

## **A Study of Tick Borne Infections in Individuals with Pre-Existing Conditions Resulting from Non Tick Borne Infections and Non Infectious Conditions**

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**Quotation:** "Proper treatment for these individuals should not only include treatment for the tick borne diseases and pre-existing infectious and non-infectious disease conditions but, also an evaluation of the immunological status of these patients by specialists in Functional Medical Evaluation".

### **Abstract**

The treatment of Tick Borne Diseases is often difficult. This is due to the fact Tick Related Infections are multi-pathogenic events. The presence of Pre-existing Non-Tick Borne Infectious and Non-Infectious Conditions further complicate matters because Tick Borne Diseases by themselves can bring about immune dysfunction. The presence of pre-existing Non-Tick Borne Infectious and Non Infectious Conditions are responsible for a pre-existing immune system that is already under stress. There are statistically significant gender differences in the occurrence of Tick Borne Diseases, and Non-Tick Borne Non-Infectious Disease States in which females have a statistically significant higher incidence of these disease states than do males. Physicians treating patients for Tick Borne Pathogens, therefore must also take note of the presence of additional pre-existing Non-Tick Borne Infectious and Non-Infectious Disease Conditions in order to successfully treat patients who have additionally acquired Tick Borne Infections via the bite of a tick.

**Keywords:** *Tick Borne Infections; Non-Tick Borne Infectious; Lyme Disease*

### **Introduction**

The literature cites the fact that 4 - 60% of patients with Lyme Disease were also infected with *Babesia*, *Anaplasma*, *Rickettsia*, *Bartonella*, *Brucella* spp, *Ehrlichia* spp, tick borne encephalitis and Powassan virus [1-3].

Thus, a tick-borne infection is a multipathogenic event, and not a routine case of one pathogen one disease [1-3,6,7]. Recent animal model studies have revealed that infections involving tick borne pathogens can also bring about immune dysfunction [1-3,6,7]. The im-

immune system of a patient having this disease state, must therefore produce immunological responses to a variety of different tick related pathogenic organisms [1-3,6,7].

The immune system of a patient with a tick borne disease state scenario, must now also have to illicit additional immunological defenses against any pre-existing non tick related infections, as well as, non-infectious disease conditions [1-3,6,7].

Pike County Pennsylvania is endemic for Tick Borne Pathogens. There are individuals in Pike County whose immune systems are already overburdened prior to any exposure to Tick Borne Pathogens via the bite of a tick, due to the presence of diverse pre-existing conditions (i.e. pulmonary, neurological, rheumatoid, oncogenic, etc).

The literature has not thoroughly investigated the issue of individuals whose immune systems are already overtaxed, and the challenges they pose to physicians who have to treat these specific individuals when they are additionally exposed to Tick Borne Infections.

This study will specifically highlight these additional states of immunological stress that physicians must be made aware of if they are to successfully treat male and female patients with Tick Borne Pathogens in a scenario of pre-existing infectious and non infectious disease conditions.

**Materials and Methods**

This study was a double-blind random study involving a sample size of Twenty-Eight (10 males and 18 females) randomly selected individuals known to have both non-tick borne infections, as well as non infectious pre-existing conditions. The sample population in this study spanned 15 to 83 years of age. These patients had also been victims of tick bite related tick borne pathogens.

Dr. Cathleen Mattos was the only person with actual knowledge of the true identities of the patients in the study sample. Dr Mattos created a number identifier code for each person in this study, and only she had access to the number codes/true identity information.

Dr. Robert-A. Ollar who evaluated the sample population in this study, was only provided with number coded information. This ensured that a non biased evaluation of the randomly selected individuals making up the sample study could be performed.

The patient data as relates to Tick Borne Diseases, Pre-existing Non-Tick Borne Infections with Lasting Consequences, and Ongoing Non-Infectious Diseases Conditions, can be seen below in table A-C.

All graphical depictions were created with the aid of Slidewrite Plus Software Program.

