Using treatment seeking data to define health catchment area models: evidence from Zambia

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Problem:
Understanding the population denominators of health facility catchments is critical for determining disease incidence rates in small areas. Two main obstacles with current data and methods:
- Administrative data are infrequently updated and often inaccurate.
- Static catchment boundaries do not accurately reflect variations in treatment seeking and choice of facility.

Task:
Develop a model parameterized on the facility-specific treatment seeking data to understand what influences facility choice.

Abstract
While routine health facility outpatient data are a vital source for tracking numbers of clinical disease cases in space and time, they are an imperfect measure of disease incidence in communities. Two main difficulties arise when trying to estimate community level incidence from cases reported at the health facility level. First, health records are only representative of those individuals who sought treatment. Thus, the number of cases captured and recorded via health facilities is likely to be an underestimate of the actual number of cases. Second, as information on the location of residence of cases is often lacking, catchment boundaries and populations are often uncertain. A better understanding of the drivers of treatment seeking, as well as the spatial distribution of the patients attending a health facility can help better estimate true incidence rates. Using data from seven rounds of parasite censuses amongst a population of over 300,000 in Southern Province, Zambia, where information on health facility choice and residence location of those seeking treatment for fever was collected, we define a probabilistic model that encodes the decision process of an individual when seeking for treatment and choosing a health facility to attend. Our model factors travel time (based on travel distance and maximum speed allowed by the terrain) as well as the types of health facilities in close proximity (Hospital, Health Center or Health Post).

How do individuals with fever choose where they seek treatment?

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Some attributes of health facilities are easy to measure:
- Type
- Capacity
- Accessibility

Data used

Main roads and facilities location
Elevation
Land cover

Seek treatment?

\[
\text{logit}(\theta) = \mu + \beta d_x + f(x,t)
\]

If seek, which health facility?

\[
p_{ij} = \frac{u_{ij}}{\sum_j u_{ij}}
\]

Results
Results demonstrate a negative relationship between travel time to the closest health facility and the decision to seek treatment. Results also demonstrate that individuals are sometimes willing to undergo longer travel times to receive treatment at a specific type of health facility, rather than going to the closest facility available.

The model allows for overlapping weighted catchment areas to be defined for each health facility depending on its type, travel time and location of other facilities.

This catchment area model will be used in future geospatial modeling work to develop high resolution estimates of the incidence of malaria infection across Zambia.

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