Geospatial and temporal patterns of annual cholera outbreaks in Matlab, Bangladesh

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Cholera is a waterborne diarrheal disease endemic to Bangladesh, resulting in 1 million diagnoses annually. Such disease burden results in incalculable lost wages and treatment expenses, taken from the pockets of an already impoverished society. Two seasonally correlated outbreaks of cholera occur in Bangladesh every year. In the spring and early summer, the Bay of Bengal – which serves as a natural reservoir for the cholera bacteria – flows inland, causing the first outbreak amongst coastal communities. Waste containing the cholera bacteria enters the sewage system and remains untreated due to poor water and sanitation infrastructure. Therefore, during the following monsoon season, flooding of cholera-contaminated sewage into drinking water sources results in a second outbreak.

Though considered common knowledge among local populations, this geographic and temporal progression has not been empirically verified in the current literature. The aim of our ongoing study is to systematically analyze the seasonal trajectory of endemic cholera in Bangladesh. This paper discusses the results obtained from a comprehensive survey of available cholera data from the International Centre of Diarrheal Disease Research, Bangladesh (ICDDR,B) in Matlab, Bangladesh. Matlab *thana* is a near-coastal community that consists of 142 villages. Monsoon season takes place from June through October. Due to its proximity to the Meghna River, which opens into the Bay of Bengal, the area experiences significant flooding during these months.

Using 10 years of geographically referenced cholera data, cases were plotted in time and space. Preliminary patterns suggest that villages closer to the Meghna River experience the majority of the area's cholera outbreaks and that case count is highest in late spring and late fall. April/May and November/December represent 25% and 23% of total annual case counts respectively. Moreover, villages further from the coastline demonstrate 57% higher relative prevalence in fall than in the spring.

Such initial results demonstrate great promise in advancing our present knowledge of endemic cholera in Bangladesh. By improving our understanding of cholera proliferating in time and space, disease mitigation resources can be distributed to the most susceptible areas when they need them most. The next step forward for our ongoing study involves the use of mobile health (mHealth) case surveillance and cloud computing for real-time geographic and temporal cholera data acquisition.