

**Lyme Carditis v1**  
**Definition Factsheet & Technical Brief**

**Authors:** Amy M. Beeson<sup>1,2</sup>, Jennifer L. White<sup>3</sup>, Abigail L. Gates<sup>4</sup>, David W. McCormick<sup>1,2</sup>, Grace E. Marx<sup>1</sup>

<sup>1</sup>Bacterial Diseases Branch, Division of Vector-Borne Diseases, National Center for Emerging and Zoonotic Infectious Diseases, Centers for Disease Control and Prevention, 3156 Rampart Road, Fort Collins, Colorado, USA;

<sup>2</sup>Epidemic Intelligence Service, Epidemiology and Laboratory Workforce Branch, Division of Workforce Development, National Center for State, Tribal, Local, and Territorial (STLT) Public Health Infrastructure and Workforce, Centers for Disease Control and Prevention, Atlanta, Georgia, USA;

<sup>3</sup>New York State Department of Health, Corning Tower, Empire State Plaza, Albany, New York, USA;

<sup>4</sup>Integrated Monitoring Branch, Detect and Monitor Division, Office of Public Health Data, Surveillance, and Technology, Centers for Disease Control and Prevention, Atlanta, Georgia, USA;

**Points of contact:**

Grace E. Marx, MD, MPH (GMarx@cdc.gov)

– Bacterial Diseases Branch, Division of Vector-Borne Diseases, NCEZID, CDC

**Definition Description:** This definition aims to detect emergency department (ED) visits for Lyme carditis in areas where Lyme disease is common. Lyme carditis occurs when Lyme disease spirochetes (bacteria) invade heart tissue. To fit the Lyme carditis definition, a case must meet definitions for both 1) Lyme disease, and 2) a cardiac syndrome compatible with carditis. The definition is intended for use by state, local, tribal, territorial, and federal public health practitioners to find cases, monitor trends, and potentially detect clusters or outbreaks. This definition is only intended to be applied in areas with high Lyme disease incidence.

**New or Revised Definition:** New

**Date Added to ESSENCE:** 2026

**Use-Cases for Definition:**

Case-finding: Primary

Trend monitoring: Primary

Early outbreak detection: Secondary

Emergent Condition: Not Intended as Use Case

**Justification:** Lyme carditis is a rare and potentially fatal manifestation of Lyme disease. Although Lyme disease is nationally notifiable, data on clinical manifestations such as carditis are not collected systematically in high-incidence states.<sup>1</sup>

**Data Source During Development:** Emergency department visits

**Validation Methods:** Authors systematically abstracted information in each identified medical record through New York's regional health information exchange system. Two physician reviewers independently assigned a clinical case status (confirmed; probable; not a case) to each record; when adjudications differed, a third provided a final adjudication. To further refine the syndromic surveillance definition used in this analysis, diagnostic codes and key words in the medical record of cases that were not detected by our definition were reviewed and incorporated. Authors also reviewed and conducted text mining analyses on national ED visits queried using the Chief Complaint Query Validation datasource to further refine results.<sup>2</sup>

---

<sup>1</sup> Kugeler KJ, Earley A, Mead PS, Hinckley AF. Surveillance for Lyme Disease After Implementation of a Revised Case Definition – United States, 2022. MMWR Morb Mortal Wkly Rep 2024;73:118–123. DOI: <http://dx.doi.org/10.15585/mmwr.mm7306a1>.

<sup>2</sup> Beeson AM, White JL, Gates AL, McCormick DW, Hinckley AF, Marx GE. Lyme Carditis Identified by a Novel Syndromic Surveillance Definition — New York State, 2017–2021. Public Health Reports. 2026;0(0). doi: 10.1177/00333549251408028.

Validation Results: In New York state, we identified records for 173 individuals. Among these, 32% (n = 55) were classified as confirmed, 16% (n = 27) as probable, and 53% (n = 91) as not a case. In total, we identified 82 cases of confirmed or probable Lyme carditis; the positive predictive value of the definition was 47%.

