Beyond the Mosquito: Mapping Anthropogenic Risk Factors

Andria E. Rusk, MScGH, PhD

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Disease Cycles
Social Cycles

"You have a 24-hour virus – of course, you’ll be dead by then."
Social Cycles

- Individual
  - (knowledge, attitude, skills, race, gender)

- Interpersonal
  - (social network)

- Organizational
  - (Environmental, ethos)

- Communal
  - (values, norms)

- Political
  - (natl, state, local)
Individual

• Occupation
• Income
• Education
• Age
• Sex
• Comorbidities
• Ethnicity
• Disease knowledge, attitude, and beliefs
• Self Efficacy
• Personal protective behaviors
• Immigration status
• Travel behavior
Interpersonal

• Social beliefs
• Religious beliefs
• Gender roles
• Poverty
• Conflict
• Care seeking behaviors
• Types of work
• Bed net usage
• Rising/sleeping hours
Organizational

• Healthcare access
• Coverage
• Quality
• Health staff knowledge
• Housing type and quality

Organizational
(Environmental, ethos)
Communal

- Urbanization
- Cultural norms
- Group behaviors
Political

- Political context
- War or conflict
- Health promotion, disease prevention, environmental protection policies at national, regional, and local levels
- Sewage systems
Statistically significant predictors of VBD


• ...
Bednet Behavior

• K-function values show clustering of HH with nets
• Income predicted net usage in urban areas but not in rural areas
• Rural area net usage predicted by Euclidean distance to nearest road or nearest health centre

Treatment Seeking Behaviors

• Hot spot analysis of treatment seeking behavior from retail vendors

• Hot spot analysis of treatment seeking behavior from national control programme

Treatment Seeking Behavior – Evaluating Control Program Effectiveness through its Determinants

• Evaluating National Control Programme effectiveness by assessing strength of relationship to determinants
Realizing TAPAS!

• The most important factor for success:

Risk =

• Anthropod Surveillance, vector breeding habits
• Land surface temperatures, rainfall, climate changes
• Provider practices
• Income, education, healthcare access, behavior...

3. ID geographical areas most at risk for introduction and/or emergence
Areas of Risk: Environment

• Bello, Medellín, and Itagüí, Colombia

• Landsat data for topography, temp and vegetation using 7 Landsat bands of classification

• Used maxent algorithm for generating predictions from incomplete datasets

• Tested model fit in target municipalities by quadrant

• Final risk model with highest predictive fit using symptomatic cases

Figure 4. Final risk model for dengue fever case-occurrences in three municipalities of Aburrá Valley. Gray areas are areas predicted as suitable for DF cases; black points are the 2008 cases of dengue fever.

Areas of Risk: Social

• Local variation of coefficients related to dengue rates
• Red = strength in association is positive, blue = strength in association is negative
• Confirmed the role of environmental factors, as well as population density and socioeconomic status in the spread of Dengue disease.
• Confirms the usefulness of spatial regression in predicting Dengue fever rates with limited data availability.
• Provided the foundation for sub-neighborhood level research investigating specific risk areas.
Intervention Successes

• Progress toward community-based interventions for Dengue control:
  • Pesticide-free vector control
  • Behavior change intervention
  • Education materials

• Left panels are baseline data of larvae and pupae per resident comparing intervention areas (A) with control areas (B)

Figure 3. Aedes aegypti larva and pupae per resident (black dots) in the compounds of (A) intervention neighborhood (Tamapa), and (B) control neighborhood (Juvenal) at baseline (left) and endline (right) of an evaluation of a community-based intervention for dengue vector control conducted in Ouagadougou, Burkina Faso, June–October 2016.

To monitor and evaluate control efforts

- Including surveillance outputs in GeoHealth Framework applications
- Including feedback loop in Surveillance and Control Program monitoring and evaluation

TAPAS
- Surveillance of VBD

GeoHealth
- Analysis of determinants and systems
- Risk assessment
- Intervention Monitoring
WHO promulgation

• WHO is calling for geospatial analysis techniques to be used for vector born disease control and eradication

• “Geographical Information Systems should greatly assist targeting of interventions at the focal and household levels, leading to improved effectiveness and cost effectiveness of control.” WHO: Carter, Mendis, and Roberts: Bulletin of the World Health Organization, 2000
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