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Hydroepidemiology of Cholera: Predicting Outbreaks using Satellite Derived Global Cholera Index

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Cholera bacteria may survive and thrive in two distinctively different environments: the micro- and the macro-environmental processes that vary over a range of spatial and temporal scales. While appropriate micro-environmental processes are necessary for epidemics, macro-environmental processes set the stage for initial disease outbreak and create conditions that allow disease to become endemic in a region. Since macro-environmental processes provide a natural ecological niche for Vibrio cholerae and because powerful evidence of new biotypes is emerging, it is highly unlikely that cholera will be fully eradicated. Consequently, to develop effective intervention and mitigation strategies, it is necessary to develop cholera prediction models with several months' lead time. Using satellite derived chlorophyll measurements; we have developed a cholera prediction model that can predict cholera outbreaks two to three months in advance with reasonably high accuracy. To further explore the utility of satellite remote sensing data and develop a prediction framework, we now develop a Global Cholera Index (GCI) using a combination of satellite derived products such as water leaving radiance. The proposed GCI is likely to provide two forms of actionable knowledge: (i) it will provide spatial vulnerability maps of possible cholera outbreaks in coastal regions and (ii) it will determine if there are detectable statistical conditions for outbreaks of cholera from satellites. We anticipate that the proposed GCI will provide essential lead time to implement effective intervention and mitigation strategies for various cholera-endemic regions of the world.