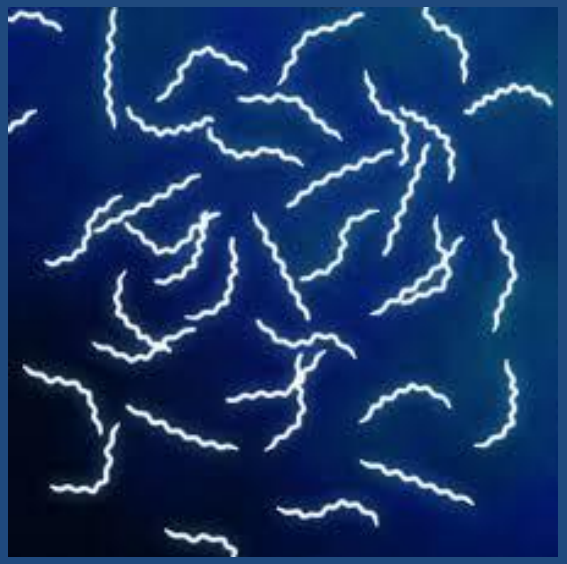
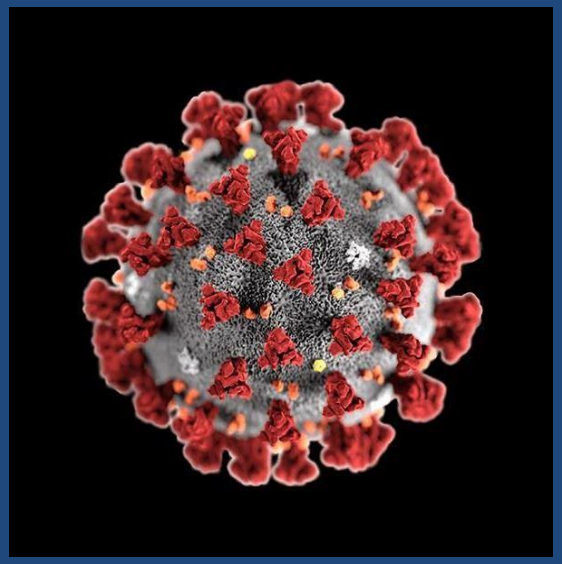
A Tale of Two Pandemics: Lyme & COVID-19





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AONM, London, England

May, 2020

Disclosure Statement

Robert Bransfield, MD, DLFAPA, PC

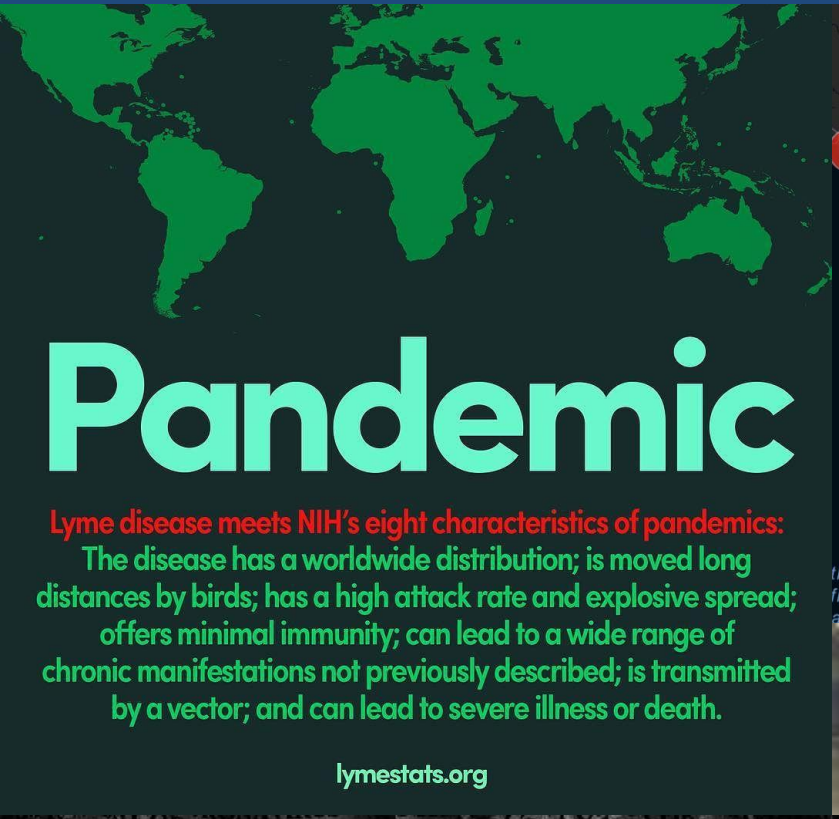
- Patients pay me money in return for trying to help them.
- Most of my income is paid directly from patients
- No Lyme, psychoimmunology or infectious disease financial interests.
- While this presentation is my own, I am pleased to be a member of the International Lyme and Associated Diseases Society (ILADS).
- I have been an expert witness in cases involving Lyme disease.

It was the best of times, it was the worst of times,

- It was the age of wisdom, it was the age of foolishness, it was the epoch of belief, it was the epoch of incredulity, it was the season of Light, it was the season of Darkness, it was the spring of hope, it was the winter of despair, we had everything before us, we had nothing before us, we were all going direct to Heaven, we were all going direct the other way—in short, the period was so far like the present period, that some of its noisiest authorities insisted on its being received, for good or for evil, in the superlative degree of comparison only.

Charles Dickens, a Tale of Two Cities


COUNTY
JAIL



Pandemic

Lyme disease meets NIH's eight characteristics of pandemics: The disease has a worldwide distribution; is moved long distances by birds; has a high attack rate and explosive spread; offers minimal immunity; can lead to a wide range of chronic manifestations not previously described; is transmitted by a vector; and can lead to severe illness or death.

lymestats.org

Healthcare Advances, Bureaucratic Barriers for Access to Effective Care

How Are Lyme & COVID-19 Similar?

- Both are zoonotic diseases
  Both have multiple strains
  Both can be avoided by wearing protection
  Both are global diseases
  Both have no symptoms in some
  Both have controversy of reinfection vs reactivation
  Both are relapsing
  Both can have a spectrum of different symptoms in different patients
  Both have difficult to understand complex pathophysiology
  Both are associated with coinfections
  Both are associated with complex immune symptoms
  Both have cytokine storm
  Both are multisystem diseases
  Both have mental symptoms
  Both have neurological manifestations
  Both have multiple strains
  Both are associated with fatigue
  Both are associated with brain fog
- Both foster isolation
- Boat are associated with muscle aches
  Both have poor quality testing
  Both are financially catastrophic
  Both have a gap between front line physicians and healthcare bureaucracies
  Both have a focus upon prevention and vaccines
  Both have an insufficient emphasis upon treatment
  Both are impacted by regulations that impede effective treatment
  Both are associated with misinformation
  Both are discussed regarding biological warfare
  Both have obstructed progress from dogma
  Both have a political disease component
  Both are improved with some of the same treatments
  Both are a money pit for some and a bankruptcy for others
  Both are active this spring
  Both are treated with off-label treatments
  Neither have an effective vaccine

How Are Lyme & COVID-19 Different?

- Lyme is a spirochete, COVID-19 is a virus
- PCR testing is labeled invalid for Lyme, but not for COVID-19
- Lyme will probably be a major problem 10 years from now, COVID-19 probably will not be
- Lyme usually has a more gradual onset of symptoms
- Lyme is associated with more disease denial
- Lyme has more relapsing and remitting symptoms
- Lyme is an ancient disease
- Lyme receives less attention
- Lyme receives less funding
- The legitimacy of Lyme symptoms are questioned
- Lyme has more advocacy groups
- Lyme progress is more dependent on private funding
- Person to person spread of COVID-19 is more prominent with COVID-19

Lyme & COVID-19 Comorbidity

- How does COVID-19 effect Lyme disease?
- How does Lyme effect COVID-19?

How do COVID-19 vs. Lyme have residual effects on brain functioning?

- The data is still being collected, but COVID-19 may have no effect in some, while in others it can cause brain inflammation, excessive clotting, and strokes, lack of oxygen to the brain which can cause residual impairments similar to what is seen in patients with hypoxia from suffocation and carbon monoxide poisoning. Lyme can have no effect in some, neurological damage from infection within the brain, infection in the body causing immune reaction causing brain impairments, and cerebral vasculitis resulting in circulation impairments and associated injury and dysfunction.

Coronavirus ‘altered the brain’ of NYC ER doc who killed herself, sister says

NY Post

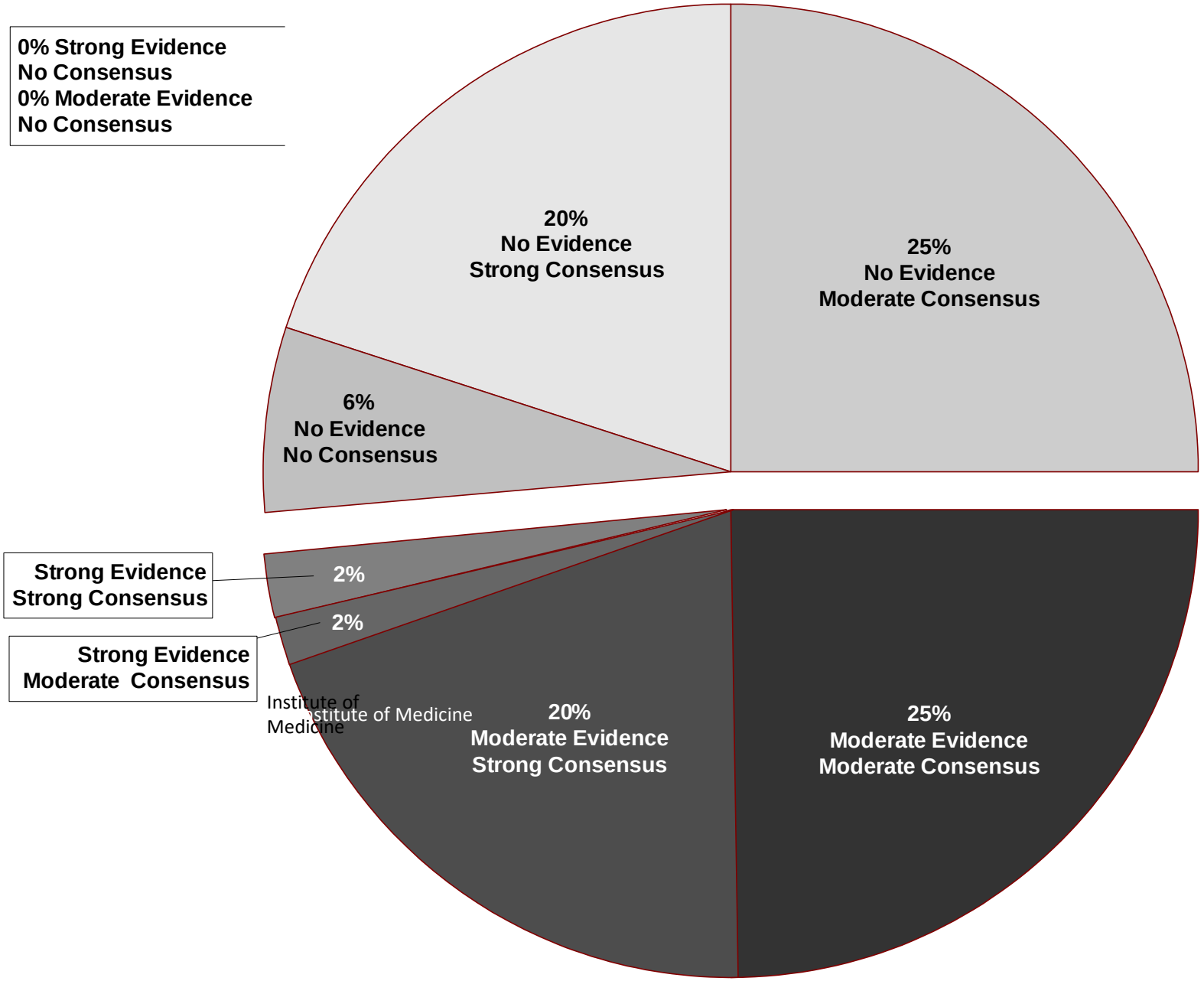
Did Infections Caused by World War I Contribute to Causing World War II?

- How many of those who recovered from WWI-associated infections had residual neurological impairments that increased their risk for violence?

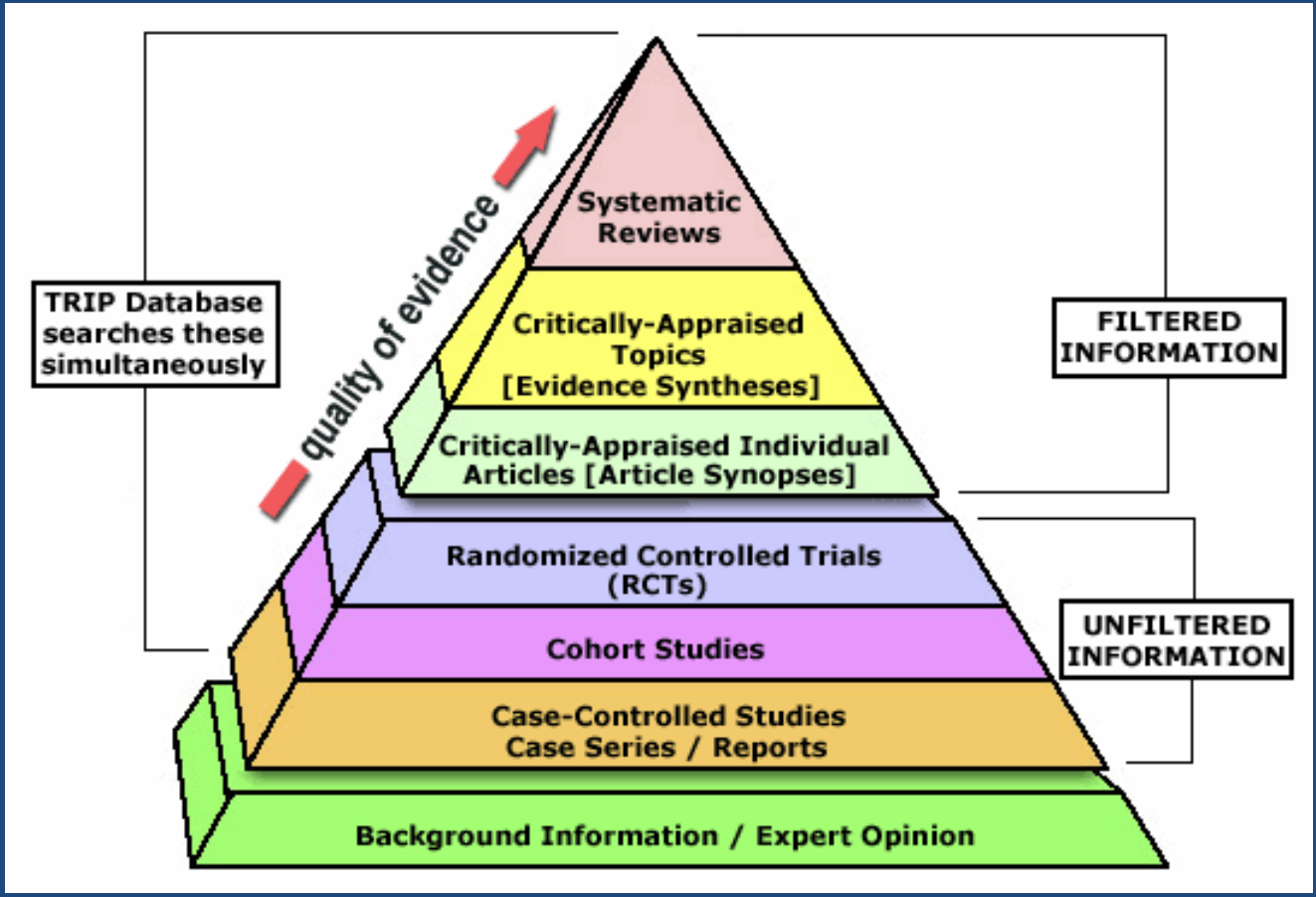
Bransfield R. ContagionLive. 2018

Is There Hope?

