



Tick-Borne Infections Council
of North Carolina, Inc.

NEWSLETTER 2016, Volume 3



Quote of the season: Some tick species, such as the Lone Star tick, *Amblyomma americanum*, which transmits southern tick-associated rash illness, have been shown to survive in flood waters for up to seven weeks (Koch, 1986)

Highlights...

Scroll down to see these features and more!

- Alabama Now Has 7 Counties Endemic for Lyme Disease
- Tennessee Finds More Lyme Disease Cases Using Insurance Records
- New Study: ~329,000 Cases of Lyme Disease Each Year
- Entomological Society of America Position Statement on Tick-Borne Diseases
- Zika Virus
- Central and South American Birds Bring Millions of Ticks into US
- The Lyme Disease Spirochete Can Develop a Dormant State
- Ticks Carrying Lyme Disease Bacteria Found Near Arctic Circle and in Mongolia and Brazil
- Canada: Lyme Disease Cases Increasing
- The CDC and the Private Good?
- CDC and a Public Survey

State Vector-Borne Disease Task Force Meeting Schedule

August 12, 2016 November 18, 2016

(Check with us before going to confirm date as they occasionally change.)

Location:

Office of the Chief Medical Examiner, 4312 District Drive, Raleigh, NC 27607
Photo ID required

Links to Letters to Medical Providers from the State Department of Public Health on Lyme Disease and Rickettsial Diseases

These links are to the letters the state Department of Public Health issues every year to medical providers on Lyme disease and the Rickettsial diseases such as RMSF:

[2015 Rickettsial Disease Memo](#)

[2015 Lyme Disease Memo](#)

[2015 Arboviral Disease Memo](#)

| Disease | Total cases by year of report 2012 Final | Total cases by year of report 2013 | Cases 2014 |
|---------------|--|---|--------------------------------|
| | Confirmed + Probable (Confirmed/Probable/Suspected) | Confirmed + Probable (Confirmed/Probable/Suspected)* | (Confirmed/Prob/Suspect) ** |
| Lyme disease | 122 (27/95/80) | 180 (39/141/89) | 170 (27/143/83) |
| Rickettsioses | 591 (12/579/341) | 426 (11/415/193) | 496 (10/486/278) |
| Ehrlichia | 105 (18/91/56) | 78 (24/54/22) | 73 (11/62/31) |
| Anaplasma | 21 (0/21/21) | 15 (1/14/14) | 0/12/12 |

*This is the year of report, not year of illness onset

** Illness onset may be prior to 1/1/14

These counties are now considered endemic for Lyme disease bringing the total of endemic counties in NC to six: Wake (2009), Guilford (2012), Haywood (2012), Alleghany (2013), Wilkes (2014), Buncombe (2015). As of August 2015.

Counties with one case of locally acquired Lyme disease: Cleveland (2008), Wilson (2009), Pitt (2009), Carteret (2009), Gates (2011), Perquimans (2011), Rowan (2013), Union (2013), Caldwell (2013), Franklin (2014), Stanley (2014), Duplin (2014).

»» TIC-NC Activities »»

TIC-NC Talks and Materials Distributed in Early 2016

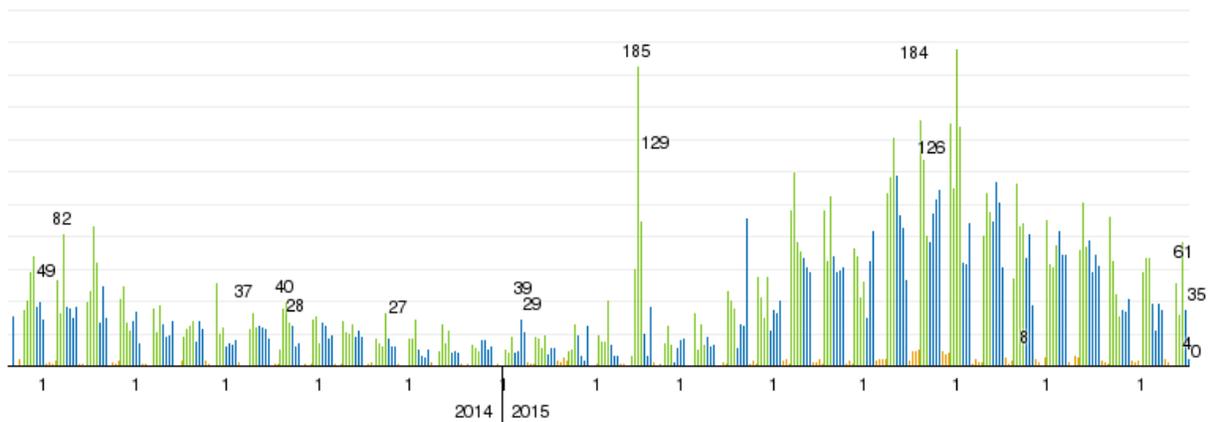
Brochures:

Centro de Empleo & Liderazgo (CEL)/Center for Employment & Leadership (CEL), Carrboro
NC Herb Association annual state meeting
Chiropractor in Cary
Chapel Hill Public Library
Chapel Hill neighbors
Individuals in Brevard, Kernersville, Lumberton, PA, FL, and CA

Talks:

NC Association of Physicians Assistants Annual State Meeting, Summer Osher Adult Learning Classes, NC State

A Sample of TIC-NC Web Stats



Our web stats for July 2014 to mid-August 2015= 19,787 hits! The peaks show mid-summer when people are having the most trouble with ticks. We get visits from several foreign countries as well.

