SPATIAL MODELING OF STH INFECTIONS IN KENYA

GIS Specialization Project: Milestone 3

1/16/2018

Zekarias Muluazez

Methods

For this analysis, two types of data sets are used: geographical data and epidemiological data. The geographical data set comprises Kenya administrative boundaries and hydrology. On the other hand, the epidemiological data set comprises data from a 2012 survey of soil-transmitted helminths in Kenya including the characteristics of the schools, school water sources and toilet type, prevalence of the three main types of STH hookworm, *Ascaris lumbricoides* and *Trichuris trichiura*.

Different methods and tools are used in the epidemiological analyses to visualize the spatial patterns of infection and/or disease. Primarily, all the relevant data sets in the spread sheet are converted to shape files to be compatible for ArcGIS. Following, spatial joints are created using join tool. On this step, the vector data of Kenya administration regions are joined with epidemiological information which contains data related to sanitation and water supply in the school and prevalence of the STH to produce school epidemiological data.

Then, symbolizing or displaying of the prevalence of each infection is followed based on the prevalence categories recommended by World Health Organization (WHO) to select a treatment strategy.

Finally, choropleths maps are produced using the aggregate epidemiological data in order to identify districts requiring mass treatment for STH infections. Therefore, it would be possible to show the district-level prevalence of each species on the map to be produced.

TABLE 1: Data sets used for the project

File Name	Description
schools.csv	Characteristics of the schools included in the baseline survey (School id, water source, toilet type)
infection.csv	Infection outcomes for pupils included in the survey (% with hookworm, *Ascaris lumbricoides* and *Trichuris trichiura)*
coord.csv	Coordinates for schools included in the survey
STH district.csv	infection outcomes for pupils included in the survey, summarized by districts
Kenya admin.shp	District boundaries for Kenya, ArcGIS shapefile
Kenya locations.shp	Administrative level (ADM) Location name Under five population per km^2 in 2010 (U5_2010)
Kenya water bodies.shp	Major water bodies for Kenya

Results

In this geospatial analysis, it is possible to produce a map that shows the prevalence of each infection types, their risk level and the required treatment strategy based on WHO recommendations.

According to the finding of the analysis the prevalence of hookworm is greater than 20 percent in 7 administrative regions that are at moderate risk level. Similar risk level of *Ascaris lumbricoides* is found in 9 administrative regions in the Western and Rift Valley provinces. In the same way, *Trichuris trichiura* is found in two regions of the above provinces with the same risk level. On the other hand, the prevalence of *Ascaris lumbricoides* and *Trichuris trichiura* in the coastal regions of Kenya are found be at lower level of risk, that is below 20%.

While the maximum district-level prevalence of the infections is limited to moderate risk level, the school-level prevalence is extended to high risk level that requires maximum treatment strategy.

One school in the coastal province and two schools in the western province are found with prevalence level of hookworm greater than 50% with higher risk level. In addition, 11 schools are found with greater than 50% level of *Ascaris lumbricoides* infection. 5 of them are in the Rift Valley provinces whose main water sources are rain and streams/rivers and the rest 6 schools are in the Western province with the same source of water.

Discussion

The findings of this analysis are found to be valid and meet the prime objective of the project, which aims to visualize data from soil transmitted helminths baseline survey in Kenya to explore the spatial distribution in the prevalence of infection, their level of risk and treatment strategy.

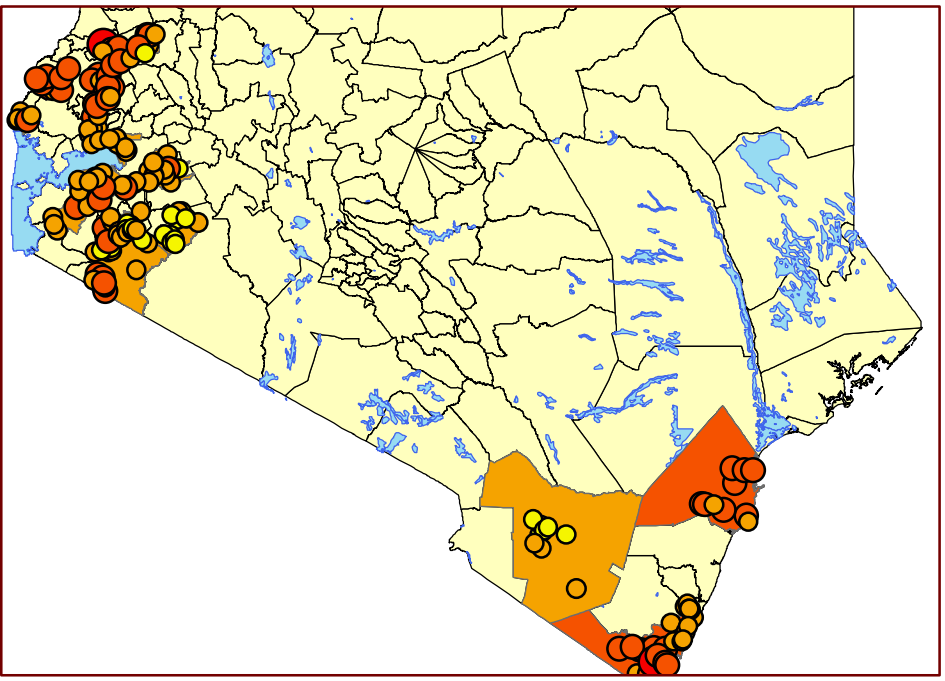
TABLE 2: WHO Prevalence Category and Treatment Strategy.