Males	Females	Tick Borne Infections (TBD)
1	2	<i>Borrelia burgdorferi</i> only
0	1	European and Asian species of <i>Borrelia</i> ( <i>B. afzelli</i> and <i>B. garinii</i> ) no travel outside of USA
1	2	European and Asian species of <i>Borrelia</i> ( <i>B. afzelli</i> and <i>B. garinii</i> ) travel outside of USA
0	1	<i>Borrelia burgdorferi</i> + European and Asian species of <i>Borrelia</i>
1	4	<i>Borrelia burgdorferi</i> +other TBD
0	1	<i>Borrelia burgdorferi</i> + European and Asian species of <i>Borrelia</i> + other TBD
2	2	European and Asian species of + other TBD
0	1	<i>Borrelia miyamotoi</i> + other TBD
2	1	Other non <i>Borrelia</i> TBD only

**Table A:** Cases of *Borrelia* and other tick borne infections.

Males	Females	Pre-existing Past Exposure to Non Tick Borne Infection
1	0	Mycotoxin
1	2	Pneumonia
1	0	<i>B. pertussis</i>
3	7	Epstein Barr Virus
3	3	Chicken Pox
1	0	<i>Chlamydia pneumoniae</i>
3	1	<i>Mycoplasma pneumoniae</i>
0	2	Coxsackie virus
1	3	Herpes simplex virus
0	1	HV6 virus
0	1	Cytomegalovirus
0	1	MRSA staph

**Table B:** Cases of pre-existing exposure to non tick borne infections with lasting consequences.

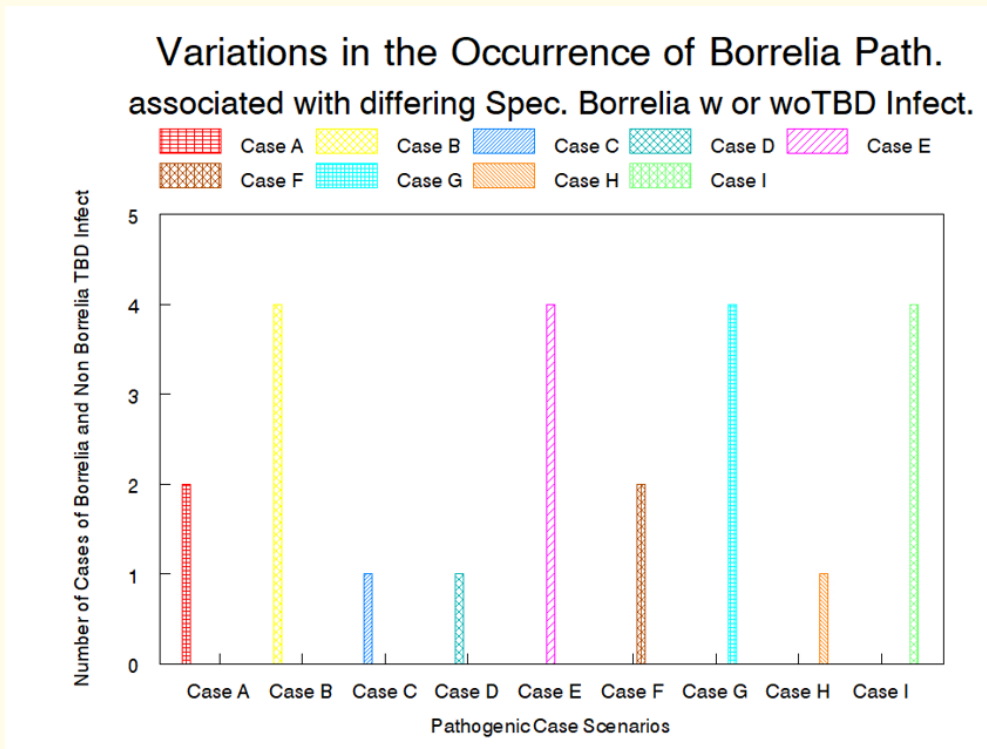
Males	Females	Non Infectious Disease Condition
2	2	Cancer
3	2	Asthma
0	4	Fibromyalgia
1	0	Anemia
1	1	Bronchitis
0	2	Rheumatoid Arthritis
0	2	Osteoporosis
1	1	Chronic Fatigue
0	1	Parkinson’s Disease
1	1	Raynaud’s Disease
0	2	Depression
0	1	Multiple Sclerosis
0	2	Bell’s Palsy

**Table C:** Cases of ongoing pre-existing non infectious disease conditions.

The statistical analyses were performed with the aid of a Statistix Software Program.

**Results**

It was found that the most commonly occurring disease scenarios involving *Borrelia* and other Tick Borne Pathogens in our sample population involved: a) the European and Asian *Borrelia* strains (*B. afzelii*, *B. garinii*) infections in people who had traveled outside of the USA, b) *B. burgdorferi* and other Tick Borne Pathogens, c) European and Asian Strains of *Borrelia* plus other Tick Borne Pathogens, d) Other Tick Borne Pathogens (See graph 1).