Alabama Now Has 7 Counties Endemic for Lyme Disease

Dramatic Rise in Lyme Disease Cases in Alabama Prompts State Health Officer to Deliver Warning to Medical Professionals in 7 Alabama Counties Endemic for the Disease (PRWEB) OCTOBER 08, 2015

The number of those affected by the potentially devastating effects of Tick-Borne illnesses continues to rise, with seven Alabama Counties (Calhoun, Chambers, Jefferson, Mobile, Shelby, Russell and Tuscaloosa) now declared to be Endemic for Lyme disease by the Alabama Department of Public Health (ADPH).

ADPH recently sent a letter to all physicians in the seven endemic counties to notify them of the potential risk to their patients and possible signs of infections.

Alabama State Representative and Study Commission Chair, Becky Nordgren (House District 29) says, “The letter from Don Williamson is critical to the advancement of the State’s effort to ensure awareness within the medical community of the growing problem with tick-borne illnesses in Alabama.”

<http://www.prweb.com/releases/2015/10/prweb13009591.htm>

Bartonella Webinar Available

Bartonella infections are increasingly implicated in complex chronic disease syndromes, yet are extremely difficult to diagnose accurately. The purpose of this webinar is to raise awareness about *Bartonella*; its prevention, diagnosis and treatment. Medical, veterinary and public health professionals will benefit from attending this webinar. Symptoms of *Bartonella* infection are often similar to those of Lyme disease.

Speakers for the Webnar that aired in 2015 included experts Edward Breitschwerdt, DVM from NC and B. Robert Mozayeni, MD. Please note that the content is highly technical and designed for an audience of medical, veterinary and public health professionals.

Learning objectives include the ability to:

- Describe the epidemiology of *Bartonella*;
- Identify populations most at risk for *Bartonella* infection; and
- Explain the process for accurate and timely diagnosis of and treatment for *Bartonella*

<http://www.galaxydx.com/web/2015/webinar-understanding-bartonella/>

Florida Pumas and Ticks

Ectoparasites Collected From Pumas From Florida, 1989-2014

The endangered Florida puma (*Puma concolor*) population is one of the world's most studied felid populations. This study was conducted to describe the diversity and natural history of ectoparasites on Florida pumas. From January 1989 to May 1993 and January 2000 to April 2014, ectoparasites were collected from free-ranging and captive pumas. Ectoparasites from a total of 262 puma records included six ixodid tick species, one mite (*Lyxacarus* sp.), a Hippoboscid fly (*Lipoptena mazamae*), and a flea (*Ctenocephalides felis*). The tick species were *Ixodes scapularis* (n= 2,014), *Dermacentor variabilis* (n= 771), *Ixodes affinis* (n= 48), *Amblyomma maculatum* (n= 35), *Amblyomma americanum* (n= 59), and *Amblyomma auricularium* (n= 3). This study represents the first report of *A. americanum* in Collier County, Florida and the first report of *A. auricularium* on a wild felid. The mite species, which was previously reported as *Lyxacarus morlani* was determined to be a novel *Lynxacarus* sp. Because many veterinary and medically important pathogens are vector-borne, additional studies should be conducted on pathogens potentially transmitted by ectoparasites commonly found on Florida pumas. This is the most comprehensive study of ectoparasites from Florida pumas which is an apex predator in the southern Florida ecosystem. Shock et al.

https://getd.libs.uga.edu/pdfs/shock_barbara_c_201408_phd.pdf#page=96

Tennessee Finds About 20% More Lyme Disease Cases Through Insurance Than Official Reports Indicated

Enhancing Lyme Disease Surveillance by Using Administrative Claims Data, Tennessee, USA

Lyme disease is underreported in the United States. We used insurance administrative claims data to determine the value of such data in enhancing case ascertainment in Tennessee during January 2011–June 2013. Although we identified ≈20% more cases of Lyme disease (5/year), the method was resource intensive and not sustainable in this low-incidence state.

Lyme disease is the most common tick-borne disease in the United States, with >36,000 cases reported to the Centers for Disease Control and Prevention (CDC) during 2013. Tennessee, a low-incidence state, reported only 25 Lyme disease cases during 2013. In addition, *Borrelia burgdorferi*-infected ticks have been identified in only 1 Tennessee county (G.J. Hickling, unpub. data).

CDC estimates that Lyme disease may be underreported by a factor of 10. A study using administrative claims data from a Tennessee health insurance provider similarly estimated that Lyme disease incidence is 7-fold higher than is reported to the Tennessee Department of Health (TDH). To determine the usefulness of claims data, which can vary in accuracy, we evaluated medical records of persons given a Lyme disease diagnosis in claims data or surveillance in Tennessee. Clayton et al. *Emerg Infect Dis.* 2015. Sept <http://dx.doi.org/10.3201/eid2109.150344>

Link to the Entire *Discover Magazine* on Lyme Disease in the South

This is not new material, but some of our readers may not have had access to the entire December 2013 article available here at: http://steveclarknd.com/wp-content/uploads/2013/11/The-Confounding-Debate-Over-Lyme-Disease-in-the-South-DiscoverMagazine.com_.pdf

Of course, we do not know how long this link will last.

