Respiratory Syncytial Virus (RSV)

Comprehensive Course for Healthcare Professionals

Financial Disclosures

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- No financial relationships to disclose

Course Objective

Learning Objectives

- Define respiratory syncytial virus.
- State the significance of the epidemiology of respiratory syncytial virus.
- Identify the common pathophysiology of respiratory syncytial virus
- Reaffirm the clinical presentation of respiratory syncytial virus.

Learning Objectives *(continued)*

- Explain the treatment options for the disease.
- Identify common complications associated with respiratory syncytial virus.
- Assess prevention measures for the virus.
- Apply evidence-based management strategies.

What Is RSV?

- Respiratory syncytial virus: a common respiratory virus in children under age 2
- Common worldwide respiratory infection with mild to severe presentation
- Affects children primarily, but also adults and elderly populations[1]
- Several differential diagnoses can accompany RSV
- Treatment revolves around supportive care with a recent FDA-approved preventative vaccine developed in 2023[2]

RSV Epidemiology in Children

- Nearly 90% of children become infected within first two years of life[1]
- Lacks long-term immunity; reinfection is common
- 80,000 hospitalizations annually in U.S. children under age 5
- 2.1 million outpatient clinic visits for children under age 5
- Nearly 300 children under age 5 die annually in the United States[3]

Worldwide RSV Impact

- 33 million children infected with lower respiratory tract infections due to RSV
- 3 million children hospitalized globally due to RSV
- Approximately 200,000 childhood deaths worldwide
- Higher mortality in countries with limited resources
- Tropical and equatorial locations have less virus presentation[1]

Worldwide RSV Impact

- Mortality rates substantially higher in developing countries due to limited resources
- Sub-Saharan Africa shows 15-40% RSV positivity in severe respiratory infections
- Healthcare costs can represent up to 30% of annual household income
- Climate change may alter RSV seasonality and transmission patterns [71;73;74;75]

RSV Seasonal Patterns

- Onset: September to November
- Peak season: December to February
- Off-season: April to May
- Varies with climate conditions
- COVID-19 pandemic disrupted typical patterns (2020-2021 had historically low numbers)[3]

RSV During COVID-19 Pandemic

- 2020-2021: Historically low RSV numbers due to nonpharmacological interventions
- No typical epidemic during this period
- 2022-2023: Numbers returned to pre-pandemic levels
- Earlier onset in June 2022 with peak in November
- Disruption resulted from reduced transmission[5]

Primary Risk Factors

- Age is largest risk factor; children have narrow airways and low respiratory reserve.
- Highest risk is at one month of age and decreases after 24 months.
- Male sex poses higher risk in some studies.
- Tobacco smoke exposure increases risk.
- Absence of breastfeeding increases risk (limited supporting data).[36]

High-Risk Patient Groups

- Premature infants
- Preexisting cardiac anomalies
- Pulmonary conditions
- Neurologic conditions
- Immunosuppressive disorders
- Children with older siblings (school exposure)[1]

Healthcare System Impact

- 500,000 emergency room visits annually
- Numbers growing since March 2021
- Adds to overwhelmed emergency departments
- Potential hospitalization, ICU admission, mechanical ventilation required
- Longer hospital stays increase caregiver burden and burnout[32,42,43]

Financial Impact

- Mean hospitalization costs (2020): $4,017 to $214,416
- Higher costs for younger children
- Outpatient RSV care: $1,567 to $1,648
- Total national annual costs: estimated $471.8 million
- Mechanical ventilation costs 10 times higher than for nonventilated patients[32,43]

Healthcare Access Considerations

- Medicaid patients are at higher risk for RSV-related hospitalizations.
- Medicaid pays average 32% less than commercial insurance.
- Low-income regions and developing countries have limited access.
- Overcrowding and poor living conditions increase risk.
- Poor hygienic practices contribute to transmission.[32,43]

Pathophysiology

- Discovered in 1956 studying captive chimpanzees (initially “Chimpanzee Coryza Agent”)
- Single-stranded RNA virus, Paramyxoviridae family, genus *Pneumovirus*
- 10 genes and 11 proteins encode the virus
- Incubation period: 2-8 days (average 4-6 days)
- Subtypes A and B identified (subtype A more severe)[1,6,7]

How RSV Infects the Body

- Virus plants in nasopharyngeal or conjunctival mucosa
- Rapidly spreads to respiratory tract
- Targets ciliated epithelial cells, particularly bronchiolar epithelium
- Binds to RSV-G glycoprotein using RSV-F fusion glycoprotein
- Triggers intracellular replication and immune response[1,7,12]

Immune System Response

- Cytokine and chemokine release triggered
- Viral cytotoxicity causes necrosis of respiratory cells
- Large mucous production leads to small airway obstruction
- Mucous, debris, and DNA cause plugging
- Results in alveolar obstruction and impaired mucous clearance[1,7,12]

Physiological Impact

- Airway edema and decreased lung compliance
- Wheezing and decreased oxygen saturations
- Increased respiratory effort
- Mixed hypotheses regarding disease severity and immune response
- Paradoxically reduced viral load in severe cases with increased IL-17a[36]

Symptoms

- Rhinorrhea (clear or purulent)
- Nasal congestion
- Cough and sneezing
- Low-grade fever (higher in severe cases)
- Myalgias may be present
- Symptoms develop slowly over 1-3 days[1,3,7-13]

Lower Respiratory Tract Involvement

- Occurs frequently in children under age 2
- Rhonchi, tachypnea, accessory muscle use
- Wheezing and prolonged expiration
- Retractions (intercostal or subcostal)
- Nasal flaring or tracheal tugging (ominous signs)
- Poor appetite and decreased feeding[1,7-11,13]

Severe RSV Manifestations

- Grunting respirations
- Hypoxia and lethargy
- Apnea episodes
- Acute respiratory failure
- Child may appear septic with weakness or dehydration
- Symptoms worsen 1-3 days after rhinorrhea onset

Diagnostic Approaches

- Clinical suspicion based on presentation and history
- Community RSV levels influence diagnosis
- Laboratory confirmation via nasopharyngeal swab
- PCR-based assay test (preferred method)
- Rapid antigen detection test (RADT): Results in <30 minutes
- Viral cultures not typically used (take days to weeks)[1,7,8,13]

Additional Diagnostic Notes

- PCR tests preferred over RADTs for accuracy
- RADT advantage: quick results and relatively inexpensive
- Clinical features and community levels guide diagnosis
- Chest x-rays not useful for RSV diagnosis
- Chest imaging used for pneumonia or co-infection concerns[1,7,13-15]

Differential Diagnoses

- Adenovirus and other respiratory viruses
- Asthma and bronchiolitis
- Croup and upper respiratory tract infections
- Human *Metapneumovirus* and *Parainfluenza* viruses
- Influenza and neonatal sepsis
- Pediatric bronchitis and pneumonia

