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Respiratory Syncytial Virus (RSV) in Adults

Disease Education

Respiratory syncytial virus (RSV):

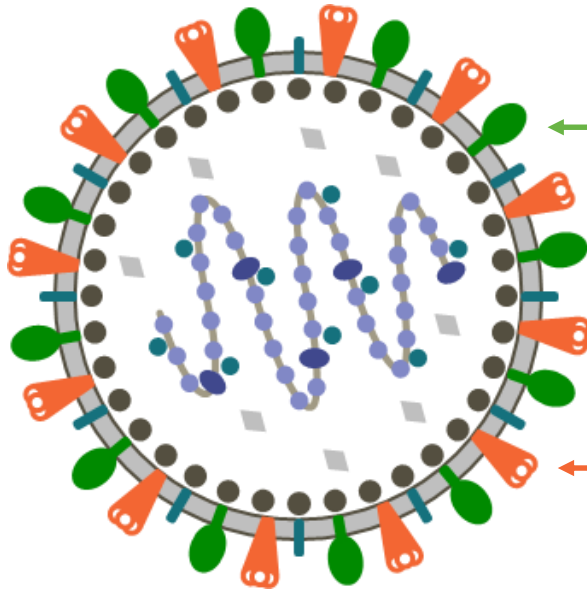
A Respiratory Seasonal Virus



Respiratory Syncytial Virus (RSV)

RSV is an enveloped RNA virus¹

Initial stages of infection are facilitated by two surface glycoproteins²



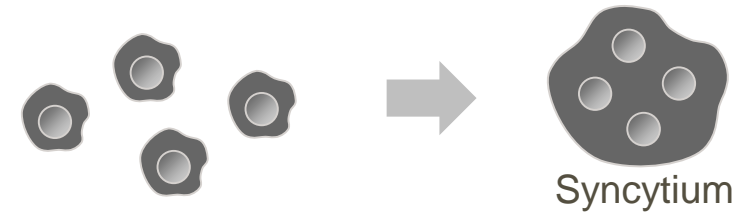
Single-strand RNA virus in the *Pneumoviridae* family¹

F: surface fusion protein

- Essential for viral entry^{2,3}
- Mediates fusion between viral envelope and airway epithelial cells⁴
- Highly conserved between RSV-A and RSV-B⁶

F protein

mediates fusion of infected cells with other cells, forming large multinucleated cells called **syncytia**⁴



G: attachment glycoprotein

- Heavily glycosylated²
- Targets ciliated cells of airways²
- Variable between RSV-A and RSV-B⁶

There are two antigenic subgroups of RSV:

