United States Public Health Approach to RSV Surveillance

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United States RSV Program Goals

• To fill evidence gaps important for future implementation of RSV vaccine and immunoprophylaxis products

• To identify areas where CDC may be able to contribute optimally

• To optimize the value of epidemiologic platforms by integrating laboratory investigations
National Respiratory and Enteric Virus Surveillance System (NREVSS)

- Passive laboratory-based surveillance system
  - Developed in the early 1980s

- Data sources: participating laboratories
  - Private, public, and academic hospitals
  - State and local public health departments
  - Reference labs

- Weekly reporting of # tests and # positives
  - Percent positive used to describe circulation
  - Moving toward integration of patient level data - ELR
  - Automated public health messaging
RSV season duration and peak by US HHS Regions and in Florida: NREVSS (2012-2014)

Haynes et al., MMWR (2014)
Note: seasonality is based on antigen testing
Reporting of RSV Diagnostic Data by NREVSS Laboratories That Consistently Report: July 2005- June 2015

From: Determining the Seasonality of Respiratory Syncytial Virus in the United States: The Impact of Increased Molecular Testing
J Infect Dis | Published by Oxford University Press for the Infectious Diseases Society of America 2017. This work is written by (a) US Government employee(s) and is in the public domain in the US.
RSV Surveillance in Pediatric Populations in the United States

<table>
<thead>
<tr>
<th>Platform (Years)</th>
<th>Population and setting</th>
<th>Design</th>
<th>Enrollment</th>
<th>Specimen and laboratory techniques</th>
</tr>
</thead>
<tbody>
<tr>
<td>NVSN (2015-2021)</td>
<td>▪ &lt;5 years at 7 sites (&lt;18 years at some sites) ▪ Inpatients and ED</td>
<td>▪ Active case finding ▪ Prospective ▪ Population-based ▪ All respiratory viruses</td>
<td>▪ Broad ARI symptoms ▪ Controls</td>
<td>▪ Flocked mid-turbinate and OP (tracheal/BAL) ▪ Molecular testing</td>
</tr>
<tr>
<td>PREVAIL (2016-2018)</td>
<td>▪ Mother-infant pairs followed for up to 2 years</td>
<td>▪ Longitudinal cohort of 240 pairs</td>
<td>▪ Pregnant women ≥18 years of age, ≥34 weeks GA ▪ Live birth</td>
<td>▪ Baseline maternal blood ▪ Cord blood, placenta ▪ Milk samples ▪ Infant blood at 2,4,6,12,18 and 24 months ▪ Weekly nasal swabs ▪ Nasal swabs if ill (household)</td>
</tr>
</tbody>
</table>

Abbreviations: NVSN=New Vaccine Surveillance Network; PREVAIL=Pediatric Respiratory and Enteric Virus Acquisition and Immunogenesis Longitudinal Cohort; ED=Emergency Department; ARI=acute respiratory infections; BAL=bronchoalveolar lavage
NVSN: Objectives

- Determine inpatient and ED, population-based burden of respiratory and enteric viruses in children <5 years
- Characterize clinical and epidemiologic factors of children with medically-attended acute respiratory infections
- Assess influenza vaccine effectiveness among hospitalized children aged <18 years
**PREVAIL**

<table>
<thead>
<tr>
<th>Years/Site</th>
<th>2016-2018/Cincinnati</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Design/Size</strong></td>
<td>Longitudinal cohort of 240 mother-infant pairs</td>
</tr>
<tr>
<td><strong>Population/Age</strong></td>
<td>Maternal enrollment in late pregnancy and infant follow-up to 2 years of age</td>
</tr>
</tbody>
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**Eligibility**

- Pregnant woman ≥34 weeks GA
- Mother ≥18 years of age
- Singleton birth
- No plans to move outside Cincinnati area within 2 years

**Exclusions**

- Fetal/infant death before maternal discharge
- Major congenital anomalies
- Mother delivers before baseline maternal blood draw
# RSV Surveillance in Adult Populations in the US

<table>
<thead>
<tr>
<th>Platform (Years)</th>
<th>Population (catchment) and setting</th>
<th>Design</th>
<th>Enrollment</th>
<th>Specimen and laboratory techniques</th>
</tr>
</thead>
<tbody>
<tr>
<td>HAIVEN (2016-2018)</td>
<td>≥18 years at 4 sites (4.3 million)</td>
<td>Prospective, Population-based, Active case finding</td>
<td>Broad ARI symptoms and diagnoses</td>
<td>Flocked mid-turbinate and OP, Molecular testing</td>
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<tr>
<td></td>
<td>Inpatients</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Emerging Infections Program (2014-2018)</td>
<td>≥18 years at 7 sites (13.2 million)</td>
<td>Population-based, Laboratory-based</td>
<td>Clinician-directed testing</td>
<td>Discretion of clinician and laboratory</td>
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<td></td>
<td>Inpatients</td>
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<tr>
<td>Veterans Affairs (2016-2018)</td>
<td>≥18 years at 1-2 sites</td>
<td>Prospective, Population-based, Active case finding, All respiratory viruses</td>
<td>Broad ARI symptoms and diagnoses, Controls</td>
<td>Flocked mid-turbinate and OP, Molecular testing</td>
</tr>
<tr>
<td></td>
<td>Inpatients</td>
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</tbody>
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**Abbreviations:**
- HAIVEN = Hospitalized Adult Influenza Vaccine Effectiveness Network
- ARI = Acute respiratory infection
HAIVEN RSV Surveillance: Objectives

