PSIDO: Predictive Surveillance of Infectious Disease Outbreaks

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Poster #235

Challenge/Need

Outbreaks of infectious diseases following weather events are frequently reported, but only after disease occurs in affected populations; often late in the epidemiological curve.

As climate change spurs more frequent and severe weather events, the need also increases for weather-related arbovirus outbreak predictive modeling supported by high-quality underlying data sources.

Noblis hypothesizes that the capacity to predict weather-correlated outbreaks would improve defense mission readiness and reduce morbidity and mortality.

Methodology

1. Create ETL pipeline to ingest weather data
2. Parse and add weather data to DB
3. Load up-to-date data into predictive model
4. Run algorithm to generate risk level predictions
5. Feed pred. model data into UI
6. Display weather events and predicted risk levels in dynamic map
7. Generate suggested mitigation actions to user

Mission Impact

Our tool bridges the gap between data analysis and actionable information for vector-borne diseases. By translating the arbovirus risk factors present in the ecosystem into prescriptive steps. This capability will provide users suggested actions that are based on their existing SOPs and the probability of an outbreak occurring after a weather event to facilitate timely, effective remediations.

Early engagements with potential end users determined that the Department of Defense has a high interest in climate impacts on personnel stationed at international military installations and deployment areas. Warfighters need to be able to operate in dangerous environments. Understanding when and where the risks of arboviral disease are greatest is important for choosing appropriate risk mitigation.

Predict Outbreaks → Mitigate More Outbreak Risks → Reduce Infections, Save Lives!

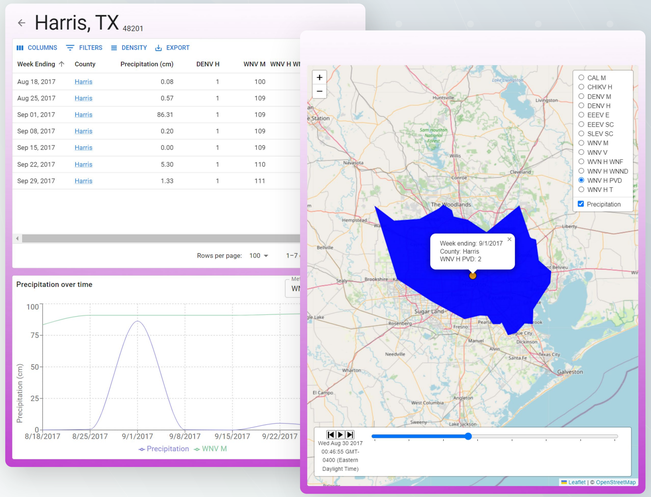
Objective

Develop and demonstrate a model that accounts for overlooked weather-related variables in arbovirus disease outbreaks. Model output data provides vector-based risk level, predicts infectious disease(s) likely to coincide with weather, and suggests mitigation methodology sufficiently far in advance to enable better preparations (e.g., mosquito abatement, stocking vaccines, prepositioning relevant medical supplies, and treating uniforms with permethrin).

Results

Our initial exploratory assessment using data from several sources shows evidence of correlations between specific weather patterns and upticks in the spread of arbovirus diseases. This observation matches our hypothesis that vector-borne illnesses (e.g., arbovirus diseases) spread largely by mosquitos will show strong positive correlation with weather producing standing water and temperatures consistent with mosquito blooms. Our research applies machine learning (ML) algorithms to this problem by better identifying specific relationships between weather and disease outbreaks (e.g., the lag period between rain and mosquito bloom) to better inform disease prevention efforts. Ultimately utilizing predicted/occurring weather, we propose to predict mosquito-borne disease risk levels early enough to intervene.

PSIDO UI Decision Support Tool



Learn More

PSIDO POCs for follow-up

Noblis Applied Sciences

Acknowledgements

Funding for this project was provided by the Noblis Sponsored Research Program

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