

Changing Epidemiology of *Ixodes scapularis*-Borne Diseases in Minnesota, 1996–2007

M. Kemperman, D. Neitzel, G. Liu, K. Smith; Minnesota Department of Health, Saint Paul, MN

Background: In eastern and north-central North America, the agents of Lyme disease (LD; *Borrelia burgdorferi*), human anaplasmosis (HA; *Anaplasma phagocytophilum*), and babesiosis (*Babesia microti*) are transmitted by *Ixodes scapularis* ticks. In Minnesota (MN), LD was the most common tick-borne disease (TBD) in the early 1990s and was limited to eastern and central counties. **Methods:** From 1996-2007, the MN Department of Health (MDH) performed TBD case surveillance and interviewed cases to ascertain counties of tick exposure. Incidence rates and spatial distribution were evaluated. In 2005-2007, MDH sampled for questing *I. scapularis* by tick drag and tested ticks for TBD agents by PCR. **Results:** From 1996-99 to 2004-07, incidence rates (cases per 100,000 person-years) increased 261% for LD (5.5 to 19.9), 700% for HA (0.5 to 4.0), and 900% for babesiosis (0.03 to 0.30). HA doubled from 8.5% of statewide TBD cases in 1996-99 to 16.5% in 2004-07 and represented 25-36% of TBDs in MN's central, west-central, northeastern, and northwestern regions in 2007. From 1996-2007, 47% of TBD cases were exposed outside their county of residence; 75% of Minneapolis-St. Paul area cases, which represented 44% of all TBD cases, were exposed outside their home county. From 1996-99 to 2004-07, the proportion of MN counties with at least 1 resident case increased from 59% to 85%, spreading to forested counties north and west of MN's endemic eastern region, and the proportion of cases exposed in west-central or northwestern counties increased from 1% to 12%. MDH identified *I. scapularis* in 10 emerging counties where they had not been previously documented. In *I. scapularis* from west-central and northwestern MN, *B. burgdorferi*, *A. phagocytophilum*, and *B. microti* DNA was present in 41%, 11%, and 8% of adults and 9%, 5%, and 4% of nymphs, respectively. **Conclusions:** *I. scapularis*-borne disease distribution is spatially heterogeneous in MN, corresponding to forested regions; peridomestic exposures explain fewer cases than in eastern states. From 1996-2007, LD, HA, and babesiosis incidence rates in MN increased multi-fold, with a marked westward and northward expansion of cases. Infected *I. scapularis* nymphs were identified in these emerging counties. Increasing entomologic risk has likely contributed to the changing epidemiology of TBDs in MN.

Powassan Encephalitis in Minnesota: An Emerging Tick-Borne Disease in *Ixodes scapularis*-Endemic Areas

M. Kemperman¹, A. DeVries¹, D. Neitzel¹, C. Lees¹, K. Smith¹, G. Liu¹, A. Hoogerland², S. Kline³, N. Fosslund³, C. Schrock⁴, R. Lynfield¹; ¹Minnesota Department of Health, Saint Paul, MN, ²Children's Hospital, Minneapolis, MN, ³University of Minnesota Medical Center, Minneapolis, MN, ⁴North Memorial Medical Center, Robbinsdale, MN

Background: Powassan virus (POW), a tick-borne flavivirus, causes CNS disease with high rates of sequelae or death among recognized cases. Prior to 2008, < 50 POW cases had been reported in North America, most in the Northeast. Most cases were attributed to prototype POW and *Ixodes cookei*, a tick that typically quests near

