printed map to maintain its scale while recalculating the extent around the existing centre point, while preserving the **map extent** may cause the scale to adjust to fit the current map extent into the printed map. You may also force a specific scale by checking the **Force scale** option and entering a scale. Click **current** to populate the value with the present scale of the map.

The **Layout metadata** allows you to override the default values set by the configuration. Enter values for the **Author** and **Copyright** fields to provide current information to the print service. Check the **Include legend** check box to display the legend on the printed map.

If the **MAP ONLY** format is selected, you may provide dimensions for the **Width** and **Height** in pixels. Otherwise, these values are ignored.

The **Print quality** section allows you to update the resolution of the printed map. Provide an updated value for the **DPI** (dots per inch) in the text box.

- After all options have been set with the applicable values, click **Print** to submit all information to the print service. A progress bar displays next to the executing task.

- Upon the completion of the print job, a link to the print output displays. Click the task to open the file in a new window.
- Click **Clear Prints** to clear the print history.

10. Masking out by country
This widget takes control over the Country Mask layer so after turning on this layer at the layer list (1 & 2) and selecting a country from the drop-down menu within the tool (3), all the countries will be hidden by this grey mask except the selected country.

This tool has been conceived to produce enhanced map layouts which only shows data for a particular country.

The ✔️ icon shows at the right top corner of the tool after the filter is applied. Click the filter button again to remove the filtering from the map. Remember to turn off the country mask layer to make the rest of layers visible.

11. Links

A suite of helpful links is accessible through this widget:

- The website of the Global Atlas of Helminth Infections, where this application is hosted.
- Web link to the publications related to the maps of: i) environmental suitability for the occurrence of STH\(^1\), and ii) coverage for water supply and sanitation across sub-Saharan Africa\(^2\).

12. Geocoder

The Geocoder widget enables end users to find locations or search features on the map. This tool may be helpful to find surveys conducted near to a referenced location.