New Study: ~329,000 Cases of Lyme Disease Each Year
Incidence of Clinician-Diagnosed Lyme Disease, United States, 2005–2010

National surveillance provides important information about Lyme disease (LD) but is subject to underreporting and variations in practice. Information is limited about the national epidemiology of LD from other sources. Retrospective analysis of a nationwide health insurance claims database identified patients from 2005–2010 with clinician-diagnosed LD using International Classification of Diseases, Ninth Revision, Clinical Modification, codes and antimicrobial drug prescriptions. Of 103,647,966 person-years, 985 inpatient admissions and 44,445 outpatient LD diagnoses were identified. Epidemiologic patterns were similar to US surveillance data overall. Outpatient incidence was highest among boys 5–9 years of age and persons of both sexes 60–64 years of age. On the basis of extrapolation to the US population and application of correction factors for coding, we estimate that annual incidence is 106.6 cases/100,000 persons and that ~329,000 (95% credible interval 296,000–376,000) LD cases occur annually. LD is a major US public health problem that causes substantial use of health care resources. Entire study at: http://wwwnc.cdc.gov/eid/article/21/9/15-0417_article Nelson et al. Emerg Infectious

CDC Looks at What Used to be Called Rocky Mountain Spotted Fever and Related Infections

National Surveillance of Spotted Fever Group Rickettsioses in the United States, 2008–2012

Spotted fever group (SFG) rickettsioses are notifiable conditions in the United States caused by the highly pathogenic *Rickettsia rickettsii* and less pathogenic rickettsial species such as *Rickettsia parkeri* and *Rickettsia* sp. 364D. Surveillance data from 2008 to 2012 for SFG rickettsioses are summarized. Incidence increased from 1.7 cases per million person-years (PY) in 2000 to 14.3 cases per million PY in 2012. During 2008–2012, cases of SFG rickettsiosis were more frequently reported among males, persons of white race, and non-Hispanic ethnicity. Overall, case fatality rate (CFR) was low (0.4%), however, risk of death was significantly higher for American Indian/Alaska Natives (relative risk [RR] = 5.4) and Asian/Pacific Islanders (RR = 5.7) compared with persons of white race. Children aged < 10 years continue to experience the highest CFR (1.6%). Higher incidence of SFG rickettsioses and decreased CFR likely result from increased reporting of tick-borne disease including those caused by less pathogenic species. Recently, fewer cases have been confirmed using species-specific laboratory methods (such as cell culture and DNA detection using polymerase chain reaction [PCR] assays), causing a clouded epidemiological picture. Use of PCR and improved documentation of clinical signs, such as eschars, will better differentiate risk factors, incidence, and clinical outcomes of specific rickettsioses in the future. Drexler et al. Published online August 31, 2015, doi:10.4269/ajtmh.15-0472 Am J Trop Med Hyg 2015 15-0472

Germes in Ticks

Variation in the Microbiota of *Ixodes* ticks with geography, species and sex

Ixodes scapularis is the principle vector of Lyme disease in the East coast and upper Midwest regions of the United States, yet the tick is also present in the Southeast, where Lyme disease is absent or rare. A closely related species, *I. affinis* also carries the pathogen in the South but does not seem to transmit to humans. In order to better understand the geographic diversity of the tick, we analyzed the microbiota of 104 adult *I. scapularis* and 13 adult *I. affinis* ticks captured in 19 locations in South Carolina, North Carolina, Virginia, Connecticut and New York. Initially ticks from 4 sites were analyzed by 454-pyrosequencing. Subsequently, ticks from these sites plus 15 others were analyzed by Illumina MiSeq. By both analyses female tick microbiomes were significantly less diverse than those of male ticks. The dissimilarity between tick microbiomes increased with distance between sites and the state in which a tick was collected could be inferred from its microbiota. The genus *Rickettsia* was prominent in all locations. *Borrelia* was also present in most locations, and was especially high in one site in Western Virginia. In contrast, Enterobacteriaceae was very common in North Carolina *I. scapularis* but uncommon in *I. scapularis* from other sites or in North Carolina *I. affinis*. These data suggest substantial variations in the *Ixodes* microbiota associated with geography, species, and sex. Trureun et al. July 2015, doi:10.1128/AEM.01562-15AEM.01562-15

Entomological Society of America Position Statement on Tick-Borne Diseases

The Entomologic Society of America issued a press release in August 2015 regarding their newly issued position statement on tick-borne diseases. “The rapid rise in tick-borne diseases is a critical national issue,” said ESA President Phil Mulder. “A recent confluence of environmental, ecological, sociological, and human demographic factors has created a near ‘perfect storm,’ leading to more ticks in more places.

ESA Position Statement on Tick-Borne Diseases: Approved on July 29, 2015.

The Entomological Society of America (ESA) strongly supports building a national strategy using Integrated Tick Management (ITM) to better control tick populations and reduce the rapidly escalating impacts of tick-borne diseases (TBD) on human and animal health. This commitment is critical to ensuring the health, economic security, and biosecurity of society while protecting the environment; we believe that modern entomological sciences form the basis for developing new technologies, concepts, and ITM applications for scientific investigators and practitioners, all needed to “solve the tick problem.”