COMPARISON OF INFLUENZA, COMMON COLD, COVID, AND RSV PRESENTATION				
Clinical Presentation	**Influenza**	**Common Cold**	**COVID-19**	**RSV**
Prodrome	None	One or more days	2 to 14 days	4 to 6 days
Onset	Sudden	Gradual	Gradual	Gradual
Fever	101 to 102°F	Rare in adults	100.4°F (38°C) or greater	Sometimes (low-grade)
Headache	May be severe	Rare	Common	Rare
Myalgia	Usual, often severe	Mild	Usual	Sometimes
Extreme exhaustion	Usual	Never	Possible	Possible
Tiredness/weakness	May last longer than two weeks	Mild	May develop into postviral conditions	Common
Sore throat	Common	Often	Sometimes	Common
Sneezing	Occasionally	Usual	Occasionally	Occasionally
Rhinitis	Occasionally	Usual	Occasionally	Usual
Cough	Usual, nonproductive	Mild hacking	Usual, nonproductive	Usual, nonproductive or productive
Loss of taste/smell	Rarely	Rarely	Often	Rarely
Wheezing	Rarely	Rarely	Sometimes	Often
Difficulty breathing	Rarely	Rarely	Often	Often
Source: Author				Table 1

Management

- Self-limiting illness
- Severe cases need more management
- Lack of support for pharmacological management
- Seeking provider recommendations 3 to 5 days[8]

Supportive Care – Airway Management

- Airway patency is first-line recommendation
- Saline nasal drops or sprays for thick mucous
- Nasal irrigation to assist airway clearance
- Bulb suctioning for nasal congestion relief
- Avoid saline in infants under 6 months (may cause irritation)
- Use distilled or sterile water to reduce infection risk[52,54,55]

Feeding and Hydration Support

- Monitor feeding patterns: More frequent, smaller quantities expected
- Assess wet diaper count for dehydration signs
- Note frequency of eating and drinking
- Honey for cough (avoid in children <12 months due to botulism risk)
- Evidence level B-1 supports honey use
  - Avoid rhoddoendron products (grayanotoxin risk)[1,4,7,8,10,13,15,47-51]

Environmental Interventions

- Room humidifiers and vaporizers for congestion relief
- Use cool mist humidifiers to prevent burn risk
- Regular cleaning of devices to prevent microbial growth
- Avoid benzocaine products in children <2 years (methemoglobinemia risk)
- Monitor oxygen saturations
- Humidified oxygen for saturations ≤90%[52,53,55,59]

Advanced Respiratory Support

- Noninvasive support with nasal CPAP if needed
- Endotracheal intubation for respiratory failure
- Early identification of mechanical ventilation needs reduces mortality
- Monitor for evolving respiratory failure
- Controlled setting management (emergency department/hospital)[1,7]

Pharmacological Management

- Antipyretics (ibuprofen or acetaminophen) for fever and discomfort
- Keep medication log to prevent dosing errors
- Anti-tussives and herbal supplements lack supportive data
- Echinacea, elderberry, vitamin C, zinc not recommended <24 months
- Antibiotics not first-line for RSV
  - May be needed for bacterial complications[1,4,7,8,10,13,15,56,57]

Medications with Limited Evidence

- Bronchodilators, corticosteroids not routinely indicated
- Hypertonic saline, racemic epinephrine, albuterol sometimes prescribed
- Systemic glucocorticoids may offer only negative side effects
- 3% hypertonic saline may improve mucociliary function
- Inconsistent data on effectiveness
- Many guidelines defer use of these medications[1,7,16,17,19,20,58]

Complications

- Most common
  - Bronchiolitis
  - Pneumonia[8,19]

Bronchiolitis as RSV Complication

- Most common RSV complication (80% of cases RSV-related)
- 125,000 hospitalizations and 250 infant deaths annually
- Peribronchiolar tissue microvascular permeability increases
- Submucosal edema and increased mucous secretions
- Classic triad: wheezing, atelectasis, bilateral hyperinflation
- Can last up to three weeks [8,20,36]

Bronchiolitis Treatment Approach

- Supportive care: RSV management
- Bronchodilators (albuterol) on trial basis only; discontinue if no improvement
- Adverse events: Tachycardia, tremor, hypokalemia, hyperglycemia
- Corticosteroids show no benefit and safety concerns during lung growth
- Emergency care needed for cyanosis, lethargy, or grunting
- Antibiotics only for suspected bacterial coinfection[1,7,8,21]

Pneumonia and Lower Respiratory Tract Infections

- RSV main cause of LRTI in young children
- Hospitalization required for serious cases in children <1 year
- Bacterial co-infection associated with higher ICU admission risk
- Empiric treatment: high-dose Augmentin or Unasyn for mild cases
- Vancomycin for severely ill patients
- Pressure support or mechanical ventilation may be required[1,22]

Longterm Respiratory Complications

- Children hospitalized with RSV have 3.2-fold increased asthma risk by age
- Risk highest with specific genetic polymorphisms in IL-4 receptor and CD14 genes
- Neurodevelopmental deficits observed at 3 years post-severe infection
- Regular pulmonary function assessments recommended for 5 years post-infection
- Structured developmental screening needed at 12, 24, and 36 months[81-85]

Basic Prevention Methods

- Hand washing and respiratory etiquette
- Cover mouth and nose when coughing/sneezing
- Frequent cleaning of high-contact surfaces
- Avoid close contact when sick (no kissing, sharing utensils)
- Avoid tobacco and smoke exposure
- Use proper PPE (gloves, gowns, masks, eye protection)[1,8,24,30,66,67]

Protecting Vulnerable Populations

- Avoid contact with premature infants when ill
- Protect infants <6 months and children <2 years with chronic conditions
- Special care for immunosuppressed children
- Virus survives 6 hours on hard surfaces, 90 minutes on gloves, 20 minutes on skin
- Viral shedding can occur for months post-infection
- Isolation/cohorting of RSV patients beneficial[8,24,30]

RSV Prevention Medications

- Beyfortus (nirsevimab-alip): FDA approved July 2023
- First preventative option for infant population
- For infants <8 months during first RSV season
- Ages 8-19 months if high-risk for second season[2,25,26,31,42,58]

Effective Caregiver Education for RSV Management

- Visual aids significantly improve caregiver recognition of warning symptoms
- Language-concordant education improves adherence by 37%
- Educational materials must be culturally appropriate and multilingual
- Video demonstrations superior to written materials alone[107-110]

Effective Caregiver Education for RSV Management

- Key education topics: nasal suctioning, distress recognition, antipyretic use, hydration
- Mobile health apps improve caregiver confidence and healthcare utilization
- Digital resources provide just-in-time guidance for symptom management[107-110]

RSV Prevention Medications

- Synagis (palivizumab): FDA approved 1998, more limited use
- Monthly dosing during RSV season (every 28-30 days)[23,27-31,42,58,70]

RSV Prevention Medications

- Enflonsia (clesrovimab): FDA approved June 2025
- Prevention of RSV lower respiratory tract disease in neonates and infants who are born during or entering their first RSV season[118-121]

Interdisciplinary Care Approaches

- Respiratory therapist-driven protocols reduce hospital stay by 1.6 days
- Dietitian involvement improves outcomes for infants with increased work of breathing
- Small, frequent feedings recommended for respiratory rates >60/min
- Structured transition programs reduce 30-day readmissions by 29%
- Telehealth follow-up within 48 hours provides post-discharge support
- Pre-discharge planning meetings between hospital and community providers essential
- Coordinated care across disciplines creates synergistic effects for improved outcomes[102-106]

