The Ebola Epidemic in West Africa: Developing a Transmission Model to Compare the Effectiveness of Interventions

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Purpose: a) Design and implement a gravity spatial model for the ongoing epidemic of Ebola Virus Disease (EVD) in West Africa; and b) use this model, to evaluate the relative effectiveness of interventions aimed at reducing local or long-range transmission, such as quarantine, lock-downs, and border closure. Methods: The gravity spatial model was fitted to data from May 24 to September 30, 2014, and simulated to October 31. The model provided data about the balance of transmission from local and long-range sources. The model was used to simulate different levels and types of intervention and compare the efficacy of interventions by examining the case reductions of each one. Results: This model accurately fits the data from the epidemic and accurately forecasts cases and deaths for the month after the data. The model's spatial spread component allows it to explain the transmission dynamics of the EVD outbreak in West Africa, including multiple "ignition" cycles of the outbreak in Guinea. The intervention analysis supports that local transmission reduction in Liberia and long-range transmission reduction in Sierra Leone were the most effective interventions. Conclusion: The gravity spatial model is an effective framework for understanding transmission dynamics in the EVD epidemic in West Africa. It successfully fits and forecasts data from the outbreak. The intervention analysis presented here can help to guide public health policy and intervention efforts for this and future outbreaks.

Awards Won:
Second Award of $2,000