World-wide, ticks transmit over 20 pathogens capable of causing significant disease in humans, domestic animals or wildlife. In North America, with an estimated 300,000+ reported human cases every year, Lyme disease, and co-infections transmitted by deer ticks, cause serious disease consequences. Direct medical costs for Lyme disease alone are estimated at \$0.7 - \$1.3 billion annually, and along with associated overall indirect costs, the public health burden just for Lyme disease may be 3 times higher. Recent discovery of 2 new tick-borne viruses (Heartland virus, Deer Tick virus) that are responsible for human deaths in multiple states illustrates how dynamic the TBD landscape is, and highlights the need for continual surveillance, education and prevention. Entire statement at: <http://www.entsoc.org/PDF/2015/ESA-PolicyStatement-TickBorneDiseases.pdf>

Zika Virus

North Carolina and the CDC have guidance pertaining to Zika virus diagnosis, management and reporting. Information is included from the Centers for Disease Control, The American Congress of Obstetricians and Gynecologists, and the Pan American Health Organization. CDC will post their latest updates at <http://www.cdc.gov/zika/>. The NC Division of Public Health is also developing web content related to Zika virus. <http://epi.publichealth.nc.gov/cd/>.

Garlic Juice May Help Control Ticks

Effectiveness of Garlic for the Control of *Ixodes scapularis* (Acari: Ixodidae) on Residential Properties in Western Connecticut

We conducted field trials to evaluate the ability of a garlic juice-based product to control or suppress nymphal activity of the blacklegged tick, *Ixodes scapularis* Say, at residential properties in Connecticut in 2009, 2010, and 2011. The product was applied at a rate of 0.2 g AI/m². Percent control of nymphal densities achieved by the spray treatment at 6, 11, and 18 d postspray for the 3 yr was 37.0, 59.0, and 47.4%, respectively. Differences between nymphal densities were greatest during the first post-spray sampling period. While garlic may require multiple applications for the suppression of tick activity, this product could provide a minimal-risk option for the short-term control of nymphal *I. scapularis* in the residential landscape. Bharadwaj et al. Journal of Medical Entomology 52(4):722-725. 2015 doi: <http://dx.doi.org/10.1093/jme/tjv044>

Arizona Non-profit Has Donated \$75,000 for Development of a Better Lyme Disease Test

Focus On Lyme funds TGen research; plans scientific conference promoting better diagnostics and treatments for infected patients

Focus On Lyme, an initiative sponsored by the Leadership Children's Foundation of Gilbert, Ariz., has donated \$75,000 to the Translational Genomics Research Institute (TGen) to support research into the development of a quick, affordable and accurate method of diagnosing Lyme disease.

The most common vector-borne illness in the U.S., Lyme disease affects an estimated 300,000 Americans annually.

Today, no perfect test for Lyme disease exists due to three main barriers: multiple strains of Lyme bacteria often confound test results, the existence of related bacteria may cause false positive test results and most Lyme infections typically present at a level not detectable by current testing methods. Entire story at: http://www.eurekalert.org/pub_releases/2015-07/ttgr-tan072015.php. The Translational Genomics Research Institute

Central and South American Birds Bring Millions of Ticks Into US With Uncertain Health Consequences

Avian migrants facilitate invasions of Neotropical ticks and tick-borne pathogens into the United States

Migratory birds have the potential to transport exotic vectors and pathogens of human and animal health importance across vast distances. We systematically examined birds that recently migrated to the United States from the Neotropics for ticks. We screened both ticks and birds for tick-borne pathogens including *Rickettsia* species and *Borrelia burgdorferi*. Over two spring seasons (2013-2014), 3.56% of birds (n = 3,844) representing 42.35% of species examined (n= 85) were infested by ticks. Ground foraging birds with reduced fuel stores were most commonly infested. Eight tick species were identified including seven in the genus *Amblyomma* of which only *Amblyomma maculatum/triste* is known to be established in the United States. Most ticks on birds (67%) were Neotropical species with ranges in Central and South America. Additionally, a single *Ixodes* genus tick was detected. A total of 29% of ticks (n= 137) and no avian blood samples (n= 100), were positive for infection with *Rickettsia* species, including *Rickettsia parkeri*, an emerging cause of spotted fever in humans in the southern United States, a species in the group of *Rickettsia monacensis*, as well as uncharacterized species and endosymbionts of unknown pathogenicity. No avian tick or blood samples tested positive for *Borrelia burgdorferi*, the etiologic agent of Lyme disease. Extrapolation of our findings suggests that anywhere from 4 to 39 million exotic Neotropical ticks are transported to the United States annually on migratory songbirds, with uncertain consequences for human and animal health if the current barriers to their establishment and spread are overcome. Cohen et al. doi:10.1128/Applied and Environmental Microbiology 2 October 2015

The Lyme Disease Spirochete Can Develop a Dormant State Persister Development by *B. burgdorferi* Populations In Vitro

Doxycycline is a commonly used antibiotic to treat Lyme disease and other bacterial infections. The Minimum Inhibitory Concentration (MIC) and Minimum Bactericidal Concentration (MBC) for *Borrelia burgdorferi* have been investigated by different groups, but are experimentally established here as a function of input cell density. We demonstrate that *B. burgdorferi* treated in the stationary phase have a higher probability of regrowth following removal of antibiotic. In addition, we determine experimentally and mathematically that the spirochetes which persist post-treatment do not have a longer lag phase, but exhibit a slower growth rate than untreated spirochetes. Finally, we demonstrate that treating the spirochetes by pulse-dosing was not found to eliminate growth or reduce the persister population *in vitro*. From these data, we propose that *B. burgdorferi* persister development is stochastic and driven by slowed growth.