Pediatric Case Studies

Case Study 1

- Emma, 14-month-old female
- 3 days worsening respiratory symptoms
- Clear rhinorrhea and mild cough
- Low grade fever (100.2°F)
- Increase work of breathing

Case Study 1 – Clinical Presentation

- Tired appearance with nasal congestion/clear discharge
- Tachypnea (RR 42) and oxygen saturation 92%
- Bilateral wheezing, rhonchi, prolonged expiration
- Intercostal retractions and accessory muscle use
- Decreased urine output in past 24 hours

Case Study 1 – Diagnosis and Management

- Nasopharyngeal PCR confirms RSV
- Supportive care implemented:
  - Nasal saline drops and bulb suctioning
  - Humidified oxygen therapy
  - Small, frequent feedings for hydration
  - Acetaminophen for fever/discomfort

Case Study 1 – Diagnosis and Management

- Hospitalization for respiratory distress and dehydration
- Parent education on RSV prevention

Case Study 1 – Clinical Course

- Symptoms peaked on day 5 of illness
- Required 3 days of hospitalization with oxygen support
- Gradual improvement with supportive care
- Discharged home with continued care instructions

Case Study 2 – Complex RSV with CHD

- 4-month-old male with unrepaired ventricular septal defect
- 2 days of rhinorrhea and progressive respiratory distress
- Poor feeding reported by parents
- Received nirsevimab at 2 weeks of age
- Breakthrough RSV infection confirmed by PCR

Case Study 2 – Complex RSV with CHD

- What is the initial emergency management plan?
  - **Option A:** Outpatient management with close follow-up
  - **Option B:** Admission for observation and supportive care
  - **Option C:** Direct PICU admission for intensive monitoring

Case Study 2 – Complex RSV with CHD

- Option C

Case Study 2 – Complex RSV with CHD

- Fluid Management:
  - Careful balance between respiratory and cardiac needs required
  - Restrictive fluid strategies (80% maintenance) improve outcomes^99^
  - Avoid fluid overload that could worsen cardiac function
  - Monitor for signs of congestive heart failure

Case Study 2 – Complex RSV with CHD

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Case Study 2 – Complex RSV with CHD

- Monitoring Requirements:
  - Continuous cardiorespiratory monitoring essential
  - Frequent assessment of cardiac status and perfusion
  - Early recognition of deterioration patterns
  - Proactive rather than reactive management approach

Adult RSV

Adult RSV

- RSV affects adults significantly, not just pediatric populations
  - Same preventative measures and supportive care principles apply
  - Treatment differences relate to adult comorbidities
  - 60,000-160,000 older adults hospitalized annually in United States
  - 6,000-10,000 deaths annually due to RSV complications
  - UK reports 8,482 deaths, 93% over age 65 [32,36]

Adult RSV Mortality and Risk

- Deaths increase after age 49 years
- Mortality: 1 per 100,000 (ages 18-49) versus 155 per 100,000 (over 75)
- Highest risk: Older adults, chronic heart/lung disease, immunocompromised
- Additional risks: Tobacco use, obesity, long-term care residents
- Nursing home patients: 38% mortality versus 3% community patients
- Coronary artery disease and diabetes do not increase severe illness risk[33,36]

Adult RSV Clinical Presentation

- Virology identical to pediatric patients
- Difficult to distinguish from other respiratory illnesses
- Typical symptoms: Nasal congestion, cough, wheezing, low-grade fever
- Wheezing without asthma history raises RSV suspicion
- Similar presentation to pediatric cases
- Clinical features overlap with common respiratory conditions[37]

Adult RSV Disease Associations

- 10% of lower respiratory tract infections
- 11% of COPD exacerbations
- 7% of asthma exacerbations
- 5% of congestive heart failure exacerbations
- Demonstrates significant impact on comorbid conditions
- Reinforces burden of viral infections with existing diseases[37]

Adult RSV Treatment – Supportive Care

- Evidence-based throat lozenges, sprays, and gargles for sore throat
- Methanol products beneficial but avoid nasal application
- Pseudoephedrine for congestion (monitor blood pressure)
- Combine pseudoephedrine with antihistamine for best relief
- Nasal products help drainage but may cause dryness/nosebleeds
- Intranasal decongestants (Afrin) limited to 3 days maximum[60-65]

Adult RSV Treatment – Medications and Hospitalization

- Phenylephrine not recommended
- Guaifenesin safe but limited efficacy
- Focus on managing worsening comorbidities (asthma, COPD, heart failure)
- Hospitalization for oxygen support, fluid management, dehydration
- Mechanical ventilation if condition warrants
- Treatment tailored to individual comorbidity profile [19,33-36]

Adult RSV Prevention and Diagnosis

- Standard prevention: hand washing, covering cough/sneeze
- Avoid close contact when ill, clean high-touch surfaces
- PCR testing same as children but performed less frequently
- Adults test positive less often due to lower viral titers
- Testing likely underestimates true adult RSV incidence
- Many providers diagnose based on exam, history, community levels[24,36,44,45,68]

Adult RSV Vaccines

- Two vaccines approved May 2023 for adults over 60
- Arexvy (GSK) and Abrysvo (Pfizer)
- Both recombinant stabilized perfusion F protein vaccines
- Single 0.5 ml injection dosing
- Clinical trials show coverage for at least two RSV seasons
- Shared decision-making with primary care provider recommended[37,38]

RSV Vaccines – Key Differences

CDC does not recommend one vaccine over the other

- Arexvy contains adjuvant for enhanced immune response
- Abrysvo approved for gestational use (August 2023)
  - Pregnant women 32-36 weeks can receive Abrysvo
    - Provides infant protection from birth to 6 months
    - Neither vaccine approved for children[38,39]

Adult RSV Vaccines – Recommendations and Safety

- ACIP recommends for patients over 75 years
- Ages 60-74 with increased risk of severe RSV disease
- Arexvy not approved for pregnant women
- Hypersensitivity reactions possible with either vaccine
- Risk-benefit discussion required during clinical decision-making[39,40,41]
- Vaccine information available at immunize.org/vis/pdf/rsv.pdf
  - Vaccine Information Statement: RSV (Respiratory Syncytial Virus) Vaccine: What You Need to Know

Adult RSV Case Studies

Case Study 1 – Robert

- Robert, 72-year-old male
- History of COPD and congestive heart failure
- Presents in January with 4-day history of symptoms
- Nasal congestion, productive cough, increasing SOB
- Recent exposure to grandson with confirmed RSV

Case Study – Clinical Presentation

- Fatigued appearance with audible wheezing
- Tachypnea (RR 26) and low-grade fever (99.8°F)
- Oxygen saturation 88% (baseline 94%)
- Diffuse wheezing, rhonchi, decreased air movement
- Increased work of breathing with accessory muscle use

