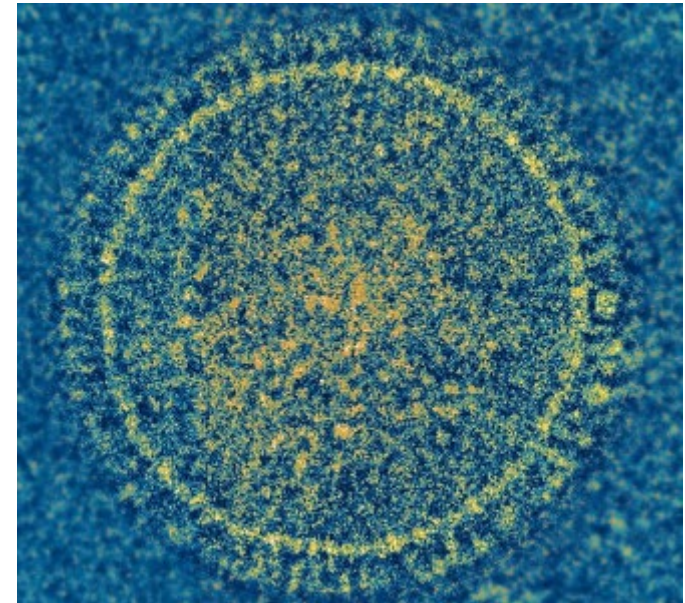


# Respiratory Syncytial Virus (RSV) seasonality in the United States and the burden of RSV in children

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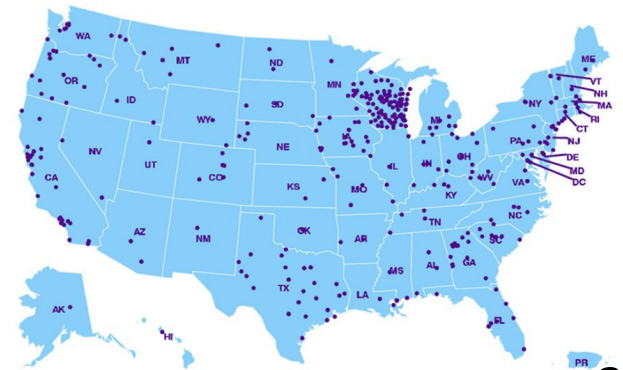
ACIP General Meeting  
June 23, 2022



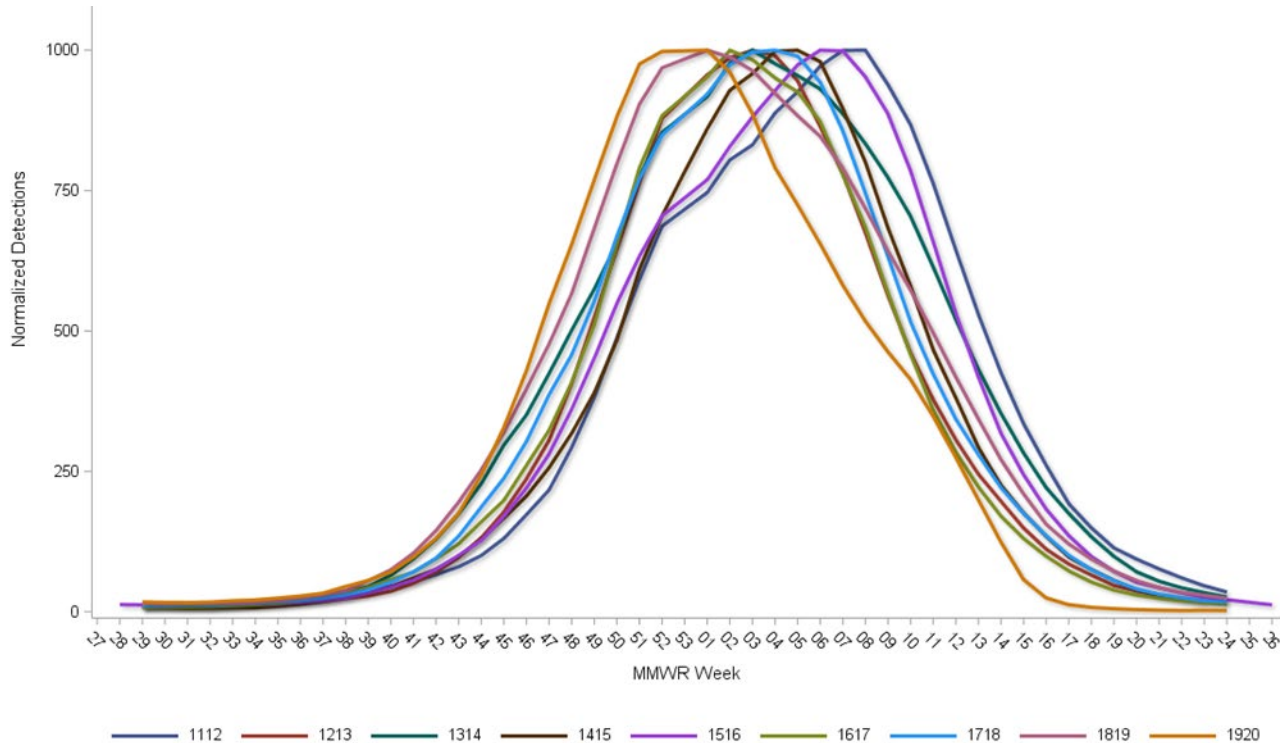
# RSV Seasonality in the U.S.

