

Geospatial Analysis of Household Spread of Ebola Virus in a Quarantined Village – Sierra Leone, 2014

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Summary: In West Africa, Ebola has spread quickly in remote villages. Here, disease detectives used Geospatial Information Systems (GIS) and computer modeling to investigate how Ebola swept through one village in Sierra Leone, where cases occurred in 27 of 64 households.

Abstract:

Background: Village X, Sierra Leone, underwent village-wide quarantine because of its high incidence of Ebola virus disease (Ebola) despite household quarantines. The village-wide quarantine isolated Village X and offered the opportunity to investigate intra-community Ebola risk factors. We examined geospatial and household determinants of household-to-household Ebola transmission within this village to evaluate and tailor response efforts.

Methods: We defined a household as a family's shared living space and a case-household as a household in Village X with at least one resident who became a suspect, probable, or confirmed case of Ebola as defined by the Ministry of Health and Sanitation of Sierra Leone between August 1, 2014 and October 10, 2014. We collected household data through in-person interviews and assigned location data using Google Earth™. We used stepwise logistic regression modeling to calculate odds ratios of household Ebola acquisition associated with households' geospatial and demographic characteristics.

Results: The population of Village X at the beginning of the observation period was 863 persons living in 64 households (median household size, 10; IQR 6-18); 27/64 households became case households (42% cumulative attack rate). Location within 10 meters of one case-household was the strongest predictor of becoming a case-household (unadjusted OR=18.00; 95% CI 2.11, 153.30). Inclusion of variables describing household crowding and latrine access in logistic models did not substantially modify the models' goodness-of-fit.

Conclusions: Likelihood of household Ebola acquisition was highly associated with proximity to a case-household in Village X, a community that practiced quarantine of case-households. To decrease Ebola transmission, response efforts should include improving the effectiveness of household quarantine through rapid implementation, provision of basic household needs, and targeted outreach to households located near case-households.