**Graph 1**

**Case A:** *Borrelia burgdorferi* only.

**Case B:** European and Asia strains (*Borrelia afzelii* and *Borrelia garinii*) only, causing Lyme disease and neuroborreliosis (in cases with travel outside).

**Case C:** European and Asian strains causing Lyme disease and neuroborreliosis only (in cases without travel outside of the USA).

**Case D:** *B. burgdorferi* with European and Asian strains.

**Case E:** *B. burgdorferi* plus other tick borne pathogens.

**Case F:** *B. burgdorferi* plus European and Asian strains plus other tick borne pathogens.

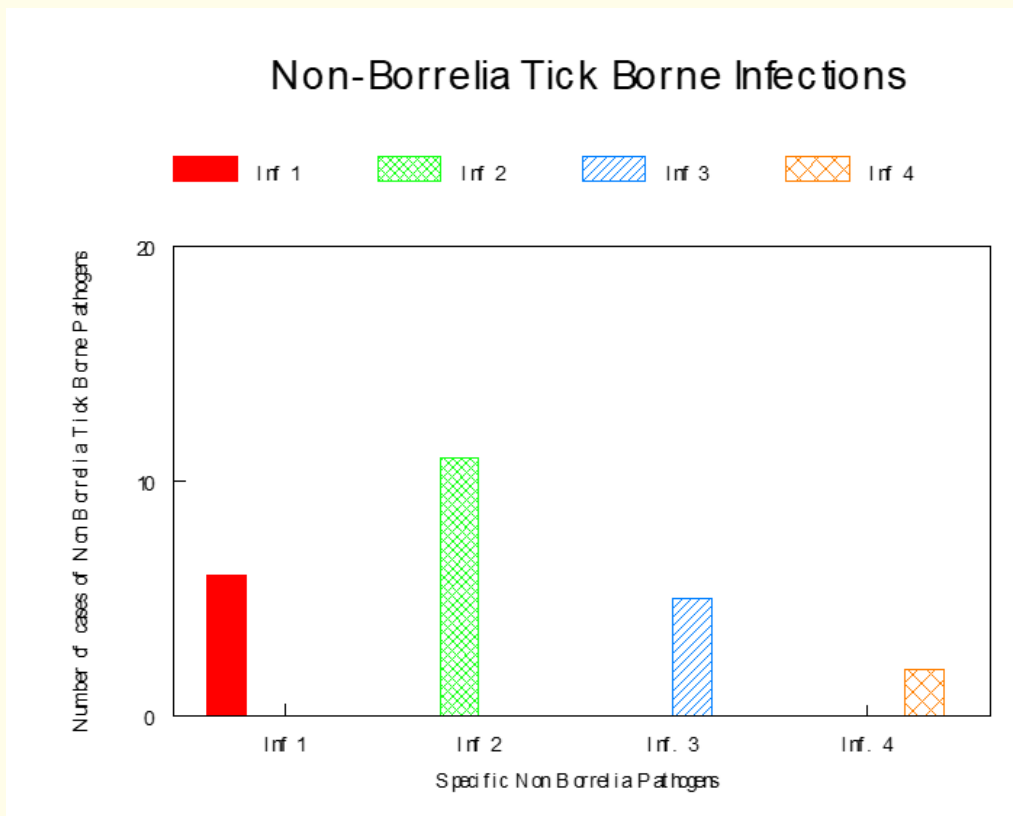
**Case G:** European and Asian strains plus other tick borne pathogens.

**Case H:** *Borrelia miyamotoi* plus other tick borne pathogens.

**Case I:** Other tick borne pathogens.

When only Non-*Borrelia* Tick Borne Infections were examined in our patient population sample, the most commonly occurring tick borne disease scenarios were: a) *Bartonella henselae*, b) *Babesia microti*, and c) Tick related *Mycoplasma pneumoniae* (See graph 1A).

The patient sample population revealed that the most commonly occurring NonTick Borne Pre-existing Infections were: a) *Epstein Barr Virus*, b) Chicken pox and c) Pneumonia (See graph 2).



