Validating a claims-based algorithm for Lyme Disease in Massachusetts

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BACKGROUND & OBJECTIVE

- **Lyme disease (LD)** is the fifth most reported notifiable disease in the US, but the **true disease burden remains unknown** due to inconsistent reporting.
- **Claims-based algorithms estimate a 10-14-fold higher incidence compared to notifiable-disease surveillance**,[1,2] but these algorithms are unvalidated.
- We validated a claims-based algorithm via **medical record review** of claims-identified LD cases residing in **Massachusetts (MA), a state where LD is endemic.**

METHODS

❖ **Study population:**
- Members of Harvard Pilgrim Health Care (HPHC)
- Medical and pharmacy benefits for ≥6 months between January 2015-July 2019
- Massachusetts residency at enrollment

❖ **Claims-based LD case-finding algorithm:**
- ≥1 **LD diagnosis code** (ICD-9-CM: 088.81; ICD-10-CM: A69.2*) **AND** ≥1 **antibiotic used to treat LD** (≥7 days' supply) within ±30 days of LD diagnosis
- No LD diagnosis codes in the 6 months prior, to establish incidence

❖ **Chart review and validation:**
- We sought medical records for patients meeting the LD algorithm who received care within the Massachusetts General Brigham system at diagnosis. Our target was ≥125 charts for review.
- Three clinicians received training on case classification and conducted chart abstractions and adjudications.
- Cases were classified as confirmed, probable, suspect, or ruled out using 2017 Council of State and Territorial Epidemiologists case definitions (Table 1).
- We assessed inter-rater reliability based on 20 multiply-adjudicated charts.
- We calculated positive predictive value (PPV) of the algorithm for identifying confirmed, probable, or suspect LD cases.

RESULTS

- We identified 171 LD diagnoses occurring at an MGB facility and obtained 128 (75%) patients' charts for review.
- The mean weighted kappa statistic of adjudicator agreement was 0.94.
- Of the 128 charts reviewed:
  - **Demographics:** 81% were adults ≥18 years; 51% were female; 70% resided in the counties closest to Boston (Middlesex, Norfolk, Suffolk)
  - **LD-related observations:** 84% treated with doxycycline; 53% lab tested; 48% with EM rash; 9% with disseminated manifestation (musculoskeletal, cardiovascular, or nervous system).
- Seasonality of confirmed, probable, and suspect cases reflected known seasonal trends in LD incidence (Figure 1).
- **PPV** of claims-based algorithm to detect:
  - **Confirmed, probable, or suspect cases: 93.8% (95% CI 89.6-97.9%)**
  - **Confirmed or probable cases: 66.4% (95% CI 57.5-74.5%).**

Table 1. 2017 Council of State and Territorial Epidemiologists Surveillance Definitions of Lyme Disease.

Classification	Definition
Confirmed	Erythema migrans (EM) with known exposure in a high-incidence state (e.g., MA)
	At least one late manifestation of LD and laboratory-confirmed LD
Probable	Diagnosis of LD in clinical notes and laboratory-confirmed LD but no evidence of EM and no eligible late manifestations of disease
Suspect	Diagnosis of LD in clinical notes and antibiotics ordered by health care provider to treat LD but no laboratory confirmation, no evidence of EM, and no eligible late manifestations of LD
	EM with no known exposure, no laboratory confirmation, and no eligible late manifestations of LD

References: 1. Nelson CA, Saha S, Kugeler KJ, et al. Incidence of clinician-diagnosed Lyme disease, United States, 2005-2010. Emerg Infect Dis. 2015;21(9):1625-1631. 2. Kugeler KJ, Schwartz AM, Delorey MJ, Mead PS, Hinckley AF. Estimating the frequency of Lyme disease diagnoses, United States, 2010-2018. Emerg Infect Dis. 2021;27(2):616-619.

Figure 1. Confirmed, probable, or suspect LD cases by calendar month (n = 120).

Table 2. Adjudication results stratified by case characteristics.

	Total (n)	Confirmed (%)	Probable (%)	Suspect (%)	Ruled Out (%)
Overall	**128**	55%	12%	27%	6%
Pediatric (<18 yrs)	**25**	76%	12%	12%	0%
Adults (≥18 yrs)[a]	**103**	50%	12%	31%	8%
ICD-9 era[b]	**25**	64%	12%	16%	8%
ICD-10 era[b]	**103**	52%	12%	30%	6%
LD lab test performed	**68**	40%	22%	31%	7%
Any lab confirmation[a]	**24**	63%	38%	0%	0%
Erythema migrans	**62**	98%	0%	2%	0%
Any disseminated symptoms[c]	**12**	75%	0%	25%	0%

[a]Percentages sum to >100% due to rounding.
[b]Case date 1/2015-9/2015 classified as ICD-9; case date 10/2015-6/2019 classified as ICD-10.
[c]Disseminated symptoms include musculoskeletal, cardiovascular, and nervous system.

CONCLUSIONS

- A claims-based algorithm combining diagnosis codes and antibiotic prescriptions identified LD cases in MA with high PPV.
- This algorithm could be used to describe the incidence of LD in regions with similar diagnostic, treatment, and coding practices.

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