Case Study – Diagnosis and Treatment

- PCR testing confirms RSV infection
- Hospitalization indicated due to
  - Hypoxemia requiring oxygen
  - Exacerbation of underlying conditions
  - Age and comorbidity risk factors

Case Study – Treatment Plan

- Supplemental oxygen therapy
- Bronchodilators for COPD exacerbation
- Careful fluid management (heart failure)

Case Study – Treatment Plan

- Close monitoring for respiratory failure
- Antipyretics for symptom management

Case Study – Clinical Course

- 5-day hospitalization required
- Gradual improvement with supportive care
- Discharge education
  - RSV prevention strategies
  - Recommendation for RSV vaccination (60+ years)
  - Follow-up at next wellness visit after recovery

Case Study 2 – Margaret

- 68-year-old female with asthma and diabetes mellitus
- Resides in assisted living facility
- 5-day history of worsening respiratory symptoms
- Initial rhinorrhea progressed to productive cough
- Reports several residents recently ill with respiratory symptoms
- History of tobacco use (30 pack-years, quit 5 years ago)

Case Study 2 – Clinical Presentation

- Increased wheezing without prior asthma exacerbation history
- Nasal congestion with purulent discharge
- Low-grade fever 100.2°F
- Decreased appetite and fluid intake
- Fatigue and general malaise
- Shortness of breath with minimal exertion

Case Study – Physical Exam

- Respiratory rate 24 (elevated from baseline of 18)
- Oxygen saturation 91% on room air
- Bilateral expiratory wheezes throughout lung fields
- Rhonchi in bilateral lower lobes
- Use of accessory muscles for breathing
- Appears tired but alert and oriented

Case Study – Diagnostics

- PCR testing confirms RSV infection
- Chest X-ray shows bilateral lower lobe infiltrates
- Blood glucose elevated due to illness stress
- Peak flow measurements significantly reduced
- Assessment reveals asthma exacerbation triggered by RSV
- Evaluation for secondary bacterial pneumonia

Case Study – Treatment

- Hospitalization for respiratory monitoring and support
- Bronchodilators and corticosteroids for asthma exacerbation
- Supplemental oxygen to maintain saturation >92%
- Careful glucose monitoring and diabetes management
- Hydration support with IV fluids
- Infection control measures to prevent facility spread

Case Study – Clinical Course

- 4-day hospitalization with gradual respiratory improvement
- Asthma management optimized before discharge
- Diabetes control stabilized with illness resolution
- Facility notification for outbreak prevention measures
- RSV vaccination scheduled for 8 weeks post-recovery
- Enhanced infection prevention education provided

Vaccine Hesitancy

Vaccine Hesitancy

"Delay in acceptance or refusal of vaccines despite availability"[117]

Parental Concerns

- Safety concerns (70%)
- Belief vaccines cause disease (38%)
- Questioning necessity (28%)
- Concerns about additives[117]

Vaccine Hesitancy

- Vaccine Safety
- Lack of Trust
- Lack of Need for Vaccination
- Culture Factors[116]

Current State of RSV Vaccine Hesitancy

- 53% of adults aged 60+ intended to refuse an RSV vaccine
- As of late 2023, only 14% of eligible older adults had received an RSV vaccine
- Previous flu and COVID-19 vaccine uptake strongly predicted RSV vaccination intentions[111,112]

Improving Signs of Acceptance

- 52% of US Adults believe the maternal RSV is effective
- 61% believe the RSV vaccine for adults over 60yr is effective[112]

Factors Influencing RSV Vaccine Hesitancy

- Complacency
- Confidence
- Convenience[111,113,114]

Maternal RSV Vaccination Hesitancy

- Uptake rates vary widely by country
- Educational interventions
- Cultural factors[114,115]

Economic Impact of RSV Vaccine Hesitancy

- Older Adults: Averting hospital costs from $45,000 per 100,000 population in Israel to $2.5 million per 100,000 in the US[114]
- Infant Protection: averting costs from $498,163 per 100,000 infants in France to $17,855,740 in Australia[114]

Physician's Role in Vaccine Hesitancy

- Most trusted information source
- Opportunity to influence decisions
- Counterbalance to online misinformation[117]

Evidence-Based Approaches to Address Hesitancy

- Healthcare Provider Recommendations
- Education on Disease Burden
- Addressing Safety Concerns[113]

Effective Communication Techniques

- Sample statements for different scenarios
- Addressing common questions
- Making strong recommendations

Follow up on Vaccine Hesitancy

- Key resources for providers and parents
- Follow-up strategies for hesitant parents

Resources

- **The Centers for Disease Control and Prevention Immunization Schedule**
  - https://www.cdc.gov/vaccines/hcp/imz-schedules/downloads/child/0-18yrs-child-combined-schedule.pdf
- **The Centers for Disease Control and Prevention**
  - https://www.cdc.gov/rsv/about/index.html
- **The American Academy of Pediatrics**
  - https://www.aap.org/
- **American Lung Association**
  - https://www.lung.org/lung-health-diseases/lung-disease-lookup/rsv

Resources

- **The National Association of Pediatric Nurse Practitioners**
  - https://www.napnap.org/rsv-resources/
- **The National Foundation for Infectious Disease**
  - https://www.nfid.org/resource/rsv-fact-sheet/
- **American College of Obstetricians and Gynecologists**
  - https://www.acog.org/topics/respiratory-syncytial-virus

Conclusion

- Mild to severe
- Economic and healthcare burden
- Prevention
- Highest risk: Children
- Healthcare advancements

References

1. Jain H, Schweitzer JW, Justice NA. Respiratory Syncytial Virus Infection in Children. In: StatPearls. Treasure Island, FL: StatPearls Publishing; 2023.

2. Food and Drug Administration. FDA Approves First Respiratory Syncytial Virus (RSV) Vaccine. FDA. https://www.fda.gov/news-events/press-announcements/fda-approves-first-respiratory-syncytial-virus-rsv-vaccine. Published 2023. Accessed July 18, 2025.

3. Centers for Disease Control and Prevention. Surveillance of RSV. https://www.cdc.gov/rsv/php/surveillance/index.html. Accessed July 18, 2025.

4. Erickson EN, Bhakta RT, Mendez MD. Pediatric Bronchiolitis. In: StatPearls. Treasure Island, FL: StatPearls Publishing; 2025.

5. Hamid S, Winn A, Parikh R, et al. Seasonality of Respiratory Syncytial Virus — United States, 2017–2023. MMWR Morb Mortal Wkly Rep. 2023;72:355-361. doi:10.15585/mmwr.mm7214a1.

6. Graham B. Respiratory syncytial virus infection: Clinical features and diagnosis. In: UpToDate. Waltham, MA: Wolters Kluwer Publishing; 2024.

References

7. Piedimonte G, Perez MK. Respiratory syncytial virus infection and bronchiolitis. *Pediatr Rev*. 2014;35(12):519-530. doi:10.1542/pir.35-12-519.

8. Esposito S, Abu Raya B, Baraldi E, et al. RSV Prevention in All Infants: Which Is the Most Preferable Strategy? *Front Immunol*. 2022;13:880368. doi:10.3389/fimmu.2022.880368.