Limitations: The lack of a specific International Classification of Diseases (ICD) diagnostic code for Lyme carditis adds to the challenge of developing a syndromic surveillance definition. A further limitation was the challenge of accurate and consistent case classification due to the often-equivocal nature of Lyme carditis diagnoses. No single test allows for a conclusive diagnosis of Lyme carditis, which can be a diagnosis of exclusion. Diagnosis is particularly challenging in individuals with cardiac comorbidities who reside in Lyme-endemic areas. Because antibodies to *B. burgdorferi* may be detected for many years after an episode of Lyme disease, Lyme carditis may be diagnosed in individuals with a remote history of LD who have antibodies to *B. burgdorferi* but who develop heart block for another reason. Alternatively, because production of antibodies can take several weeks after initial infection, a patient presenting with carditis due to early disseminated Lyme disease may test negative for antibodies to *B. burgdorferi*, which can make diagnosis challenging. In New York State and other Lyme-endemic areas, healthcare providers may often initiate treatment despite uncertainty about a diagnosis of Lyme carditis, given the potential to treat a reversible cause of heart block and avoid permanent pacemaker placement.

Definition Fields and Structure: This definition leverages the Chief Complaint Discharge Diagnosis (CCDD) field to query both discharge diagnosis codes and chief complaint text to identify emergency department visits for patients with Lyme carditis. The definition identifies visits that satisfy conditions of two syntax clauses. Clause 1 indicates visits related to Lyme disease to ensure the visit is consistent with Lyme disease (see Table 1). Clause 2 indicates visits with symptoms and signs consistent with carditis from any cause. For the definition to identify a visit related to Lyme carditis, the visit must be captured based on Clause 1 *and* Clause 2.

## Detailed Definition Components

**Table 1a.** Inclusion and exclusions terms for the Lyme carditis definition, Clause 1.

Terms	Description
<b>Inclusion</b>	
<b>ICD-10-CM: International Classification of Diseases, Tenth Revision, Clinical Modification</b>	
A69.2	Lyme disease
<b>ICD-9-CM: International Classification of Diseases, Ninth Revision, Clinical Modification</b>	
088.81	Lyme disease
<b>SNOMED Concepts</b>	
23502006	Lyme disease (disorder)
69588003	Erythema chronica migrans (disorder)
426637005	Acute Lyme disease (disorder)
714327004	Suspected Lyme disease (situation)
33937009	Lyme arthritis (disorder)
718311001	Suspected erythema chronica migrans (situation)
230605007	Lyme mononeuritis multiplex (disorder)
715507005	Infection of central nervous system caused by <i>Borrelia burgdorferi</i> (disorder)
77863005	Lyme disease (disorder)
230150008	Meningitis in Lyme disease (disorder)
733166004	Infection of skin caused by <i>Borrelia</i> (disorder)
735520000	Disseminated infection caused by <i>Borrelia</i> (disorder)
<b>Chief Complaint</b>	
(LYME or LIME) and DISEASE	
ERYTHEM MIGRAN	
BULL and EYE and RASH	
<b>Exclusion</b>	
<b>Chief Complaint</b>	
HISTORY LYME or HISTORY LIME	
HISTORY OF LYME or HISTORY OF LIME	
LYMENT	