# National Respiratory and Enteric Virus Surveillance System (NREVSS) for monitoring RSV seasonality

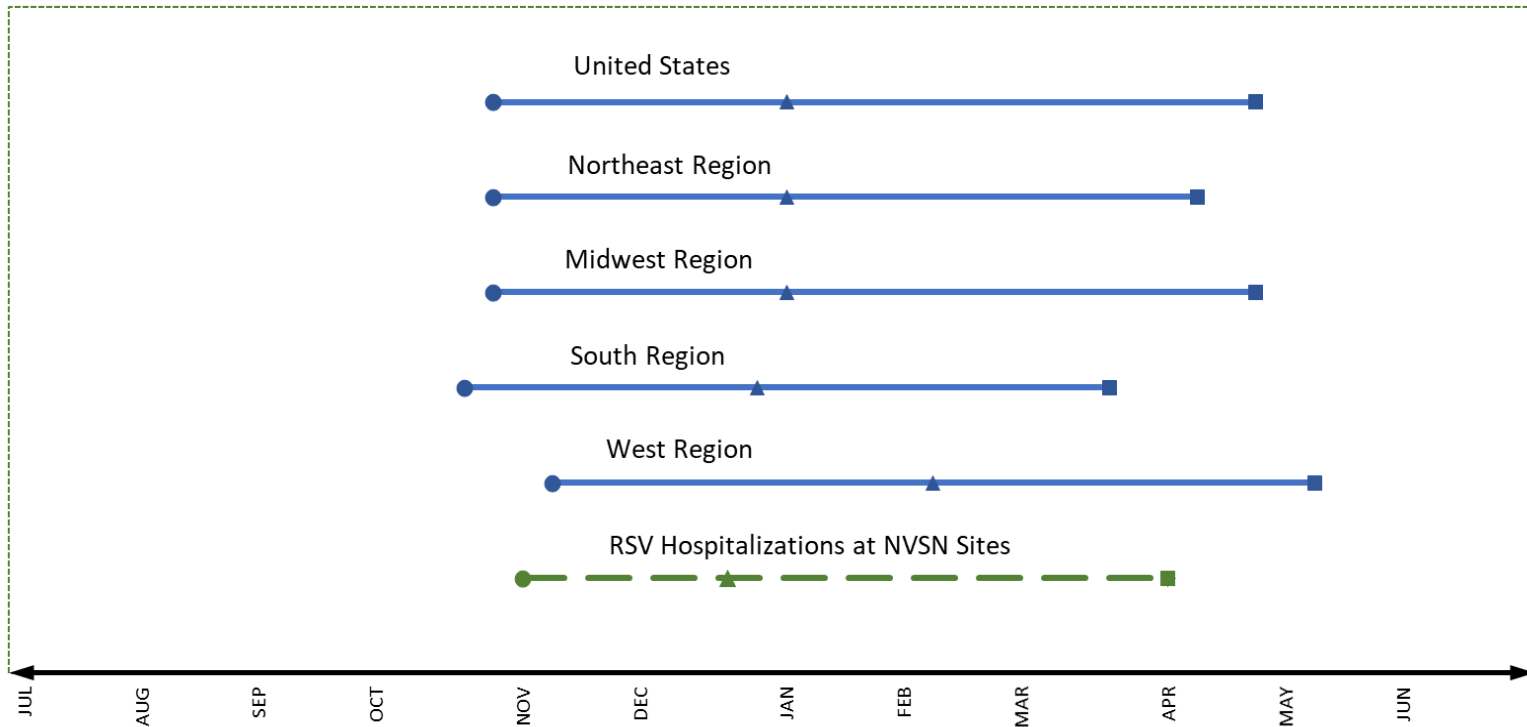
- Passive, laboratory-based surveillance
  - Commercial, hospital, and state/local public health laboratories
  - ~300 laboratories report RSV results
  - Weekly reporting of total tests performed and RSV positive tests
- All test types (majority PCR assays)
- Testing is clinician-directed
- All ages