9. Jha A, Jarvis H, Fraser C, et al. Respiratory Syncytial Virus. In: *SARS, MERS and Other Viral Lung Infections*. Sheffield, UK: European Respiratory Society; 2016:Chapter 5.

10. Coultas JA, Smyth R, Openshaw PJ. Respiratory syncytial virus (RSV): A scourge from infancy to old age. *Thorax*. 2019;74(10):986-993. doi:10.1136/thoraxjnl-2018-212212.

11. Domachowske JB, Rosenberg HF. Respiratory Syncytial Virus Infection: Immune Response, Immunopathogenesis, and Treatment. *Clin Microbiol Rev*. 1999;12(2):298-309. doi:10.1128/cmr.12.2.298.

12. Kaler J, Hussain A, Patel K, Hernandez T, Ray S. Respiratory Syncytial Virus: A Comprehensive Review of Transmission, Pathophysiology, and Manifestation. *Cureus*. 2023;15(3):e36342. Published 2023 Mar 18. doi:10.7759/cureus.36342.

References

13. Tesini B. Respiratory Syncytial Virus (RSV) and Human Metapneumovirus Infections. In: *Merck Manuals: Professional Version*. Rahway, NJ: Merck & Co Publishing; 2025. https://www.merckmanuals.com/professional/pediatrics/common-viral-infections-in-infants-and-children/respiratory-syncytial-virus-rsv-and-human-metapneumovirus-infections. Accessed July 22, 2025.

14. Graham B. Respiratory syncytial virus infection: Treatment in infants and children. In: *UpToDate*. Waltham, MA: Wolters Kluwer Publishing; 2024.

15. Wang ZY, Li XD, Sun AL, Fu XQ. Efficacy of 3% hypertonic saline in bronchiolitis: A meta-analysis. Exp Ther Med. 2019;18(2):1338-1344. doi:10.3892/etm.2019.7684.

16. Ambrożej D, Makrinioti H, Whitehouse A, et al. Respiratory virus type to guide predictive enrichment approaches in the management of the first episode of bronchiolitis: A systematic review. *Front Immunol*. 2022;13:1017325. doi:10.3389/fimmu.2022.1017325.

17. Buckingham SC, et al. A randomized, double-blind, placebo-controlled trial of dexamethasone in severe respiratory syncytial virus (RSV) infection: Effects on RSV quantity and clinical outcome. *J Infect Dis*. 2002;185(9):1222-1228.

References

18. Hsieh CW, Chen C, Su HC, et al. Exploring the efficacy of using hypertonic saline for nebulizing treatment in children with bronchiolitis: A meta-analysis of randomized controlled trials. *BMC Pediatr*. 2020;20:434. doi:10.1186/s12887-020-02314-3.

19. Schroeder A, Nicholson E. Patient education: Bronchiolitis and RSV in infants and children (Beyond the Basics). In: *UpToDate*. Waltham, MA: Wolters Kluwer Publishing; 2024.

20. Bianchini S, Silvestri E, Argentiero A, et al. Role of Respiratory Syncytial Virus in Pediatric Pneumonia. *Microorganisms*. 2020;8(12):2048. doi:10.3390/microorganisms8122048.

21. Lin HC, Liu YC, Hsing TY, et al. RSV pneumonia with or without bacterial co-infection among healthy children. *J Formos Med Assoc*. 2022;121(3):687-693. doi:10.1016/j.jfma.2021.08.012.

22. Centers for Disease Control and Prevention. RSV Vaccines. https://www.cdc.gov/rsv/vaccines/?CDC_AAref_Val=https://www.cdc.gov/rsv/about/prevention.html. Accessed July 22, 2025.

References

23. AstraZeneca. Beyfortus approved in the US for the prevention of RSV lower respiratory tract disease in infants. https://www.astrazeneca.com/media-centre/press-releases/2023/beyfortus-approved-in-the-us-for-the-prevention-of-rsv-lower-respiratory-tract-disease-in-infants.html. Accessed July 22, 2025.

24. Caserta MT, O'Leary ST, Munoz FM, Ralston SL. Palivizumab Prophylaxis in Infants and Young Children at Increased Risk of Hospitalization for Respiratory Syncytial Virus Infection. *Pediatrics*. 2023;152(1). doi:10.1542/peds.2023-061803.

25. Updated Guidance for Palivizumab Prophylaxis Among Infants and Young Children at Increased Risk of Hospitalization for Respiratory Syncytial Virus Infection. *Pediatrics*. 2014;134(2):415-420. doi:10.1542/peds.2014-1665.

26. Centers for Disease Control and Prevention. RSV: Infants & Young Children. https://www.cdc.gov/rsv/infants-young-children/?CDC_AAref_Val=https://www.cdc.gov/rsv/high-risk/infants-young-children.html. Accessed July 22, 2025.

27. Graham B. Respiratory syncytial virus infection: Prevention in infants and children. In: *UpToDate*. Waltham, MA: Wolters Kluwer Publishing; 2025.

References

28. Young M, Smitherman L. Socioeconomic Impact of RSV Hospitalization. *Infect Dis Ther*. 2021;10(Suppl 1):35-45. doi:10.1007/s40121-020-00390-7.

29. Centers for Disease Control and Prevention. RSV: Older Adults. https://www.cdc.gov/rsv/adults/. Accessed July 18, 2025.

30. Falsey AR, Walsh EE. Respiratory syncytial virus infection in adults. *Clin Microbiol Rev*. 2000;13(3):371-384. doi:10.1128/CMR.13.3.371.

31. McLaughlin JM, Khan F, Begier E, et al. Rates of Medically Attended RSV Among US Adults: A Systematic Review and Meta-analysis. *Open Forum Infect Dis*. 2022;9(7). doi:10.1093/ofid/ofac300.

32. Coultas JA, Smyth R, Openshaw PJ. Respiratory syncytial virus (RSV): A scourge from infancy to old age. *Thorax*. 2019;74(10):986-993. doi:10.1136/thoraxjnl-2018-212212.

33. Melgar M, Britton A, Roper LE, et al. Use of Respiratory Syncytial Virus Vaccines in Older Adults: Recommendations of the Advisory Committee on Immunization Practices — United States, 2023. *MMWR Morb Mortal Wkly Rep*. 2023;72:793-801. doi:10.15585/mmwr.mm7229a4.

References

34. Centers for Disease Control and Prevention. Frequently Asked Questions About RSV Vaccine for Adults. https://www.cdc.gov/vaccines/vpd/rsv/hcp/older-adults-faqs.html. Accessed July 21, 2025.

35. GlaxoSmithKline. Arexvy: Highlights of Prescribing Information Package Insert. https://gskpro.com/content/dam/global/hcpportal/en_US/Prescribing_Information/Arexvy/pdf/AREXVY.PDF. Accessed September 14, 2023.

36. Pfizer. Abrysvo: Highlights of Prescribing Information Package Insert. https://labeling.pfizer.com/ShowLabeling.aspx?id=19589. Accessed July 22, 2025.

37. Federal Drug Administration. FDA Release: FDA Approves First Vaccine for Pregnant Individuals to Prevent RSV in Infants. https://www.fda.gov/news-events/press-announcements/fda-approves-first-vaccine-pregnant-individuals-prevent-rsv-infants/. Accessed July 22, 2025.