Graph #1A

**Inf 1:** *Babesia microti*.

**Inf 2:** *Bartonella henselae*.

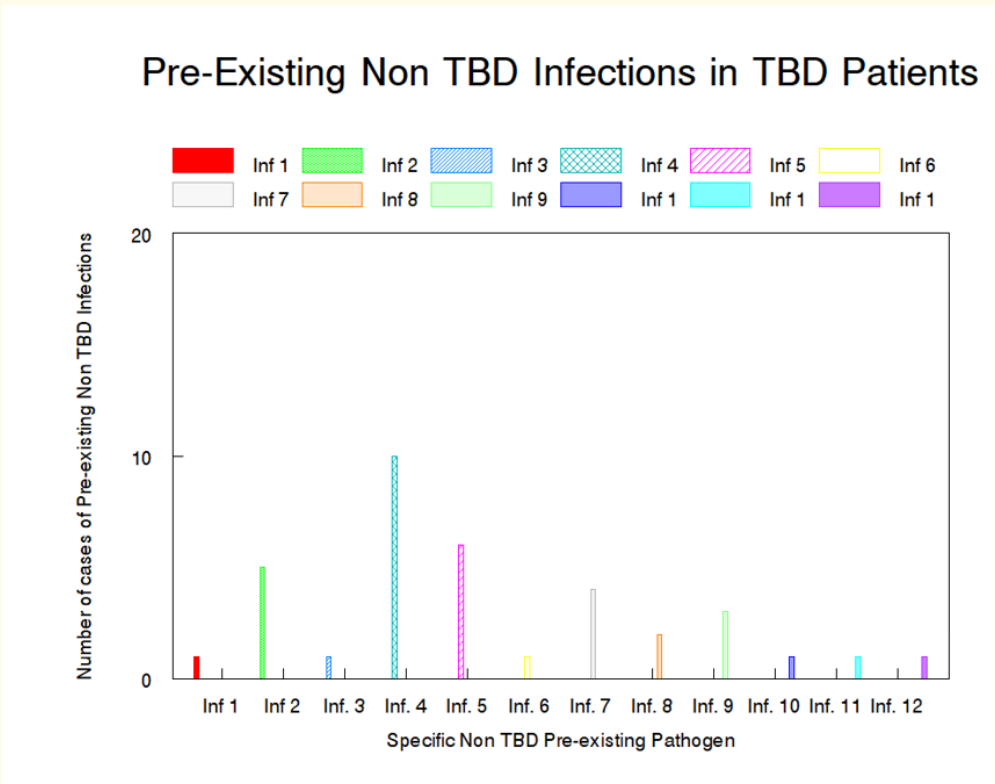
**Inf 3:** *Mycoplasma pneumoniae*.

**Inf 4:** Rocky mountain spotted fever.

The most frequently occurring Non-Infectious Pre-existing conditions among the sample population in our study were: a) Rheumatoid arthritis, b) Asthma, c) Cancer, d) Fibromyalgia, e) Chronic fatigue, f) Bell’s Palsy, g) Raynaud’s Disease, h) Depression and i) Bronchitis (See graph 3).

**Statistical data analyses**

Statistical evaluations were performed using the Wilcoxon Rank Sum Test to determine if statistical significant differences existed between Males and Females as relates to: a) *Borrelia* and non *Borrelia* Tick Borne Pathogens, b) Non Tick Borne Pre-existing Infections, c) Non-Infectious Pre-existing Conditions, and d) *Borrelia* and non *Borrelia* Tick Borne Infections + Non Tick Borne Pre-existing Infections + Non Tick Borne Non-Infectious Pre-existing Conditions.