Prevalence Range	Risk	Treatment Strategy
0%	No infections	
1 – 20%	Low Risk	*Ensure drugs are available at health facilities for case management*
20 – 50%	Moderate Risk	Deworming once a year
≥ 50%	High Risk	Deworming twice a year

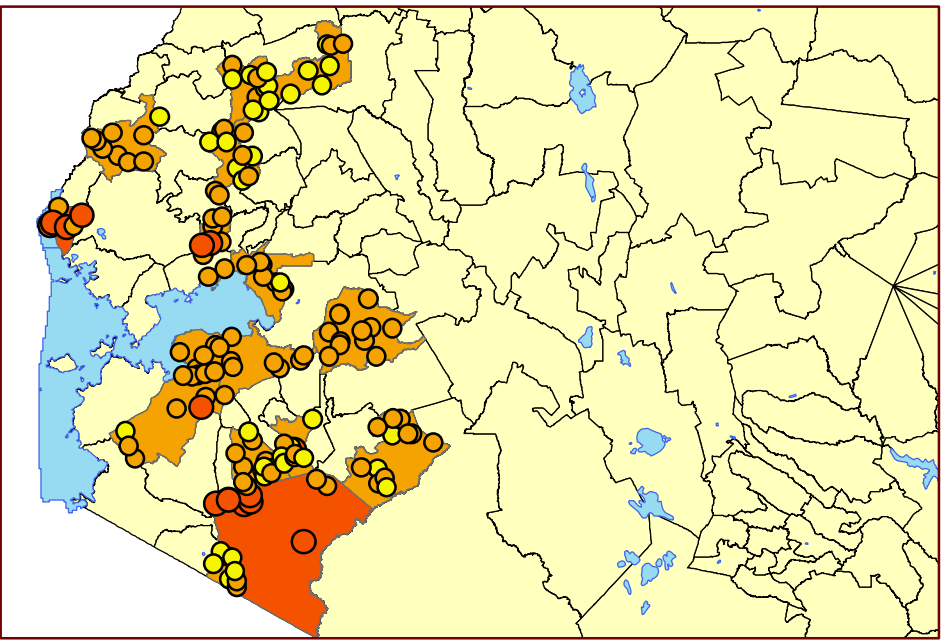
Hence, findings from school's epidemiological data shows that the three types of STH infections are the major health threat of school children. Even if, on average, the risk level of the administrative regions where a school is found to be low, the school might not be safe and will be at the higher level of risk. Most importantly, schools whose main water sources are rain and streams or rivers are at the high risk level of these infections. This can be supported by the findings of the analysis: in11 schools whose primary water sources are rain and rivers or streams the prevalence of *Ascaris lumbricoides* is greater than 50%. According to WHO classification, this level of prevalence has high risk of infection and requires the maximum level of treatment strategy – deworming twice a year.

In district-level of prevalence, Western and Rift Valley provinces are more affected by the three types of infections than the coastal provinces. Hence, most of the administrative regions in the Western and Rift Valley provinces need a treatment strategy of deworming once a year due to their moderate risk level of infection.

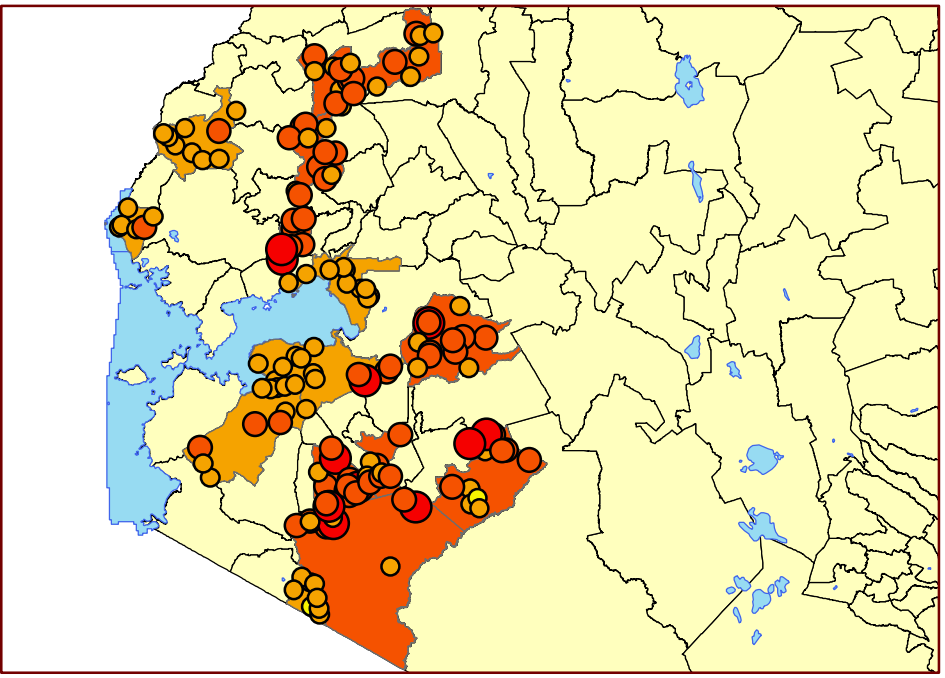
Spatial Modeling of STH Infections in Kenya



(a) Hookworm



(b) Ascaris lumbricoides



(c) Trichuris trichiura

School STH Infections

- No Infection
- Low Risk
- Moderate Risk
- High Risk

District Level STH Infections & WHO Treatment Strategy

- 0%
- 0 - 20% | Ensure drugs are available
- 20 - 50% | Deworming once a year
- >50% | Deworming twice a year
- Kenya water bodies
- Kenya admin

N

0 0.0001 0.0002 0.0004 0.0006 0.0008
Miles

Created by: Zekarias Muluazez
Date: 1/17/2018
Data Source: GAHI (www.thiswormyworld.org)
Projection: ESPG:3395
WGS84|World Mercator