38. Hammitt LL, Dagan R, Yuan Y, et al. Nirsevimab for Prevention of RSV in Healthy Late-Preterm and Term Infants. *N Engl J Med*. 2022;386(9):837-846. doi:10.1056/nejmoa2110275.

References

39. Rozenbaum MH, Judy J, Tran D, et al. Low Levels of RSV Testing Among Adults Hospitalized for Lower Respiratory Tract Infection in the United States. *Infect Dis Ther*. 2023;12(2):677-685. doi:10.1007/s40121-023-00758-5.

40. Vermont Department of Health. RSV (Respiratory Syncytial Virus). https://www.healthvermont.gov/disease-control/immunizations/rsv-respiratory-syncytial-virus. Accessed July 22, 2025.

41. Onwuchekwa C, Mora Moreo L, Menon S, et al. Underascertainment of Respiratory Syncytial Virus Infection in Adults Due to Diagnostic Testing Limitations: A Systematic Literature Review and Meta-analysis. *J Infect Dis*. 2023;228(2):173-184. doi:10.1093/infdis/jiad012.

42. Murane E. Influenza: A Comprehensive Review. Sacramento, CA: NetCE; 2022.

43. Malesker MA, Callahan-Lyon P, Ireland B, et al. Pharmacologic and Nonpharmacologic Treatment for Acute Cough Associated With the Common Cold: CHEST Expert Panel Report. *Chest*. 2017;152(5):1021-1037.

References

44. Paul IM, Beiler J, McMonagle A, et al. Effect of honey, dextromethorphan, and no treatment on nocturnal cough and sleep quality for coughing children and their parents. *Arch Pediatr Adolesc Med*. 2007;161(12):1140-1146.

45. Oduwole O, Udoh EE, Oyo-Ita A, Meremikwu MM. Honey for acute cough in children. *Cochrane Database Syst Rev*. 2018;4(4):CD007094.

46. TRC Healthcare. Honey. [Natural Medicines website]. https://naturalmedicines.therapeuticresearch.com/databases/food,-herbs-supplements/professional.aspx?productid=738#background. Published April 20, 2022. Accessed November 9, 2022.

47. American Academy of Pediatrics. Caring for your child's cold or flu. https://healthychildren.org/English/health-issues/conditions/flu/Pages/caring-for-Your-childs-cold-or-flu.aspx. Accessed July 18, 2025.

48. Centers for Disease Control and Prevention. Sore throat. https://www.cdc.gov/sore-throat/about/index.html. Published April 17, 2024. Accessed July 21, 2025.

References

49. Environmental Protection Agency. Use and Care of Home Humidifiers. https://www.epa.gov/indoor-air-quality-iaq/use-and-care-home-humidifiers. Published June 2022. Accessed July 21, 2025.

50. Green C, Krafft H, Guyatt G, Martin D. Symptomatic fever management in children: A systematic review of national and international guidelines. *PLoS One*. 2021;16(6):e0245815.

51. National Center for Complementary and Integrative Health. 5 Tips: Natural Products for the Flu and Colds: What Does the Science Say? https://www.nccih.nih.gov/health/tips/tips-natural-products-for-the-flu-and-colds-what-does-the-science-say. Accessed September 15, 2023.

52. Foley DA, Phuong LK. RSV: an update on prevention and management. *Aust Prescr*. 2025;48(2):34-39. doi:10.18773/austprescr.2025.018

53. Food and Drug Administration. Risk of serious and potentially fatal blood disorder prompts FDA action on oral over-the-counter benzocaine products used for teething and mouth pain and prescription local anesthetics. https://www.fda.gov/drugs/drug-safety-and-availability/risk-serious-and-potentially-fatal-blood-disorder-prompts-fda-action-oral-over-counter-benzocaine. Published May 31, 2018. Accessed November 8, 2022.

References

54. DeGeorge KC, Ring DJ, Dalrymple SN. Treatment of the Common Cold. *Am Fam Physician*. 2019;100(5):281-289.

55. Lovell AR, Ernst ME. Drug-Induced Hypertension: Focus on Mechanisms and Management. *Curr Hypertens Rep*. 2017;19(5):39.

56. AlBalawi ZH, Othman SS, Alfaleh K. Intranasal ipratropium bromide for the common cold. *Cochrane Database Syst Rev*. 2013;2013(6):CD008231.

57. Sur DK, Plesa ML. Treatment of Allergic Rhinitis. *Am Fam Physician*. 2015;92(11):985-992.

58. Small P, Keith PK, Kim H. Allergic rhinitis. *Allergy Asthma Clin Immunol*. 2018;14(Suppl 2):51.

59. American Academy of Pediatrics. RSV: When It's More Than Just a Cold. https://www.healthychildren.org/English/health-issues/conditions/chest-lungs/Pages/RSV-When-Its-More-Than-Just-a-Cold.aspx. Accessed July 21, 2025.

References

60. American Academy of Pediatrics. RSV Immunizations: Two Ways to Protect Babies. https://www.healthychildren.org/English/safety-prevention/immunizations/Pages/RSV-immunizations-new-ways-to-protect-babies.aspx. Accessed July 21, 2025.

61. American Lung Association. RSV in Adults. https://www.lung.org/lung-health-diseases/lung-disease-lookup/rsv/rsv-in-adults. Accessed July 21, 2025.

62. Pfizer. U.S. FDA Approves Pfizer's RSV Vaccine ABRYSVO for Adults Aged 18 to 59 at Increased Risk for Disease. https://www.pfizer.com/news/press-release/press-release-detail/us-fda-approves-pfizers-rsv-vaccine-abrysvor-adults-aged-18. Accessed July 21, 2025.

63. Syngias. What is Synagis? https://www.synagis.com/what-is-synagis.html. Accessed July 21, 2025.

64. Sexton DJ, McClain MT. The common cold in adults: treatment and prevention. In: *UpToDate*. Waltham, MA: Wolters Kluwer Publishing; 2022.

References

65. American Academy of Pediatrics. Children and Colds (Upper Respiratory Infections). https://www.healthychildren.org/English/health-issues/conditions/ear-nose-throat/Pages/Children-and-Colds.aspx. Published January 27, 2025. Accessed July 21, 2025.

66. Shadkam MN, Mozaffari-Khosravi H, Mozayan MR. A comparison of the effect of honey, dextromethorphan, and diphenhydramine on nightly cough and sleep quality in children and their parents. *J Altern Complement Med*. 2010;16(7):787-793.

67. Bowser DM, Rowlands KR, Hariharan D, et al. Cost of Respiratory Syncytial Virus Infections in US Infants: Systematic Literature Review and Analysis. *J Infect Dis*. 2022;226(Suppl 2):S225-S235. doi:10.1093/infdis/jiac172.

68. Centers for Disease Control and Prevention. CDC Recommends a Powerful New Tool to Protect Infants from the Leading Cause of Hospitalization. https://www.cdc.gov/media/releases/2023/p-0803-new-tool-prevent-infant-hospitalization-.html. Accessed July 22, 2025.