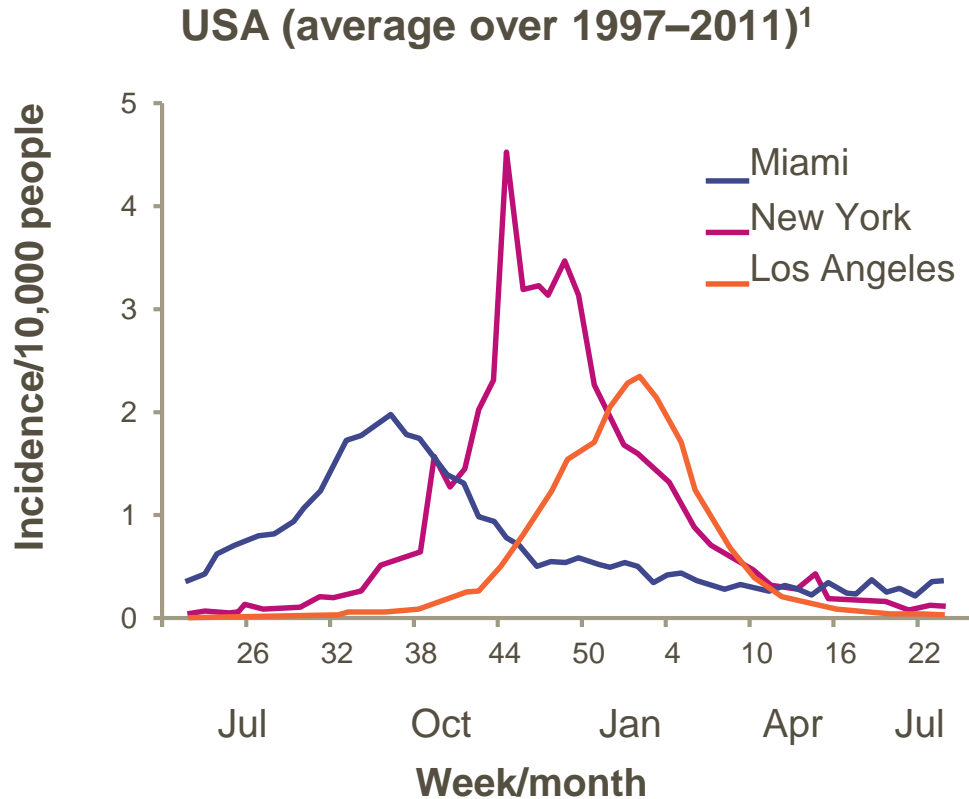


Variations in **G protein** account for many of the antigenic differences between these subgroups^{2,3,5}

1. Rima B, et al. *J Gen Virol.* 2017;98(12):2912-2913. <https://doi.org/10.1099/jgv.0.000959>. 2. McLellan JS, et al. *Curr Top Microbiol Immunol.* 2013;372:83-104. https://doi.org/10.1007/978-3-642-38919-1_4. 3. Graham BS, et al. *Curr Opin Immunol.* 2015;35:30-38. <https://doi.org/10.1016/j.coi.2015.04.005>. 4. Tian J, et al. *J Gen Virol.* 2013;94:1691-1700. <https://doi.org/10.1099/vir.0.049254-0>. 5. Battles MB, et al. *Nat Rev Microbiol.* 2019;17:233-245. <https://doi.org/10.1038/s41579-019-0149-x>. 6. Mejias A, et al. *Ann Allergy Asthma Immunol.* 2020;125:363-346. <https://doi.org/10.1016/j.anai.2020.06.040>.

RSV Seasonality

RSV seasons vary by region, peaking during winter in temperate climates



Globally, seasonal RSV epidemics within most regions remain relatively consistent with some year-to-year variation²

In the US, RSV season onset, duration, and peak incidence varies¹

More recently, non-pharmaceutical interventions to control COVID-19 have temporarily limited the spread of RSV and may lead to large future outbreaks³

Graph above was reproduced from Baker RE et al. *Nat Commun* 2019, under a Creative Commons Attribution License (<https://creativecommons.org/licenses/by/4.0/>).

