A Socio-environmental framework for developing predictive intelligence for water-borne diseases

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Context

Waterborne infectious diseases cannot be eradicated because the pathogens are native to aquatic media and are related to modalities of climate and weather patterns. A disease outbreak occurs only when the waterborne pathogens interact with the vulnerable populations under certain sociological pathways. The development of anticipatory decision frameworks is required to expect the unexpected. A perfect prediction for disease outbreak cannot be developed, however, a heuristic understanding can provide a roadmap to develop a predictive intelligence system to aid in an anticipatory decision-making space.

Cholera is perhaps one of the oldest and deadly vibrio (Vibrio cholerae) borne disease that affects a significant amount of human population each year around the globe. The disease was first documented in the Indian subcontinent around 5 BC. Since 18th century, seven cholera pandemics have been recorded worldwide.

Data used

Hydroclimatic data:
Rainfall: NASA TRMM data at 0.25° X 0.25° resolution (1998-2018) at monthly scale.
NASA GPM data at 0.1° X 0.1° resolution (Mar 2014–Nov 2018) at daily scale.
Temperature: NASA MERRA2 data at 0.625° X 0.5° resolution (1980-2018) at monthly and daily resolution.

Human geography data:
Population: ORNL LandScan data at 1km X 1km resolution yearly data.

Predicted Cholera Risk Map

Cholera Trigger Mechanism

Vibrio Prediction Hub: https://vibrio-prediction-ufl.hub.arcgis.com/

Anticipatory Interventions

Key anticipatory intervention steps to stop a potential outbreak or limit the spread must include:

- Distribution of water safety kits.
- Stockpiling and ensuring availability of antibiotics.
- Provisions for timely vaccinations.
- Strengthening the education of the local population to ensure caution on handling water in conflicted regions.