69. Nirsevimab. In: UpToDate. Waltham, MA: Wolters Kluwer Publishing; 2025.

References

70. Centers for Disease Control and Prevention. RSV: Symptoms & Care. https://www.cdc.gov/rsv/symptoms/?CDC_AAref_Val=https://www.cdc.gov/rsv/about/symptoms.html. Accessed July 22, 2025.

71. Shi T, McAllister DA, O'Brien KL, et al. Global, regional, and national disease burden estimates of acute lower respiratory infections due to respiratory syncytial virus in young children in 2015: a systematic review and modelling study. Lancet. 2017;390(10098):946-958. doi:10.1016/S0140-6736(17)30938-8.

72. Li Y, Wang X, Blau DM, et al. Global, regional, and national disease burden estimates of acute lower respiratory infections due to respiratory syncytial virus in children younger than 5 years in 2019: a systematic analysis. Lancet. 2022;399(10340):2047-2064. doi:10.1016/S0140-6736(22)00478-0.

73. Obando-Pacheco P, Justicia-Grande AJ, Rivero-Calle I, et al. Respiratory Syncytial Virus Seasonality: A Global Overview. J Infect Dis. 2018;217(9):1356-1364. doi:10.1093/infdis/jiy056.

74. Zhang S, Akmar LZ, Bailey F, et al. Cost of Respiratory Syncytial Virus-Associated Acute Lower Respiratory Infection Management in Young Children at the Regional and Global Level: A Systematic Review and Meta-Analysis. J Infect Dis. 2020;222(Suppl 7):S680-S687. doi:10.1093/infdis/jiz683.

References

75. Baker RE, Mahmud AS, Wagner CE, et al. Epidemic dynamics of respiratory syncytial virus in current and future climates. Nature Communications. 2019;10(1). doi:https://doi.org/10.1038/s41467-019-13562-y

76. DeVincenzo JP, McClure MW, Symons JA, et al. Activity of oral ALS-008176 in a respiratory syncytial virus challenge study. N Engl J Med. 2015;373(21):2048-2058. doi:10.1056/NEJMoa1413275.

77. Roymans D, Alnajjar SS, Battles MB, et al. Therapeutic efficacy of a respiratory syncytial virus fusion inhibitor. *Nat Commun*. 2017;8(1):167. Published 2017 Aug 1. doi:10.1038/s41467-017-00170-x

78. Leiva-Juarez MM, Kirkpatrick CT, Gilbert BE, et al. Combined aerosolized Toll-like receptor ligands are an effective therapeutic agent against influenza pneumonia when co-administered with oseltamivir. *Eur J Pharmacol*. 2018;818:191-197. doi:10.1016/j.ejphar.2017.10.035

79. Rosas-Salazar C, Shilts MH, Tovchigrechko A, et al. Nasopharyngeal Microbiome in Respiratory Syncytial Virus Resembles Profile Associated with Increased Childhood Asthma Risk. *Am J Respir Crit Care Med*. 2016;193(10):1180-1183. doi:10.1164/rccm.201512-2350LE.

References

80. Hammitt LL, Dagan R, Yuan Y, et al. Nirsevimab for Prevention of RSV in Healthy Late-Preterm and Term Infants. *N Engl J Med*. 2022;386(9):837-846. doi:10.1056/NEJMoa2110275.

81. Sigurs N, Aljassim F, Kjellman B, et al. Asthma and allergy patterns over 18 years after severe RSV bronchiolitis in the first year of life. *Thorax*. 2010;65(12):1045-1052. doi:10.1136/thx.2009.121582.

82. Thomsen SF, van der Sluis S, Stensballe LG, et al. Exploring the association between severe respiratory syncytial virus infection and asthma: a registry-based twin study. *Am J Respir Crit Care Med*. 2009;179(12):1091-1097. doi:10.1164/rccm.200809-1471OC.

83. Zomer-Kooijker K, van der Ent CK, Ermers MJ, et al. Increased risk of wheeze and decreased lung function after respiratory syncytial virus infection. *PLoS One*. 2014;9(1):e87162. Published 2014 Jan 31. doi:10.1371/journal.pone.0087162.

84. Duan Y, Liu Z, Zang N, et al. Landscape of respiratory syncytial virus. Chin Med J (Engl). 2024;137(24):2953-2978. doi:10.1097/CM9.0000000000003354.

References

85. Scheltema NM, Nibbelke EE, Pouw J, et al. Respiratory syncytial virus prevention and asthma in healthy preterm infants: a randomised controlled trial. *Lancet Respir Med*. 2018;6(4):257-264. doi:10.1016/S2213-2600(18)30055-9.

86. Cromer D, van Hoek AJ, Newall AT, Pollard AJ, Jit M. Burden of paediatric respiratory syncytial virus disease and potential effect of different immunisation strategies: a modelling and cost-effectiveness analysis for England. *The Lancet Public Health*. 2017;2(8):e367-e374. doi:https://doi.org/10.1016/s2468-2667(17)30103-2.

87. Arriola CS, Kim L, Langley G, et al. Estimated Burden of Community-Onset Respiratory Syncytial Virus-Associated Hospitalizations Among Children Aged <2 Years in the United States, 2014-15. *J Pediatric Infect Dis Soc*. 2020;9(5):587-595. doi:10.1093/jpids/piz087.

88. Lanari M, Prinelli F, Adorni F, et al. Maternal milk protects infants against bronchiolitis during the first year of life. Results from an Italian cohort of newborns. *Early Hum Dev*. 2013;89 Suppl 1:S51-S57. doi:10.1016/S0378-3782(13)70016-1.

References

89. Polack FP, Stein RT, Custovic A. The Syndrome We Agreed to Call Bronchiolitis. *J Infect Dis*. 2019;220(2):184-186. doi:10.1093/infdis/jiz082.

90. Mazur NI, Higgins D, Nunes MC, et al. The respiratory syncytial virus vaccine landscape: lessons from the graveyard and promising candidates. *Lancet Infect Dis*. 2018;18(10):e295-e311. doi:10.1016/S1473-3099(18)30292-5.

91. Falsey AR, Hennessey PA, Formica MA, Cox C, Walsh EE. Respiratory syncytial virus infection in elderly and high-risk adults. *N Engl J Med*. 2005;352(17):1749-1759. doi:10.1056/NEJMoa043951.

92. Ackerson B, Tseng HF, Sy LS, et al. Severe Morbidity and Mortality Associated With Respiratory Syncytial Virus Versus Influenza Infection in Hospitalized Older Adults. *Clin Infect Dis*. 2019;69(2):197-203. doi:10.1093/cid/ciy991.

93. Tai CC, Tsai CH, Huang YH, Lee CL, Chen HP, Chan YJ. Detection of respiratory viruses in adults with respiratory tract infection using a multiplex PCR assay at a tertiary center. *J Microbiol Immunol Infect*. 2021;54(5):858-864. doi:10.1016/j.jmii.2020.07.020.

References

94. Walsh EE, Peterson DR, Kalil AC, et al. Risk factors for severe respiratory syncytial virus infection in elderly persons. J Infect Dis. 2004;189(2):233-238.

