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## Rule of 7s for Lyme Meningitis

**Introduction:** The Rule of 7s for Lyme Meningitis is a validated clinical prediction rule to distinguish Lyme meningitis from aseptic meningitis.

### Points & Pearls

- The Rule of 7s should not be used in settings in which patients do not have access to close follow-up care by a medical provider.
- If the cerebrospinal fluid (CSF) red blood cell count is  $> 500$  cells/mm<sup>3</sup>, the CSF white blood cell count must be corrected using a ratio of 1 white blood cell for every 500 red blood cells in the CSF cell count.

### Advice

This tool should be used to assist clinicians in decision-making, not to replace clinical evaluation of a patient. Patients with scores of 1 to 3 points are not at low risk for Lyme meningitis, and antibiotic therapy for Lyme meningitis should be considered for these patients. Patients with a score of 0 are at low risk for Lyme meningitis; their symptoms may be due to aseptic meningitis or another etiology. Clinicians should use clinical judgment and consider whether the patient has access to adequate follow-up care before initiating antibiotic therapy.

### Critical Actions

The Rule of 7s is meant to aid in the decision to begin antibiotic therapy for suspected Lyme meningitis. It should not replace clinical judgement and clinician assessment of patients.

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### Why to Use

The Rule of 7s has been validated by a retrospective cohort study of 423 children in Lyme-endemic areas. It can help guide clinicians in assessing the need to initiate antibiotic therapy for Lyme meningitis, versus observation and close follow-up care.

### When to Use

Use the Rule of 7s in Lyme-endemic areas when considering antibiotic treatment for pediatric patients who:

- Are aged 2 to 18 years, AND
- Have undergone a lumbar puncture and the CSF demonstrates pleocytosis (CSF WBC count  $\geq 10$  cells/mm<sup>3</sup>, corrected for CSF RBC count if  $> 500$  cells/mm<sup>3</sup> by using a ratio of 1 WBC for every 500 RBCs).

### Next Steps

- If the patient is at low risk for Lyme meningitis, consider discharging the patient after stressing the importance of follow up with a primary care provider.
- If the patient is not at low risk for Lyme meningitis, consider treatment with an antibiotic that covers *Borrelia burgdorferi*, using an age-appropriate dosage.

Abbreviations: CSF, cerebrospinal fluid; RBC, red blood cell; WBC, white blood cell.

## Evidence Appraisal

Avery et al (2006) first derived a clinical prediction model to calculate the probability of Lyme meningitis in children from Lyme-endemic regions, using a statistical analysis of history, physical examination, and laboratory findings. Their model was prospectively validated by Garro et al (2009) in a study of 50 children aged 2 to 18 years who lived in a Lyme-endemic region. Fourteen of the children had Lyme meningitis, 6 had possible Lyme meningitis, and 30 were ultimately diagnosed with aseptic meningitis. Categories of low (< 10%), indeterminate (10%-50%), and high (> 50%) probabilities of Lyme meningitis were derived based on the percentage of CSF mononuclear cells, duration of headache, and presence of cranial nerve neuropathy.

The positive predictive value with a cutoff of > 50% probability of Lyme meningitis was 100% (95% confidence interval [CI]: 66%-100%). The negative predictive value with a cutoff of < 10% probability of Lyme meningitis was 100% (95% CI: 82%-100%). The authors noted that when patients had < 7 days of headache, < 70% CSF mononuclear cells, and no seventh or other cranial nerve palsy, the probability of Lyme meningitis was always < 10%, indicating that those patients were at low risk for Lyme meningitis. The authors termed this the Rule of 7s.

The Garro et al study was validated in a large retrospective cohort study by Cohn et al (2012) using electronic medical record data from 3 pediatric emergency departments in Lyme-endemic areas. The sample of 423 children, aged 90 days to 19 years, included 117 children who were diagnosed with Lyme meningitis and 306 who were diagnosed with aseptic meningitis. The specificity of the Rule of 7s for low risk was 41% (95% CI: 36%-47%), and the sensitivity was 96% (95% CI: 90%-99%).

## Use the Calculator Now

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## Calculator Creator

Aris Garro, MD, MPH

[Click here to read more about Dr. Garro.](#)

## References

### Primary Reference

- Garro AC, Rutman M, Simonsen K, et al. Prospective validation of a clinical prediction model for Lyme meningitis in children. *Pediatrics*. 2009;123(5):e829-e834.

DOI: <https://doi.org/10.1542/peds.2008-2048>

### Validation Reference

- Cohn KA, Thompson AD, Shah SS, et al. Validation of a clinical prediction rule to distinguish Lyme meningitis from aseptic meningitis. *Pediatrics*. 2012;129(1):e46-e53.

DOI: <https://doi.org/10.1542/peds.2011-1215>

### Other Reference

- Avery RA, Frank G, Glutting JJ, et al. Prediction of Lyme meningitis in children from a Lyme disease-endemic region: a logistic-regression model using history, physical, and laboratory findings. *Pediatrics*. 2006;117(1):e1-e7.

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