mammal burrows. A 2nd POW genotype, deer tick virus (DTV), is associated with *I. scapularis*, which commonly bites humans. During 2008-09, the Minnesota (MN) Department of Health (MDH) investigated 3 cases of summer-onset encephalitis of unknown infectious etiology in males ages 10, 43 and 61 years. **Methods:** Serologic and molecular assays for POW were performed on case sera and spinal fluid (CSF). Medical records were reviewed, and cases were interviewed about tick exposures. MDH collected ticks from northwestern, north-central, and eastern MN and conducted molecular testing for POW. **Results:** All 3 cases presented with encephalitis and fever, 2 had maculopapular rash, and 1 had bulbar dysfunction. CSF WBCs were 78, 101 and 104 cells/mL (24, 71 and 93% lymphocytes). All had mid-brain hyperintensity on brain imaging, hemiplegia, and persistent neurologic sequelae after 3 months. POW seroconversion occurred in all cases. CSF from the pediatric case was positive for POW RNA, genotype DTV. All cases reported tick bites and outdoor activities in wooded *I. scapularis*-endemic areas of north-central MN; 2 cases lived on wooded properties in Cass County, and 1 lived in a metropolitan area of eastern MN but visited a wooded property in Hubbard County. None had close contact with wild mammals or burrows. POW of genotype DTV was present in pooled *I. scapularis* specimens from the DTV case property in north-central MN (Cass County) and from northwestern and eastern MN (Clearwater and Pine Counties). **Conclusions:** These are the western-most reported human POW cases in North America and include the first documented DTV case in the Midwest. DTV in *I. scapularis* from multiple sites indicates widespread infection risk in MN. Recently, the incidence of other *I. scapularis*-transmitted diseases (e.g., Lyme disease and human anaplasmosis) has risen sharply in MN and nationwide. POW is likely underdiagnosed and should be considered in patients with encephalitis or hemiplegia and potential exposure to ticks, including *I. scapularis*.

Rocky Mountain Spotted Fever Associated with *Rhipicephalus sanguineus* Ticks: From Emergence to Establishment of an Enzootic Focus in the United States

J. McQuiston¹, C. Levy², M. Traeger³, S. Piontkowski³, T. Stewart², W. Nicholson¹, J. Regan¹; ¹CDC, Atlanta, GA, ²Arizona Department of Health Services, Phoenix, AZ, ³Indian Health Service, Whiteriver, AZ

Background: During 2002-2004, an outbreak of Rocky Mountain spotted fever (RMSF) occurred in eastern Arizona, a part of the country where RMSF had not been previously reported. Transmission to humans was shown to be associated with *Rhipicephalus sanguineus* (the brown dog tick). This widely distributed tick had not previously been associated with U.S. RMSF cases, but has been linked to infections in Central and South America. Although *R. sanguineus* is not thought to commonly bite people, human host-seeking behavior has been speculated to increase in warmer climates. We provide an update on the continued presence of RMSF in this region.

Methods: Review of published data and AZ surveillance reports. **Results:** At the time of the outbreak, > 70% of dogs from affected area were found to have antibodies to spotted fever group rickettsiae (SFGR), compared to < 5% from that same region in 1996, suggesting a recent change in disease ecology. The explosive emergence of human RMSF cases in this region is speculated to have occurred as a result of large numbers of stray dogs supporting robust tick populations, and ample opportunities for

tick-dog-human interactions. Despite limited coordinated efforts to control ticks on dogs and in the environment, human infections have continued to occur; from 2003-2009, 88 human infections and 9 deaths (case fatality 10%) were reported. The annual incidence was ~ 437 per million persons (62 times the national average), and human cases were reported across an area over 5,000 square miles. A canine serologic study in 2005-2006 showed that > 5% of stray dogs from some nearby counties had evidence of exposure to SFGR, and during 2009 two human cases were reported for the first time in south-central AZ, suggesting *R. rickettsii*-infected ticks may be even more widespread than is currently appreciated. **Conclusions:** *R. rickettsii* now appears firmly established as an enzootic focus in eastern Arizona. Disease control efforts are being hampered by inadequate funding and animal control infrastructure within the affected communities. Unless sustained and effective canine and vector control programs can be implemented, RMSF will continue to cause significant morbidity and mortality in this region. If similar conditions are allowed to develop elsewhere, this pathogen is likely to expand its current range.