- Estimate population-based, age-specific incidence of RSV-associated hospitalizations among adults ≥18 years

- Describe the clinical and epidemiologic characteristics of adults hospitalized with RSV

- Describe the outcomes of adults hospitalized with RSV
FluSurv-NET: Objectives

- Estimate **age-specific RSV hospitalization rates** among adults

- Describe **characteristics of adults ≥ 18 years** hospitalized with laboratory-confirmed RSV.

- Estimate proportion of **severe RSV-associated outcomes**

- Assess **risk factors for RSV-associated complications** among hospitalized adults ≥ 18 years.
VA Surveillance: Objectives

- Determine the population-based, inpatient burden of respiratory viruses as causes of ARI among adults in the VA population, particularly respiratory syncytial virus (RSV).

- Characterize the clinical and epidemiologic factors of adults with ARI that require hospitalization.
### RSV Surveillance in Special Populations in the United States

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<thead>
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<th>Enrollment</th>
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</tr>
</thead>
<tbody>
<tr>
<td>Alaska Natives (2016-2018)</td>
<td>≥18 years from the YK Delta</td>
<td>Prospective</td>
<td>Broad symptoms and diagnoses</td>
<td>Flocked nasopharyngeal swab</td>
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<tr>
<td></td>
<td>Inpatients</td>
<td>Population-based</td>
<td></td>
<td>Molecular testing</td>
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<tr>
<td></td>
<td></td>
<td>Active case finding</td>
<td></td>
<td></td>
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<tr>
<td>Chronic care facilities—children</td>
<td>≤21 years in 3 facilities</td>
<td>Prospective</td>
<td>Acute respiratory illness</td>
<td>Flocked mid-turbinate and OP</td>
</tr>
<tr>
<td>(2016-2017)</td>
<td>Residents and healthcare workers</td>
<td>Active case finding</td>
<td></td>
<td>Serum in subset</td>
</tr>
<tr>
<td></td>
<td></td>
<td>All respiratory viruses</td>
<td></td>
<td>Molecular testing</td>
</tr>
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Optimization of Current Strategies

• Evaluation of platform surveillance systems
• Opportunities to understand correlates of immunity within surveillance platforms
• RSV sequencing collaborations within surveillance platforms
• Lessons learned for development of post-vaccine (or immunoprophylaxis product) implementation regarding vaccine effectiveness
Acknowledgements: Collaborators

- **Hospitalized Adult Influenza Vaccine Effectiveness Network (HAIVEN)**
  - Baylor Scott & White, Temple, TX
  - University of Michigan, Ann Arbor, MI
  - University of Pittsburgh, Pittsburgh, PA
  - Vanderbilt University Medical Center, Nashville, TN

- **New Vaccine Surveillance Network (NVSN)**
  - Children’s Mercy Hospitals and Clinics, Kansas City, MS
  - Cincinnati Children’s Hospital Medical Center, Cincinnati, OH
  - Seattle Children’s Hospital, Seattle, WA
  - Texas Children’s Hospital, Houston, TX
  - University of Pittsburgh, Pittsburgh, PA
  - University of Rochester Medical Center, Rochester, NY
  - Vanderbilt University Medical Center, Nashville, TN

- **Active Surveillance for Viral Gastroenteritis and ARIs in US Veterans Affairs Patients**
  - Michael E. DeBackey VA Medical Center, Houston, TX
  - VA Greater Los Angeles Healthcare System. Los Angeles, CA

- **Influenza Hospitalization Surveillance Network (FluSurv-NET)**
  - California Emerging Infections Program (EIP)
  - Georgia EIP
  - Michigan Department of Health and Human Services
  - Minnesota EIP
  - New York EIP
  - Oregon EIP
  - Tennessee EIP

- **Study of Influenza and other Respiratory Viral Infections in Pediatric Care Centers**
  - Columbia University Medical Center, New York, NY

- **Active Surveillance for RSV in Hospitalized Alaska Native Adults from the YK Delta Region**
  - Arctic Investigations Program-CDC, Anchorage, AK
  - Yukon Kuskokwim Health Corporation, Bethel, AK
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**Prevail:**
- Daniel Payne