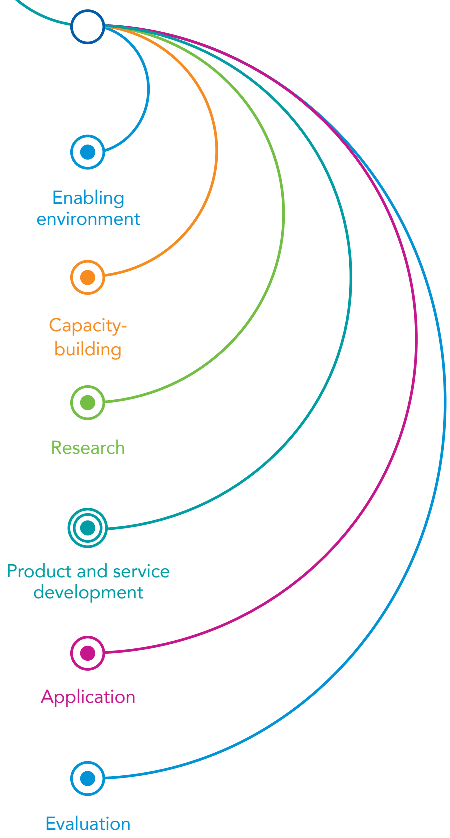
CASE STUDY 5G



CORE ANALYTICS

MAPPING AND MODELLING PLAGUE IN UGANDA TO IMPROVE HEALTH OUTCOMES

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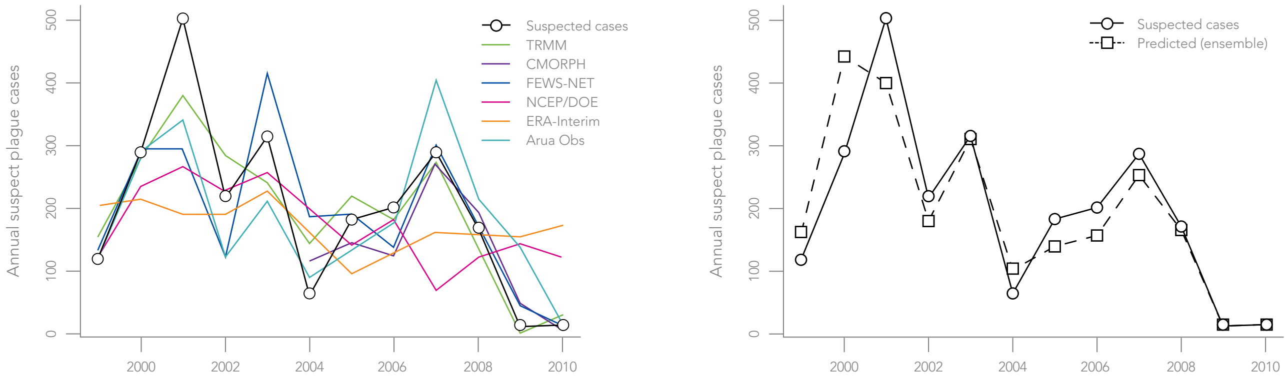
CONTEXT

The West Nile region in northwestern Uganda is a focal point for human plague, which peaks in boreal autumn and is spread by fleas that infest rodent hosts *(37,38)*. The U.S. Centers for Disease Control and Prevention (CDC) is partnering with the National Center for Atmospheric Research (NCAR) to quantitatively address the linkages between climate and human plague risk in this region.

NEW APPROACHES

The primary aim of the research is to advance knowledge of the climatic conditions that may be required to maintain enzootic cycles and to trigger epizootic cycles that lead to human plague cases, and ultimately, to target limited surveillance, prevention and control resources. Because in-situ meteorological records are sparse, a hybrid dynamic–statistical meteorological down-scaling technique was applied to generate a multi-year high spatial resolution climate dataset based on NCAR's Weather Research and Forecasting Model *(39)*. The dataset was subsequently employed to develop a spatial risk model for human plague occurrence in the West Nile region above 1300 metres *(40)* that improved upon a previous model *(41)* developed before validated meteorological data were available for the region. The revised risk model revealed robust positive associations with rainfall at the ends of the rainy season and negative associations with rainfall during a dry spell each summer. A temporal risk model for human plague was also developed for the region with an ensemble-based approach using numerous model-based and remotely-sensed temperature and precipitation records (Figure. 5.16)*(41)*. As with the spatial model results, the temporal model indicates that rainfall is the key driver of year-to-year plague incidence. Ensemble modelling, commonly used in meteorology to predict weather, also worked well in this instance, allowing characterization of uncertainty and, when averaged, providing a robust simulation of year-to-year plague variability. Additional predictive models are being developed that may aid in targeting resources for animal-based surveillance during periods that pose the greatest risk for human plague transmission.

Figure 5.17 Left panel: modelled (colour) and observed (black) annual human plague cases in West Nile, Uganda from 1999–2010. Right panel: ensemble model average (dotted) and observed (black) annual human plague cases.



BENEFITS AND LESSONS

The CDC and NCAR pilot programme enrolled and trained traditional healers in the regions of West Nile above 1 300 metres that, compared to surrounding areas, have cooler and wetter climatic conditions that are associated with elevated risk for plague transmission. Healers were trained to recognize and refer plague patients to local health clinics in support of a broader active plague surveillance programme in collaboration with the Uganda Virus Research Institute (Figure 5.18). The programme is in its seventh year and has 45 healers in the referral network. Feedback from community officials indicates the programme has led to hundreds of referrals. A lesson learned is the need to regularly engage the healers in order to update training and reinforce their important role in strengthening public health in the West Nile region of Uganda.

Figure 5.18 Poster addressing plague in Uganda, jointly developed by CDC and NCAR.

ACKNOWLEDGEMENTS

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