Predicting Town-level Cases of Lyme Disease in Southern Maine: Can we do it, and What Does it Tell Us?  

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Maine has some of the highest rates of Lyme in the United States.  

**Problem:** Most Lyme exposure happens locally, but our understanding of Lyme is at the statewide or county scale.  

**Are there important spatial differences in Lyme at the town scale?**  
(Yes)

**Could we use this spatial information for targeted prevention?**  
(Yes)

**Do we have enough information for town-level forecast of Lyme?**  
(Maybe)

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**Null Model**  
\[ Y_i \sim \text{binom}(X_i, p_{\text{detected}}) \]  
\[ X_i \sim \text{binom}(\text{Population}_{i}, p_{\text{infection}}) \]  
\[ p_{\text{infection}} \sim \text{beta}(0, 1) \]  
\[ p_{\text{detected}} \sim \text{beta}(a, b) \]

**Temperature Model**  
\[ Y_i \sim \text{binom}(X_i, p_{\text{detected}}) \]  
\[ X_i \sim \text{binom}(\text{Population}_{i}, p_{\text{infection}}) \]  
\[ \text{temp} \sim \text{norm}(\text{temp}, \text{error}) \]  
\[ \text{aqua} \sim \text{norm}(\text{aqua}, \text{error}) \]  
\[ \text{temp} \sim \text{unif}(\text{max_temp}, \text{min_temp}) \]  
\[ \log(\text{p}_{\text{detected}}) \sim \beta_1 + \beta_2 \times \text{temp} + \text{error} \]  
\[ X_i \sim \text{binom}(\text{Population}_{i}, p_{\text{infection}}) \]  
\[ \beta \sim \text{mnorm}(b, V) \]  
\[ y \sim \text{gamma}(ag, bg) \]  
\[ \text{error} \sim \text{gamma}(ag, bg) \]  
\[ p_{\text{detected}} \sim \text{beta}(a, b) \]

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Temperature had significant effect on Lyme, that differs by town  

- Raymond Model narrowly outperforms Null for half of towns  
- Much more uncertainty around censored data  
- Null model outperformed Temperature for majority of towns when projected into the future  
- Null model captured 93% validation points within 95% confidence interval.

- Temperature captured 84% of validation points within 95% confidence interval.

Both models were able to predict held-out data most of the time, but temperature is less suited to yearly-forecasts.

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**Future Directions**

- Contact Us!  
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**Acknowledgments**

This work was done in collaboration with NASA DEVELOP’s Summer 2019 Boston – MA Health and Air Quality team. Thanks to participants: Celeste Gambino, Britnay Beaudry, Madison Berman, Monica Colmenares, and node lead Zach Bengtssson. Dr. Susan Elias, and Chuck Lubelczyk from MMCRI Vector-Borne Disease Laboratory advised model development. Dr. Michael Dietze assisted in model fitting.