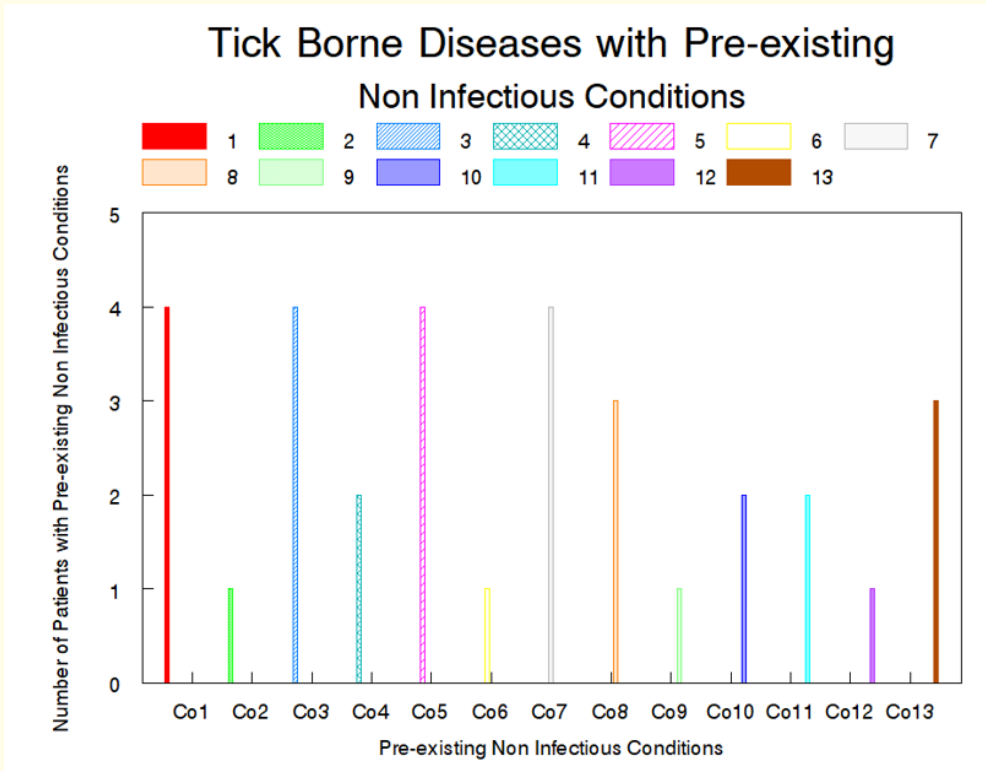


Graph 2

- Inf. 1:** Mycotoxin.
- Inf. 2:** Pneumonia.
- Inf. 3:** B. pertussis.
- Inf. 4:** Epstein Barr Virus.
- Inf. 5:** Chicken pox.
- Inf. 6:** Chlamydia pneumoniae.
- Inf. 7:** Mycoplasma pneumoniae.
- Inf. 8:** Coxsackie virus.
- Inf. 9:** Herpes Simplex Virus.
- Inf. 10:** HV6.
- Inf. 11:** Cytomegalovirus.
- Inf. 12:** MRSA Staph.

**Statistical evaluation of differences between males and females as relates To Borrelia and non-Borrelia tick borne pathogen occurrence (See table A, graph #1, graph #1A)**

The Wilcoxon Rank Sum Test for evaluating differences between Males and Females revealed: a) An Exact Permutation Test Two-tailed P-value of 0.0484, and b) Two-tailed P-Value for Normal Approximation of 0.0290. These statistics thus confirm the existence of statisti-



Graph 3

- Co1: Fibromyalgia
- Co2: Anemia
- Co3: Cancer
- Co4: Bronchitis
- Co5: Asthma
- Co6: Osteoporosis
- Co7: Rheumatoid Arthritis
- Co8: Chronic Fatigue
- Co9: Parkinson's Disease
- Co10: Raynaud's Disease
- Co11: Depression
- Co12: Multiple Sclerosis
- Co13: Bell's Palsy.

cally significant differences in the male and female population in our sample population as relates to the occurrence of *Borrelia* and Non *Borrelia* Tick Borne Pathogens (see discussion section).

**Statistical evaluation of differences between males and females as relates to pre-existing non-tick borne infection occurrence (See table B, graph 2)**

The Wilcoxon Rank Sum Test for evaluating differences between Males and Females revealed: a) An Exact Permutation Test Two-tailed P-value of 0.4182 and b) Two-tailed P-value for Normal Approximation of 0.3891. These statistics thus confirm that there did not exist a statistically significant difference in the males and females in our sample population as relates to Pre-existing Non Tick Borne Infection occurrence (see discussion section).

**Statistical evaluation of differences between males and females as relates to pre-existing non tick borne non infectious disease occurrence (See table C, graph 3)**

The Wilcoxon Rank Sum Test for evaluating differences between Males and Females revealed: a) A Two-tailed P-value for Normal Approximation of 0.0061. These statistics thus confirmed that there did exist a statistically significant difference in males and females in our sample population as relates to Pre-existing Non Tick Borne Non-Infectious Disease conditions (see discussion section).

**Statistical evaluation of differences between males and females as relates to a scenario of *Borrelia* and non *Borrelia* tick borne infections + non tick borne pre- statistical evaluation of differences between males and females as relates to pre-existing non tick borne non infectious disease occurrence existing infections + non tick borne non-infectious pre-existing conditions**

*Borrelia* and non *Borrelia* tick borne infections + non tick borne pre-existing infections + non tick borne non-infectious pre-existing conditions.

