PREDICTIVE RISK MAPPING OF HUMAN LEPTOSPIROSIS IN FIJI USING SPATIAL BAYESIAN NETWORKS

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Background: Risk maps of leptospirosis can be used to inform prevention and control strategies, and provide eco-epidemiological insights. Spatial Bayesian networks (SBNs) provide a novel approach for risk mapping and scenario modelling; advantages over more traditional methods include the visual and interactive interface; the ability to include spatial and non-spatial data and rapidly update maps as new data become available; and risk prediction under different scenarios.

Methods: Community-level data were obtained from a human leptospirosis study in Fiji (Lau et al 2016), including seroprevalence (average 17%), environmental variables and socio-demographic factors. Variables were selected using 'sensitivity to findings' analysis to eliminate those with least influence on model performance, as measured by area under the curve of the receiver operating characteristic (AUC). Selected variables were used to build an expert-structured model, predict risk under different scenarios, and create an interactive and dynamic risk map using GeoNetica software (Norsys 2017).

Results: The most influential variables included population density, community type, water supply, ethnic composition, presence of pigs, and distance to rivers. Average AUC over 20 trials was 0.83. Using scenario analysis, the model predicted that an urban residential community with good water supply and no pigs had an 8.6% probability of having >17% seroprevalence. In contrast, a rural village with poor water supply and pigs had an 86.9% probability.

Conclusions: SBNs offer a valuable approach to leptospirosis risk mapping. Scenario analysis can help identify high-risk areas, predict the impact of future environmental/demographic change, and compare the effectiveness of prevention and control strategies.

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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.

Norsys Software Coorporation 2017. GeoNetica. https://www.norsys.com/WebHelp/NETICA/X_GeoNetica.htm