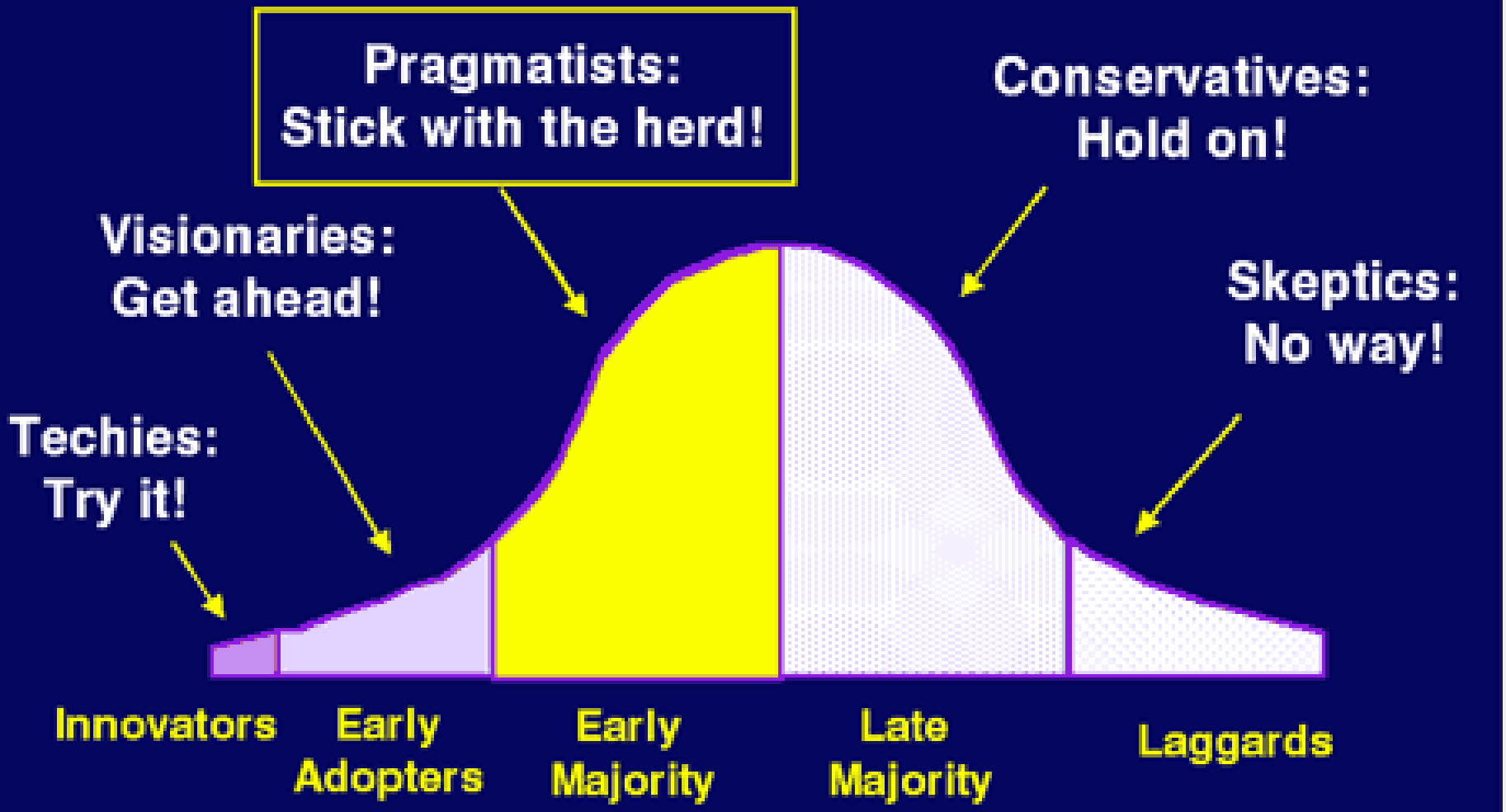
The Role of Evidence and Consensus in Medicine



How Much Medical Evidence Is Needed to Treat?



Technology Adoption Life Cycle

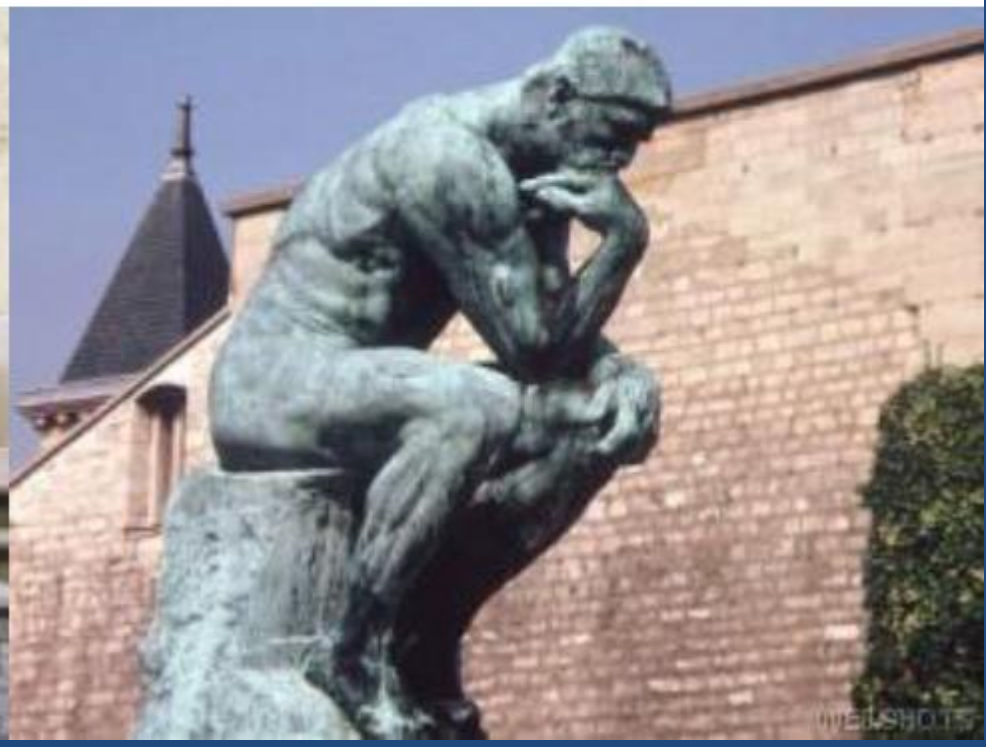


Pragmatists cast the deciding vote

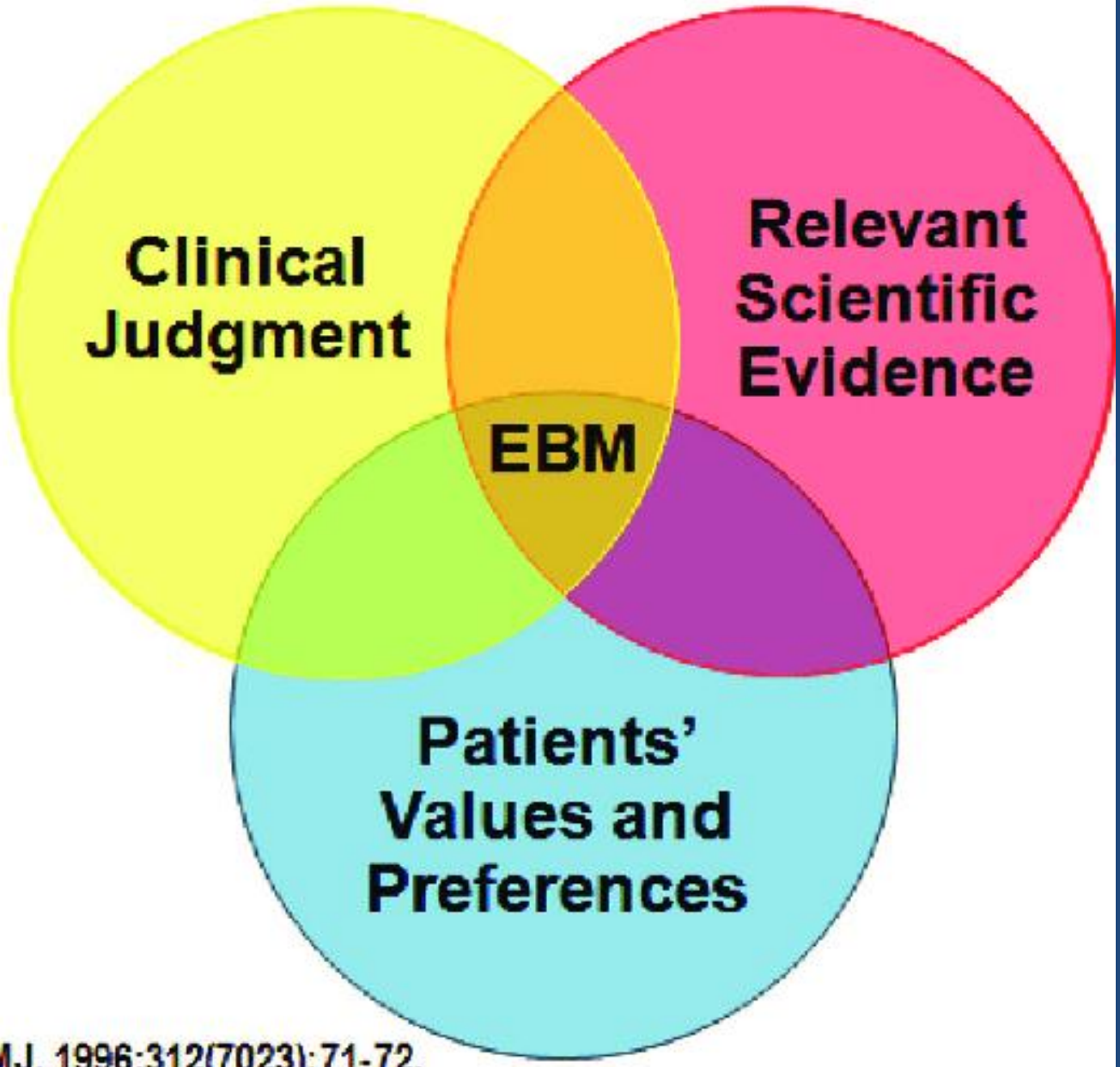
When Is Research Excessive?

Public Health Approaches

With Emerging & Complex Diseases Think Outside the Box



What Is Evidence-Based Medicine?



Sackett DL, et al. BMJ. 1996;312(7023):71-72.

Understanding Lyme disease, mental illness and other chronic illnesses

Past

- When mental hospitals were filled with syphilis patients everyone eventually recognized infections caused mental illness.
- After penicillin few physicians had capability in both infectious disease and psychiatry.
- Psychodynamic and then neurochemical explanations became more dominant and widely accepted.
- But what caused neurochemical pathology?

