Respiratory Syncytial Virus (RSV) seasonality in the United States and the burden of RSV in children

Meredith McMorrow, MD, MPH, FAAP
Team Lead, Enhanced Surveillance Platforms
Respiratory Viruses Branch, Division of Viral Diseases

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RSV Seasonality in the U.S.
National Respiratory and Enteric Virus Surveillance System (NREVSS) for monitoring RSV seasonality

- Passive, laboratory-based surveillance
  - Commercial, hospital, and state/local public health laboratories
  - ~300 laboratories report RSV results
  - Weekly reporting of total tests performed and RSV positive tests

- All test types (majority PCR assays)
- Testing is clinician-directed
- All ages
During 2011-2020, RSV circulation was highly seasonal in the U.S. with predictable peak activity during December – February annually.
Geographic differences in RSV seasonality in the U.S.

Median RSV season onset (circle), peak (triangle), and end (square) by census region from NREVSS and pediatric hospitalizations from 7 sites in the New Vaccine Surveillance Network (NVSN), July 2017 – June 2020
Peak RSV transmission during December – February, average weekly detections from NREVSS 2015-2019
Following over 1 year of limited RSV circulation, the U.S. experienced an intraseasonal RSV wave that peaked in early August 2021.
The burden of RSV in U.S. children
RSV is the leading cause of hospitalization in U.S. infants

- Most (68%) infants are infected in the first year of life and nearly all (97%) by age 2\(^1\)
- Premature infants born at <30 weeks gestation had hospitalization rates ~3x higher than term infants\(^2\)
  - Preterm infants have higher rates of ICU admission, mechanical ventilation\(^3\)
  - Average cost of hospitalization in infant <29 weeks ~4x higher than for term infant\(^3\)
- 79% of children hospitalized with RSV aged <2 years had no underlying medical conditions\(^2\)
- 2-3% of all infants will be hospitalized for RSV\(^2,4\)

\(^1\)Glezen et al, Arch Dis Child, 1986; \(^2\)Hall et al, Pediatrics, 2013; \(^3\)McLaurin et al, J Perinatol, 2016; \(^4\)Langley & Anderson, PIDJ, 2011
Each year in U.S. children aged less than 5 years, RSV is associated with...

- **100-300** deaths
- **58,000-80,000** hospitalizations
- **~520,000** emergency department visits
- **~1,500,000** outpatient visits


(*estimate 80,000 hospitalizations in infants <1y*)
RSV-associated hospitalization rates vary by year, study design, and assumptions

- An industry-sponsored systematic review estimated median annual hospitalization rate of 25.6 per 1000 in infants aged 0-5 months (25 studies)
  - Included 4 studies with a single year of hospital data, 5 with 2 years
  - Rates were imputed, not directly reported from all but 9 studies
  - Median estimates varied considerably based upon methods
    - Lowest (15.8) from active surveillance
    - Highest (31.2) from modeling studies
  - Clear outliers were not excluded

- For cost-effectiveness analyses, CDC will use estimates from active surveillance in primary analyses, others will inform sensitivity analyses
RSV-associated disease burden estimates from the New Vaccine Surveillance Network (NVSN)

- Year-round acute respiratory illness (ARI) surveillance at 3 sites during 2000-2009
- Expanded to 7 sites during 2016-2021
- Prospective surveillance in inpatient, ED, outpatient clinics
- PCR testing for multiple respiratory viruses, including RSV
- Population denominators and market share used to estimate disease burden
RSV-associated hospitalization rates are highest in children aged 0-5 months and decrease with increasing age, NVSN


- Emergency department
  - Highest rates in infants (55/57 per 1000) among 0-5/6-11 months\(^1\)
  - Highest rate in infants aged 0-5 months (75 per 1000)\(^2\)

- Outpatient pediatric clinics
  - Highest rates in infants aged 6-11 months (177 per 1000)\(^1\)
  - Highest rates in infants aged 6-11 months (246 per 1000)\(^2\)

\(^1\)Hall et al, NEJM, 2009; \(^2\)Lively et al, J Ped Infect Dis Soc, 2019
RSV-associated hospitalization rates in children aged 0-11 months, NVSN

Prevention - Palivizumab (Synagis®).

- Humanized monoclonal IgG directed against F glycoprotein
- Monthly administration due to short half-life (28 days)
- Efficacy against RSV-associated hospitalization in:
  - Preterm infants and infants with chronic lung disease (CLD) (55%)¹,
  - Infants with congenital heart disease (CHD) (45%)²
- AAP recommends³ use in:
  - Infants <29 weeks gestation during first year of life
  - Preterm infants with CLD
  - Infants with hemodynamically significant CHD
  - Infants with profound immunocompromise
  - 5% of US infants eligible, ~2% receive one or more doses⁴

Conclusions

- Pre-pandemic RSV seasonality is well defined with limited geographic variability in most of the U.S.
- RSV is the most common cause of hospitalization in U.S. infants
  - Highest hospitalization rates in first months of life
  - Risk declines with increasing age in early childhood
- Prematurity and other chronic diseases increase risk of RSV-associated hospitalization but most hospitalization are in healthy, term infants
- Currently licensed prevention product targets only 5% of US infants
- RSV prevention candidates are in late stages of development
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Thank you

For more information, contact CDC
1-800-CDC-INFO (232-4636)

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