The Wilcoxon Rank Sum Test for evaluating differences between Males and Females revealed: a) A Two-tailed P-value for Normal Approximation of 0.0039. These statistics thus confirmed that there did exist a statistically difference in males and females in our sample populations as relates to a scenario of *Borrelia* and non *Borrelia* Tick Borne Infections + Non Tick Borne Pre-existing Infections + Non Tick Borne Non-Infectious Pre-existing Conditions (see discussion section).

**Discussion**

This study indicated that the majority of patients in our study had additional pre- conditions long before their encounter with a tick bite. These infections included both non-tick borne infectious diseases, and non-tick borne non-infectious disease conditions.

The most commonly occurring pre-existing non-tick borne infections observed in this study were: a) *Epstein Barr Virus*, b) Chicken pox, and c) Pneumonia. *Epstein Barr Virus* by itself has been linked to oncogenic disease, and encounters with Chicken pox in early life has been seen in older individuals as a disease known as Shingles [4]. Pneumonia has been responsible for death in older individuals whose immune system as been weakened by other diseases such as those associated with various forms cancer [5]. These pre-existing disease have already stressed the immune system long before the disease dysfunctional factors of tick borne infections have occurred [6]. An additionally interesting finding in this study was that *Mycoplasma pneumonia* can occurs either as a Non-Tick Borne pathogen, as well as, a Tick Borne Pathogens

The most commonly occurring pre-existing disease conditions that were not associated with either Tick Borne or Non-Tick Borne Infections frequently occurring Non-Infectious Pre-existing conditions among the sample population in our study were: a) Rheumatoid arthritis, b) Asthma, c) Cancer, d) Fibromyalgia, e) Chronic fatigue, f) Bell's Palsy, g) Raynaud's Disease, h) Depression and i) Bronchitis [6,7].

Pre-existing disease like Rheumatoid arthritis, Fibromyalgia, Chronic fatigue, Bell's Palsy, and Depression, can occur as pre-existing conditions long before an individual has had an encounter with a tick bite and its associated collection of pathogens. However, what must never be overlooked is the fact that these aforementioned conditions have also been seen as second conditions in individuals with Lyme



and other tick borne infections. This is truly a further complication, which often requires that a physician take a detailed case history of a patient long before their misadventure with a tick bite [7].

A most interesting discovery that this investigation revealed is that when it comes to the causative agents of Lyme Disease (i.e. *Borrelia burgdorferi*, *Borrelia afzelii*, *Borrelia garinii*) was that it is extremely important for a physician to ask a patient if he or she had ever traveled outside of the United States and North America. Many of the individuals in our study been bitten with the European and Asian causative agents of Lyme disease (i.e. *Borrelia burgdorferi*, *Borrelia afzelii*, *Borrelia garinii*) because of their travels outside of the USA [8]. We had even seen cases of individuals who also were bitten by the North American causative agent of Lyme disease *Borrelia burgdorferi* in addition to the aforementioned European and Asian Causative agents (i.e. *Borrelia afzelii*, and *Borrelia garinii*) of Lyme diseases. Our study had even encountered a finding of an individual in who had never traveled outside of the USA but, had Lyme disease associated with a European strain that was responsible for his tick borne disease [8].

Of the non *Borrelia* Tick Borne Infections that were found to occur mostly frequently in our patient population sample, the most commonly occurring tick borne were: a) *Bartonella henselae*, b) *Babesia microti*, and c) Tick related *Mycoplasma pneumoniae*. The Tick Borne Pathogen *Bartonella henselae* was found to be the most frequently occurring tick borne [9]. The presence this pathogen been found to occur more frequently than the causative agent of Lyme disease in North American *Borrelia burgdorferi* in our study region of Pike County Pennsylvania [9]. Tick Pathogen Carriage Survey in our regions has revealed an elevated presence of this pathogen. Another commonly occurring Non-*Borrelia* Pathogen seen frequently among the patients in our study was protozoan parasite *Babesia microti*. The frequently encountered tick related disease scenario is the simultaneous occurrence of *Borrelia burgdorferi*, *Babesia microti*, and *Bartonella henselae*.

