

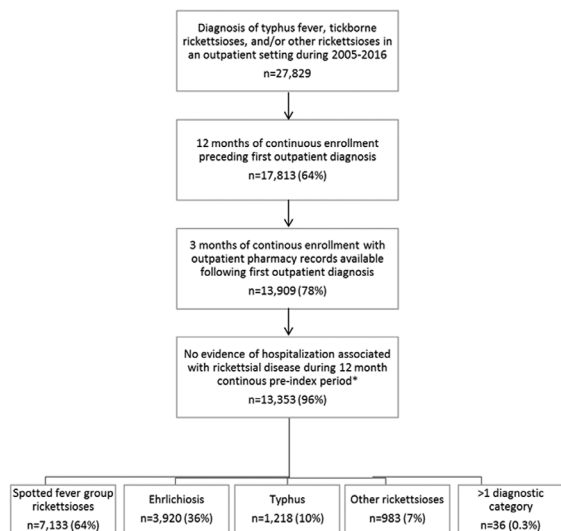
**Background.** Rickettsial diseases (RD) include Spotted Fever Group (SFG) Rickettsiosis, Ehrlichiosis, Anaplasmosis, Typhus Group (TG) and Rickettsialpox, among others. Doxycycline is the treatment of choice in all age groups; early treatment based on clinical diagnosis is important to prevent severe and fatal outcomes. SFG, Ehrlichiosis, and Anaplasmosis are nationally notifiable in the United States, but data on treatment patterns are not collected.

**Methods.** We conducted a retrospective analysis using Truven Health MarketScan<sup>®</sup> Commercial Claims and Encounters databases. We included any individual with an outpatient claim using an ICD-9/10-CM code for RD, who had one-year continuous pre- and 3 months post-diagnosis enrollment and pharmaceutical claim data. The first outpatient record with RD was considered the incident diagnosis, and those with an RD hospitalization in the prior 1 year were excluded. Epidemiologic characteristics, treatment patterns, and outcomes were summarized.

**Results.** 13,353 individuals were included; median age was 45 years (IQR: 28–55 years), 2,045 (15%) were under 18 years of age, and 51% were male. The most common diagnosis was SFG (7,133; 50%), followed by Ehrlichiosis (3,920; 30%), and Typhus (1,281; 10%); 36 individuals had >1 diagnosis. Over half (7,075; 53%) received doxycycline within 30 days of the index date; of these, 3,634 (51%) received it within 14 days. The majority (5,369; 86%) were treated for at least 10 days at the recommended dose. The proportion with a pharmaceutical claim for doxycycline varied considerably across diagnoses and ranged from 24% for TG to 60% for SFG Rickettsiosis. Among the 6,278 (47%) without a claim for doxycycline, 2,185 (35%) were prescribed another antibiotic; 4,093 (28%) were not prescribed any antibiotic. Hospitalization within 30 days of the incident diagnosis was infrequent (149, 1.1%), and the majority were due to either SFR (40%) or ehrlichiosis (37%). No in-hospital deaths were recorded.

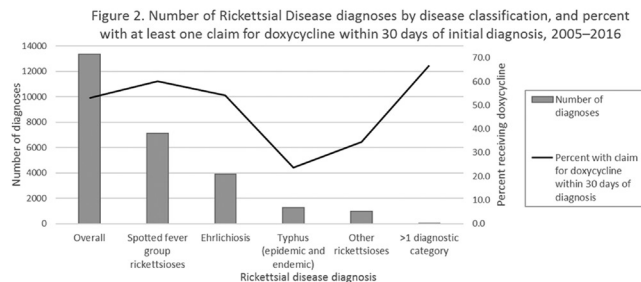
**Conclusion.** RD continues to be an important cause of disease in the outpatient population, but providers are still only prescribing the recommended treatment to about half of those in whom they suspect the disease. Continued education and increased awareness is critical to prevent severe outcomes from RD.

Figure 1. Study population and number of patients with diagnosis of Rickettsial Disease an outpatient setting in MarketScan database, United States, 2005–2016



\*n=14,476 (52%) of patients were excluded from analysis for at least one of the following reasons:

- 1) less than 12 months of continuous enrollment prior to initial outpatient Rickettsial disease diagnosis;
- 2) less than three months of continuous enrollment following initial outpatient Rickettsial disease diagnosis;
- 3) outpatient pharmacy records not available during entire 15 month enrollment period surrounding initial diagnosis; or
- 4) inpatient hospitalization associated with Rickettsial disease diagnosis identified during 12 month continuous enrollment period.