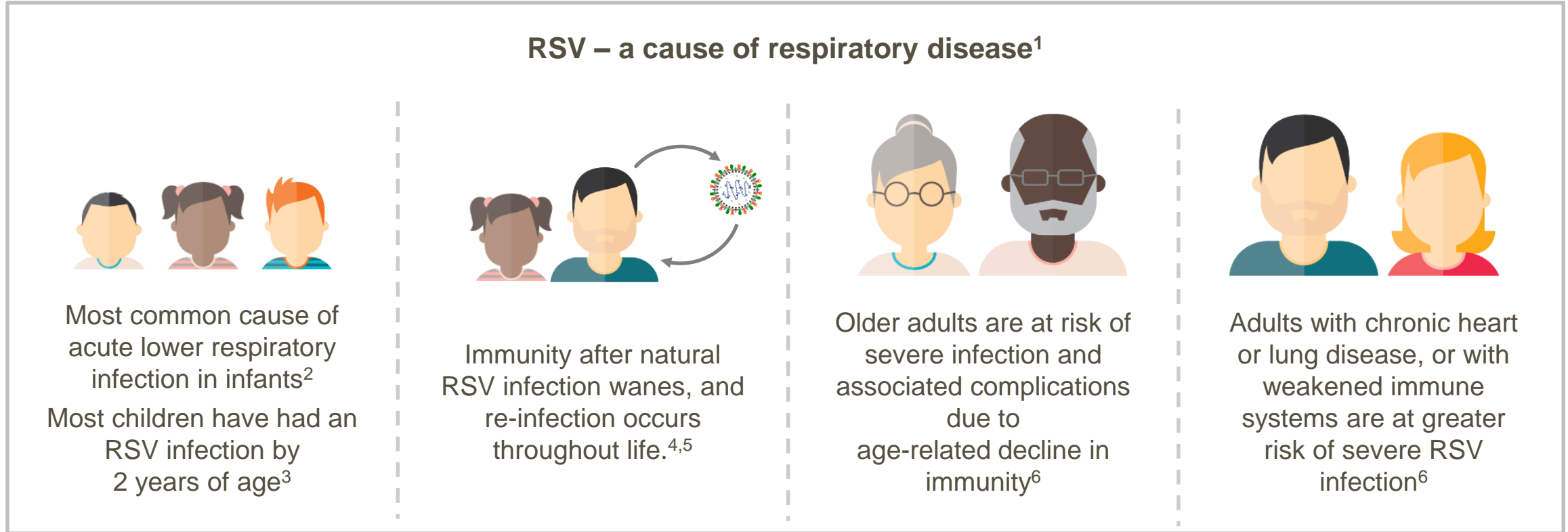
1. Baker RE, et al. *Nat Commun*. 2019;10:5512. <https://doi.org/10.1038/s41467-019-13562-y>. 2. Obando-Pacheco P, et al. *J Infect Dis*. 2018;217:1356–1364. <https://doi.org/10.1093/infdis/jiy056>. 3. Baker RE, et al. *Proc Natl Acad Sci USA*. 2020;117:30547–30553. <https://doi.org/10.1073/pnas.2013182117>.

RSV-associated Disease



RSV Infection: An Illness of All Ages

A cause of disease in infants, young children, older adults, and adults with underlying conditions

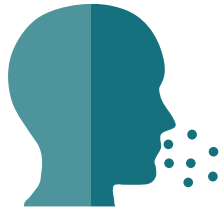


1. Walsh EE. Clin Chest Med. 2017;38:29–36. <https://doi.org/10.1016/j.ccm.2016.11.010>. 2. Nair H, et al. Lancet. 2010;375:1545–1555. [https://doi.org/10.1016/s0140-6736\(10\)60206-1](https://doi.org/10.1016/s0140-6736(10)60206-1). 3 Centers for Disease Control and Prevention. RSV in Infants and Young Children | CDC. Accessed September 2022. 4. Graham BS. Immunol Rev. 2011;239:149–166. <https://doi.org/10.1111/j.1600-065x.2010.00972.x>. 5. Anderson LJ, et al. Vaccine. 2013;31S:B209–B215. <https://doi.org/10.1016/j.vaccine.2012.11.106>. 6. Centers for Disease Control and Prevention. RSV in Older Adults and Adults with Chronic Medical Conditions | CDC. Accessed September 2022.

Transmission of RSV

RSV is a contagious virus¹ with multiple routes of transmission

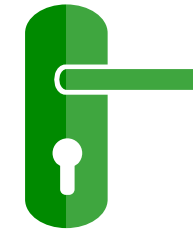
Three main routes of transmission:¹



Coughing or sneezing spreads virus-filled droplets, which then come into contact with other people's nose, mouth or eyes



Direct contact with nasal or oral secretions from infected people.



Indirect contact with nasal or oral secretions from infected people: RSV can survive on hard surfaces for many hours

People Infected with RSV are usually contagious for 3 to 8 days¹
Within families, RSV has been shown to spread rapidly,²
with older siblings or parents the most likely source of infant RSV infections^{2,3}

Signs and Symptoms of RSV Infection in Older Adults

Symptoms are similar to those of other respiratory infections



Frequency of clinical manifestations of respiratory viral infections in older adults, by virus¹

