Chronic Conditions as Risk Factors for RSV-Associated Hospitalization

Advisory Committee on Immunization Practices Meeting

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Information is needed about which chronic conditions increase the risk of hospitalization for RSV infection.
Research Questions

Which chronic medical conditions are associated with higher rates of RSV-associated hospitalization among community-dwelling adults aged ≥50 years?

What are the rate ratios comparing RSV hospitalization rates among community-dwelling adults aged ≥50 years with and without chronic medical conditions?

How do the rates and rate ratios comparing RSV hospitalization rates among community-dwelling adults aged ≥50 years with and without chronic medical conditions vary by age group?
Methods
We leveraged multiple data sources to calculate RSV-associated hospitalization rates during the 2017-2018 RSV season by chronic condition and age group.

**Numerator**
- RSV-Associated Hospitalization Surveillance Network (RSV-NET)

**Denominator**
- Behavioral Risk Factor Surveillance System (BRFSS)
- Census population counts

RSV-Associated Hospitalization Surveillance Network (RSV-NET)

- RESP-NET: a population-based hospitalization surveillance platform
- Active, population-based surveillance of laboratory-confirmed RSV-associated hospitalizations
  - >300 acute-care hospitals, 58 counties in 12 states
  - ~8.6% of U.S. population
- Tests positive for RSV within 14 days prior to or during hospitalization
  - Clinician-driven testing

RSV-NET surveillance areas with percentage of state population represented by participating RSV-NET counties
Behavioral Risk Factor Surveillance System (BRFSS) Overview

• Annual telephone-based survey in the US, DC, and select territories
• Self-reported history of select chronic conditions
• Representative of the state population
• Eligible participants:
  • Civilian, community-dwelling residents
  • Aged ≥18 years
We evaluated 9 chronic medical conditions as potential risk factors for RSV-associated hospitalization.

- Asthma
- Chronic kidney disease (CKD)
- Chronic obstructive pulmonary disease (COPD)
- Coronary artery disease (CAD)
- Current smoking
- Diabetes mellitus
- Obesity (body mass index 30-39 kg/m$^2$)
- Severe obesity (body mass index ≥40 kg/m$^2$)
- Stroke
We calculated RSV-associated hospitalization rates using the following methods.

- Obtained **counts of RSV-associated hospitalizations** among community-dwelling adults aged ≥50 years with and without chronic medical conditions during the 2017-2018 surveillance season (RSV-NET).

- Obtained estimated **counts of community-dwelling adults** aged ≥50 years with and without chronic medical conditions in 2018 for the 38-county RSV-NET catchment area.

- Calculated **RSV-associated hospitalization rates** (per 100,000 population) among adults with and without chronic medical conditions stratified by age group (50-64, 65-74, ≥75 years).

- Applied **burden multipliers** to the rates to account for frequency of RSV testing among adults hospitalized with respiratory illness and sensitivity of diagnostic tests.
We calculated RSV-associated hospitalization rate ratios using the following methods.

Divided the RSV-associated hospitalization rates in adults with vs. without chronic medical conditions (ages 50-64, 65-74, ≥75 years)

Used Monte Carlo simulation and generalized Poisson models to estimate rate ratios adjusted for sex and race or ethnicity group and 95% Monte Carlo (confidence) intervals
Preliminary Results
RSV-associated hospitalization rates among community-dwelling adults aged 50-64 years with and without chronic medical conditions, 2017-2018 surveillance season

**Adjusted rate ratio:**

7.9
(4.7–13.8)

<table>
<thead>
<tr>
<th>Condition</th>
<th>RSV-associated hospitalization rate (per 100,000)</th>
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</thead>
<tbody>
<tr>
<td>All</td>
<td>7.9 (4.7–13.8)</td>
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<tr>
<td>Chronic Kidney Disease</td>
<td>5.8 (3.7–9.3)</td>
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<tr>
<td>COPD</td>
<td>4.2 (2.5–7.1)</td>
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<tr>
<td>≥40 Body Mass Index (kg/m²)</td>
<td>1.5 (1.0–2.3)</td>
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<td>30-39 Body Mass Index (kg/m²)</td>
<td>3.7 (2.4–5.7)</td>
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<td>&lt;30 Body Mass Index (kg/m²)</td>
<td>3.3 (2.1–5.1)</td>
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<td>Coronary Artery Disease</td>
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COPD: Chronic Obstructive Pulmonary Disease. Data are preliminary and unpublished. Rates of laboratory-confirmed RSV-associated hospitalization account for under-detection of RSV infection among hospitalized adults and sensitivity of diagnostic tests, rates exclude residents of nursing homes and long-term care facilities and are not adjusted for sex or race/ethnicity group. Adjusted rate ratios are derived from generalized Poisson models using Monte Carlo simulation methods and adjust for sex and race and ethnicity group.
RSV-associated hospitalization rates among community-dwelling adults aged 50-64 years with and without chronic medical conditions, 2017-2018 surveillance season

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RSV-associated hospitalization rates among community-dwelling adults aged 65-74 years with and without chronic medical conditions, 2017-2018 surveillance season

**Adjusted rate ratio:**

- **COPD:** 6.1 (3.7–10.7)
- **Asthma:** 4.5 (2.3–8.8)
- **Current smoker:** 4.2 (2.7–6.7)
- **Coronary Artery Disease:** 3.3 (2.0–5.9)
- **Diabetes:** 2.3 (1.4–3.8)
- **Stroke:** 2.2 (1.5–3.3)
- **All:** 1.6 (0.8–3.0)