# During 2011-2020, RSV circulation was highly seasonal in the U.S. with predictable peak activity during December – February annually

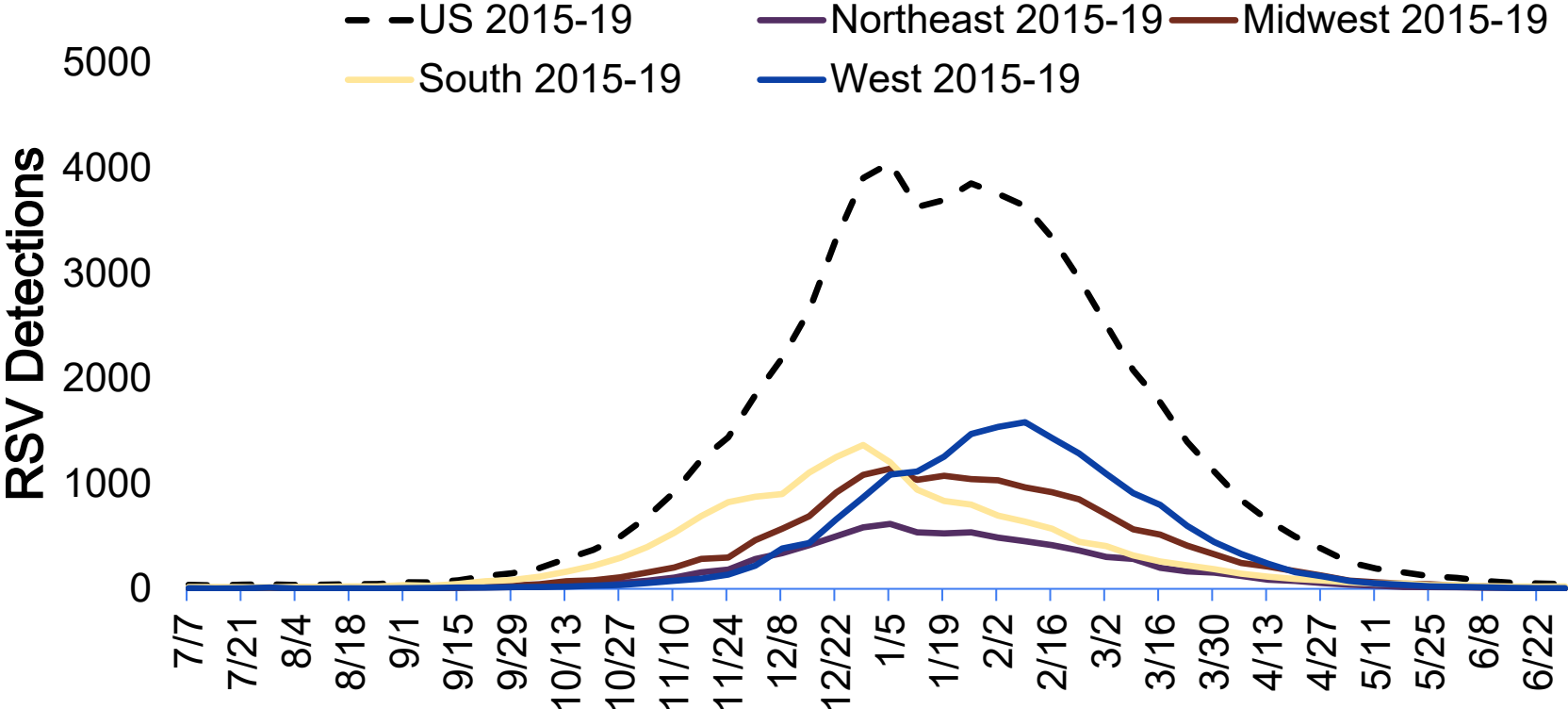


# Geographic differences in RSV seasonality in the U.S.

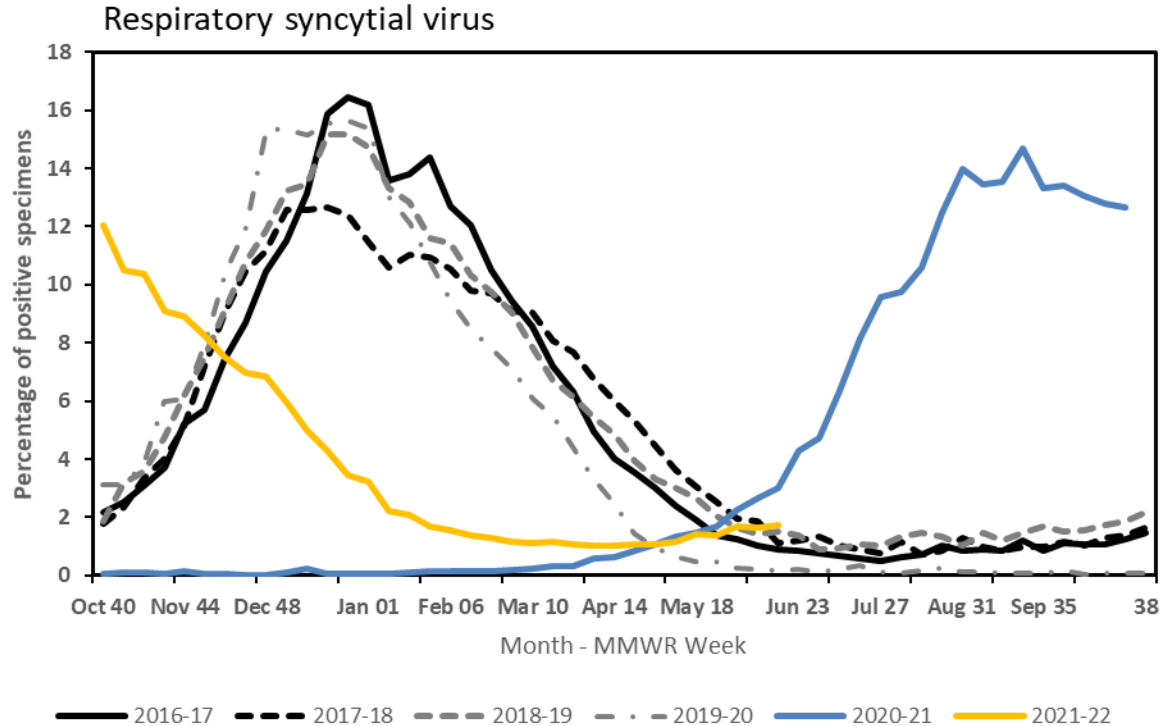


Median RSV season onset (circle), peak (triangle), and end (square) by census region from NREVSS and pediatric hospitalizations from 7 sites in the New Vaccine Surveillance Network (NVSN), July 2017 – June 2020

# 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<sup>1</sup>
- Premature infants born at <30 weeks gestation had hospitalization rates ~3x higher than term infants<sup>2</sup>
  - Preterm infants have higher rates of ICU admission, mechanical ventilation<sup>3</sup>
  - Average cost of hospitalization in infant <29 weeks ~4x higher than for term infant<sup>3</sup>
- 79% of children hospitalized with RSV aged <2 years had no underlying medical conditions<sup>2</sup>
- 2-3% of all infants will be hospitalized for RSV<sup>2,4</sup>



Image: Goncalves et al. Critical Care Research and Practice 2012

<sup>1</sup>Glezen et al, Arch Dis Child, 1986; <sup>2</sup>Hall et al, Pediatrics, 2013; <sup>3</sup>McLaurin et al, J Perinatol, 2016; <sup>4</sup>Langley & Anderson, PIDJ, 2011

# Each year in U.S. children aged less than 5 years, RSV is associated with...

**100-300**<sup>1,2</sup>  
deaths

**58,000-80,000**<sup>3,4</sup>  
hospitalizations

**~520,000**<sup>3</sup>  
emergency department visits

**~1,500,000**<sup>3</sup>  
outpatient visits

**10**

<sup>1</sup>Thompson et al, JAMA, 2003; <sup>2</sup>Hansen et al, JAMA Network Open, 2022; <sup>3</sup>Hall et al, NEJM, 2009; <sup>4</sup>McLaughlin et al, J Infect Dis, 2022  
(\*estimate 80,000 hospitalizations in infants <1y)

