Assessment and optimization of RSV prophylaxis in Connecticut

Ben Artin, YSPH/YSM 2018

Objectives

- Estimate variation in timing of respiratory syncytial virus (RSV) season in Connecticut by county and by year
- Evaluate effectiveness of the RSV immunoprophylaxis regimen recommended by the American Academy of Pediatrics (AAP)
- Formulate alternative prophylaxis regimens to account for regional and annual variation in timing of RSV season in Connecticut
- Compare effectiveness of alternative regimens against the AAP recommendation

Background

Respiratory syncytial virus (RSV) causes seasonal respiratory infection with potentially serious complications in children, and leads to hospitalization rates as high as 50% in high-risk infants. Safe and effective immunoprophylaxis (palivizumab) is available, but costly.

The American Academy of Pediatrics (AAP) recommends palivizumab only for infants at high risk of complications, and only during the RSV season. Although the current AAP guidelines acknowledge the existence of spatial and temporal variation in RSV incidence, they do not recommend spatial or temporal adjustments to immunoprophylaxis regimen outside of Florida.

In this study, we investigated the value of using spatial and temporal variation in RSV incidence to adjust the RSV prophylaxis regimen in Connecticut.

Methods

1. Identified 318660 RSV-associated hospitalizations in Connecticut between July 1995 and June 2013.
2. Modeled RSV seasons using Monte Carlo sampling of log-linked generalized additive model with penalized cubic B-splines.
3. Estimated the fraction of all RSV-associated hospitalizations that occur during the interval when RSV prophylaxis is recommended ("preventable fraction") under the AAP guidelines.
4. Estimated RSV season onset and offset in each region across all years.
5. Constructed alternative prophylaxis regimens based on regional variation in RSV season timing.
6. Estimated preventable fraction of the regionally adjusted alternative regimens.

Results

AAP-recommended prophylaxis lags behind RSV season

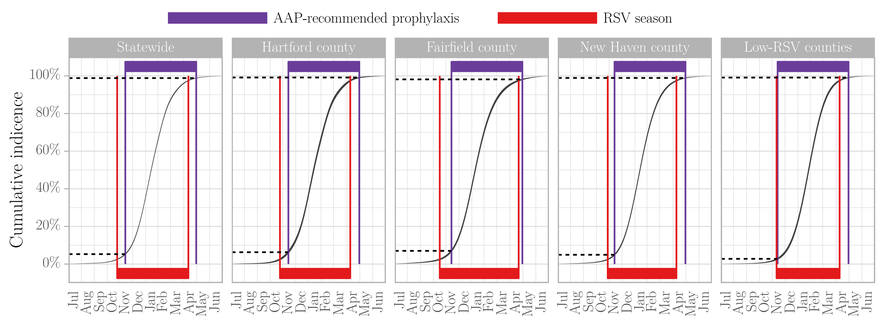

Figure 1: Regional variation in the lag between RSV seasons and the AAP-recommended prophylaxis regimen

Spatial adjustments yield up to 1% improvement

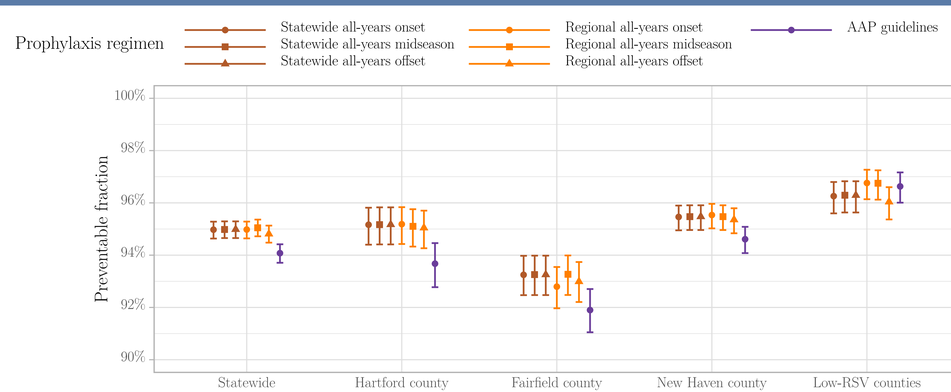

Figure 2: Comparison of six spatially adjusted RSV prophylaxis regimens to the AAP-recommended regimen

Conclusion

Timing of RSV season in Connecticut varies by several weeks in different parts of the state. The AAP-recommended prophylaxis regimen is misaligned with the RSV season in the counties with highest RSV incidence.

Timing of RSV immunoprophylaxis could be adjusted to achieve approximately a 1% increase in RSV prevention statewide.

This gain requires using immunoprophylaxis schedule based on 1-week or 2-week intervals, rather than the month-based schedule currently used in AAP recommendations.

Year-to-year variability of RSV season timing in Connecticut is less significant than regional differences within the state. Accounting for year-to-year variability in our model did not produce any additional improvements beyond the 1% gained from accounting for regional variability.

Limitations

Our model of AAP prophylaxis regimen assumes protection begins on November 15th, whereas prophylaxis start dates are actually spread out throughout November.

We assumed that RSV illness after receiving prophylaxis (breakthrough illness) is negligible.

We do not have data for RSV infections among travelers from other states, and therefore our analysis underestimates RSV incidence in regions with high levels of interstate travel, such as urban centers near state lines.

Our regional analysis does not account for inter-county travel, such as in employment hubs near county lines.

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