	URTI symptoms			LRTI symptoms				Systemic symptoms				
	Congestion	Sore throat	Hoarseness	Coughing	Wheezing	Dyspnea	Sputum	Chest pain	Fever	Myalgia	Fatigue	Headache
RSV	+++	++	+++	+++	+++	+++	++++	+	++	++	++	+++
Influenza ¹	+++	++	+++	++	++++	+++	++++	++	+++	++	+++	++++
Seasonal coronavirus ¹	+++		++		++	+++	+++		++	++	++	++
Human metapneumovirus ¹	++	++	+++	++	+++	++++	++++	++	++	++	++	++

Frequency: + 0–25% ++ 26–50% +++ 51–75% ++++ 76–100% □ Insufficient data/not reported

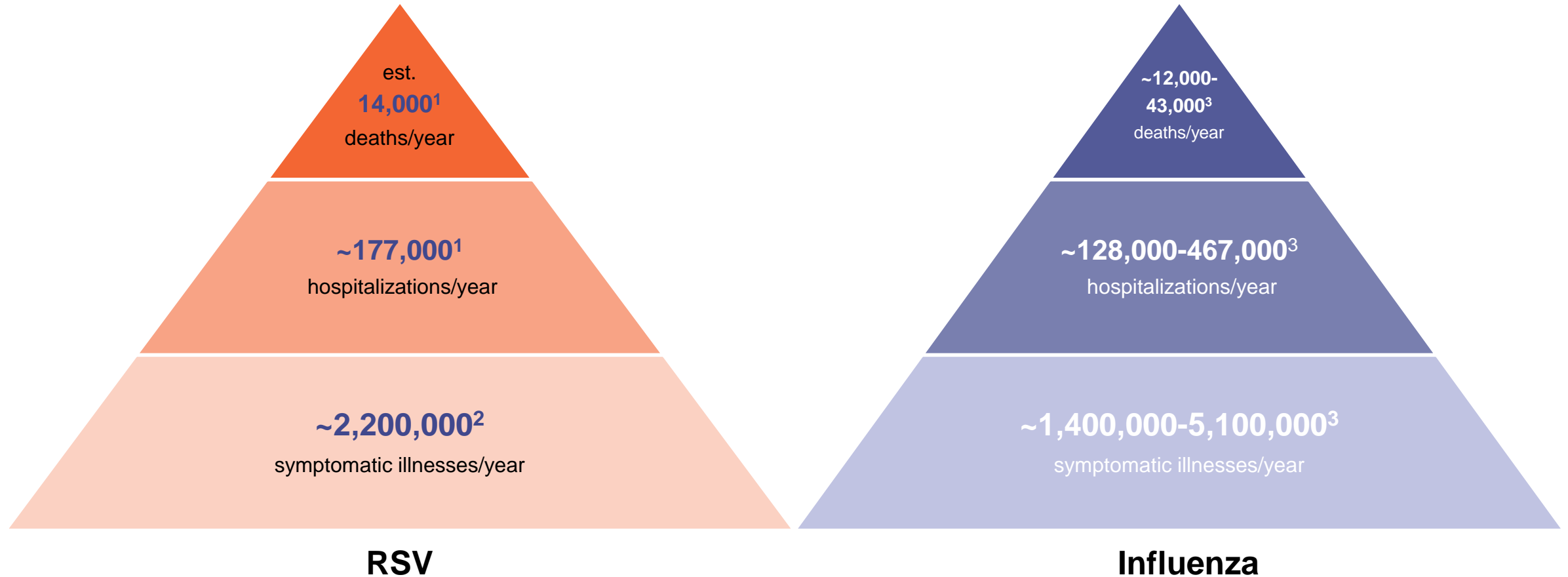
These results were published by Kodama F *et al.* 2017.¹ The table was independently created for GSK from the original data.

LRTI = Lower respiratory tract infection; URTI = Upper respiratory tract infection.

1. Kodama F, et al. *Infect Dis Clin North Am.* 2017;31:767–790. <https://doi.org/10.1016/j.idc.2017.07.006>.



RSV and Influenza Burden of Disease Among Adults ≥ 65 Years of Age in the US



est. = estimated.