It had been cited above that *Mycoplasma pneumoniae* can occur as a Pre-existing Non-Tick Borne Pathogen, however, this pathogen can also occur as a Tick Borne Pathogen as well. Thus, it is important for a physician treating patients for mycoplasma infections to understand, that this pathogen can be occur as either a Non-Tick Borne Pathogen or as a Tick Borne Pathogen.

The investigation of Wormser and Shapiro that consisted of a study sample size of N = 490 individuals observed that females were more significantly likely to have chronic lyme disease [10]. In Finland the study by Sajanti., *et al.* investigated respectively 21,051 and 10,402 10,402 patient cases of confirmed Lyme Neuroborreliosis [9]. The overall findings of this study confirmed that Lyme Neuroborreliosis occurred predominantly in women [11].

The studies aforementioned studies only looked at Chronic Lyme Disease, and Lyme Neuroborreliosis, and did not investigate gender differences between men and females. Our study looked beyond Lyme Disease and Lyme Neuroborreliosis vis a vis gender differences between male and female patients as relates to:

- a) Statistical evaluation of differences between males and females as relates *Borrelia* and non-*Borrelia* tick borne pathogen occurrences.
- b) Statistical evaluation of differences between males and females as relates to pre-existing non-tick borne infection occurrence.
- c) Statistical evaluation of differences between males and females as relates to pre-existing non tick borne non infectious disease occurrence.
- d) Statistical evaluation of differences between males and females as relates to a scenario of *Borrelia* and non *Borrelia* tick borne infections + non tick borne pre- statistical evaluation of differences between males and females as relates to pre-existing non tick borne non infectious disease occurrence existing infections + non tick borne non-infectious pre-existing conditions.

When we looked the differences between males and females as relates to *Borrelia* and Non *Borrelia* Pathogen occurrence we found that there were indeed statistically significant gender differences between females and males, which echoed the earlier findings of Wormser

and Shapiro and Sajanti, *et al.* namely that females were more likely to have *Borrelia* infections [10,11]. Our investigation went further to add to the earlier findings in that this could also be extended to include both *Borrelia* and Non-*Borrelia* Tick Borne Infections (see results section).

When we evaluated the difference between males and females genders as relates to the occurrence of Non Tick Borne Pre-existing Infections by contrast, there did not occur any statistically significant gender differences between male and females (see results section).

In the case of gender differences between male and female genders vis a vis Non Infectious Disease States, females had a statistically higher incidence of Pre-existing Non-Infectious Disease conditions (see results section).

The statistical evaluation of differences between males and females as relates to a scenario of *Borrelia* and non *Borrelia* Tick Borne Infections + Non Tick Borne Pre- Statistical Evaluation of Differences between Males and Females as relates to Pre-existing Non Tick Borne Non Infectious Disease Occurrence existing Infections + Non Tick Borne Non-Infectious Pre-existing Conditions revealed that there was a statistically gender difference between males and females.

It was observed that there was a cumulative effect of conditions of tick borne infection plus non-tick borne infection plus non infectious pre-existing disease states. The statistical evaluation revealed a highly statistically significant gender difference between males and females. This cumulative effect showed females to a statistically higher incidence than males when tick borne diseases were evaluated in connection with *Borrelia* and non *Borrelia* tick borne infections + non tick borne Infections + non infectious disease conditions.

This investigation found that our local population in the main suffered from a variety of pre-existing conditions both infectious and non-infectious which reveal that they had initially an unhealthy immune system. This unhealthy Immune system thus puts these individuals into a more serious tick borne scenario, especially since it is known the tick borne diseases can cause an immune dysfunction [6,7].

Proper treatment for these individuals should not only include treatment for the tick borne diseases and pre-existing infectious and non-infectious disease conditions but, also an evaluation of the immunological status of these patients by specialists in Functional Medical Evaluation.

With the recent advent of the Coronavirus COV-19, individuals with a stressed and depressed immune system are now even more vulnerable to acquire a more serious and deadly version of this virus as additional opportunistic pathogen.

### Conclusion

Lyme and related Tick Borne Infections are multi-pathogenic events which are often quite difficult to treatment. It is known that Tick Borne Infections can cause immune dysfunction as well. What must never be overlooked is the general condition of immunological stress of a patient as relates to the presence of additional pre-existing Non-Tick Borne Infectious and Non-Infectious Conditions. These additional pre-existing factors must always be taken into consideration in order to successfully treat the complex and multi-pathogenic event known as Tick Borne Diseases.

### Acknowledgement

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