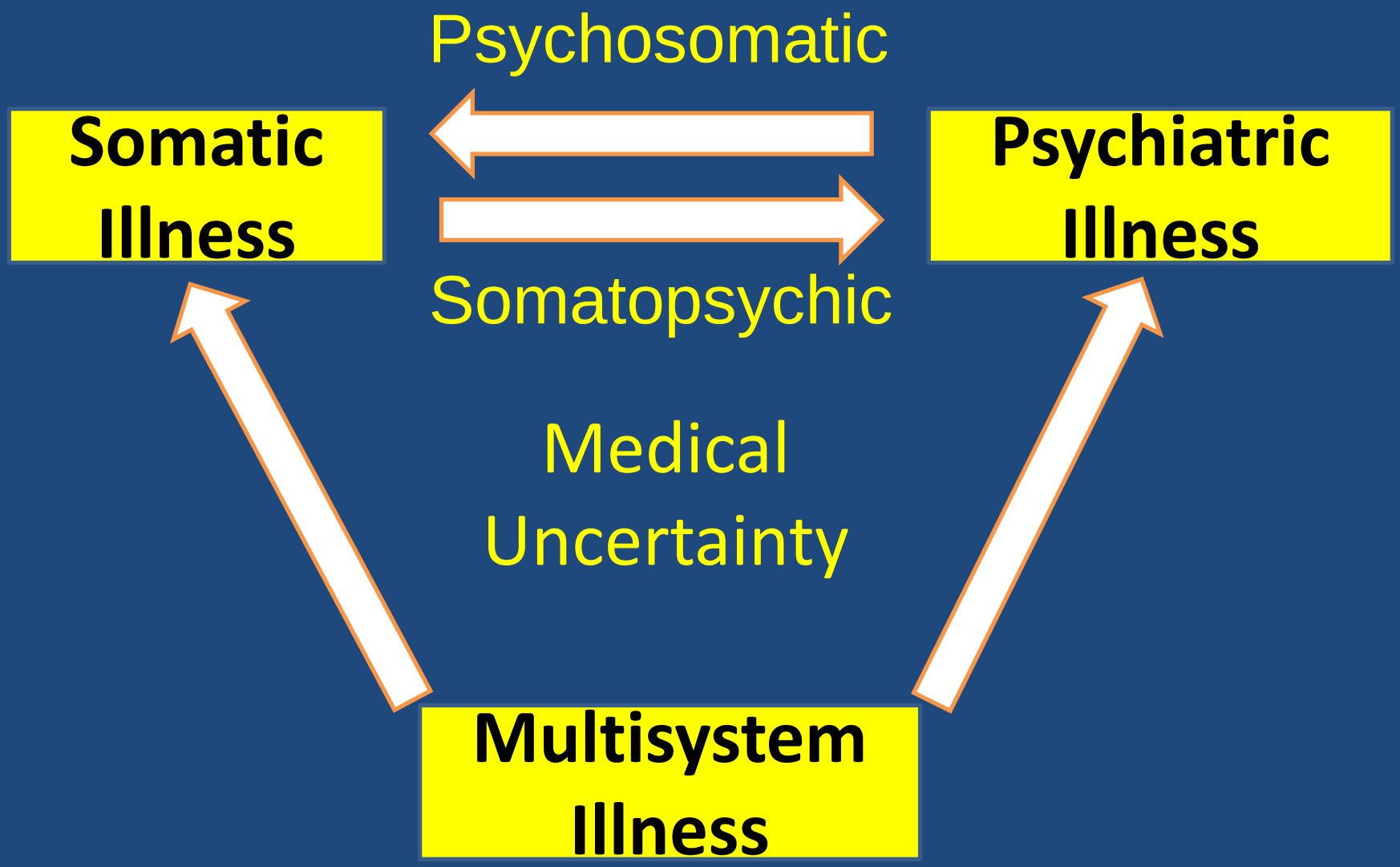
Present

- Advances in evolutionary medicine, the microbiome, psychoimmunology, brain imaging and PCR microarray testing [1] expands our knowledge of the pathophysiology of mental illness.
- But limited multidisciplinary cooperation slows progress appreciating the association between microbes and mental illness.[2]

1 Fredricks, D. N. & Relman, D. A. Sequence-based identification of microbial pathogens: A reconsideration of Koch's postulates. Clin. Microbiol. Rev. 1996 9(1):18-33.
2 Bransfield RC. Building Bridges Between Infectious Disease Physicians and Psychiatrists. Contagion Live. 2017 Nov 30

Recent Articles

- Suicide and Lyme and associated diseases. Neuropsychiatr Dis Treat. 2017 16;13:1575-87.
- Did Infections Caused by World War I Contribute to Causing World War II? Contagion Live. January 5, 2018.
- Aggressiveness, Violence, Homicidality, Homicide and Lyme Disease. Neurol Disease and Treatment. 2018:14; 693—713
- Neuropsychiatric Lyme Borreliosis: An Overview with a Focus on a Specialty Psychiatrist's Clinical Practice. Healthcare (Basel) 2018. 6(3), 104
- Proposed Lyme Disease Guidelines and Psychiatric Illnesses. Bransfield RC, Cook MJ, Bransfield DR. Healthcare (Basel). 2019. 9;7(3).
- Differentiating Psychosomatic, Somatopsychic, Multisystem Illnesses and Medical Uncertainty. Bransfield RC. Friedman KJ. Healthcare (Basel). 2019 Oct 8;7(4). pii: E114.
- Chronic Lyme Disease: An Evidence-Based Definition by the ILADS
- Working Group Shor S, Szantyr B, Green C, Bransfield RC, Phillips S, Liegner K, Burrascano, J, Maloney E. Antibiotics. 2019. 8(4), 269.
- A Clinical Diagnostic System for Late Stage Neuropsychiatric Lyme Borreliosis Based upon an Analysis of 100 Patients Bransfield RC , Cook MJ, Aidlen DM, Javia S. Healthcare (Basel). 2020, *8*(1), 13



Bransfield RC, Friedman KJ. Healthcare (Basel). Differentiating Somatopsychic, Psychosomatic, Multisystem Illness and Medical Uncertainty 2019, 8;7(4).

Term	DSM-5 Diagnosis	ICD-10 Diagnosis	ICD-11 Diagnosis
All in your head	No	No	No
Somatic symptom disorder	Yes	Yes	No
Somatoform disorder	No	No	No
Medically unexplained symptoms	No	No	No
Functional neurological symptom disorder	Yes	Yes	No
Conversion disorder	No	Yes	No
Illness anxiety disorder	Yes	No	Yes
Factitious disorder imposed upon another (Munchausen's by proxy)	Yes	Yes	Yes
Functional disorders	No	Yes	No
Psychogenic disorders	No	Yes	No
Compensation neurosis	No	No	No
Psychogenic seizures	No	Yes	Yes
Psychogenic pain	No	Yes	No
Psychogenic fatigue	No	No	No
Delusional parasitosis	No	Yes	Yes
Subjective vs. Objective	No	No	No
Non-specific or vague symptoms	No	No	No
Bodily distress disorder	No	No	Yes
Bodily distress syndrome	No	No	No

BABCP Spring Conference 8th June Persistent (Medically Unexplained) Physical Symptoms

- Persistent (medically unexplained) physical symptoms…With COVID-19 we are likely to see people experience ongoing persistent physical symptoms which will impact their functioning.
- Trudie Chalder at King's College London has worked as a clinician and a researcher in the area of long-term conditions and medically unexplained symptoms for 30 years. Trudie develops specific CBT models to understand and treat symptoms and distress in MUS.

Proposed Lyme Disease Guidelines and Psychiatric Illnesses

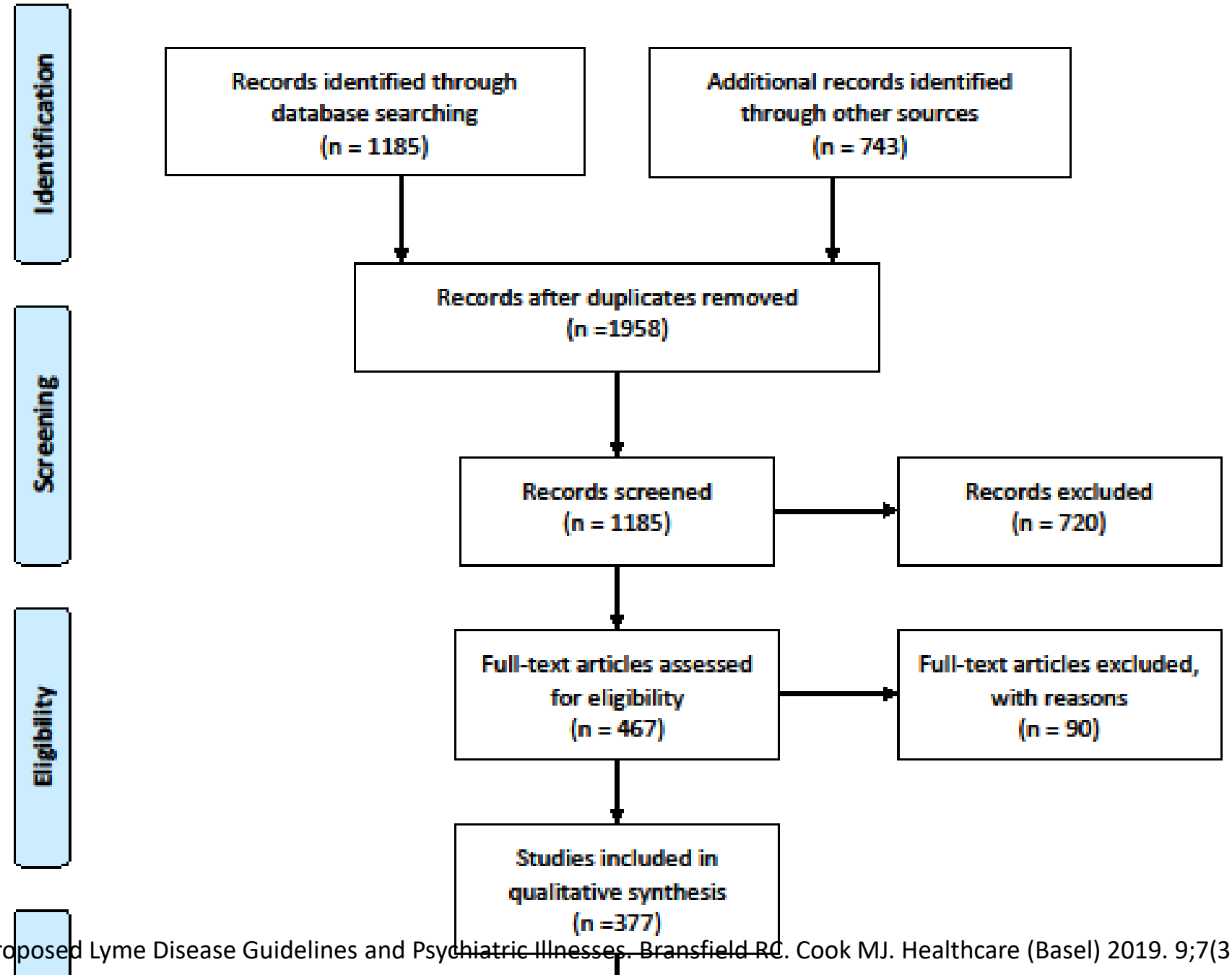
- The disclaimer and the manner these guidelines are implemented are insufficient to remove the authors and sponsoring organizations from liability for harm caused by these guidelines.
- The guidelines and supporting citations place improper credibility upon surveillance definition rather than clinical diagnosis criteria.
- The guidelines fail to address the clear causal association between Lyme disease and psychiatric illnesses, suicide, violence, developmental disabilities and substance abuse despite significant supporting evidence.

Proposed Lyme Disease Guidelines and Psychiatric Illnesses. Bransfield RC. Cook MJ. Healthcare (Basel) 2019. 9;7(3).

Proposed Lyme Disease Guidelines and Psychiatric Illnesses II

- If these guidelines are published without very major revisions, and if the sponsoring medical societies attempt to enforce these guidelines as a standard of care, it will directly contribute to increasing a national and global epidemic of psychiatric illnesses, suicide, violence, substance abuse and developmental disabilities and the associated economic and non-economic societal burdens.
- The guideline flaws could be improved with a more appropriate disclaimer, an evidence based rather than an evidence biased approach, more accurate diagnostic criteria, and recognition of the direct and serious causal association between Lyme disease and psychiatric illnesses.

Proposed Lyme Disease Guidelines and Psychiatric Illnesses. Bransfield RC. Cook MJ. Healthcare (Basel) 2019. 9;7(3).



Proposed Lyme Disease Guidelines and Psychiatric Illnesses. Bransfield RC. Cook MJ. Healthcare (Basel) 2019. 9;7(3).

Systematic review of Lyme disease causing psychiatric illness

The PubMed electronic search for citations:

- Lyme disease psychiatric illness: 1054
- Lyme disease causing psychiatric illness: 384
- Lyme disease causing mental illness: 413
- Lyme disease causing developmental disorders children: 134
- Lyme disease causing behavioral disorders children: 268
- Lyme disease psychiatric disorders children: 267
- ILADS Lyme/TBD causing psychiatric illness: 377 citations (304 psychiatry, 73 Dementia)
- My archives: 389

Proposed Lyme Disease Guidelines and Psychiatric Illnesses. Bransfield RC. Cook MJ. Healthcare (Basel) 2019. 9;7(3).

Citations in Perspective

- Lyme causing psychiatric symptoms: 387
- Lyme causing dementia: 73
- IDSA: 4 (only 2 failed to show an association)
- Citation total: 467 vs. 2, (0.4% of literature)
- Therefore the guidelines are evidence biased, not evidence based due to the selective reporting of outcomes

Proposed Lyme Disease Guidelines and Psychiatric Illnesses. Bransfield RC. Cook MJ. Healthcare (Basel) 2019. 9;7(3).

There are many faces to Lyme disease

I’ve learned the most from my patients

- Sir William Osler:
- There is no more difficult art to acquire than the art of observation.
- If you listen long enough, the patient will give you the diagnosis.
- Yogi Berra:
- You can observe a lot by watching.
- I would have never seen if I didn’t believe it.