# RSV-associated hospitalization rates vary by year, study design, and assumptions

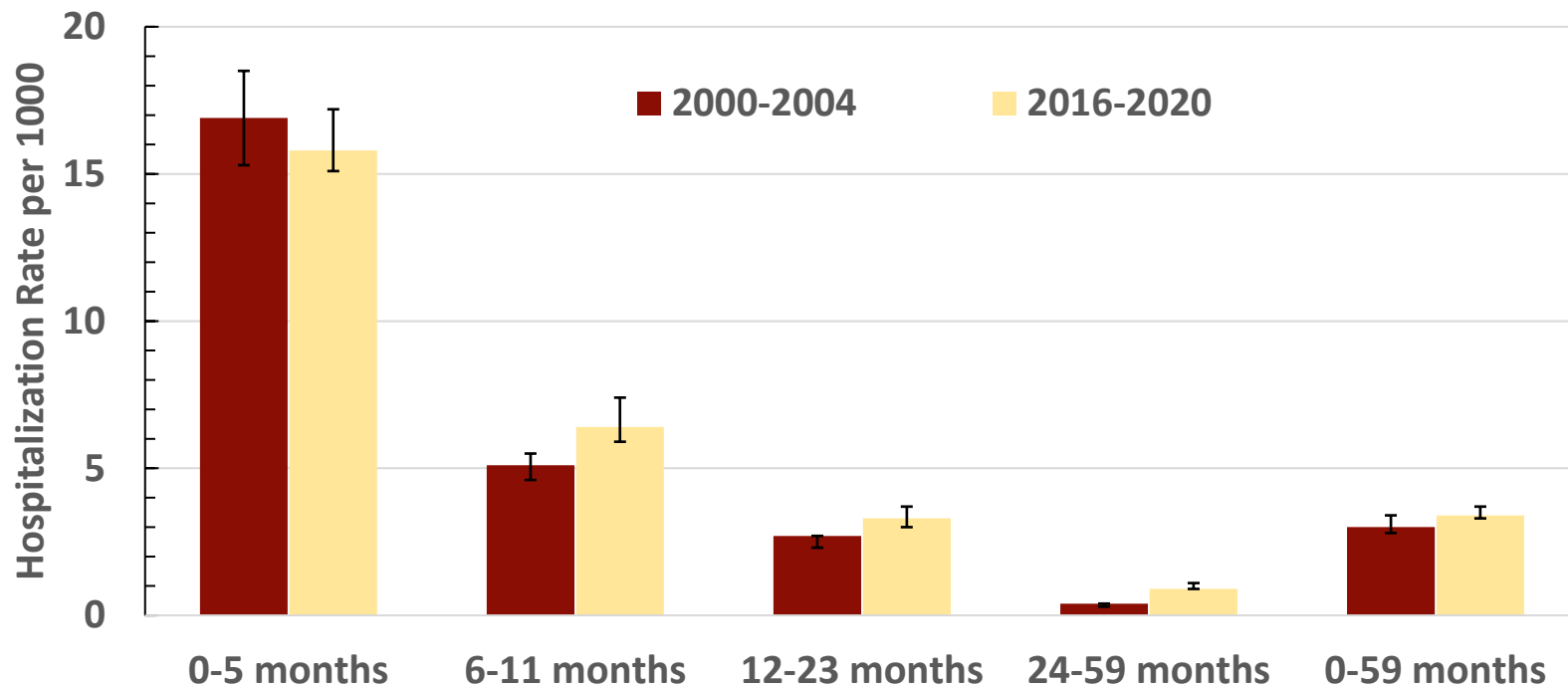
- An industry-sponsored systematic review estimated median annual hospitalization rate of 25.6 per 1000 in infants aged 0-5 months (25 studies)
  - Included 4 studies with a single year of hospital data, 5 with 2 years
  - Rates were imputed, not directly reported from all but 9 studies
  - Median estimates 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