1. Falsey AR, et al. *N Engl J Med*. 2005;352:1749–1759. <https://doi.org/10.1056/nejmoa043951>. 2. Centers for Disease Control and Prevention. <https://www.cdc.gov/vaccines/acip/meetings/downloads/slides-2022-06-22-23/04-RSV-Havers-508.pdf>. Accessed September 2022. 3. Centers for Disease Control and Prevention. [Past Seasons Estimated Influenza Disease Burden | CDC](#). Accessed September 2022.



Epidemiology and Burden of RSV



Annual burden of RSV in the US

RSV burden in infants, young children and in older adults

RSV is a major cause of hospitalization and mortality in older **adults**

In older adults, ≥ 65 years:

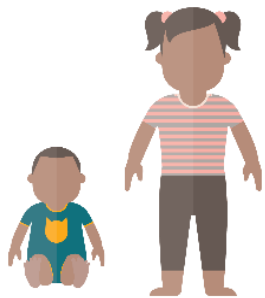
~177,000 hospitalizations

Outpatient and ED visits in adults are underestimated due to lack of surveillance and underreporting

an estimated **14,000** deaths



RSV is a major cause of hospitalization in **infants**¹



In children aged < 5 years:

~58,000 hospitalizations,

~1.5 million outpatient visits

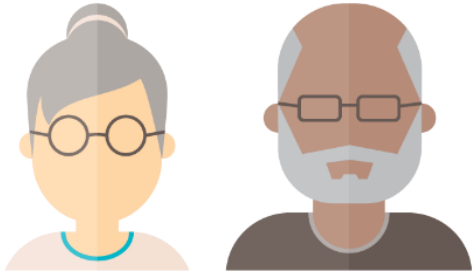
~520,000 ED visits

~100-500 deaths

Risk Factors for RSV in Adults

Older adults and adults with underlying conditions are at increased risk of RSV

Risk factors for severe RSV infection



Older age¹⁻³

Especially for those
aged ≥ 65 years



Comorbidities¹

Adults at **highest risk**
include those with
chronic heart or lung disease



Weak immune status¹

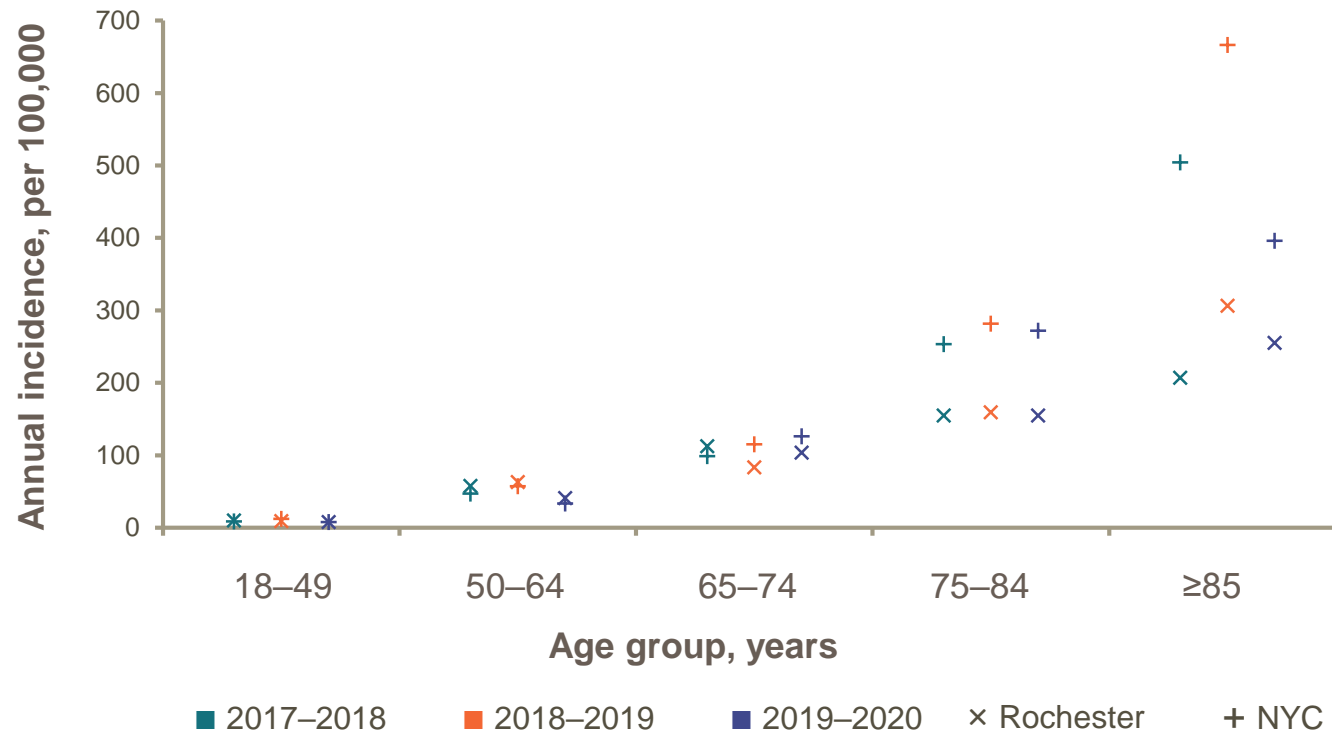
Adults with **weakened immune systems** are particularly vulnerable