Variable Presentation

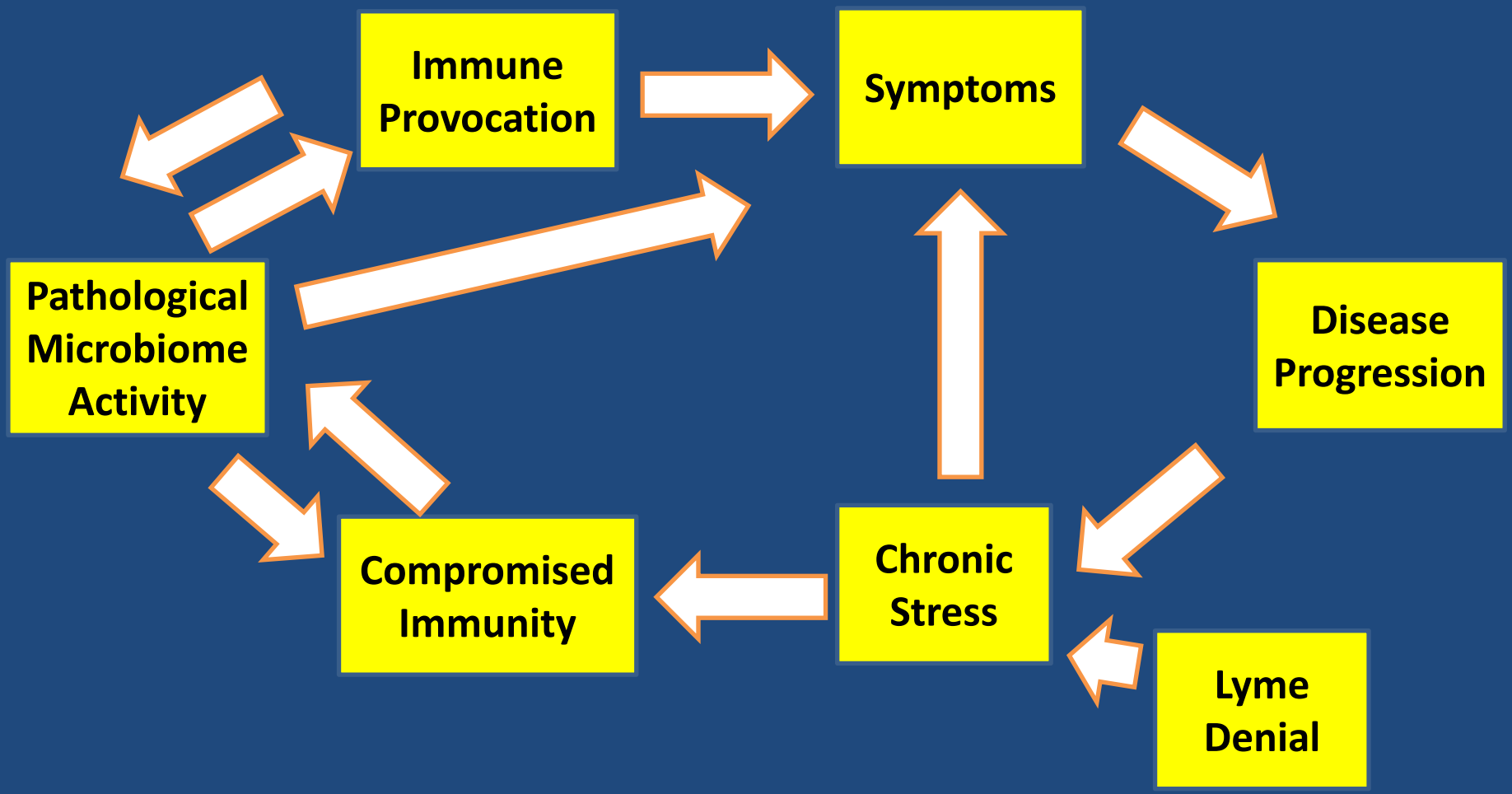
- Lyme borreliosis may have no effect, be latent or cause a broad spectrum of multisystem symptoms.
- Most neuropsychiatric symptoms appear later in disease progression.
- Although there are general patterns, each patient has a unique presentation.

Neuropsychiatric Lyme Borreliosis: An Overview with a Focus on a Specialty Psychiatrist's Clinical Practice

- Lyme borreliosis causes immune and metabolic effects that result in a gradually developing spectrum of neuropsychiatric symptoms, usually presenting with significant comorbidity which may include developmental disorders, autism spectrum disorders, schizoaffective disorders, bipolar disorder, depression, anxiety disorders (panic disorder, social anxiety disorder, generalized anxiety disorder, posttraumatic stress disorder, intrusive symptoms), eating disorders, decreased libido, sleep disorders, addiction, opioid addiction, cognitive impairments, dementia, seizure disorders, suicide, violence, anhedonia, depersonalization, dissociative episodes, derealization and other impairments.

Bransfield RC. Healthcare (Basel). 2018 Aug 25;6(3). pii: E104. doi: 10.3390/healthcare6030104.

Disease Progression



A Clinical Diagnostic System for Late-Stage Neuropsychiatric Lyme Borreliosis Based upon an Analysis of 100 Patients

- Bransfield RC, Aidlen DM, Cook MJ, Javia S. Healthcare (Basel). 2020 Jan 6;8(1). pii: E13. doi: 10.3390/healthcare8010013. PubMed PMID: 31935905.

A Clinical Diagnostic System for Late Stage Neuropsychiatric Lyme Borreliosis Based upon an Analysis of 100 Patients

Inclusion Criteria

- Patients who had met the CDC surveillance definition for Lyme disease. These criteria included erythema migrans rash, nervous system criteria, musculoskeletal criteria, cardiovascular criteria and/or laboratory criteria and most patients met more than one criterion. More specifically, 100% met neurological criteria with cranial nerve and other neurological findings, 81% met the musculoskeletal criteria, 52% met the criteria based upon erythema migrans rash, and 11% met cardiac criteria with heart block. In addition, 100% met laboratory criteria with all having positive Lyme Western blots, some on multiple testing, some were also positive with spinal fluid testing and polymerase chain reaction testing for DNA.

Four Control Groups

- The health status of the same 100 patients pre-infection
- Healthy medical students who did not have Lyme disease, N=23
- Patients with other chronic illnesses, N=10
- The National Comorbidity Replication Survey

Results

- History of exposure to an endemic area, 98%; history of tick bite(s), 60%; erythema migrans rash, 53%; early flu-like symptoms, 68%; recurrent erythema migrans rash, 37%.
- 30 were diagnosed and treated within 6 months of infection but continued to have disease progression. 70 had a delayed diagnosis and treatment, with the average delay being 9 years. The longest delay between infection and treatment was 40 years.
- Most clinical findings evaluated showed a statistically significant difference when comparing the prevalence of these clinical findings pre-infection to the prevalence of the same clinical findings post-infection.

Results: Control Groups

- The 100 patients pre-infection: the average patient had 4.6 clinical findings pre-infection and 82 clinical findings post-infection.
- Healthy medical students w/o Lyme disease: the average had 4 clinical findings.
- Age-matched controls with conditions other than Lyme disease. The average patient had 21.7 clinical findings, N=10.
- The National Comorbidity Replication Survey

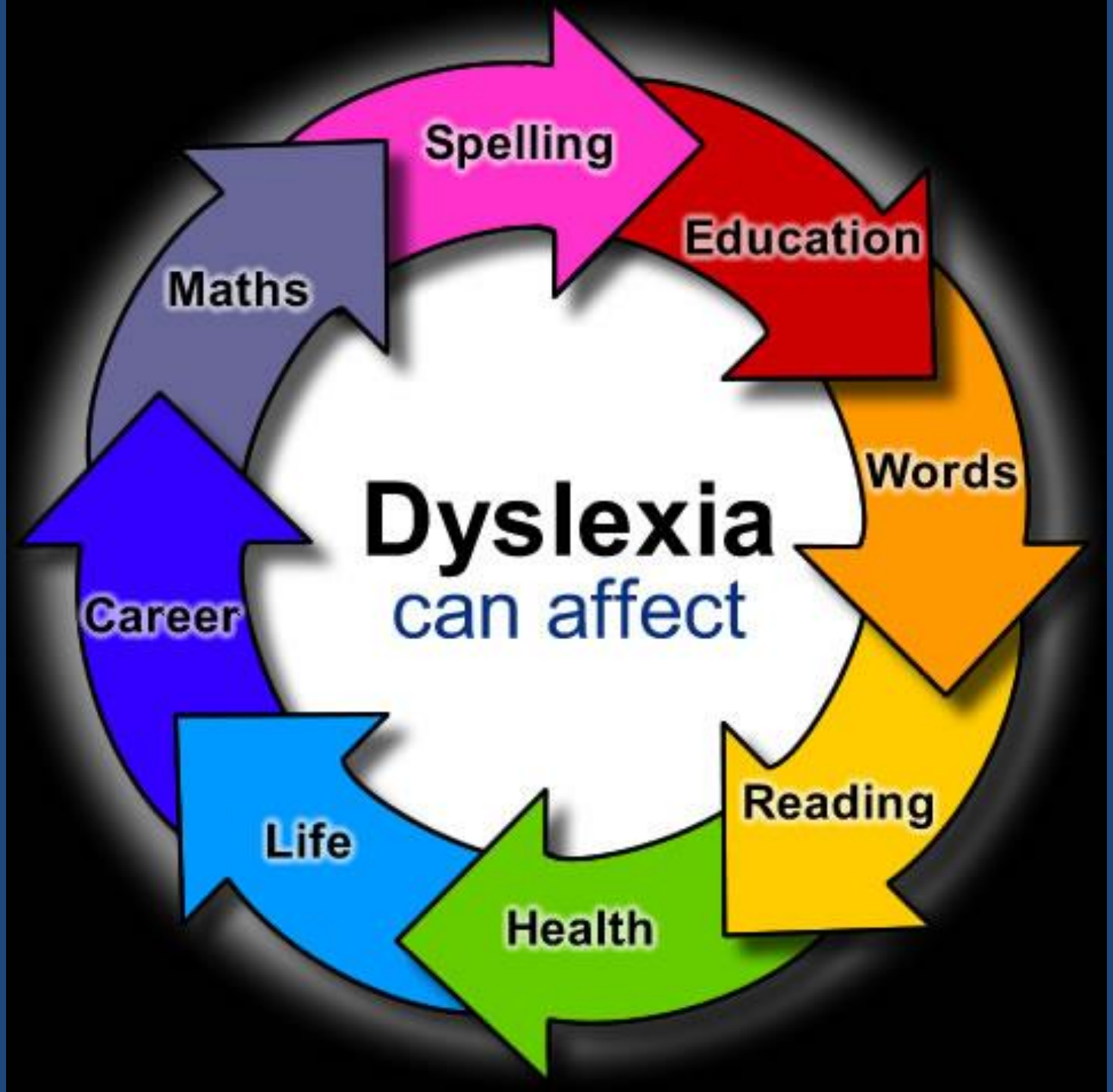
Pre-infection prevalence of mental disorders in the patients studied compared to the prevalence of the same disorders in the 12 month National Comorbidity Replication Survey

Psychiatric Syndromes	Pre-Infection	95% CI	National Comorbidity Survey
Depression	9.0%	(3–15%)	8.2%
Rapid cycling bipolar	3.0%	(0–6%)	2.6%
Panic disorder	2.0%	(0–5%)	2.7%
Obsessive compulsive disorder	2.0%	(0–5%)	1.0%
Social anxiety disorder	7.0%	(2–12%)	6.8%
Generalized anxiety disorder	3.0%	(0–6%)	3.1%
Posttraumatic stress disorder	6.0%	(1–11%)	3.5%
Explosive anger	3.0%	(0–6%)	2.6%

Attention Span

Clinical Impairment	Pre-Infection	95% CI	Post-Infection	95% CI
Attention span				
Sustained attention	7%	(2–12%)	84%	(77–91%)
Distracted by frustration	7%	(2–2%)	79%	(71–87%)
Allocation of attention	6%	(1–11%)	66%	(57–75%)
Hypersensitivity to sound	3%	(0–6%)	66%	(57–75%)
Hypersensitivity to light	2%	(0–5%)	63%	(54–72%)
Hypersensitivity to touch	2%	(0–5%)	41%	(31–51%)
Hypersensitivity to smell	5%	(1–9%)	36%	(27–45%)
Sensory overload	No data			

Memory				
Working memory	3%	(0–6%)	78%	(70–86%)
Recent memory	5%	(1–9%)	77%	(69–85%)
Working spatial memory	1%	(0–3%)	46%	(36–56%)
Remote memory	4%	(0–8%)	35%	(26–44%)
Memory retrieval				
Words	3%	(0–6%)	70%	(61–79%)
Names	6%	(1–11%)	68%	(59–77%)
Numbers	3%	(0–6%)	52%	(42–62%)
Geographical/spatial	1%	(0–3%)	49%	(39–59%)
Faces	1%	(0–3%)	23%	(15–31%)
Motor memory	1%	(0–3%)	10%	(4–16%)

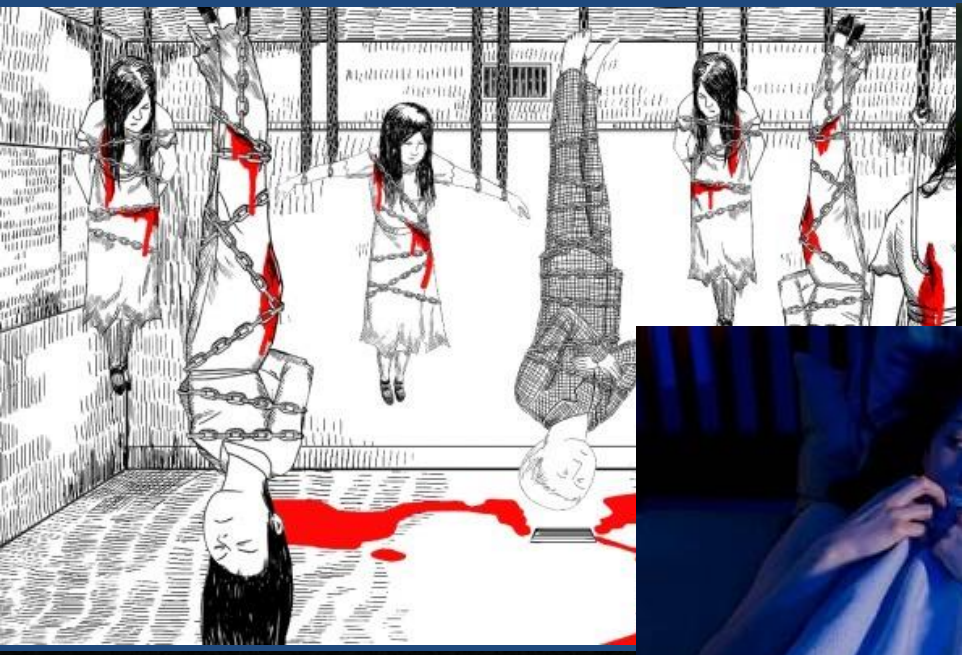

Spelling
Education
Words
Reading
Health
Life
Career
Maths
Dyslexia
can affect

Processing				
Fluency of speech	4%	(0–8%)	62%	(52–72%)
Reading comprehension	6%	(1–11%)	59%	(49–69%)
Spelling errors	8%	(3–13%)	56%	(46–66%)
Word substitution errors	5%	(1–9%)	55%	(45–65%)
Calculation	10%	(4–16%)	51%	(41–61%)
Optic ataxia	1%	(0–3%)	51%	(41–61%)
Auditory comprehension	5%	(1–9%)	49%	(39–59%)
Handwriting	8%	(3–13%)	47%	(37–57%)
Letter reversals	2%	(0–5%)	45%	(35–55%)
Fluency of written language	2%	(0–5%)	43%	(33–53%)
Number reversals	1%	(0–3%)	39%	(29–49%)
Left–right confusion	6%	(1–11%)	30%	(21–39%)
Transposition of laterality	2%	(0–5%)	22%	(14–30%)
Spatial perceptual distortions	1%	(0–3%)	21%	(13–29%)
Sound localization	3%	(0–6%)	19%	(11–27%)

Executive Functioning

Executive functioning				
Brain fog	3%	(0–6%)	84%	(77–91%)
Unfocused concentration	4%	(0–8%)	81%	(73–89%)
Prioritizing multiple tasks	6%	(1–11%)	76%	(68–84%)
Multitasking	3%	(0–6%)	74%	(65–83%)
Mental apathy	4%	(0–8%)	72%	(63–81%)
Obsessive thoughts	4%	(0–8%)	56%	(46–66%)
Racing thoughts	1%	(0–3%)	54%	(44–64%)
Abstract reasoning	3%	(0–6%)	51%	(41–61%)
Intrusive thoughts	no data			
Time management	no data			

Imagery



Imagery				
Vivid nightmares	3%	(0–6%)	38%	(28–48%)
Hypnagogic hallucinations	2%	(0–5%)	21%	(13–29%)
Illusions	2%	(0–5%)	20%	(12–28%)
Capacity for visual imagery	2%	(0–5%)	19%	(11–27%)
Intrusive aggressive images	1%	(0–3%)	19%	(11–27%)
Hallucinations (auditory, visual, olfactory, and tactile)	2%	(0–5%)	18%	(10–26%)
Intrusive images, other	1%	(0–3%)	10%	(4–16%)
Intrusive sexual images	1%	(0–3%)	6%	(1–11%)

Intrusive Symptoms

- “Frightening, stabbing, horrific images -usually of death, dying or pain and suffering. Often gory and unreal as in a horror story. Faces mostly with blood or terror exaggerated awful expressions. Visions of stabbing or killing often of those close to you or familiar. Episodic, not continuous. Fleeting faces most usually of the worse possible situation Helpless stumped bodies perhaps close to death. These images don’t seem to necessarily be associated with a particular occasion, place or time, but come and invade the privacy of my mind.”