Caskey and Embers. Accepted manuscript posted online 27 July 2015, Antimicrobials Agents and Chemotherapy, doi:10.1128/AAC.00883-15

Note: Persisters can be thought of as antibiotic tolerance, or the capability of bacteria to enter a non-dividing, dormant state in response antibiotics. This not a new phenomenon.

Ticks Carrying Lyme Disease Bacteria Found Near Arctic Circle

***Borrelia burgdorferi* sensu lato-infected *Ixodes ricinus* collected from vegetation near the Arctic Circle**



This is the first study to determine the density of questing *Ixodes ricinus* in northern Norway. It was performed at two sites in Brønnøy, which has been known for its tick permissive habitats for decades and is one of the northernmost habitats with an abundant *I. ricinus* population in the world. From April to November 2011, all stages of host-seeking *I. ricinus* were collected from the two sites. The overall prevalence of nymphs infected with *Borrelia burgdorferi* sensu lato was 21% and that of adult ticks 46%. The rates of the genospecies *B. afzelii*, *B. garinii*, and *B. valaisiana* were similar to findings in most other studies in Scandinavia, with *B. afzelii* by far the most prevalent at 76%. The high *Borrelia*-infection

prevalence in ticks from Brønnøy may explain the high incidence rate of reported Lyme borreliosis in the municipality. doi:10.1016/j.ttbdis.2015.07.002 Hvidtsen et al. Ticks and Tickborne Diseases July 2015

Lyme Disease Bacteria Found in Mongolia and Brazil

Molecular Biological Detection of Emerging Tick-borne Zoonotic Pathogens in Ixodid Tick Species

Tick infestation activity has increased in Mongolia in recent years. Rickettsiosis, ehrlichiosis, Lyme disease and Q fever are all tick borne zoonoses. In total, 1462 ticks were harbored from various geographical regions of Mongolia. Genomic DNA was extracted from 400 pasture ticks (*Dermacentor nuttalli*, *Dermacentor daghestanicus*, *Hyalomma dromedarii*, *Hyalomma asiaticum*) and 100 forest ticks (*Ixodes persulcatus*). PCR was performed to detect zoonotic pathogens and the prevalence of *Rickettsia* spp., was 12.5 % and 22.9% in pasture and forest tick DNA samples respectively. *Ehrlichia* spp., were detected in 28.5 % and 75 % in pasture and forest ticks respectively. Interestingly, Lyme disease agent *Borrelia* spp. was not detected in 200 pasture tick DNA samples, but found in one out of 96 forest tick DNA samples. Contrary to this, *Coxiella burnetii*, the causative agent of Q fever found only in one out of 240 pasture ticks and was not detected in 96 forest tick DNA samples. Results have proven that molecular diagnostic PCR method is the fastest reliable tool to detect zoonotic pathogens in vector ticks. Narantsatsral et al. Mongolian Journal of Agricultural Sciences Vol.13(2) 2014:3-7

***Borrelia burgdorferi* sensu lato in humans in a rural area of Paraná State, Brazil**

This study describes the detection of *Borrelia garinii* and *Borrelia burgdorferi* sensu stricto (s.s.) in Brazilian individuals using PCR and DNA sequencing. Our results suggest that these species are emerging pathogens in this country, and additional studies are necessary to determine the epidemiological characteristics of this disease in Brazil. DD Gonçalves, et al. Braz. J.

Sweden: Infections with *Candidatus Neorhlichia mikurensis* and Cytokine Responses in 2 Persons Bitten by Ticks

Candidatus Neorhlichia mikurensis (there is no common name at this point) is a tick-borne pathogen found in Europe and Asia. It causes an infectious disease in immunocompromised persons that is characterized by fever and thromboembolic events. In contrast, An erythematous rash in a person bitten by a tick can be caused by *Candidatus N. mikurensis*, rather than by *Borrelia* spp. Moreover, immunocompetent persons may be infected by *Candidatus N. mikurensis* for unexpectedly long periods, even after symptoms have disappeared. Patients scheduled to receive immunosuppressive treatment, and who live in *Candidatus N. mikurensis*-endemic areas should be screened for this pathogen before beginning therapy. Grankvist et al. http://wwwnc.cdc.gov/eid/article/21/8/15-0060_article

Canada: Lyme Disease Cases Increasing **Surveillance for Lyme disease in Canada, 2009 to 2012**

Objectives: To summarize the first four years of national surveillance for Lyme disease in Canada from 2009 to 2012 and to conduct a preliminary comparison of presenting clinical manifestations in Canada and the United States. The numbers of reported cases rose significantly from 144 in 2009 to 338 in 2012 (coefficient = 0.34, standard error = 0.07, P < 0.05), mostly due to an increased incidence of infections acquired in Canada. Conclusion: Lyme disease incidence is increasing in Canada. Most cases are acquired where vector tick populations are spreading and this varies geographically within and among provinces. There is also variation in the frequency of age, season and presenting manifestations. The lower proportion of cases presenting with early Lyme disease in Canada compared with the US suggests lower awareness of early Lyme disease in Canada, but this requires further study. Ogden, et al. Canada Communicable Disease Report . Jun2015, Vol. 41 Issue 6, p132-145. 14p.

