

# Dynamics of Visceral Leishmaniasis for different distributions of non-adherence to the treatment in the population of Bihar, India and its effect on elimination

Mugdha Thakur<sup>1,\*</sup>, Carlos Castillo-Chavez<sup>1</sup>, Anuj Mubayi<sup>1</sup>

<sup>1</sup>*Simon A. Levin Mathematical, Computational and Modelling Sciences Center, Arizona State University, Tempe AZ 85287*

`mthakur4@asu.edu`

Visceral Leishmaniasis (VL) is one of the vector-borne neglected tropical diseases with an estimated 50,000 to 90,000 new cases per year worldwide and an estimated over 20,000 to 40,000 deaths annually worldwide. WHO's elimination target in the South-east Asia region (India, Bangladesh and Nepal), defined as reducing the incidence of disease to less than 1 per 10,000 individuals at a sub-district level, failed to achieve various milestones by their previous deadlines (latest deadline being 2017). After careful review of literature and personal communication with local experts, we identified that non-adherence of patients to the treatment regime may be one of the significant obstacles in achieving the milestones and may not be covered well in the existing surveillance system, leading to such patients being reservoirs of the VL pathogen. This modeling work attempts to study the impact of treatment-related mechanisms that have limited understanding in the literature and which may act as hindrance in reducing the burden of VL. The goal of the study is to understand the role of improving adherence level for treatment in VL patients in India on elimination of VL via a transmission dynamics model. The model analysis is supported by empirical information from Bihar (state having 90 in India), a highest prevalent region in the world. The analysis stresses how the improvement in adherence to treatment significantly enhances the efforts of the current rigorous vector control strategies. The analysis is performed based on two different data-driven modeling assumptions on treatment defaulting rates of the patients: (i) gamma distributed and (ii) exponentially distributed. Outcomes suggest that improving adherence can speed up the process of elimination upon combination with the current integrated vector control program; people who default from the treatment pose more risk by becoming hidden from the surveillance than the people who delay seeking the treatment; and, non-adherence to treatment is detrimental to increasing and maintaining the endemicity of the infection in the population.