**Disclosures.** All authors: No reported disclosures.

#### 664. Factors Associated with the Need for ICU Care Among Patients with Human Ehrlichiosis

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**Session:** 66. Public Health: Epidemiology and Outbreaks

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**Background.** Despite the availability of effective therapy, the case fatality rate of human monocytic ehrlichiosis (HME) is 3%, and has been reported to be higher among the immunocompromised. Little is known about predictors of severe disease.

**Methods.** We performed an observational cohort study at a tertiary care medical center in Nashville, TN. Patients with a positive whole blood or cerebrospinal fluid *Ehrlichia* polymerase chain reaction between 2007 and 2017 were included. Clinical and demographic data were obtained by chart abstraction. Modified Poisson Regression was used to estimate the adjusted relative risk (aRR) of requiring intensive care unit (ICU) care, adjusting for age, sex, race, Charlson Comorbidity Index, immunosuppression, patient-reported tick exposure, and number of days from first contact with healthcare system to treatment initiation.

**Results.** We included 155 patients; median age was 48 years, 64% were male, 94% were Caucasian, 74% reported a tick exposure, and 21% were immunocompromised. 28% of patients required ICU care. Immunosuppression and reported tick exposure were associated with a decreased risk of requiring ICU care. An increasing number of days from first contact with the healthcare system to treatment initiation were associated with an increased risk of requiring ICU care.

**Conclusion.** Twenty-eight percent of patients required ICU care. We found that a delay in initiation of therapy was associated with an increased risk of requiring ICU care. In contrast to other studies, we found immunosuppression to be associated with milder clinical illness, perhaps reflecting a lower threshold to seek care and thus earlier presentation. Patients with recent tick exposure were also less likely to require ICU care, potentially reflecting a higher index of suspicion for HME among providers. Future studies evaluating the impact of provider education on early recognition and treatment may lead to a decreased need for ICU care in patients with HME.

Table 1: Modified Poisson Regression Model for Relative Risk of Requiring ICU Care

	Adjusted RR (95% CI)
Age (per year)	0.99 (0.97–1.01)
Female sex	1.38 (0.81–2.35)
White race	1.48 (0.74–2.94)
Immunosuppression	<b>0.39 (0.17–0.88)</b>
Charlson Comorbidity Index (per 1)	1.15 (0.95–1.38)
Patient-reported tick exposure	<b>0.56 (0.34–0.91)</b>
Days from first contact to treatment initiation	<b>1.07 (1.03–1.12)</b>

**Disclosures.** All authors: No reported disclosures.

#### 665. Key Clinical and Laboratory Features in Early Diagnosis of Ehrlichiosis in an Endemic Area of Long Island, New York

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**Session:** 66. Public Health: Epidemiology and Outbreaks

Thursday, October 4, 2018: 12:30 PM

**Background.** Human monocytic ehrlichiosis (HME) is a tick-borne disease caused by *Ehrlichia chafeensis* in the northeast United States. Suffolk County, New York has the highest amount of HME cases in NY (176 from 2010 to 2014). Our aim is to identify risk factors for HME and compare clinical presentation and laboratory findings of young vs. older adults.

**Methods.** A retrospective chart review from January 1, 2014 to December 31, 2017 was performed on all patients ≥18 years who presented to the ER at Stony Brook University Hospital (SBUH) or Stony Brook Southampton Hospital (SBSH) with (i) ICD-9 code 082.4 or ICD-10 code A77.40 and (ii) a positive *E. chafeensis* PCR. Data were collected on demographics, clinical presentation, and laboratory results.

**Results.** Twenty-seven cases of HME were found and separated into Group 1 (G1, n = 10) or Group 2 (G2, n = 17) based on age (Table 1). G1 had a significantly higher chance of being Hispanic than G2. Twenty-four of the 27 patients (89%) were hospitalized with an average length of stay of 3.4 days (range 1–14 days). The only significant difference in clinical presentation was that G1 was more likely to have myalgia (P = 0.02). 40% or more of patients in both groups presented with an acute kidney injury and the average length of hospital stay in days was 4.0 ± 2.9 and 3.2 ± 3.1 for G1 and G2, respectively. The number of cases overall have increased 6.0% per year between 2014 and 2017. Thrombocytopenia presented in all cases.