China Is Having Increasing Trouble with Tick-borne Diseases **Emerging tick-borne infections in mainland China: an increasing public health threat**

Since the beginning of the 1980s, 33 emerging tick-borne agents have been identified in mainland China, including eight species of spotted fever group rickettsiae, seven species in the family Anaplasmataceae, six genospecies in the complex *Borrelia burgdorferi* sensu lato, 11 species of *Babesia*, and the virus causing severe fever with thrombocytopenia syndrome. In this Review we have mapped the geographical distributions of human cases of infection. 15 of the 33 emerging tick-borne agents have been reported to cause human disease, and their clinical characteristics have been described. The non-specific clinical manifestations caused by tick-borne pathogens present a major diagnostic challenge and most physicians are unfamiliar with the many tick-borne diseases that present with non-specific symptoms in the early stages of the illness. Advances in and application of modern molecular techniques should help with identification of emerging tick-borne pathogens and improve laboratory diagnosis of human infections. We expect that more novel tick-borne infections in ticks and animals will be

identified and additional emerging tick-borne diseases in human beings will be discovered. Entire article is open access. Fang, et al. *Lancet Infect Dis* 2015 Published Online October 7, 2015

Lyme Disease Incidence Increasing in Scandinavian Bears

Serological signature of tick-borne pathogens in Scandinavian brown bears over two decades

Bears had high levels of IgG antibodies against *B. burgdorferi* sensu lato but not tick-borne encephalitis. Bears at the southern area had higher values of anti-*Borrelia* IgG antibodies than bears at the northern area. Over the duration of the study, the value of anti-*Borrelia* IgG antibodies increased in the southern area but not the northern area. Anti-*Borrelia* IgG antibodies increased with the age of the bear but declined in the oldest age classes. This study is consistent with the view that ticks and tick-borne pathogens are expanding their abundance and prevalence in Scandinavia. Long-term serological monitoring of large mammals can provide insight into how anthropogenic disturbances are changing the distribution of ticks and tick-borne diseases. Paillard et al. *Parasites & Vectors* 2015, 8:398. The electronic version of this article is the complete one and can be found online at: <http://www.parasitesandvectors.com/content/8/1/398>

Interesting Study from Japan on Ticks on Reptiles Imported for Pets

Detection of *Rickettsia* and *Ehrlichia* spp. in Ticks Associated with Exotic Reptiles and Amphibians Imported into Japan

Reptiles and amphibians are exempt from quarantine in Japan, thus facilitating the entry of parasites and pathogens to the country through import. These researchers examined the presence of *Rickettsia* and *Ehrlichia* spp. genes in ticks associated with reptiles and amphibians originating from outside Japan. Ninety-three ticks, none native to Japan, were isolated from at least 28 animals spanning 10 species and originating from 12 countries. Genetic analysis showed that several of the rickettsial and ehrlichial sequences were highly similar to human pathogen genes, including agents not previously detected in Japan. These imported animals have potential to transfer pathogens into human life. These results highlight the need to control the international transportation of known and potential pathogens carried by ticks in reptiles, amphibians, and other animals, in order to improve national and international public health. Andoh M, et al. (2015). *PLoS ONE* 10(7): e0133700. doi:10.1371/journal.pone.0133700. Paper free at: journals.plos.org/plosone/article?id=10.1371/journal.pone.0133700

Alpha-Gal in Europe (Red Meat Allergy)

High prevalence of sIgE to Galactose- α 1,3-galactose in rural pre-Alps area: a cross-sectional study

IgE antibodies against Galactose- α 1,3-galactose (α -Gal) were recently identified in a subset of patients, who developed severe anaphylactic reactions at the first treatment with cetuximab. In addition, IgE antibodies to α -Gal have also been shown to be related to delayed anaphylactic reactions after ingestion of red meat. Intriguingly, both reactions caused by cetuximab and ingestion of red meat were initially reported from the same region, a group of southeastern states of the United States, which led to the suggestion that the cross-reactivity could originate from

locally occurring biting insect or other parasites. In the US, the development of IgE antibody to α -Gal has been linked to bites from ecto-parasitic ticks, especially those of the Lone Star tick, *Amblyomma americanum*, whereas in Europe and Australia sensitization is associated with bites of the *Ixodes* species. Hamsten and coworkers showed that the α -Gal epitope is present in gastrointestinal tract if *Ixodes ricinus* and it involves host exposure to α -Gal during a tick bite. Vilalta et al. *Clinical & Experimental Allergy*. DOI: 10.1111/cea.12655

§§ General Section §§

Centers for Disease Control and Prevention: protecting the private good?

After revelations that the CDC is receiving some funding from industry, Jeanne Lenzer, associate editor, The BMJ, USA, investigates how it might have affected the organization's decisions.

The Centers for Disease Control and Prevention (CDC) includes the following disclaimer with its recommendations: "CDC, our planners, and our content experts wish to disclose they have no financial interests or other relationships with the manufacturers of commercial products . . . CDC does not accept commercial support." The CDC's image as an independent watchdog over the public health has given it enormous prestige, and its recommendations are occasionally enforced by law.

Despite the agency's disclaimer, the CDC does receive millions of dollars in industry gifts and funding, both directly and indirectly, and several recent CDC actions and recommendations have raised questions about the science it cites, the clinical guidelines it promotes, and the money it is taking.