1. Centers for Disease Control and Prevention. [RSV in Older Adults and Adults with Chronic Medical Conditions](#) | CDC. Accessed September 2022. 2. Branche AR et al. *Clin Infect Dis*. 2022 Mar 23;74(6):1004-1011. <https://doi.org/10.1093/cid/ciab595>. 3. Belongia EA, et al. *Open Forum Infect Dis*. 2018;27;5:ofy316. <https://doi.org/10.1093/ofid/ofy316>.

Incidence of Respiratory Syncytial Virus Infection among Hospitalized Adults

A large prospective study in two regions of New York State, 2017–2020 (N = 1099 cases)

Incidence of RSV-associated hospitalization by age group and season



Hospitalization rates for RSV were higher in older adults with underlying conditions

Comorbidity	Incidence rate ratio ^a	
	Rochester	NYC
COPD		
50-64y	6.35	6.3
≥ 65y	13.41	3.51
Asthma		
50-64y	2.34	3.6
≥ 65y	2.52 ^b	2.27
Diabetes		
50-64y	3.36	3.58
≥ 65y	6.44	2.35
CAD		
50-64y	3.74	4.41
≥ 65y	6.46	3.75
CHF		
60-79y	7.63	5.86
≥ 80y	3.99	5.4

CAD = coronary artery disease; CHF = congestive heart failure; COPD = chronic obstructive pulmonary disease; NYC = New York City.

^a Ratio of rate among people with each comorbidity vs those without it, in the surveillance area population. ^b The incidence rate ratio was not statistically significant.

Branche AR et al. Clin Infect Dis. 2022 Mar 23;74(6):1004-1011. <https://doi.org/10.1093/cid/ciab595>.



Disease management



Diagnosis of RSV

Testing for RSV is Key for Diagnosis

Different laboratory tests are available to confirm RSV infection:^{1,2}



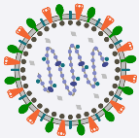
Antigen detection by ELISA or immunofluorescence

- Most reliable in young children in whom these tests have sensitivity of around 80–90%
- Less useful in older children and adults due to low viral loads



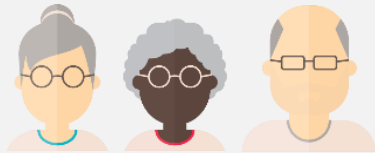
RNA detection by rRT-PCR

- Excellent sensitivity and specificity
- Useful for older children and adults with lower viral loads in respiratory secretions



Culture isolation

- Time consuming (3–5 days) and requires skilled personnel
- Generally reliable in young children
- Less useful in older children and adults (due to lower viral loads)

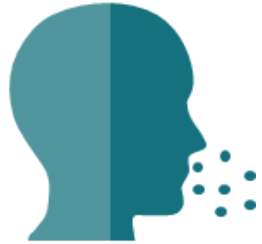


- Diagnosis in primary care is usually based on symptoms and local epidemiology³
- RSV is **under-diagnosed and under-reported in adults**, in part because:
 - Symptoms of RSV may be indistinguishable from those of other respiratory infections¹
 - Laboratory diagnosis of viral respiratory infections in older adults is not routine practice⁴

ELISA = enzyme-linked immunosorbent assay; PCR = Polymerase chain reaction; rRT-PCR = real-time reverse transcriptase-PCR.