	Ehrlichiosis		P value
	<65 years (n = 10)	≥ 65 years (n = 17)	
<b>Median age</b>	57	79	
SD	6.57	5.45	
<b>Average length of hospital stay (days)</b>	4.0	3.2	
SD	2.94	3.10	
<b>Sex</b>			
Male	8 (80%)	10 (58.8%)	0.3
Female	2 (20%)	7 (41.2%)	0.3
<b>Ethnicity</b>			
Hispanic	3 (30%)	0	0.02
Non-Hispanic	7 (70%)	17 (100%)	0.02
<b>Clinical presentation</b>			
Fever	7 (70%)	12 (70.6%)	1.0
Headaches/dizziness	5 (50%)	7 (41.2%)	0.7
Arthralgia	3 (30%)	2 (11.8%)	0.2
Fatigue	10 (100%)	14 (82.4%)	0.4
Myalgia	7 (70%)	4 (23.5%)	0.02
Tick exposure	4 (40%)	10 (58.8%)	0.4
<b>Laboratory</b>			
Leukopenia	8 (80)	15 (88.2)	0.6
Anemia	3 (30%)	10 (58.8%)	0.2
Thrombocytopenia	10 (100%)	17 (100%)	1.0
AKI	4 (40%)	8 (47.1%)	0.7
Transaminitis	8 (80%)	15 (88.2%)	0.6

**Conclusion.** HME is prevalent in Suffolk County. Clinical presentation and laboratory findings were largely similar between the two groups, except the younger population more often presented with myalgia. A risk factor in this study was to be young and Hispanic, likely due to occupational exposure.

**Disclosures.** All authors: No reported disclosures.

#### 666. Human Granulocytic Anaplasmosis and Ehrlichiosis Presenting to an Upstate New York Emergency Department

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**Session:** 66. Public Health: Epidemiology and Outbreaks

Thursday, October 4, 2018: 12:30 PM

**Background.** Human granulocytic anaplasmosis (HGA) is an increasingly common tickborne infection in the North-East United States. Statewide incidence of human cases of anaplasmosis in New York (excluding New York City) increased 407% from 2010–2017, with a corresponding increase in *Anaplasma phagocytophilum* prevalence in ticks. While previous observational studies have described the clinical features of HGA, there has been little documentation of HGA diagnosed in the emergency department (ED) setting.

**Methods.** Demographic and clinical data were extracted from electronic records of cases with a positive polymerase chain reaction (PCR) for HGA or the closely related clinical entity ehrlichiosis from 2016 to 2017. HGA and ehrlichiosis PCR were performed by the Albany Medical Center laboratory on patients treated in the ED. Basic descriptive analyses were performed.

**Results.** During the 2-year period, there were 37 cases of PCR-positive HGA and four cases of PCR-positive ehrlichiosis treated in the ED. Electronic data were available for extraction for 40 of these cases. Mean age was 54 years old (range 7–94 years). Thirty-four (85%) patients presented with fever, and 9 (23%) reported a tick bite or tick exposure. Twenty-two (55%) patients had leukopenia; 32 (80%) thrombocytopenia; 26 (65%) hyponatremia; 24 (60%) elevated transaminases; 38 (95%) at least one of these laboratory abnormality; and 13 (33%) all four laboratory abnormalities. Twenty-four patients (60%) were given the empiric diagnosis of a tickborne illness upon disposition from the ED, with 19 (48%) patients admitted to the hospital.

**Conclusion.** To our knowledge, this study represents the first description of patients diagnosed with HGA (and ehrlichiosis) in the ED setting. Because of the inherent testing bias, further study is needed to establish the true ED prevalence of HGA in highly endemic regions. Notably, only 23% reported either a tick bite or tick exposure, highlighting the need to consider this for diagnosis in patients presenting to the ED with consistent symptoms and laboratory findings in endemic areas. Further study might explore whether there exists a collection of laboratory findings that could accurately identify HGA in ED patients.

**Disclosures.** All authors: No reported disclosures.

#### 667. An Emerging Tick-Borne Disease in Long Island, New York: Relapsing Fever Caused by *Borrelia miyamotoi*

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**Session:** 66. Public Health: Epidemiology and Outbreaks

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**Background.** Suffolk County (Long Island, New York) reports annually the highest absolute number of tick-borne diseases in New York. A new *Borrelia* species, *Borrelia miyamotoi* which causes a relapsing fever, has been reported in New York recently. The aim of this study was to identify the number of cases of *B. miyamotoi* diagnosed in Suffolk county.

**Methods.** A retrospective chart review was performed in Stony Brook (SB) Medicine hospitals, SB University Hospital (the only tertiary medical center in Suffolk County) and Southampton Hospital (a major hospital in the east end of Suffolk County). Laboratory records were queried for a positive *B. miyamotoi* PCR test from blood or a positive IgG antibody with a *B. miyamotoi*-specific EIA that utilizes a recombinant GlpQ antigen (both tests performed in a commercial laboratory).