**Table 1b.** Inclusion terms for the Lyme Carditis definition, Clause 2.

	Terms	Description
<b>Inclusion</b>		
<b>ICD-10-CM: International Classification of Diseases, Tenth Revision, Clinical Modification</b>		
Myocarditis & Pericarditis	I40	Acute myocarditis
	I40.0	Infective myocarditis
	I40.1	Isolated myocarditis
	I40.8	Other acute myocarditis
	I40.9	Acute myocarditis, unspecified
	I41	Myocarditis in diseases classified elsewhere
	I30	Acute pericarditis
	I30.0	Acute nonspecific idiopathic pericarditis
	I30.1	Infective pericarditis
	I30.8	Other forms of acute pericarditis
	I30.9	Acute pericarditis, unspecified
	I31.3	Pericardial effusion (noninflammatory)
	I31.8	Other specified disease of pericardium
	I31.9	Disease of pericardium, unspecified
	I32	Pericarditis in diseases classified elsewhere
	I51.4	Myocarditis, unspecified
	I51.5	Myocardial degeneration
Heart Block	I44	Atrioventricular and left bundle-branch block
	I44.0	Atrioventricular block, first degree
	I44.1	Atrioventricular block, second degree
	I44.2	Atrioventricular block, complete
	I44.3	Other and unspecified atrioventricular block
	I44.30	Unspecified atrioventricular block
	I44.39	Other atrioventricular block
	I44.4	Left anterior fascicular block
	I44.5	Left posterior fascicular block
	I44.6	Other and unspecified fascicular block
	I44.60	Unspecified fascicular block
	I44.69	Other fascicular block
	I44.7	Left bundle-branch block, unspecified
	I45	Other conduction disorders
	I45.0	Right fascicular block
	I45.1	Other and unspecified right bundle-branch block
	I45.10	Unspecified right bundle-branch block
	I45.19	Other right bundle-branch block
	I45.2	Bifascicular block
	I45.3	Trifascicular block
	I45.4	Nonspecific intraventricular block
	I45.5	Other specified heart block
	I45.6	Pre-excitation syndrome
	I45.8	Other specified conduction disorders
	I45.89	Other specified conduction disorders
	I45.9	Conduction disorder, unspecified
	I49.5	Sick sinus syndrome
<b>ICD-9-CM: International Classification of Diseases, Ninth Revision, Clinical Modification</b>		
Myocarditis & Pericarditis	420	Acute pericarditis
	420.0	Acute pericarditis in diseases classified elsewhere
	420.9	Other and unspecified acute pericarditis
	420.91	Acute idiopathic pericarditis
	420.90	Acute pericarditis, unspecified

	420.99	Other acute pericarditis
	422	Acute myocarditis
	422.0	Acute myocarditis in diseases classified elsewhere
	422.9	Other and unspecified acute myocarditis
	422.90	Acute myocarditis, unspecified
	422.91	Idiopathic myocarditis
	422.92	Septic myocarditis
	422.99	Other acute myocarditis
	422.93	Toxic myocarditis
	423.9	Unspecified disease of pericardium
	423.8	Other specified diseases of pericardium
	429.0	Myocarditis, unspecified
	429.1	Myocardial degeneration
Heart Block	426.0	Atrioventricular block, complete
	426.10	Atrioventricular block, unspecified
	426.11	First degree atrioventricular block
	426.12	Mobitz (type) II atrioventricular block
	426.13	Other second degree atrioventricular block
	426.2	Left bundle branch hemiblock
	426.3	Other left bundle branch block
	426.4	Right bundle branch block
	426.50	Bundle branch block, unspecified
	426.51	Right bundle branch block and left posterior fascicular block
	426.52	Right bundle branch block and left anterior fascicular block
	426.53	Other bilateral bundle branch block
	426.54	Trifascicular block
	426.50	Bundle branch block, unspecified
	426.6	Other heart block
	426.89	Other specified conduction disorders
	426.9	Conduction disorder, unspecified
	427.81	Sinoatrial node dysfunction
<b>SNOMED Concepts</b>		
Myocarditis & Pericarditis	77863005	Lyme carditis (disorder)
	46701001	Acute myocarditis (disorder)
	50920009	Myocarditis (disorder)
	399617002	Carditis (disorder)
	57809008	Myocardial disease (disorder)
	194942007	Acute myocarditis associated with another disorder (disorder)
	91025000	Idiopathic myocarditis (disorder)
	3238004	Pericarditis (disorder)
	15555002	Acute pericarditis (disorder)
	266235007	Acute idiopathic pericarditis (disorder)
	233881003	Acute infective pericarditis (disorder)
	11176009	Acute myopericarditis (disorder)
	81376009	Non-infectious pericarditis (disorder)
	286954005	Acute/subacute carditis (disorder)
	128562005	Bacterial infectious disease of heart (disorder)
Heart Block	233917008	Atrioventricular block (disorder)
	472809000	Atrioventricular block due to endocarditis (disorder)
	27885002	Complete atrioventricular block (disorder)
	418341009	Atrioventricular conduction disorder (disorder)
	44808001	Conduction disorder of the heart (disorder)
	233916004	Heart block (disorder)
	65778007	Sinoatrial block (disorder)
<b>Chief Complaint</b>		