1. Henrickson KJ, et al. *Pediatr Infect Dis J.* 2007;26:S36–S40. <https://doi.org/10.1097/inf.0b013e318157da6f>. 2. Centers for Disease Control and Prevention. [For Healthcare Professionals: RSV \(Respiratory Syncytial Virus\) | CDC](#). Accessed September 2022; 3. Mayo Clinic. [Diagnosis and treatment - Mayo Clinic](#). Accessed September 2022; 4. Kodama F, et al. *Infect Dis Clin North Am.* 2017;31:767–790. <https://doi.org/10.1016/j.idc.2017.07.006>.

Prevention Measures



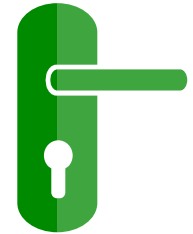
Cover your coughs and sneezes with a tissue or your upper shirt sleeve, not your hands



Wash your hands often with soap and water for at least 20 seconds



Avoid close contact with individuals infected with RSV



Clean frequently touched surfaces such as doorknobs and mobile devices

Prevention measures can help reduce the risk of RSV transmission

Summary



Summary

RSV is a common cause of acute respiratory illness which affects all ages.¹



In infants and young children, RSV is the most common cause of bronchiolitis.² Most children have had an RSV infection by 2 years of age.²



Immunity after natural infection wanes, and re-infection occurs throughout life^{3,4}



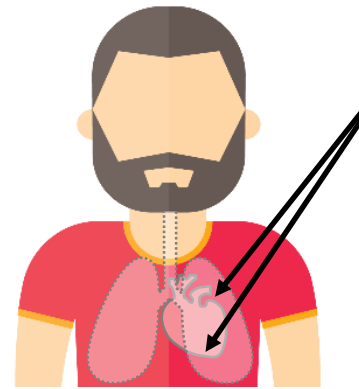
Among adults, older adults and adults with certain chronic medical conditions or weakened immune systems are at highest risk for severe RSV infection⁵



RSV symptoms are similar to those of other respiratory infections⁸

Differential diagnosis requires laboratory confirmation⁹

In adults, RSV infection typically results in mild, cold-like symptoms; however, it may lead to:⁵



Severe complications such as pneumonia, exacerbation of underlying asthma, COPD or congestive heart failure⁵

Hospitalization and death, particularly in older adults⁵

RSV infection in older adults may lead to serious complications and is associated with substantial clinical and economic burden⁵⁻⁷

COPD = chronic obstructive pulmonary disease; LRTI = lower respiratory tract infection; RSV = respiratory syncytial virus.

1. Walsh EE. *Clin Chest Med* 2017;38:29–36 2. Nair H *et al. Lancet* 2010;375:1545–1555; 3. Graham BS. *Immunol Rev* 2011;239:149–166; 4. Anderson LJ *et al. Vaccine* 2013;31S:B209–B215; 5. CDC. 2020. RSV in older adults and adults with chronic medical conditions. <https://www.cdc.gov/rsv/high-risk/older-adults.html>; 6. Amand C *et al. BMC Health Serv Res* 2018;18:294; 7. Falsey AR *et al. N Engl J Med* 2005;352:1749–1759; 8. Kodama F *et al. Infect Dis Clin North Am* 2017;31:767-790. 9. Centers for Disease Control and Prevention. For Healthcare Professionals: RSV (Respiratory Syncytial Virus) | CDC. Accessed September 2022.



“Respiratory Syncytial Virus (RSV) – Disease Education”
September 2022