Emotional				
Decreased frustration tolerance	5%	(1–9%)	80%	(72–88%)
Sudden mood swings	3%	(0–6%)	74%	(65–83%)
Anhedonia	3%	(0–6%)	64%	(55–73%)
Crying spells	0%	(0–0%)	50%	(40–60%)
Hypervigilance	1%	(0–3%)	45%	(35–55%)
Paranoia	1%	(0–3%)	26%	(17–35%)
Hyperarousal	no data			
Dissociative symptoms				
Depersonalization	2%	(0–5%)	64%	(55–73%)
Derealization	1%	(0–3%)	29%	(20–38%)
Dissociative Episodes	0%	(0–0%)	12%	(6–18%)

Behavioral				
Decreased job/school performance	2%	(0–5%)	78%	(70–86%)
Decreased social functioning	6%	(1–11%)	72%	(63–81%)
Compensatory compulsions	2%	(0–5%)	58%	(48–68%)
Dropping objects	2%	(0–5%)	52%	(42–62%)
Exaggerated startle reflex	1%	(0–3%)	49%	(39–59%)
Explosive anger	3%	(0–6%)	39%	(29–49%)
Marital/Family problems	4%	(0–8%)	39%	(29–49%)
Accident prone	4%	(0–8%)	35%	(26–44%)
Disinhibition	2%	(0–5%)	33%	(24–42%)
Suicidal	1%	(0–3%)	28%	(19–37%)
Substance abuse	1%	(0–3%)	12%	(6–18%)
Legal difficulties	1%	(0–3%)	8%	(3–13%)
Homicidal	0%	(0–0%)	1%	(0–3%)

Suicide and Lyme and Associated Diseases

- Suicidality seen in LAD contributes to causing a significant number of previously unexplained suicides and is associated with immune-mediated and metabolic changes resulting in psychiatric and other symptoms which are possibly intensified by negative attitudes about LAD from others. Some LAD suicides are associated with being overwhelmed by multiple debilitating symptoms, and others are impulsive, bizarre, and unpredictable.
- Negative attitudes about LAD from family, friends, doctors, and the health care system may also contribute to suicide risk. By indirect calculations, it is estimated there are possibly over 1,200 LAD suicides in the US per year.

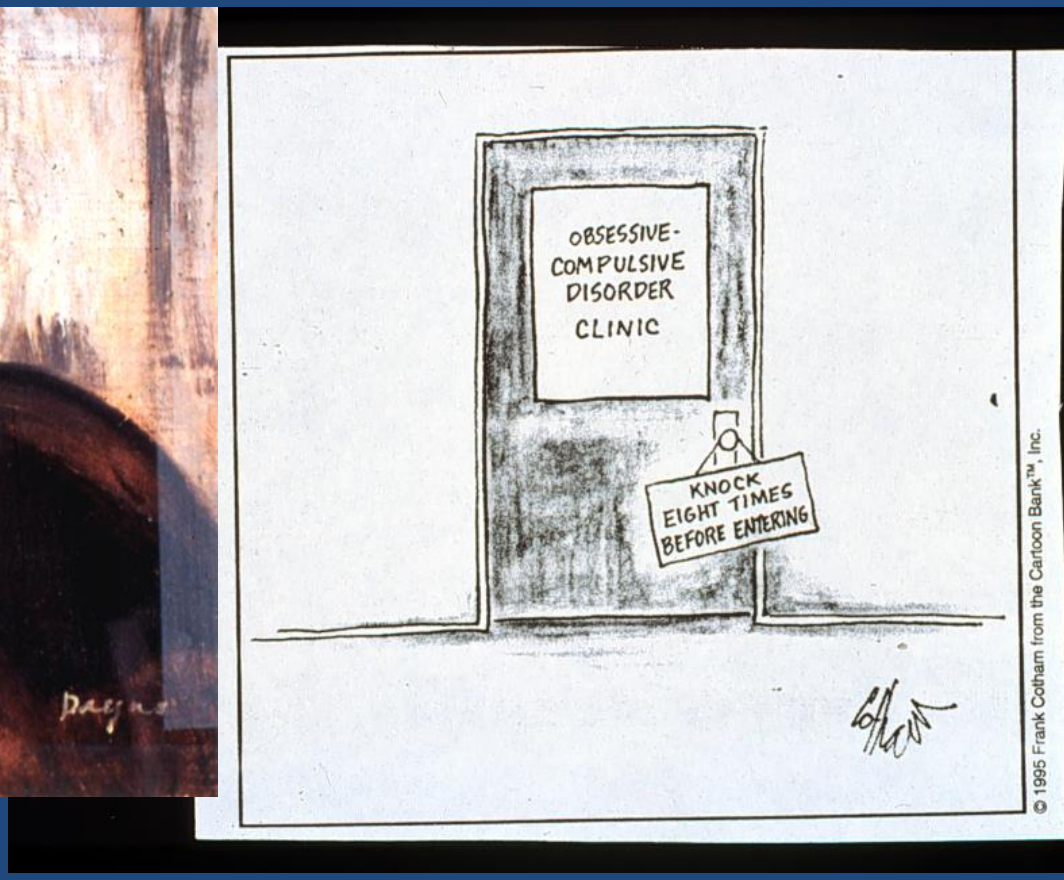
Bransfield RC. Neuropsychiatr Dis Treat. 2017 Jun 16;13:1575-1587.

Lyme, Opioid, Substance Use & Death from Overdoses

- Lyme can cause chronic pain & chronic anxiety with increased opioids and benzodiazepine use. [1,2]
- Some LYD/TBD patients self-medicate, become dependent upon and engage in drug-seeking behavior with benzodiazepines, hypnotics, alcohol, pain medication and marijuana. [3]
- Some die from overdoses. [3]

[1] Saito K, Takanishi T, Okuda Y, Kitajima T. [Long-term administration of large doses of oral morphine for chronic pain]. Masui. 1998 Jun;47(6):749-50.
[2] Zimering JH, Williams MR, Eiras ME, Fallon BA, Logigian EL, Dworkin. Pain. 2014. Aug;155(8):1435-8.
[3] Bransfield RC. Lyme/Tick-Borne Diseases and Addictive Disorders. ILADS Washington, 2014.

Psychiatric Syndromes



Psychiatric syndromes				
Depression	9%	(3–15%)	79%	(71–87%)
Generalized anxiety disorder	3%	(0–6%)	53%	(43–63%)
Panic disorder	2%	(0–5%)	49%	(39–59%)
Social anxiety disorder	7%	(2–12%)	36%	(27–45%)
Obsessive compulsive disorder	2%	(0–5%)	24%	(16–32%)
Posttraumatic stress disorder	6%	(1–11%)	16%	(9–23%)
Rapid cycling bipolar	3%	(0–6%)	11%	(5–17%)

Fatigue & Sleep Disorders

Vegetative				
Energy				
Fatigue	1%	(0–3%)	76%	(68–84%)
Sleep				
Non-restorative sleep	4%	(0–8%)	76%	(68–84%)
Insomnia				
Hypersomnia	2%	(0–5%)	73%	(64–82%)
Insomnia, mid	1%	(0–3%)	72%	(63–81%)
Insomnia, initial	5%	(1–9%)	70%	(61–79%)
Insomnia, late	1%	(0–3%)	58%	(48–68%)
Loss of circadian rhythm	5%	(1–9%)	44%	(34–54%)
Delayed sleep phase disorder	no data			
Sleep apnea, central	no data			
Sleep apnea, obstructive	no data			
Sleep paralysis	no data			
Cataplexy	no data			
Narcolepsy	no data			

Eating				
Anorexia	1%	(0–3%)	45%	(35–55%)
Weight loss	1%	(0–3%)	45%	(35–55%)
Non-appetite over-eating	2%	(0–5%)	34%	(25–43%)
Weight gain without increased food intake	1%	(0–3%)	27%	(18–36%)
Weight gain with increased food intake	2%	(0–5%)	22%	(14–30%)

Sexual functioning				
Decreased libido	4%	(0–8%)	60%	(50–70%)
Decreased arousal	1%	(0–3%)	42%	(32–52%)
Decreased orgasm	2%	(0–5%)	41%	(31–51%)
Increased libido	1%	(0–3%)	9%	(3–15%)
Altered sexual imagery	0%	(0–0%)	3%	(0–6%)

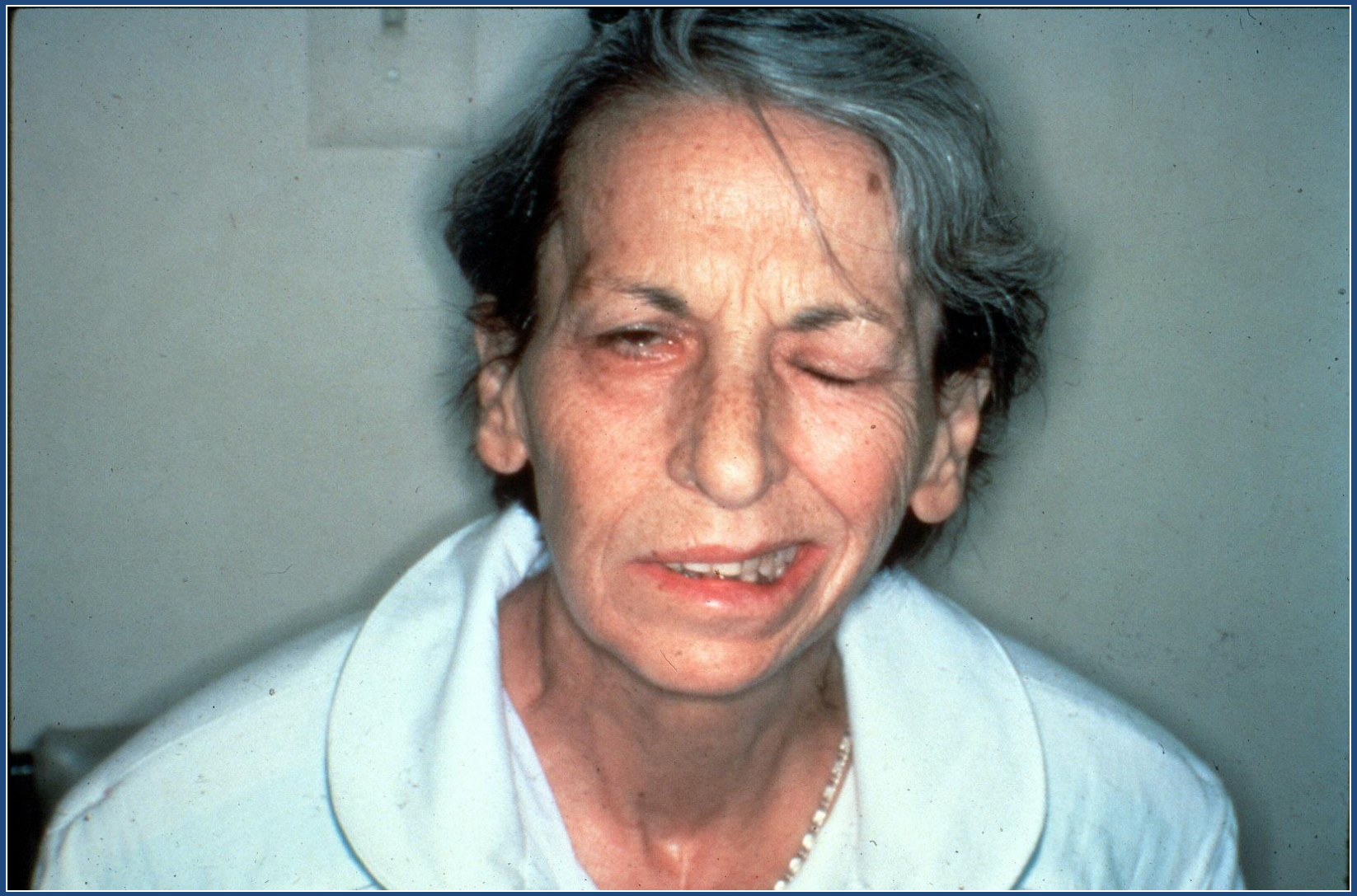
Temperature control				
Intolerance to cold	2%	(0–5%)	64%	(55–73%)
Body temperature fluctuations	3%	(0–6%)	63%	(54–72%)
Night sweats	2%	(0–5%)	60%	(50–70%)
Chills	2%	(0–5%)	59%	(49–69%)
Intolerance to heat	2%	(0–5%)	58%	(48–68%)
Decreased body temperature	5%	(1–9%)	52%	(42–62%)
Flushing	3%	(0–6%)	49%	(39–59%)
Low grade fevers	1%	(0–3%)	47%	(37–57%)

Headaches


L'imagination
Le mal de tête.
Hola ! hola !.... pan ! pan !... dindrelindin — dindrelindin hola hola hola !!

