The epidemiology of rickettsial infections
and Q fever in Bhutan

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THESIS ABSTRACT

At the commencement of this project in 2014, some data were available on scrub typhus (ST) in Bhutan but none on the Spotted Fever Group (SFG) and Typhus Group (TG) *Rickettsia* and Q fever (QF).

Following an ST outbreak in 2009, heightened awareness increased case notifications from 91 (no deaths) in 2010 to 753 (3 deaths) in 2017. Another outbreak in 2014 saw two deaths from meningoencephalitis. These events inspired this doctoral thesis to explore the epidemiology of rickettsioses in Bhutan. Clinico-demographic information, human and animal samples were collected from Bhutan and analyzed at the Australian Rickettsial Reference Laboratory. Findings suggest that approximately 15% (159/1044) of patients with acute undifferentiated fevers attending 14 Bhutanese hospitals were due to rickettsioses, ST being the commonest (6.7%). About 49% of 864-healthy Bhutanese showed evidence of past exposure to ST (22.6%), SFG (15.7%), QF (6.9%) and TG (3.5%). ST and SFG exposure significantly increased with age and farming activities. Trongsa district residents had the highest exposure to ST but residents at altitudes >2000 meters were relatively protected. In animals, an overall seropositivity of 46% (106/294) with SFG (36%), ST (21%), TG (15%), and QF (4%) was determined. Seropositivity differences between animal species appeared to have been significant and warrant confirmation.

A few inferences should be interpreted with caution, but findings in general constitute baseline data for Bhutan and serve to prompt further research. Rickettsial outbreaks and the high incidence and prevalence rates established the endemicity of rickettsioses in Bhutan. Health authorities should ensure that services are equipped to manage these infections by developing diagnostic and clinical guidelines. Increased human-livestock sector collaborations in research, diagnostics and therapeutics through a ‘One Health’ approach is recommended. Future studies
should consider vector profiles, geospatial, biosocial and environmental risk assessment for strategic prevention and control of rickettsioses.

**Key words:** Bhutan, Epidemiology, Q fever, *Rickettsia*, Scrub typhus, Seroprevalence