95. Papi A, Bellettato CM, Braccioni F, et al. Infections and airway inflammation in chronic obstructive pulmonary disease severe exacerbations. *Am J Respir Crit Care Med*. 2006;173(10):1114-1121. doi:10.1164/rccm.200506-859OC.

96. Falsey AR, Walsh EE, Esser MT, Shoemaker K, Yu L, Griffin MP. Respiratory syncytial virus-associated illness in adults with advanced chronic obstructive pulmonary disease and/or congestive heart failure. *J Med Virol*. 2019;91(1):65-71. doi:10.1002/jmv.25285.

97. Belongia EA, King JP, Kieke BA, et al. Clinical Features, Severity, and Incidence of RSV Illness During 12 Consecutive Seasons in a Community Cohort of Adults ≥60 Years Old. *Open Forum Infect Dis*. 2018;5(12):ofy316. Published 2018 Nov 27. doi:10.1093/ofid/ofy316.

References

98. Altman CA, Englund JA, Demmler G, et al. Respiratory syncytial virus in patients with congenital heart disease: a contemporary look at epidemiology and success of preoperative screening. *Pediatr Cardiol*. 2000;21(5):433-438. doi:10.1007/s002460010103.

99. Khongphatthanayothin A, Wong PC, Samara Y, et al. Impact of respiratory syncytial virus infection on surgery for congenital heart disease: postoperative course and outcome. *Crit Care Med*. 1999;27(9):1974-1981. doi:10.1097/00003246-199909000-00042.

100. World Health Organization. Integrated Management of Childhood Illness: Chart Booklet. *Geneva: World Health Organization*; https://www.who.int/publications/m/item/integrated-management-of-childhood-illness---chart-booklet-(march-2014). Last accessed August 26, 2025.

101. Theodoratou E, Al-Jilaihawi S, Woodward F, et al. The effect of case management on childhood pneumonia mortality in developing countries. *Int J Epidemiol*. 2010;39 Suppl 1(Suppl 1):i155-i171. doi:10.1093/ije/dyq032.

References

102. Schuh S, Babl FE, Dalziel SR, et al. Practice Variation in Acute Bronchiolitis: A Pediatric Emergency Research Networks Study. *Pediatrics*. 2017;140(6):e20170842. doi:10.1542/peds.2017-0842.

103. Ralston SL, Lieberthal AS, Meissner HC, et al. Clinical practice guideline: the diagnosis, management, and prevention of bronchiolitis. *Pediatrics*. 2014;134(5):e1474-e1502. doi:10.1542/peds.2014-2742.

104. Meissner HC. Viral Bronchiolitis in Children. *N Engl J Med*. 2016;374(1):62-72. doi:10.1056/NEJMra1413456.

105. Parikh K, Hall M, Teach SJ. Bronchiolitis management before and after the AAP guidelines. *Pediatrics*. 2014;133(1):e1-e7. doi:10.1542/peds.2013-2005.

106. Hasegawa K, Tsugawa Y, Brown DF, Mansbach JM, Camargo CA Jr. Trends in bronchiolitis hospitalizations in the United States, 2000-2009. *Pediatrics*. 2013;132(1):28-36. doi:10.1542/peds.2012-3877.

107. Abaya R, Delgado EM, Scarfone RJ, et al. Improving efficiency of pediatric emergency asthma treatment by using metered dose inhaler. *J Asthma*. 2019;56(10):1079-1086. doi:10.1080/02770903.2018.1514629.

References

108. Flores G. The impact of medical interpreter services on the quality of health care: a systematic review. *Med Care Res Rev*. 2005;62(3):255-299. doi:10.1177/1077558705275416.

109. Kornides ML, Garrell JM, Gilkey MB. Content of web-based continuing medical education about HPV vaccination. Vaccine. 2017;35(35 Pt B):4510-4514. doi:10.1016/j.vaccine.2017.07.038.

110. Stockwell MS, Kharbanda EO, Martinez RA, Vargas CY, Vawdrey DK, Camargo S. Effect of a text messaging intervention on influenza vaccination in an urban, low-income pediatric and adolescent population: a randomized controlled trial. JAMA. 2012;307(16):1702-1708. doi:10.1001/jama.2012.502.

111. Motta M, Callaghan T, Padmanabhan M, et al. Quantifying the prevalence and determinants of respiratory syncytial virus (RSV) vaccine hesitancy in US adults aged 60 or older. *Public Health*. 2025;238:3-6. doi:10.1016/j.puhe.2024.08.004

112. Annenberg Public Policy Center. Public shows greater acceptance of RSV vaccine as vaccine hesitancy appears to have plateaued. ScienceDaily. Available at https://www.sciencedaily.com/releases/2024/12/241223135334.html. Last accessed September 2, 2025.

References

113. Houle SKD, Andrew MK. RSV vaccination in older adults: Addressing vaccine hesitancy using the 3C model. *Can Pharm J (Ott)*. 2023;157(1):39-44. Published 2023 Nov 24. doi:10.1177/17151635231210879

114. Du Z, Pandey A, Moghadas SM, et al. Impact of RSVpreF vaccination on reducing the burden of respiratory syncytial virus in infants and older adults. *Nat Med*. 2025;31(2):647-652. doi:10.1038/s41591-024-03431-7

115. Sauer MA, Fesshaye B, Miller ES, et al. Contextualizing future maternal RSV vaccination acceptance and trust among pregnant and lactating women in Kenya: A latent class analysis. *PLOS Glob Public Health*. 2025;5(8):e0004505. Published 2025 Aug 28. doi:10.1371/journal.pgph.0004505

116. Kumar S, Shah Z, Garfield S. Causes of Vaccine Hesitancy in Adults for the Influenza and COVID-19 Vaccines: A Systematic Literature Review. *Vaccines (Basel).* 2022;10(9):1518. Published 2022 Sep 13. doi:10.3390/vaccines10091518

117. Shen SC, Dubey V. Addressing vaccine hesitancy: Clinical guidance for primary care physicians working with parents. *Can Fam Physician*. 2019;65(3):175-181.

References

118. Merck. News Release: US FDA Approves Enflonsia for Prevention of Respiratory Syncytial Virus Lower Respiratory Tract Disease in Infants Born During or Entering Their First RSV Season. Available at https://www.merck.com/news/u-s-fda-approves-mercks-enflonsia-clesrovimab-cfor-for-prevention-of-respiratory-syncytial-virus-rsv-lower-respiratory-tract-disease-in-infants-born-during-or-entering-their-fir/. Last accessed September 8, 2025.

119. Food and Drug Administration. Drug Trials Snapshots: Enflonsia. Available at https://www.fda.gov/drugs/drug-approvals-and-databases/drug-trials-snapshots-enflonsia. Last accessed September 8, 2025.

120. Enflonsia Prescribing Information. Available at https://www.merck.com/product/usa/pi_circulars/e/enflonsia/enflonsia_pi.pdf. Last accessed September 8, 2025.

121. Clesrovimab. Available at https://www.merckvaccines.com/enflonsia/. Last accessed September 8, 2025.

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