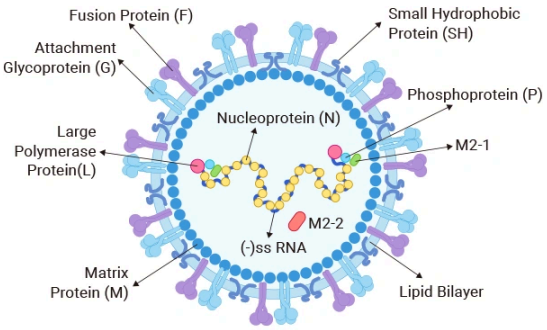
Respiratory Syncytial Virus (RSV)

Overview

RSV is the leading cause of severe respiratory infections in infants worldwide, causing 3.6 million hospitalizations and ~100,000 deaths annually in children under 5. Reinfection is common throughout life due to lack of long-term immunity.

Viral Classification

- **Scientific Name:** Human orthopneumovirus (Family: Pneumoviridae)
- **Genome:** Negative-sense, single-stranded RNA (~15.2 kb)
- **Subtypes:** RSV-A (more severe) and RSV-B
- **Structure:** Enveloped virus with three key surface proteins:
    - **G protein** – attachment to host cells
    - **F protein** – fusion and syncytia formation
    - **SH protein** – small hydrophobic protein
- **Hallmark Feature:** Forms syncytia (multinucleated giant cells)



Transmission

- **Route:** Respiratory droplets, direct contact, contaminated surfaces (fomites)
- **Human-specific** – no animal vectors
- **Incubation:** 2-8 days
- **Contagious period:** Up to 3 weeks after symptoms resolve
- **R_0:** Each infected person infects 5-25 others
- **Seasonality:** Fall-winter peaks in temperate climates

Pathogenesis

1. G protein attaches to ciliated epithelial cells
2. F protein fuses viral envelope with host membrane
3. Infected cells form syncytia, allowing cell-to-cell spread
4. Strong inflammatory response causes tissue damage
5. Mucosal sloughing + mucus accumulation → airway obstruction

Key Point: RSV produces NO exotoxins. **Inflammation drives symptoms.**

High-Risk Populations

- **Infants <1 year:** Developing immunity, small airways
- **Adults 65+:** Declining immune function, comorbidities
- **Others:** Young children, immunocompromised individuals

Clinical Presentation

Children:

- Runny nose, fever, cough, wheezing
- Apnea (breathing pauses)
- Difficulty feeding
- Respiratory distress (flaring nostrils, rapid breathing)
- Cyanosis (blue lips/fingertips)**

Adults:

- Cold-like symptoms (congestion, runny nose, sore throat)
- Fever, headache, fatigue
- Severe cases: pneumonia

Diagnosis

- **rRT-PCR (NAAT):** Detects viral RNA (gold standard)
- **Antigen test:** Detects RSV proteins in nasal sample (results within 1 hour)
- **Additional:** Blood tests, chest X-ray, pulse oximetry for severe cases

Treatment & Prevention

Treatment (Supportive Care):

- Rest, hydration, OTC pain medication
- Severe cases: oxygen therapy, mucus suctioning, bronchodilators, antivirals

Prevention:

- **Vaccines:**
    - Arexvy (adults 60+, high-risk 50-59)
    - Abrysvo (maternal vaccine, 32-36 weeks gestation)
- **Monoclonal antibody:** Provides passive immunity

- **Hygiene:** Handwashing, covering coughs, disinfecting surfaces, avoiding sick contacts

Long-Term Effects

- **Children:** Increased asthma risk, recurrent respiratory infections, chronic wheezing
- **Adults:** Exacerbation of asthma, COPD, heart failure

Public Health Impact

- 100,000 pediatric deaths annually (97% in low/middle-income countries)
- 10,000 adult deaths (65+) annually
- RSV can remain dormant in dendritic cells, with viral RNA persisting in lung tissue