CARDITIS
AV BLOCK
ATRIOVENTRICULAR BLOCK
HEART BLOCK
HEARTBLOCK
COMPLETE HEART
DEGREE BLOCK
DEGREE HEART

**Table 2. ESSENCE syntax for the Lyme Carditis definition, with Clause 1 and Clause 2 joined by an AND operation**

```
(, (^lyme^,or,( (^lime
^,or,^lime,or,lime^,),AND,^disease^,),or,^erythem^migran^,or,( (^Bull^,AND,^Eye^,AND,^Rash^,),or,^[/A69.2^,or,
^A692^,or,^;23502006^,or,^;69588003^,or,^;426637005^,or,^;714327004^,or,^;33937009^,or,^;718311001^,or,^
;230605007^,or,^;715507005^,or,^;77863005^,or,^;230150008^,or,^;733166004^,or,^;735520000^,or,^;088.81^,
or,^;08881;^,),ANDNOT,( (^history l[iy]me^,or,^history of
l[iy]me^,or,^lyment^,)),AND,( (^;I4[014]^,or,^;I51.[45]^,or,^;I51[45]^,or,^;I3[02]^,or,^;I31.[389]^,or,^;I31[389]^,or,^;I
45.[0-69]^,or,^;I45[0-69]^,or,^;I45.89^,or,^;I4589^,or,^;I49.5^,or,^;I495^,or,^;422.9[0-39]^,or,^;4229[0-
39]^,or,^;429.[0-1]^,or,^;429[0-
1]^,or,^;422.[09]^,or,^;422[09]^,or,^;422;^,or,^;420;^,or,^[/420.[09]^,or,^;420[09]^,or,^;420.9[019]^,or,^;4209[01
9]^,or,^;426.1[0-3]^,or,^;4261[0-3]^,or,^;426.[069]^,or,^;426[069]^,or,^;426.50^,or,^;42650;^,or,^;426.[2-
4]^,or,^;426[2-4]^,or,^;426.5[0-4]^,or,^;4265[0-
4]^,or,^;426.89^,or,^;42689;^,or,^;427.81^,or,^;42781;^,or,^;77863005;^,or,^;46701001;^,or,^;50920009;^,or,^;3
99617002;^,or,^;57809008;^,or,^;194942007;^,or,^;91025000;^,or,^;3238004;^,or,^;15555002;^,or,^;266235007;
^,or,^;233881003;^,or,^;11176009;^,or,^;81376009;^,or,^;286954005;^,or,^;128562005;^,or,^;233917008;^,or,^;4
72809000;^,or,^;27885002;^,or,^;418341009;^,or,^;44808001;^,or,^;233916004;^,or,^;65778007;^,or,^AV
block^,or,^atrioventricular block^,or,^heart block^,or,^heartblock^,or,^complete heart^,or,^degree
block^,or,^degree heart^,or,^carditis^,)
```

**Syntax Plain Language Description:** The definition for Lyme carditis uses discharge diagnosis codes and free-text chief complaint terms. The definition requires that an emergency department visit meet both the general Lyme Disease syndromic surveillance definition ([CDC Lyme Disease v1](#)) and contain specific cardiac-related diagnostic codes or chief complaint terms to ensure a visit also meets signs and symptoms consistent with carditis from any cause. Therefore, the general Lyme Disease syndromic surveillance definition includes ICD-10-CM and ICD-9-CM diagnostic codes for Lyme Disease, along with direct mentions of “Lyme disease” (including one common misspelling, ‘Lime’) or a bull’s eye rash (characteristic of EM) in chief complaint text. To ensure that only acute Lyme Disease episodes were captured, we excluded records with chief complaint text that includes ‘history of Lyme’. No specific ICD or SNOMED codes are available for Lyme carditis; therefore, for the cardiac-related diagnostic code portion of the definition, we developed a list of ICD-9-CM and ICD-10-CM codes, and SNOMED concepts that describe myocarditis, pericarditis, or heart block, or chief complaint terms including ‘heart block,’ ‘heartblock,’ ‘atrioventricular block,’ ‘AV block,’ or ‘carditis.’ The presence of one of these diagnostic codes or one of these terms in the chief complaint text field was sufficient to satisfy the cardiac syndrome definition.