Neurological				
Headache (neurological and musculoskeletal)				
Headache	3%	(0–6%)	68%	(59–77%)
Tension	2%	(0–5%)	57%	(47–67%)
Cervical radiculopathy	0%	(0–0%)	43%	(33–53%)
Temporal mandibular joint	2%	(0–5%)	41%	(31–51%)
Sinus	5%	(1–9%)	41%	(31–51%)
Migraine	4%	(0–8%)	33%	(24–42%)
Cluster	0%	(0–0%)	10%	(4–16%)
Coital cephalgia	0%	(0–0%)	4%	(0–8%)
Thunderclap	no data			

Cranial Nerves I-XII



Cranial nerves				
I Olfactory: loss of smell, altered taste	2%	(0–5%)	22%	(14–30%)
II Optic (and ophthalmologic)				
Photophobia to bright light	3%	(0–6%)	61%	(51–71%)
Floaters	1%	(0–3%)	56%	(46–66%)
Blurred vision	2%	(0–5%)	50%	(40–60%)
Sensitivity to fluorescent and flicker	3%	(0–6%)	48%	(38–58%)
Eye pain	2%	(0–5%)	36%	(27–45%)
Night blindness	4%	(0–8%)	36%	(27–45%)
Dry eyes	0%	(0–0%)	32%	(23–41%)
Flashes	0%	(0–0%)	23%	(15–31%)
Conjunctivitis	0%	(0–0%)	19%	((11–27%)
Peripheral shadows	2%	(0–5%)	18%	(18–26%)
Blind spots	1%	(0–3%)	12%	(6–18%)
Optic neuritis	0%	(0–0%)	2%	(0–5%)
Papilledema	0%	(0–0%)	1%	(0–3%)
Iritis	0%	(0–0%)	1%	(0–3%)
Panopsia	no data			

III, IV, VI Double vision or eye drifts when tired, ptosis	2%	(0–5%)	36%	(27–45%)
V Sensory loss, pain	0%	(0–0%)	27%	(18–36%)
VII Bell’s palsy	2%	(0–5%)	16%	(9–23%)
VIII Dizziness	2%	(0–5%)	53%	(43–63%)
Tinnitus	1%	(0–3%)	51%	(41–61%)
Motion sickness	9%	(3–15%)	40%	(30–50%)
Vertigo	1%	(0–3%)	29%	(20–38%)
Hearing loss	1%	(0–3%)	26%	(17–35%)
Tullio’s	0%	(0–0%)	12%	(6–18%)
Mal de debarquement	no data			
IX, X Episodic loss of speech, choking on food, difficulty swallowing	0%	(0–0%)	36%	(27–45%)
XI. Sternocleidomastoid and trapezius pain and/or paresis	0%	(0–0%)	44%	(34–54%)
XII. Tongue deviates to side	0%	(0–0%)	5%	(1–9%)

Seizures				
Partial	2%	(0–5%)	8%	(3–13%)
Grand mal	1%	(0–3%)	4%	(0–8%)

Other neurological				
Tingling	1%	(0–3%)	71%	(62–80%)
Paresis	2%	(0–5%)	66%	(57–75%)
Numbness	1%	(0–3%)	59%	(49–69%)
Twitching	1%	(0–3%)	56%	(46–66%)
Muscle tightness	0%	(0–0%)	56%	(46–66%)
Restless leg	5%	(1–9%)	50%	(40–60%)
Sensory loss	1%	(0–3%)	40%	(30–50%)
Tremor	3%	(0–6%)	40%	(30–50%)
Myoclonic jerks	1%	(0–3%)	38%	(28–48%)
Burning	1%	(0–3%)	36%	(27–45%)
Static electric sensation	0%	(0–0%)	35%	(26–44%)
Formication, crawling sensation	0%	(0–0%)	35%	(26–44%)
Stabbing sensation	0%	(0–0%)	28%	(19–37%)
Romberg positive	1%	(0–3%)	21%	(13–29%)
Herniated disc(s)	4%	(0–8%)	14%	(7–21%)
Ataxia	1%	(0–3%)	6%	(1–11%)
Other neurological	1%	(0–3%)	6%	(1–11%)
Extrapyramidal symptoms	0%	(0–0%)	3%	(0–6%)
Tourette’s	0%	(0–0%)	2%	(0–5%)
Torticollis	0%	(0–0%)	1%	(0–3%)
Spasticity	1%	(0–3%)	1%	(0–3%)
Sensation of wetness	no data			
Sensation of vibration	no data			

Musculoskeletal				
Joint pain, swelling, tightness, and crepitation (specify joints)	2%	(0–5%)	81%	(73–89%)
Myalgia	1%	(0–3%)	54%	(44–64%)
Chondritis (ear, nose, and costochondral)	0%	(0–0%)	38%	(28–48%)
Fibromyalgia	1%	(0–3%)	36%	(27–45%)
Plantar fasciitis	0%	(0–0%)	33%	(24–42%)
Epicondylitis	2%	(0–5%)	20%	(12–28%)
Tendonitis	3%	(0–6%)	17%	(10–24%)
Carpal tunnel	1%	(0–3%)	15%	(8–22%)
Bone thinning/fractures	1%	(0–3%)	7%	(2–12%)
Periostitis (tibia, ribs, iliac crest, sternum, clavicle,	4%	(0–8%)	7%	(2–12%)
Deep bone pain	no data			
Foot pain	no data			
Ehlers-Danlos	no data			

Cardiovascular

Cardiovascular				
Racing pulse	0%	(0–0%)	48%	(38–58%)
Chest pain	2%	(0–5%)	39%	(29–49%)
Episodes rapid and slow heart rate	0%	(0–0%)	34%	(25–43%)
Mitral valve prolapse	4%	(0–8%)	20%	(12–28%)
Murmur	7%	(2–12%)	16%	(9–23%)
Hypertension	2%	(0–5%)	15%	(8–22%)
Postural orthostatic hypotension	0%	(0–0%)	12%	(6–18%)
Heart block	2%	(0–5%)	11%	(5–17%)
Hypertensive crisis	1%	(0–3%)	3%	(0–6%)
Cardiomyopathy	0%	(0–0%)	2%	(0–5%)
Pericarditis	0%	(0–0%)	1%	(0–3%)
Postural orthostatic tachycardia	no data			

Upper respiratory, dental, and pulmonary				
Shortness of breath	1%	(0–3%)	43%	(33–53%)
Swollen glands	0%	(0–0%)	41%	(31–51%)
Allergies	7%	(2–12%)	35%	(26–44%)
Tooth pain	0%	(0–0%)	32%	(23–41%)
Cough	1%	(0–3%)	28%	(19–37%)
Periodontal disease	0%	(0–0%)	19%	(11–27%)
Asthma	4%	(0–8%)	14%	(7–21%)
Nose bleeds	1%	(0–3%)	7%	(2–12%)
Air hunger	no data			

Gastrointestinal				
Irritable bowel	6%	(1–11%)	50%	(40–60%)
Abdominal bloating	1%	(0–3%)	42%	(32–52%)
Upper GI distress	6%	(1–11%)	25%	(17–33%)
Inflammatory bowel	0%	(0–0%)	2%	(0–5%)
Cholecystitis	0%	(0–0%)	2%	(0–5%)
Gastroparesis	0%	(0–0%)	1%	(0–3%)
Hepatitis	0%	(0–0%)	1%	(0–3%)
Pancreatitis	0%	(0–0%)	1%	(0–3%)
Gall stones	0%	(0–0%)	1%	(0–3%)
Non-calculous cholecystitis	no data			
Cyclic vomiting	no data			

Genitourinary				
Spastic bladder	1%	(0–3%)	47%	(37–57%)
Menstrual irregularity	3%	(0–6%)	30%	(21–39%)
Genital pain	1%	(0–3%)	27%	(18–36%)
Breast tenderness, pain	1%	(0–3%)	24%	(16–32%)
Urinary incontinence	1%	(0–3%)	18%	(10–26%)
Recurrent UTI	1%	(0–3%)	11%	(5–17%)
Lactation	0%	(0–0%)	8%	(3–13%)
Anesthesia of genitalia	0%	(0–0%)	6%	(1–11%)
Atrophy of genitalia	0%	(0–0%)	3%	(0–6%)
Interstitial cystitis	0%	(0–0%)	1%	(0–3%)

Other				
Hair loss	2%	(0–5%)	47%	(37–57%)
Chronic pain	0%	(0–0%)	41%	(31–51%)
Alcohol intolerance	3%	(0–6%)	41%	(31–51%)
Ecchymosis	1%	(0–3%)	34%	(25–43%)
Multiple chemical sensitivity	2%	(0–5%)	25%	(17–33%)
Thyroid dysfunction	1%	(0–3%)	20%	(12–28%)
Hypoglycemia	2%	(0–5%)	20%	(12–28%)
Ankle edema	1%	(0–3%)	20%	(12–28%)
Adrenal insufficiency	0%	(0–0%)	10%	(4–16%)
Vasculitis	0%	(0–0%)	5%	(1–9%)
Wilson syndrome	0%	(0–0%)	4%	(0–8%)
Splenomegaly	0%	(0–0%)	4%	(0–8%)
Lymphocytoma	3%	(0–6%)	3%	(0–6%)
Acrodermatitis chronicum atrophicans	0%	(0–0%)	1%	(0–3%)
Erythema of palms and soles	0%	(0–0%)	0%	(0–0%)
Mold sensitivity	no data			
Bartonella tracks	no data			

Symptom patterns				
Progression of symptoms	0%	(0–0%)	86%	(79–93%)
Fluctuation of symptoms	0%	(0–0%)	82%	(74–90%)
Stress increased symptoms	0%	(0–0%)	77%	(69–85%)
Herxheimer reaction	0%	(0–0%)	73%	(64–82%)
Antibiotic reduce symptoms	0%	(0–0%)	72%	(63–81%)
A 28 day or longer symptom cycle	0%	(0–0%)	43%	(33–53%)

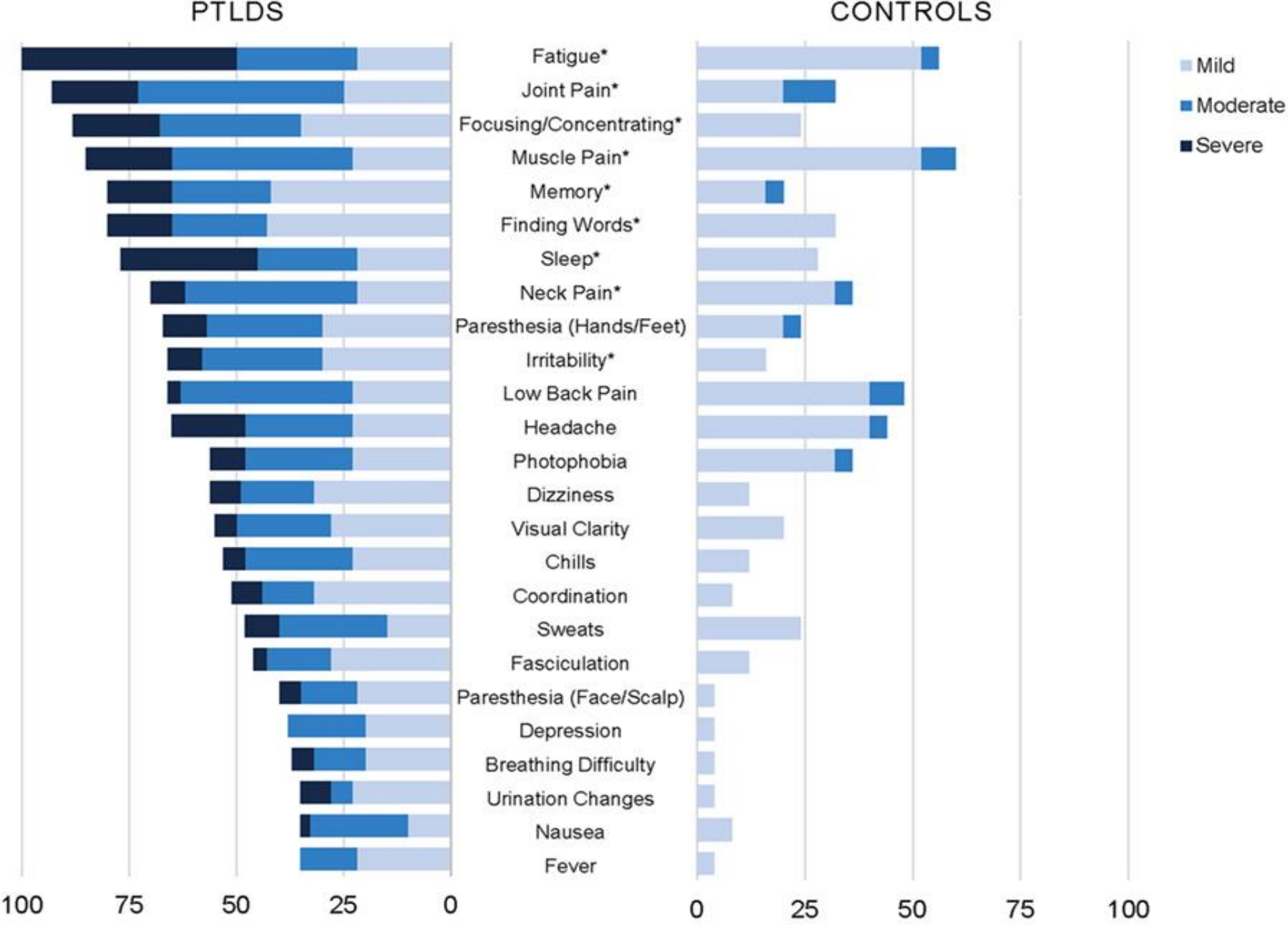
Findings Compared to Other Studies

Psychiatric Syndromes	Post-Infection	Other Lyme Patient Studies (Reference [9])
Sustained attention	84%	(44%, 91%)
Distracted by frustration	79%	(82%)
Allocation of attention	66%	(98%)
Hypersensitivity to sound	66%	(58%, 88%)
Hypersensitivity to light	63%	(74%)
Working memory	78%	(98%)
Recent memory	77%	(94%)
Fluency of speech	62%	(46%, 75%, 79%, 82%)
Reading comprehension	59%	(79%)
Auditory comprehension	49%	(73%)
Brain fog	84%	(88%)
Abstract reasoning impairments	51%	(60%, 93%)