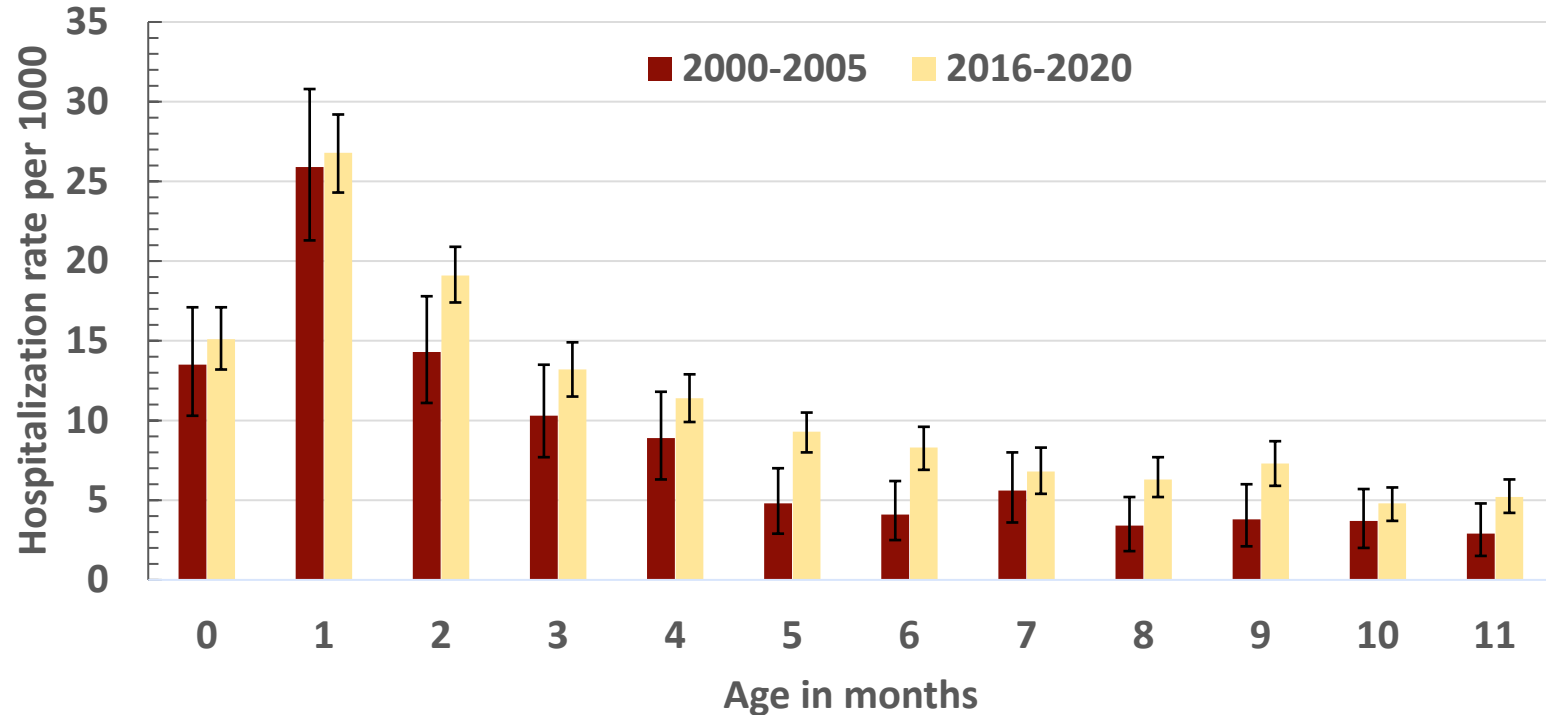
2000-2004: Adapted from Hall et al, NEJM 2009; 2016-2020: CDC unpublished data

# NVSN estimates of emergency and outpatient visits during 2002-2004, 2004-2009

- Emergency department
  - Highest rates in infants (55/57 per 1000) among 0-5/6-11 months<sup>1</sup>
  - Highest rate in infants aged 0-5 months (75 per 1000)<sup>2</sup>
- Outpatient pediatric clinics
  - Highest rates in infants aged 6-11 months (177 per 1000)<sup>1</sup>
  - Highest rates in infants aged 6-11 months (246 per 1000)<sup>2</sup>

<sup>1</sup>Hall et al, NEJM, 2009; <sup>2</sup>Lively et al, J Ped Infect Dis Soc, 2019

# RSV-associated hospitalization rates in children aged 0-11 months, NVSN



2000-2005: Adapted from Hall et al, Pediatrics 2013; 2016-2020: CDC unpublished data

# 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%)<sup>1</sup>,
  - Infants with congenital heart disease (CHD) (45%)<sup>2</sup>
- AAP recommends<sup>3</sup> 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 doses<sup>4</sup>

<sup>1</sup>Impact-RSV Study group, Pediatrics, 1998; <sup>2</sup>Feltes et al, Pediatrics, 2003; <sup>3</sup>American Academy of Pediatrics, Red Book, 2021;

<sup>4</sup>Ambrose et al, Human Vaccines Immuno, 2014



# 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

# Acknowledgements

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# Thank you

For more information, contact CDC  
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TTY: 1-888-232-6348 [www.cdc.gov](http://www.cdc.gov)

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