**Results.** Twenty-eight cases were positive for serology (IgG EIA; n = 19) or PCR (n = 9). None of the IgG-positive cases had a positive PCR result indicating that individuals were likely exposed to *B. miyamotoi* in the past. Of the nine PCR-positive cases (median age:67 years), eight were men, three were diagnosed in the outpatient clinic (33.3%) and six were diagnosed through the emergency department and required hospitalization (66.6%). Thrombocytopenia and transaminitis were common findings. Two-thirds of these nine cases were diagnosed in the period of 2016–2017 and one-third in the period, 2013–2015 (P = 0.17).

**Conclusion.** An increasing number of cases of *B. miyamotoi* were observed in Suffolk County during 2013–2017 and two-thirds required hospitalization. The real burden of this tick borne disease in Suffolk County and the rest of the state is unknown.

**Table 1:** Clinical-Demographics Features of *B. miyamotoi* Cases Diagnosed by PCR Blood Test

Year of Presentation	Age (Years)	Gender	Symptoms	Leukocytes (/mm <sup>3</sup> )	Hemoglobin (g/dL)	Platelets (/mm <sup>3</sup> )	Creatinine (mg/dL)	AST (U/L)	ALT (U/L)
2013	74	M	N/A	4,600	14.2	154,000	0.7	21	28
2015	67	F	Flu-like syndrome	5,500	14.7	260,000	0.8	33	23
2015	64	M	Flu-like syndrome	3,600	14.1	109,000	0.7	65	74
2016	32	M	N/A	3,000	15.6	166,000	1	98	65
2016	68	M	N/A	N/A	N/A	N/A	N/A	20	18
2016	74	M	Flu-like syndrome and vomiting	6,800	15.6	51,000	3.1	212	165
2017	90	M	Fever and vomiting	4,100	9.7	91,000	1.46	74	46
2017	22	M	Fever and diarrhea	3,200	14.7	99,000	0.8	73	117
2017	26	M	Fever and diarrhea	5,400	16.3	127,000	1.05	51	68

AST, aspartate transaminase; ALT, alanine transaminase; N/A, no available.

**Disclosures.** All authors: No reported disclosures.

#### 668. Clinical Spectrum of Powassan Virus Infection in Patients Presenting with Suspected Acute Tick-Borne Illness From a Lyme-Endemic Focus in the Midwest

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**Session:** 66. Public Health: Epidemiology and Outbreaks

Thursday, October 4, 2018: 12:30 PM

**Background.** Powassan virus (POWV) is the North American member of the tick-borne encephalitis complex of viruses. The potential for concurrent transmission with other tick-borne pathogens, particularly the Lyme disease agent *Borrelia burgdorferi*, is under studied. To better understand the clinical spectrum of POWV infection patient health records were reviewed and laboratory studies performed to evaluate the frequency of tick-borne pathogen exposure in patients presenting with suspected acute tick-borne illness (TBI) from a Lyme-endemic focus in the Midwest.

**Methods.** One hundred and thirty-five samples selected from patients seen at Gundersen Health System presenting during 2016 with Lyme-like symptoms were tested for Anaplasmosis, Babesiosis, Lyme disease and POWV. PCR testing was performed for Anaplasma and Babesia. Serologic testing for *B. burgdorferi* was performed using two-tier serologic testing. POWV infection was confirmed by POWV-EIA/IFA (Coppe Laboratories). IRB approval was obtained.

**Results.** Anaplasma infection was seen in 44/88 (50%), Babesia infection in 5/67 (7.5%), Lyme disease in 45/135 (33.3%) and POWV infection in 16/132 (12.1%) patients. Co-infections were seen in 21/135 (15.5%) patients. Patients with Babesia more often presented with anemia, myalgia and decreased appetite. Patients with Anaplasma presented with fever, chills/sweats, nausea/vomiting, rash, elevated liver function tests, thrombocytopenia, leukopenia, and remembered the tick exposure. Lyme disease patients complained of fatigue, rash, chills/sweats, headache and remembered the tick exposure. Co-infection with both Lyme and Powassan virus was seen in 10/45 (23%) of patients. Patients with Lyme, Powassan virus or co-infection had no other significant difference in symptoms.

**Conclusion.** POWV infection is more prevalent in the Midwest than previously appreciated. Clinical data suggest that symptoms of POWV infection may be