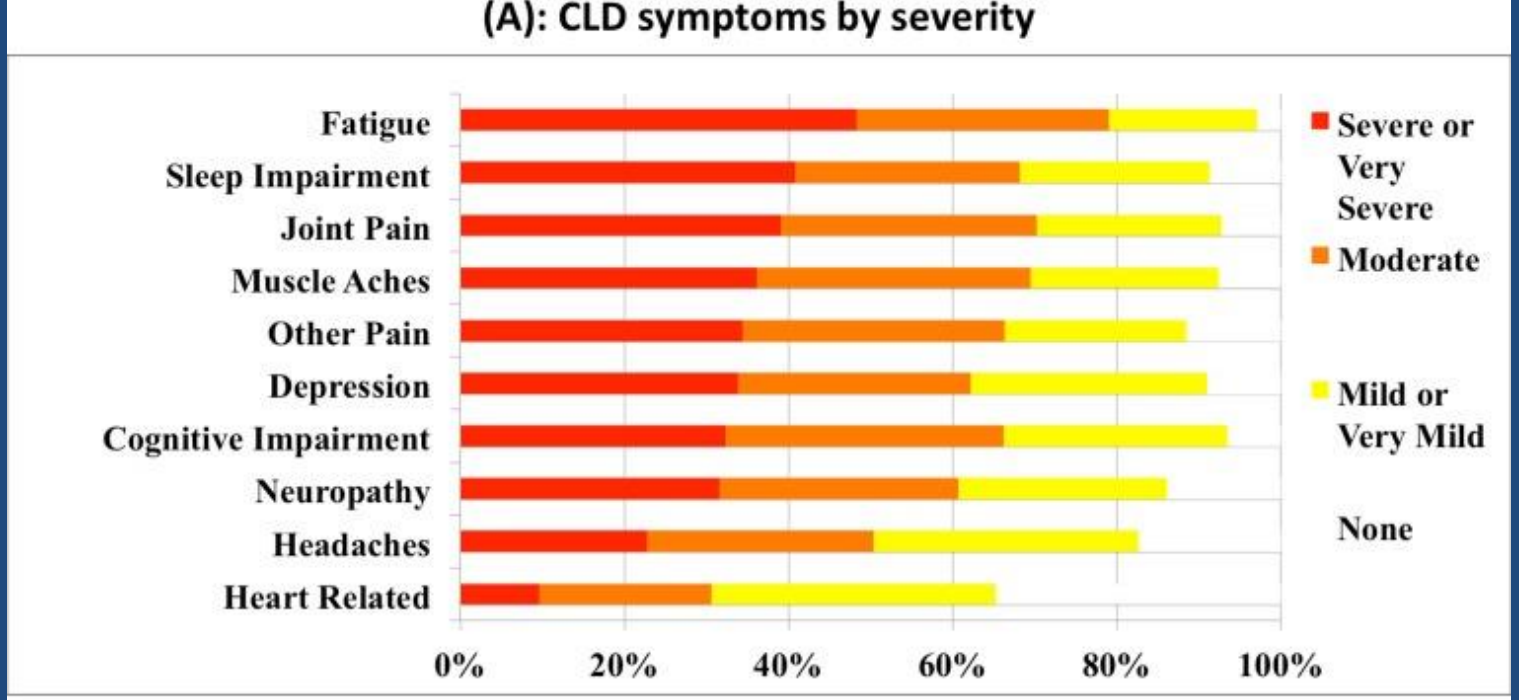
Vivid nightmares	38%	(58%, 70%, 82%)
Intrusive aggressive images	19%	(16%, 62%),
Intrusive sexual images	6%	(26%, 16%, 6%)
Hallucinations	18%	(42%, 45%, 47%)
Decreased frustration tolerance	80%	(80%, 98%)
Sudden mood swings	74%	(15%, 47%, 66%, 85%, 93%, 94%)
Anhedonia	64%	(56%, 59%, 71%, 72%, 85%)
Exaggerated startle reflex	49%	(66%, 75%, 84%)
Hypervigilance	45%	(35%, 54%, 55%, 69%, 72%, 84%)
Disinhibition	33%	(20, 32%, 35%, 58%, 80%, 84%)
Paranoia	26%	(10%, 25%, 36%, 62%, 76%, 88%)
Dissociative episodes	12%	(0%, 5%, 12%, 18%, 25%, 38%)

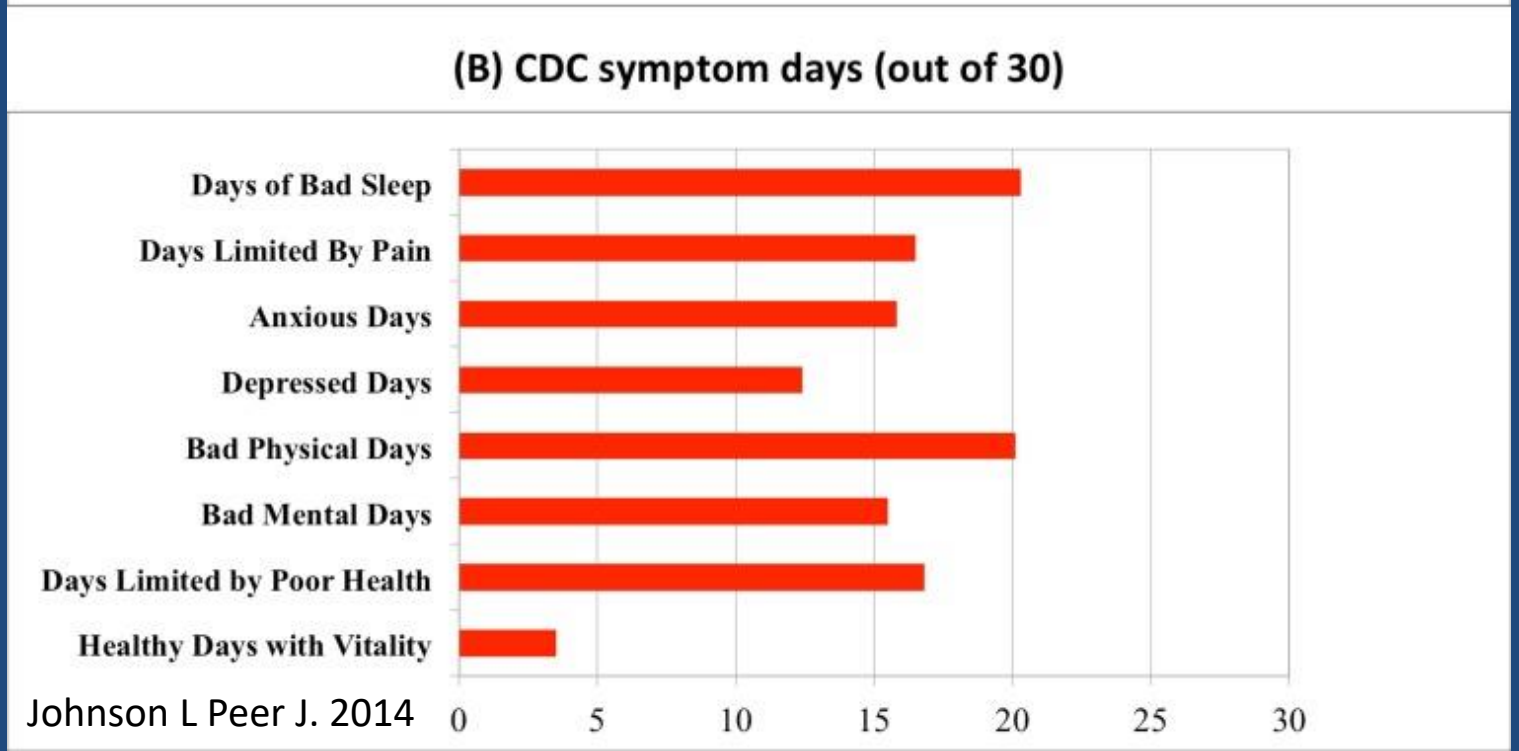
Dysphoria/depression	79%	(37%, 37%, 50%, 51%, 64%, 70%, 76%, 80%, 97%, 98%, 100%)
Generalized anxiety disorder	55%	(50%, 65%, 70%, 86%, 90%)
Panic disorder	49%	(35%, 50%, 54%, 80%, 82%)
Social anxiety disorder	36%	(20%, 55%, 65%, 66%, 68%, 70%)
Obsessive compulsive disorder	24%	(32%, 42%, 44%, 51%, 84%)
Posttraumatic stress disorder	16%	(15%, 15%, 24%, 30%, 36%)
Rapid cycling bipolar	11%	(5%, 10%, 19%, 20%, 21%, 28%)
Depersonalization	64%	(40%, 52%, 55%, 71%, 76%)
Derealization	29%	(24%, 31%, 37%)
Decreased school/job performance	78%	(94%)
Decreased social functioning	72%	(91%)
Explosive anger	39%	(52%, 72%, 91%)

Marital/family problems	39%	(48%, 80%)
Suicidal	28%	(20%, 43%, 46%, 63% 72%, 98%)
Substance abuse	12%	(5%, 10%, 10%, 28%, 33%)
Legal problems	8%	(4%, 42%)
Homicidal	1%	(9.6%)
Fatigue	73%	(85%, 85%, 92%, 97%)
Irritable bladder	47%	(44%, 50%, 56%)
Genital pain	26%	(24%, 28%, 32%)
Decreased libido	22%	(38%, 44%, 62%, 80%)
Urinary incontinence	18%	(18%, 28%, 38%)
Chronic pain	41%	(35%, 57%, 65%)
Alcohol intolerance	11%	(24%, 34%, 44%)



Rebman AW. Front. Med. 2017





Johnson L Peer J. 2014

Assessment

- Like other illnesses, Lyme Borreliosis is diagnosed by a screening assessment followed by a thorough history, comprehensive psychiatric clinical exam, review of systems, mental status exam, neurological exam and physical exam relevant to the patient's complaints and findings with clinical judgment, pattern recognition and knowledgeable interpretation of laboratory findings facilitates diagnosis.

Bransfield RC. Neuropsychiatric Lyme Borreliosis: An Overview with a Focus on a Specialty Psychiatrist's Clinical Practice. Healthcare (Basel). 2018 Aug 25;6(3).

Screening & 3 Assessment Forms

- Screening questions
- 24-item patient self-assessment
- 61-item assessment (more common symptoms)
- 283-item assessment with 810 data points (full assessment)
- Coinfection Screen

Bransfield RC. Neuropsychiatric Lyme Borreliosis: An Overview with a Focus on a Specialty Psychiatrist's Clinical Practice. Healthcare (Basel). 2018 Aug 25;6(3).

Screening questions

- Do you live, vacation, or engage in occupational or other activities in areas that may expose you to ticks?
- Have family members, neighbors, or the family dog been infected?
- Is there a history of a tick bite, possibly with a flu-like illness and/or a bull's eye or other rash?
- Is there a point at which your health declined, followed by a fluctuating progression and development of multi-systemic symptoms, including cognitive, psychiatric, neurological, and somatic symptoms adversely impacting school, social life, family life?
- Have you ever been treated for Lyme disease, suspected you had Lyme disease but was told it was ruled out?
- Have antibiotics ever caused a sudden worsening followed by an improvement of symptoms?"

Reduced set of 24 highly significant impairments. Suitable for pre-evaluation by patients

- Concentration impairment
- Short term memory problems
- Word finding difficulty
- Name recall difficulty
- Fluency of speech difficulties
- Brain fog
- Sudden mood swings
- Decreased social functioning
- Decreased job/school performance
- Depression
- Fatigue
- Insomnia
- Night sweats
- Low body temperature
- Headache
- Blurred vision
- Floaters
- Tinnitus (ringing in the ears)
- Sensitive to sound
- Dizziness
- Numbness
- Tingling
- Joint pain, swelling
- Fluctuation of symptoms
- Stress increases symptoms

Most Common Symptoms

Common symptoms in which ≥50% or more have the clinical finding I

- **Attention span**
- Sustained attention
- Distracted by frustration
- Allocation of attention
- Hypersensitivity to sound
- Hypersensitivity to light
- **Memory**
- Working memory
- Recent memory
- Remote memory
- **Memory retrieval**
- Words
- Names
- Numbers
- **Processing**
- Fluency of speech
- Reading comprehension
- Spelling errors
- Word substitution errors
- Optic ataxia
- Calculation
- **Executive functioning**
- Brain fog
- Unfocused concentration
- Prioritizing multiple tasks
- Multitasking
- Mental apathy
- **Emotional**
- Decreased frustration tolerance
- Sudden mood swings

Common symptoms in which ≥50% or more have the clinical finding II

- **Behavioral**
- Decreased job/school performance
- Decreased social functioning
- Dropping objects
- **Psychiatric syndromes**
- Depression
- Generalized anxiety disorder
- Posttraumatic stress disorder
- **Energy**
- Fatigue
- **Sleep**
- Non-restorative sleep
- **Insomnia**
- Hypersomnia
- Insomnia, mid
- Insomnia, initial
- Insomnia, late
- **Sexual functioning**
- Decreased libido
- **Temperature control**
- Intolerance to cold
- Body temperature fluctuations
- Night sweats
- Chills
- Intolerance to heat
- Decreased body temperature

Common symptoms in which ≥50% or more have the clinical finding III

- **Neurological**
- Headache (neurological & other)
- Tension headache
- **Cranial nerves**
- II Optic/ophthalmologic
- Photophobia to bright light
- Floaters
- Dizziness
- VIII Tinnitus
- Blurred vision
- **Other neurological**
- Tingling
- Paresis
- Numbness
- Twitching
- Muscle tightness
- **Musculoskeletal**
- Joint pain, swelling, tightness, and crepitation (specify joints)
- Myalgia
- **Gastrointestinal**
- Irritable bowel
- **Symptom patterns**
- Progression of symptoms
- Fluctuation of symptoms
- Stress increased symptoms
- Herxheimer reaction
- Antibiotic reduce symptoms

Coinfection Screen I

- **Bartonella and "Bartonella-Like Organisms"** • Gradual onset of initial illness. • Central nervous system symptoms are out of proportion to the musculoskeletal ones and can include muscle twitches, tremors, insomnia, seizures, agitation, anxiety, severe mood swings, outbursts, and antisocial behavior. • Gastrointestinal involvement may present as gastritis or abdominal pain (mesenteric adenitis). • Sore soles, especially in the morning. • Tender subcutaneous nodules along the extremities, especially outer thigh, shins, and occasionally along the triceps. • Occasional lymphadenopathy. • Morning fevers, usually around 99; occasionally light sweats are noted. • Elevated vascular endothelial growth factor (VEGF) occurs in a minority, but the degree of elevation correlates with activity of the infection and may be used to monitor treatment. • Rapid response to treatment changes– often symptoms improve within days after antibiotics are begun, but relapses occur also within days if medication is withdrawn early. • May have papular or linear red rashes (like stretch marks that do not always follow skin planes), especially in those with GI involvement.

