USING GEOGRAPHICALLY-WEIGHTED REGRESSION TO UNDERSTAND SPATIAL VARIATION IN THE INFLUENCE OF ENVIRONMENTAL DRIVERS ON LEPTOSPIROSIS TRANSMISSION IN FIJI

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Background: Leptospirosis is a globally important zoonotic disease, with complex exposure pathways that depend on interactions between humans, animals, and the environment. Major drivers of outbreaks include flooding, urbanisation, poverty, and agricultural intensification. The intensity of drivers and their relative importance vary between geographic areas and socio-ecological niches, but standard regression methods are incapable of capturing these spatial variations.

Methods: Data on human infection, environment, and socio-demographics were collected from 2152 participants in 81 communities in Fiji (Lau et al 2016). Geographically weighted logistic regression (GWLR) was used to quantify the spatial variation in the relative importance of five environmental and socio-demographic covariates (cattle density, distance to rivers, poverty rate, residential setting and rainfall) on leptospirosis transmission in Fiji. GWLR results were compared against standard logistic regression (LR), used to produce a leptospirosis risk map, and maps showing the spatial variation in odds ratios (OR) for each covariate.

Results: GWLR performed better than LR (Aikaike Information Criterion 1254 vs 1935). Both models produced similar OR, but GWLR also detected spatial non-stationarity in all covariates. OR for maximum rainfall (median 1·30, IQR 1·27-1·35) varied the least across the study area, while distance to river varied the

Conclusions: GWLR provides a valuable method for modelling spatial heterogeneity of covariates and their relative importance over geographic space. Results of GWLR could be used to develop more targeted and more cost-effective public health interventions, particularly for diseases with strong environmental or socio-demographic drivers of transmission.

References

Lau CL, Watson CH, Lowry JH, David MC, Craig SB, Wynwood SJ, Kama M, Nilles EJ. *Human Leptospirosis Infection in Fiji: An Eco-epidemiological Approach to Identifying Risk Factors and Environmental Drivers for Transmission*. PLoS Negl Trop Dis 10(1):e0004405, 2016.