## Appendix

The Lyme Carditis definition began development in 2022, prior to the development of the Parsed CCDD field, and as such was developed using non-parsed syntax. This original query was converted to Parsed language prior to adding to ESSENCE. The original query syntax that was used for definition development and validation is included below for reference:

```
(, (^lyme^,or,(, (^lime  
^,or, (^lime,or,lime^),AND, (^disease^),or, (^erythem^migran^,or,( (^Bull^,AND, (^Eye^,AND, (^Rash^),or,^[/J A69.2^,or,  
[/ J A692^,or,^[/ J 23502006^,or,^[/ J 69588003^,or,^[/ J 426637005^,or,^[/ J 714327004^,or,^[/ J 33937009^,or,^[/  
J 718311001^,or,^[/ J 230605007^,or,^[/ J 715507005^,or,^[/ J 77863005^,or,^[/ J 230150008^,or,^[/  
J 733166004^,or,^[/ J 735520000^,or,^[/ J 088.81^,or,^[/ J 08881[/ J ^),ANDNOT,( (^history l[iy]me^,or, (^history of  
l[iy]me^,or, (^lyment^),),AND,( (^[/ J 14[014]^,or,^[/ J 151.[45]^,or,^[/ J 151[45]^,or,^[/ J 13[02]^,or,^[/ J 131.[389]^,or,^[/  
J 131[389]^,or,^[/ J 145.[0-69]^,or,^[/ J 145[0-69]^,or,^[/ J 145.89^,or,^[/ J 14589^,or,^[/ J 149.5^,or,^[/ J 1495^,or,^[/  
J 422.9[0-39]^,or,^[/ J 4229[0-39][^/ J ^,or,^[/ J 429.[0-1]^,or,^[/ J 429[0-1][^/ J ^,or,^[/ J 422.[09]^,or,^[/ J 422[09][^/  
J ^,or,^[/ J 422[;^/ J ^,or,^[/ J 420[;^/ J ^,or,^[/ J 420.[09]^,or,^[/ J 420[09][^/ J ^,or,^[/ J 420.9[019]^,or,^[/ J 4209[019][^/  
J ^,or,^[/ J 426.1[01-3]^,or,^[/ J 4261[01-3][^/ J ^,or,^[/ J 426.[069]^,or,^[/ J 426[069][^/ J ^,or,^[/ J 426.50^,or,^[/ J 42650[/  
J ^,or,^[/ J 426.[2-4]^,or,^[/ J 426[2-4][^/ J ^,or,^[/ J 426.5[0-4]^,or,^[/ J 4265[0-4][^/ J ^,or,^[/ J 426.89^,or,^[/ J 42689[/  
J ^,or,^[/ J 427.81^,or,^[/ J 42781[;^/ J ^,or,^[/ J 77863005[;^/ J ^,or,^[/ J 46701001[;^/ J ^,or,^[/ J 50920009[;^/ J ^,or,^[/  
J 399617002[;^/ J ^,or,^[/ J 57809008[;^/ J ^,or,^[/ J 194942007[;^/ J ^,or,^[/ J 91025000[;^/ J ^,or,^[/ J 3238004[;^/ J ^,or,^[/  
J 15555002[;^/ J ^,or,^[/ J 266235007[;^/ J ^,or,^[/ J 233881003[;^/ J ^,or,^[/ J 11176009[;^/ J ^,or,^[/ J 81376009[;^/ J ^,or,^[/  
J 286954005[;^/ J ^,or,^[/ J 128562005[;^/ J ^,or,^[/ J 233917008[;^/ J ^,or,^[/ J 472809000[;^/ J ^,or,^[/ J 27885002[;^/ J ^,or,^[/  
J 418341009[;^/ J ^,or,^[/ J 44808001[;^/ J ^,or,^[/ J 233916004[;^/ J ^,or,^[/ J 65778007[;^/ J ^,or,^AV  
block^,or, (^atrioventricular block^,or, (^heart block^,or, (^heartblock^,or, (^complete heart^,or, (^degree  
block^,or, (^degree heart^,or, (^carditis^),
```