Is There Pee in the Water?

Leptospirosis Risk and Vulnerability Analysis, Peru

Introduction

Leptospirosis is a zoonotic bacterial infection caused by spirochetes of the genus Leptospira. This neglected tropical disease is widespread in Peru and other tropical regions (Bhattacharyya et al. 2005) due to hot and humid climates coupled with dense human to mammal reservoir populations (Johnson et al. 2004). Many animals (wildlife, rodents, livestock, and pets), and occasionally humans (Ramos et al. 2010), can be asymptomatic carriers of the bacteria, excluding them in urine. Most humans are infected via contact with infected urine, either directly or from contaminated water or soil (WHO 2005). Exposure is common in urban slums, in water recreation, and agricultural endemic areas of humans. Symptoms range from mild and flu-like, to jaundice, respiratory distress, and death, and can be confused with the symptoms of viral hemorrhagic fevers like Ebola (Bhattacharyya et al. 2005). In livestock it causes reproductive failure and losses in milk production and growth rates, damaging livelihoods in addition to animal well-being (Lindenthal and Martin 2014).

Presence of leptospirosis in wild and domestic mammals (Blomfield et al. 2008) and in humans (Cruz et al. 2002) has been established in several regions of Peru. For example, in lagoon, seroprevalence of in humans is 12-20% (Johnson et al. 2004). Local or national control of the disease remains elusive. This weighted risk analysis predicts where interventions achieve the highest number of people will be affected by any intervention, which the Rosenbaum study aims to accomplish. The flood zone layer was incomplete, visualizing 5 levels of the incidence of poverty in Peru. This analysis relied upon data from a variety of sources, from the year 2000-2010. The flood zone layer is complete, covering only the coastal half of the country, and the approximation for the rest of the country may overestimate risk because it does not take steps into account. The population layer is from 2000, so that risk factor is likely to have a broader effect than this analysis visualized due to population growth. Land use did not include information on urban/remote differences. This analysis is the only representation by population density. Predicted risk is not tested here, but its accuracy should be prior to the implementation of any large intervention. A pilot study would be appreciated.

In order to design public health interventions capable of reducing incidence ratios of leptospirosis in Peru, understanding risk factors and vulnerability is crucial. Local to county level, the Rose- baum study aims to accomplish.

Methods

Research Questions

- Where should interventions be targeted?
- Which people are predisposed to worse health outcomes from leptospirosis infection (high vulnerability) due to poverty and/or population density?

Vulnerability & Population Density

Poverty gap and population density were added to show three groups to reduce color confusion. Both vulnerability and population density were redacted into three groups to reduce color confusion.

Land use was ranked according to local vegetation, and likelihood of waterlogged soils. Occupational infection with leptospirosis is common in agricultural settings, especially those involving irrigation for rice cultivation or other purposes, and livestock farming. The center was recalculated following the factor table.

Poverty gap is a measure for the mean income of a population fall below the poverty line. The local medium households income (US$ 1,000-1,200) Poverty gap data was obtained from the Peruvian government and joined to the departmental boundary layer to create a map of poverty layer. It was overlaid with gradient to visualize 5 levels of the incidence of poverty in Peru.

Economes were ranked according to their elevation, humidity, likelihood of standing water/waterlogged soils as these are all risk factors for Leptospira bacteria. Being able to optimize the amount of time in the water is critical for the bacteria to survive. Economies were ranked based on the ranking, which can be examined in the factor table.

Leptospira species

Data Sources

Food and Agriculture Organization of the United Nations, the Center of Conservation Data at the National University of Agriculture at La Molina, GAD, the Ministry of the Andean, Peru, National Earth, the Center for International Earth Science Information Network, and the Digital Chart of the World.

Data Projection: Universal Transverse Mercator Projection, Zone 18S

Limitations and Conclusions

Poverty gap is a scale of how far the mean income of a population falls below the poverty line. The local medium households income (US$ 1,000-1,200) Poverty gap data was obtained from the Peruvian government and joined to the departmental boundary layer to create a map of poverty layer. It was overlaid with gradient to visualize 5 levels of the incidence of poverty in Peru.