Marcia Angell, former editor in chief of the *New England Journal of Medicine*, told *The BMJ*, "The CDC has enormous credibility among physicians, in no small part because the agency is generally thought to be free of industry bias. Financial dealings with biopharmaceutical companies threaten that reputation." Read more at <http://www.bmj.com/content/350/bmj.h2362>

CDC's Public Tick Survey Reveals Surprising Lack of Knowledge

US public's experience with ticks and tick-borne diseases: Results from national HealthStyles surveys

Surveillance data indicate that tick-borne diseases (TBDs) are a substantial public health problem in the United States, yet information on the frequency of tick exposure and TBD awareness and prevention practices among the general population is limited. The objective of this study was to gain a more complete understanding of the U.S. public's experience with TBDs using data from annual, nationally representative HealthStyles surveys. There were 4728 respondents in 2009, 4050 in 2011, and 3503 in 2012. Twenty-one percent of respondents reported that a household member found a tick on his or her body during the previous year; of these, 10.1% reported

consultation with a health care provider as a result. Overall, 63.7% of respondents reported that Lyme disease (LD) occurs in the area where they live, including 49.4% of respondents from the West South Central and 51.1% from the Mountain regions where LD does not occur.

Conversely, in the New England and Mid-Atlantic regions where LD, anaplasmosis, and babesiosis are common, 13.9% and 20.8% of respondents, respectively, reported either that no TBDs occur in their area or that they had not heard of any of these diseases. The majority of respondents (51.2%) reported that they did not routinely take any personal prevention steps against tick bites during warm weather. Results from these surveys indicate that exposure to ticks is common and awareness of LD is widespread. Nevertheless, use of TBD prevention measures is relatively infrequent among the U.S. public, highlighting the need to better understand barriers to use of prevention measures. Hook et al. *Ticks Tick Borne Dis.* 2015 Jun;6(4):483-8. doi: 10.1016/j.ttbdis.2015.03.017. Epub 2015 Apr 15

Predicting the Future Expansion of the Lone Star Tick

Modeling the Present and Future Geographic Distribution of the Lone Star

Tick, *Amblyomma americanum* (Ixodida: Ixodidae), in the Continental United States

The Lone star tick (*Amblyomma americanum* L.) is the primary vector for pathogens of significant public health importance in North America, yet relatively little is known about its current and potential future distribution. Building on a published summary of tick collection records, we used an ensemble modeling approach to predict the present-day and future distribution of climatically suitable habitat for establishment of the Lone star tick within the continental United States. Of the nine climatic predictor variables included in our five present-day models, average vapor pressure in July was by far the most important determinant of suitable habitat. The present-day ensemble model predicted an essentially contiguous distribution of suitable habitat extending to the Atlantic coast east of the 100th western meridian and south of the 40th northern parallel, but excluding a high elevation region associated with the Appalachian Mountains. Future ensemble predictions for 2061–2080 forecasted a stable western range limit, northward expansion of suitable habitat into the Upper Midwest and western Pennsylvania, and range contraction along portions of the Gulf coast and the lower Mississippi river valley. These findings are informative for raising awareness of *A. americanum*-transmitted pathogens in areas where the Lone Star tick has recently or may become established.

Springer, et al. Published online July 27, 2015 , doi:10.4269/ajtmh.15-0330 *Am J Trop Med Hyg* 2015 15-0330

The Burden of Lyme Borreliosis Expressed in Disability-Adjusted Life Years

Lyme borreliosis (LB) is the most commonly reported tick-borne infection in Europe and North America. In the last 15 years a 3-fold increase was observed in general practitioner consultations for LB in the Netherlands. To support prioritization of prevention and control efforts for LB, we estimated its burden expressed in Disability-Adjusted Life Years (DALYs). **Methods:** We used available incidence estimates for three LB outcomes: (i) erythema migrans (EM), (ii) disseminated LB and (iii) Lyme-related persisting symptoms. To generate DALYs, disability weights and duration per outcome were derived using a patient questionnaire including health-related quality of life as measured by the EQ-5D. **Results:** We estimated the total LB burden for the Netherlands in 2010 at 10.55 DALYs per 100 000 population (95% CI: 8.80–12.43); i.e. 0.60 DALYs for EM, 0.86 DALYs for disseminated LB and 9.09 DALYs for Lyme-related persisting

symptoms. Per patient this was 0.005 DALYs for EM, 0.113 for disseminated LB and 1.661 DALYs for a patient with Lyme-related persisting symptoms. In a sensitivity analysis the total LB burden ranged from 7.58 to 16.93 DALYs per 100 000 population. **Conclusions:** LB causes a substantial disease burden in the Netherlands. The vast majority of this burden is caused by patients with Lyme-related persisting symptoms. EM and disseminated Lyme have a more modest impact. Further research should focus on the mechanisms that trigger development of these persisting symptoms that patients and their physicians attribute to LB.

Cees et al. DOI: <http://dx.doi.org/10.1093/eurpub/ckv091> First published online: 16 June 2015

Blumenthal, Ayotte, Colleagues Introduce Bill to Strengthen Lyme Disease Prevention, Education, and Research, Following Lyme Awareness Month

*CDC estimates nearly 300,000 Americans contract Lyme disease annually
95% of Lyme disease cases occur in Connecticut, New Hampshire, New York, Delaware, Rhode
Island, Pennsylvania, Minnesota, Vermont, Virginia, New Jersey, Maine, Maryland,
Massachusetts, and Wisconsin*

(Washington, DC) – Today, Senators Richard Blumenthal (D-Conn.) and Kelly Ayotte (R.-N.H.) introduced legislation to increase public awareness and strengthen efforts to combat tick-borne diseases - a significant threat to public health. The Lyme and Tick-Borne Disease Prevention, Education, and Research Act of 2015 would help ensure the necessary resources are dedicated to fighting tick-borne diseases.