Burrascano JJ. Sorting out Lyme and Associated Coinfections. LymeDisease.org.

Coinfection Screen II

- **Babesia Species** • Rapid onset of initial illness, often with sudden onset of high fever, severe headaches, sweats, and fatigue; thus, it is easy to know when infection began. • Obvious sweats, usually at night, but can be day sweats as well. • Air hunger, the need to sigh and take a deep breath; dry cough without apparent reason. • Headaches can be severe–dull, global (involves the whole head, described like the head is in a vise). • Fatigue is prominent, does not clear with rest, and is made worse with exercise. • Mental dullness and slowing of reactions and responses. • Dizziness–more like a tippy feeling, and not vertigo or purely orthostasis. • Symptoms cycle rapidly, with flares every four to six days. • Hypercoagulation is often associated with Babesia infections. • Rarely, splenomegaly. • Very severe Lyme disease can be a clue to Babesia infection, as it will make Lyme symptoms worse and Lyme treatments less effective.

Burrascano JJ. Sorting out Lyme and Associated Coinfections. LymeDisease.org.

Coinfection Screen III

- **Ehrlichia/Anaplasma** • Rapid onset of initial illness with fever, headache, prostration. • Headaches are sharp, knife-like, and often behind the eyes. • Muscle pain, not joint pain, and can be mild or severe. • Low WBC, low platelet count, elevated liver enzymes, and (rarely) inclusions seen in the WBCs. • Rarely see diffuse vasculitic rash, including palms and soles (less than 10%). • Rapid response to treatment.
- **DNA Viruses (HHV-6, EBV, CMV)** • Persistent fatigue, made worse with exercise. • Sore throat, lymphadenopathy, and other viral-like complaints. • May see elevated liver enzymes and low WBCs.
- **Mycoplasma** • Gradual onset. • May be light night sweats. • Symptoms are made worse with exercise. • Major fatigue and neurological dysfunction, especially autonomic neuropathies. • Metabolic disturbances, immune damage, very low CD57 count (less than 20). • Found in the sickest and most poorly responding Lyme patients (CFIDS-like).

Burrascano JJ. Sorting out Lyme and Associated Coinfections. LymeDisease.org.

Conclusion I

- The prevalence of psychiatric and other symptoms seen in 100 patients with late-stage Lyme neuroborreliosis was compared pre-infection vs. post-infection and the confidence intervals were calculated. The validity of pre-infection health status was partially confirmed by comparing it to two additional groups. Also, the post-infection findings were compared to patients with other systemic illnesses and compared to results from other studies.

Conclusion II

- In this study, there was a large separation between the average number of clinical findings pre-infection (5) and in in healthy controls (4) vs. other diagnoses (22) vs. post-infection (82). All of the patients with Lyme disease had multisystem symptoms. The greater number of multisystem symptoms correlated with a diagnosis of Lyme disease, and a lesser number of multisystem symptoms correlated with not having a diagnosis of Lyme disease.

Conclusion III

- The results of this study were then used to develop three clinical assessment forms that can be used when the diagnosis of Lyme disease is suspected. This includes the 24-item patient pre-evaluation form, the common symptom 61-item assessment, and the full assessment. If the results of this study are then generalized to other patients, it suggests a greater number of multisystem symptoms correlates with the possibility of a diagnosis of Lyme, and a lesser number of multisystem symptoms correlates with a lower possibility of Lyme disease.

Lyme & COVID-19 Comorbidity

- How does COVID-19 effect Lyme disease?
- How does Lyme effect COVID-19?
- One article on Lyme & COVID-19:
  - Stricker RB, Fesler MC. A Novel Plan to Deal with SARS-CoV-2 and COVID-19 Disease . *J Med Virol*. 2020;10.1002/jmv.25945.

Lyme & COVID-19: Preliminary Hypothesis

- 1. If someone has a latent or active case of Lyme/TBD and is not in treatment and they acquire COVID-19, there is an initial exacerbation of Lyme/TBD symptoms in addition to the COVID-19 symptoms, however some who have fever report a later improvement in Lyme/TBD symptoms, possibly from immune activation.
- 2. If someone is in treatment for Lyme/TBD and they acquire COVID-19, it is a milder infection and adaptive immunity to COVID-19 may be acquired. However some Lyme/TBD treatments my be more effective than others.

COVID-19 Treatment: Semo Survey

- The Semo survey asked over 6000 doctors internationally how they were treating COVID-19. The response was Hydroxychloroquine or Chloroquine 37%, Azithromycin or similar antibiotics 32%, Nothing 32%, Analgesics (e.g., Paracetamol/Acetaminophen) 31%, Anti-HIV drugs (e.g. Lopinavir plus Ritonavir) 16%, Cough medications 13%, Compassionate use of experimental drugs (e.g. Remdesivir) 13%, Drugs used to treat flu (e.g., Oseltamivir) 12%, Expectorants (e.g., Mucinex 10%, Interferon-beta 7%, Antihistamines/Decongestants 7%, Plasma from patients who have recovered from COVID-19 7%, Vitamin D 6%, Zinc tablets 5%, Glycopyrrolate inhaler 3%.

Chloroquine/Hydroxychloroquine Mechanism of Action & Antiviral Properties with SARS-CoV-2

- Immune modulatory effects
- Alkalinizes vacuolar & lysosomal pH
  - It is alkaline
  - Inhibits protozoal food vacuole functioning
  - Inhibits endocytosis, liposomal fusion and function
- Is a zinc ionophore
  - Allows influx of zinc into cells and lysosomes
- Binds to sialic acid

COVID-19 Hydroxychloroquine Treatment Brings Prolonged QT Arrhythmia Issues

- According to Tisdale et al. (2013), there are risk factors associated with QTc prolongation. They have been developed into a risk score tool that takes age, sex, diuretic use, potassium level, baseline QTc, acute myocardial infarction, use of QTc prolonging drugs, sepsis and heart failure into account.

Pre-Exposure Prophylaxis with Hydroxychloroquine for COVID-19 Disease

- We propose instituting a prophylactic regimen for SARS-CoV-2 in high-risk patients: hypertension, diabetes, chronic kidney disease, asthma/emphysema/smoking, congestive heart failure, cirrhosis, malignancy/immune suppression, age over 80 & medical personnel
- The dose should be 400mg weekly based on malaria prophylaxis recommendations and continuing for one month or longer depending on the degree of social interaction and risk of viral exposure. The use of this prophylactic regimen will allow individuals to resume work with some modicum of protection against COVID-19 disease. It would also prevent high-risk individuals from acquiring infection from close contacts infected with the virus, and it would hopefully attenuate SARS-CoV-2 infection if it did occur.
- If symptoms of COVID-19 disease develop, further treatment should be instituted immediately: doxycycline or minocycline at 100mg twice daily and continue for one week with monitoring of PO_2. (clarithromycin or azithromycin) can be substituted.

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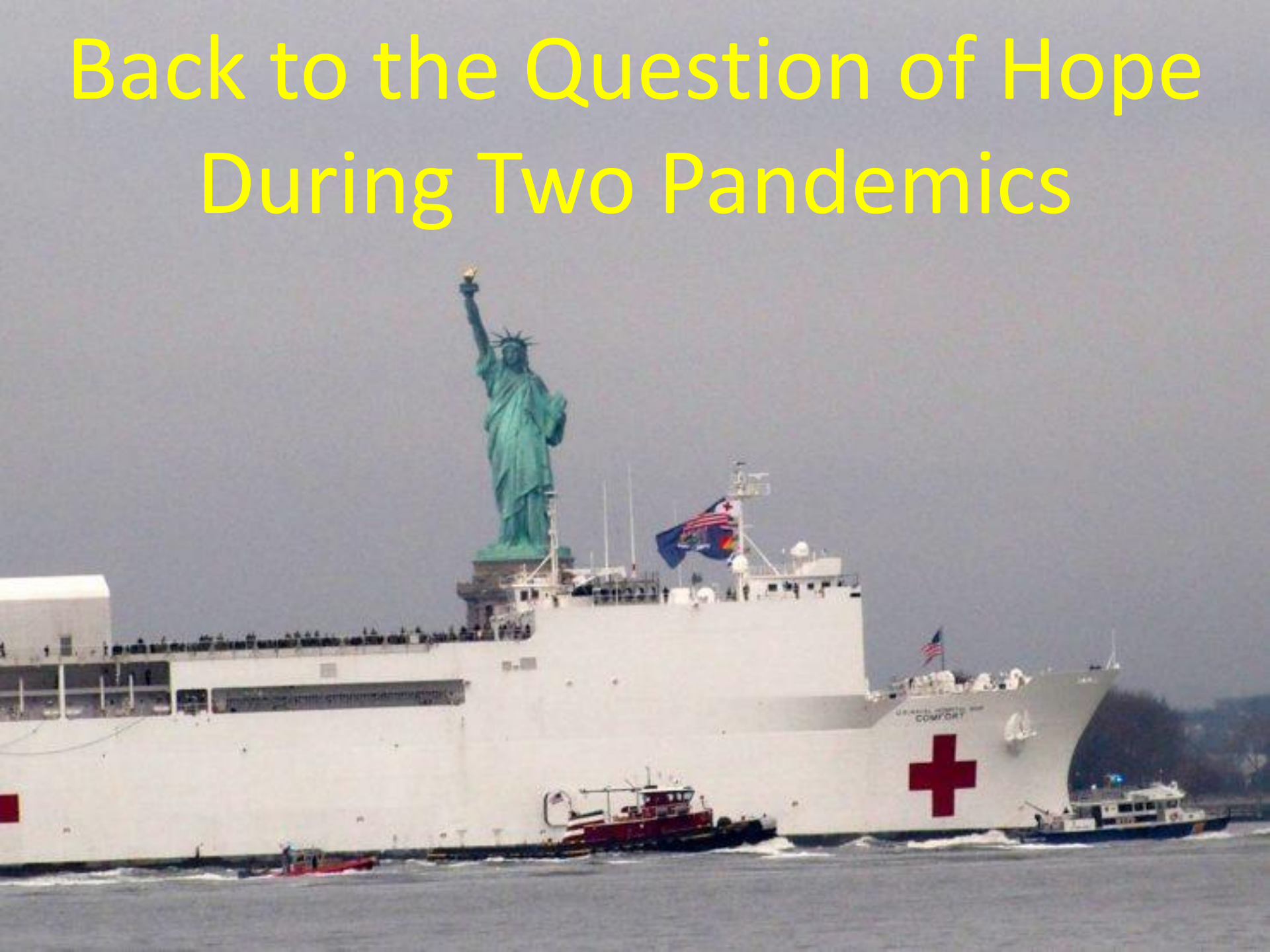
Lyme Treatments with COVID-19 Therapeutic Potential (Some Only InVivo)

- Hydroxychloroquine, Mepron, other anti-malaria treatments
- Zithromax, other antibiotics
- Disulfiram
- Ivermectin
- Quercetin
- Methylene blue
- Treatments that improve immune functioning
- Vitamin A, B-3, D, zinc, NAC

Back to the Question of Hope During Two Pandemics



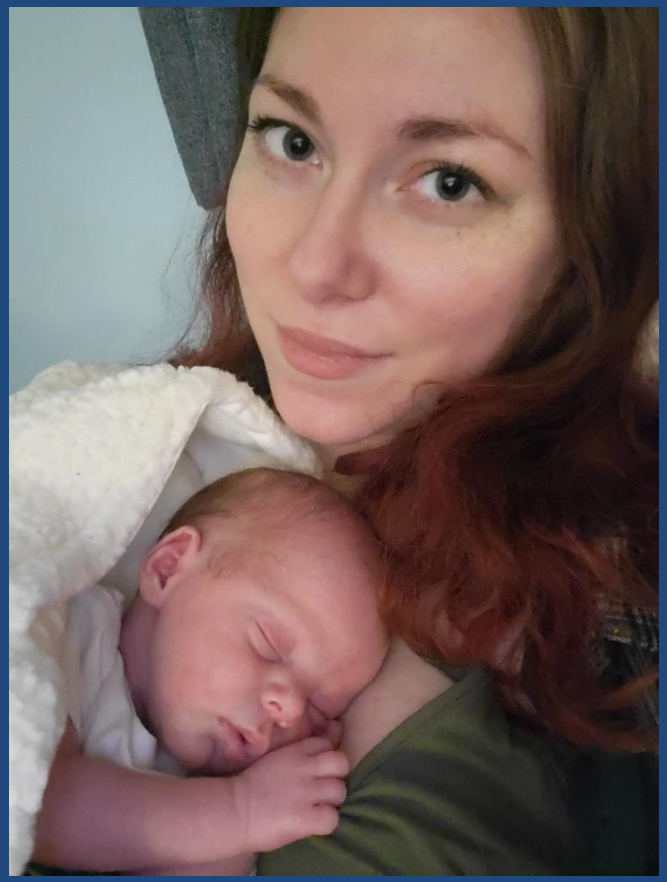
Is There Hope?

Action Plan

- A greater recognition of the symptoms of Lyme diseases & COVID-19 and effective treatment can help prevent needless suffering, disability, death, developmental impairments, learning disabilities, mental illnesses, suicides, violence, general medical illnesses and economic and non-economic costs.
- Let’s develop a protective legacy.

Yes, There Is Hope

Thanks for your attention and your commitment to our patients



Discussion and Questions?