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Estimating the reproductive number, total outbreak size, and reporting rates for Zika epidemics in South and Central America

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Abstract

As South and Central American countries prepare for increased birth defects from Zika virus outbreaks and plan for mitigation strategies to minimize ongoing and future outbreaks, understanding important characteristics of Zika outbreaks and how they vary across regions is a challenging and important problem. We developed a mathematical model for the 2015 Zika virus outbreak dynamics in Colombia, El Salvador, and Suriname. We fit the model to publicly available data provided by the Pan American Health Organization, using Approximate Bayesian Computation to estimate parameter distributions and provide uncertainty quantification. The model indicated that a country-level analysis was not appropriate for Colombia. We then estimated the basic reproduction number to range between 4 and 6 for El Salvador and Suriname with a median of 4.3 and 5.3, respectively. We estimated the reporting rate to be around 16% in El Salvador and 18% in Suriname with estimated total outbreak sizes of 73,395 and 21,647 people, respectively. The uncertainty in parameter estimates highlights a need for research and data collection that will better constrain parameter ranges.

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