Blumenthal said, “Now that the weather is warmer, people will be spending much more time outdoors. Unfortunately, more time outside – especially in wooded areas that are so common in my home state of Connecticut – also means more exposure to tick-borne illnesses, like Lyme disease – a pernicious and insidious public health threat. I am proud to re-introduce a measure that will address the need for a strong national effort to fight these diseases as they become more rampant in the warmer months. By making improvements to reporting methods and diagnostic tools, as well as creating a national advisory body that brings together patients, scientists, and policymakers, this legislation will make critical improvements to prevention and treatment methods.”

Ayotte said, “According to the Centers for Disease Control and Prevention, in 2013, New Hampshire had the second highest incidence rate of Lyme disease in the country. Our legislation will help address this troubling statistic by creating a strong national effort to fight this disease, which is dangerous if untreated. Our bill would create a Tick-Borne Diseases Committee comprised of physicians, scientific experts, patients, and Lyme advocates to focus on improving reporting methods, developing better diagnostic tools, ensuring better coordination of efforts, and working to improve prevention and treatment methods related to Lyme and other tick-borne diseases.” July 4, 2015 <http://www.blumenthal.senate.gov/newsroom/press/release/blumenthal-ayotte-colleagues-introduce-bill-to-strengthen-lyme-disease-prevention-education-and-research-following-lyme-awareness-month>

Lyme Disease Suppresses Immunity in Mice Suppression of Long-Lived Humoral Immunity Following *Borrelia burgdorferi* Infection

Infections with the Lyme Disease agent, *Borrelia burgdorferi*, often fail to generate long-term protective immunity. We show here that this is because the immune system of the *Borrelia*-

infected host generates only short-lived, structurally abnormal and non-functional germinal centers. These germinal centers fail to induce memory B cells and long-lived antibody-producing plasma cells, leaving the host susceptible to reinfection with Bb. This inability to induce long-term immunity was not due to the nature of Borrelia antigens, as even T-dependent antigens of Borrelia were unable to induce such responses. Moreover, influenza vaccine antigens, when applied during Borrelia-infection, failed to induce strong antibody responses and immune-protection from influenza challenge. This data illustrate the potent, if temporal, immune suppression induced by Borrelia-infection. Collectively, the data reveal a new mechanism by which *B. burgdorferi* subverts the adaptive immune response. Entire paper free at: Elsner RA et al: July 2, 2015 DOI: 10.1371/journal.ppat.1004976

Collar Worked Better Than Oral Tablet for Dog Tick Prevention **Comparative Efficacy of an Imidacloprid/ Flumethrin Collar (Seresto®) and an Oral Fluralaner Chewable Tablet (Bravecto®) against Tick (Dermacentor variabilis and Amblyomma americanum) Infestations on Dogs: a Randomised Controlled Trial**

This controlled laboratory study demonstrated the residual speed of efficacy of an imidacloprid/flumethrin collar (Seresto®, Bayer) for the control of ticks (*Dermacentor variabilis*, *Amblyomma americanum*) at 6 and 12 hours post-infestation on dogs when compared to oral fluralaner (Bravecto®, Merck). Dogs were randomised by pre-treatment tick counts: Group 1) imidacloprid 10 % (w/w)/ flumethrin 4.5 % (w/w) collar, 2) fluralaner (dosage 25.1–49.4mg/kg), and 3) non-treated controls. Ticks (50/species/dog) were infested on days 3, 14, 21, 28, 42, and 56 followed by 50 *D. variabilis* on days 70 and 84. Live and dead attached ticks were counted 6 and 12 hours later. Efficacy against both species at 6 and 12 hours for Group 1 was 94–100%. Efficacy for Group 2 against both species at 6 hours was 4–69%; efficacy at 12 hours was 8–100%. Live (attached and non-attached) tick counts at 6 hours in Group 1 were significantly lower ($p \leq 0.05$) than counts in Group 2 and 3 on all days. At 12 hours, live counts were significantly lower ($p \leq 0.05$) in Group 1 than Group 2 for *D. variabilis* from days 56 – 84 and for *A. americanum* from days 28 – 56. There were significantly fewer ($p \leq 0.05$) total ticks (total live and dead attached) on dogs in Group 1 compared to Group 2 and 3 at all time points. This study demonstrated that an imidacloprid/flumethrin collar was highly efficacious (94 – 100 %) at repelling and killing ticks on dogs at 6 and 12 hours post-infestation and was more efficacious than fluralaner as early as 6 hours post-infestation on all challenge days. Ohmes et al. *Parasitol Res* (2015) 114:S89–S102 DOI 10.1007/s00436-015-4516-x

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About Insect Shield Technology:

Insect Shield's EPA-registered technology converts clothing and gear into effective and convenient insect protection. The repellency is long-lasting and appropriate for use by the entire family with no restrictions for use.

Quick Facts:

- Repellency is in the clothing and gear – not on your skin

- Lasts through 70 launderings
- EPA-registered
- No restrictions for use
- Appropriate for the entire family
- No need to re-apply
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TIC-NC is grateful for the financial contributions of Insect Shield International, LLC.

Tick-Borne Infections Council of North Carolina is a non-profit 501(c)3 organization formed to improve the recognition, treatment, control, and understanding of tick-borne diseases in North Carolina. We are all-volunteer and appreciate donations.

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