**RSV-Associated Hospitalization Rate (per 100,000)**

- **All:** 6.1 (3.7–10.7)
- **Chronic Kidney Disease:** 4.5 (2.3–8.8)
- **Body Mass Index (kg/m²):**
  - ≥40
  - 30-39
  - <30
- **COPD:** 4.2 (2.7–6.7)
- **Asthma:** 3.3 (2.0–5.9)
- **Current smoker:** 2.3 (1.4–3.8)
- **Coronary Artery Disease:** 2.5 (1.6–4.2)
- **Diabetes:** 2.2 (1.5–3.3)
- **Stroke:** 1.6 (0.8–3.0)

**COPD:** Chronic Obstructive Pulmonary Disease. Data are preliminary and unpublished. Rates of laboratory-confirmed RSV-associated hospitalization account for under-detection of RSV infection among hospitalized adults and sensitivity of diagnostic tests; rates exclude residents of nursing homes and long-term care facilities and are not adjusted for sex or race/ethnicity group. Adjusted rate ratios are derived from generalized Poisson models using Monte Carlo simulation methods and adjust for sex and race and ethnicity group.
Adults Aged 65-74 Years

RSV-associated hospitalization rates among community-dwelling adults aged 65-74 years with and without chronic medical conditions, 2017-2018 surveillance season

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Adults Aged ≥75 Years

RSV-associated hospitalization rates among community-dwelling adults aged ≥75 years with and without chronic medical conditions, 2017-2018 surveillance season

Adjusted rate ratio:

6.1

(3.6–12.6)

RSV-associated hospitalization rates among community-dwelling adults aged ≥75 years with and without chronic medical conditions, 2017-2018 surveillance season

<table>
<thead>
<tr>
<th>Condition</th>
<th>All (per 100,000)</th>
<th>Chronic Kidney Disease (per 100,000)</th>
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<th>30-39 (per 100,000)</th>
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RSV-Associated Hospitalization Rates by Chronic Condition and Age Group

RSV-associated hospitalization rates among community-dwelling adults aged ≥50 years with chronic medical conditions, 2017-2018 season

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Adjusted Rate Ratios for RSV-Associated Hospitalization by Chronic Condition among Adults Aged ≥50 Years

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RSV-Associated Hospitalization Rates by Combinations of Chronic Conditions
RSV-associated hospitalization rates* among community-dwelling adults aged ≥50 years by number of chronic conditions and age group, 2017-2018 season

Adjusted rate ratio:

- 50-64 years: 2.9 (1.7–5.1)
- 65-74 years: 12.4 (7.8–20.2)
- ≥75 years: 10.6 (6.3–18.6)

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RSV-associated hospitalization rates* among community-dwelling adults aged ≥50 years by chronic kidney disease (CKD), coronary artery disease (CAD), and age group, 2017-2018 season

Adjusted rate ratio:

- 50-64 years:
  - CKD & CAD: 3.1 (1.6–5.5)
  - CKD Alone: 7.3 (3.8–13.9)
  - CAD Alone: 15.7 (6.8–37.7)
- 65-74 years:
  - CKD & CAD: 5.7 (3.0–11.2)
  - CKD Alone: 2.1 (1.1–4.0)
  - CAD Alone: 10.5 (4.8–23.3)
- ≥75 years:
  - CKD & CAD: 7.9 (3.5–17.6)
  - CKD Alone: 6.3 (3.4–13.4)
  - CAD Alone: 1.7 (0.9–3.2)

* Data are preliminary and unpublished. Rates of laboratory-confirmed RSV-associated hospitalization account for under-detection of RSV infection among hospitalized adults and sensitivity of diagnostic tests; rates exclude residents of nursing homes and long-term care facilities and are not adjusted for sex or race/ethnicity group. Adjusted rate ratios are derived from generalized Poisson models using Monte Carlo simulation methods and adjust for sex and race and ethnicity group.
RSV-associated hospitalization rates* among community-dwelling adults aged ≥50 years by chronic kidney disease (CKD), diabetes, and age group, 2017-2018 season

Adjusted rate ratio:

- **50-64 years**
  - CKD & Diabetes: 12.8 (6.1–27.7)
  - CKD Alone: 2.3 (1.3–3.8)
  - Diabetes Alone: 7.3 (3.4–16.4)
  - Neither Condition

- **65-74 years**
  - CKD & Diabetes: 6.0 (2.6–13.7)
  - CKD Alone: 1.7 (1.0–3.0)
  - Diabetes Alone: 7.4 (4.0–14.9)

- **≥75 years**
  - CKD & Diabetes: 9.0 (4.6–18.7)
  - CKD Alone: 5.8 (2.7–13.1)
  - Diabetes Alone: 1.4 (0.8–2.7)
  - Neither Condition

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Limitations

- Denominator data were created based on self-reported history of chronic conditions from BRFSS
  - ~49.9% response rate in 2018
  - Subject to recall & social desirability biases

- BRFSS might underestimate true prevalence of select chronic medical conditions, which would drive the rates and rate ratios upwards

- Could not assess all chronic medical conditions or potential risk factors of interest
  - Heart failure
  - End-stage renal disease
  - Immunocompromise

- Results do not necessarily generalize to non-community-dwelling adults (e.g., residents of nursing homes, long-term care facilities, shelters, treatment facilities, or correctional institutions)
Select chronic medical conditions were associated with higher rates of RSV-associated hospitalization among community-dwelling adults, which varied by condition and age group.
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