



2023 Pediatric  
**Virtual Symposium**

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# Acute Management of Bronchiolitis in Infants and Young Children in Primary and Acute Care Settings

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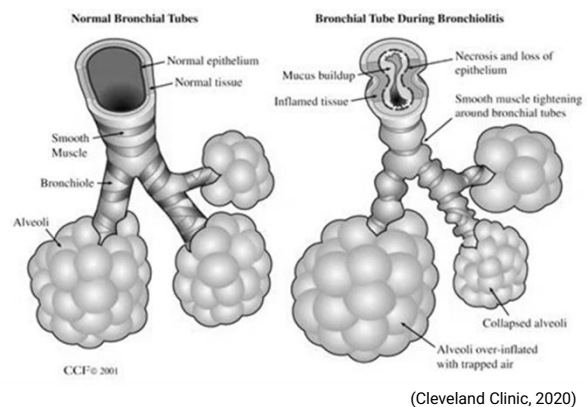
## Objectives

- Define bronchiolitis diagnostic criteria and categorize illness severity based on the history and physical examination of the pediatric patient
- Appraise current evidence-based treatment recommendations to manage bronchiolitis.
- Design comprehensive anticipatory guidance and return criteria for discharge and preventative care for the pediatric patient diagnosed with bronchiolitis.

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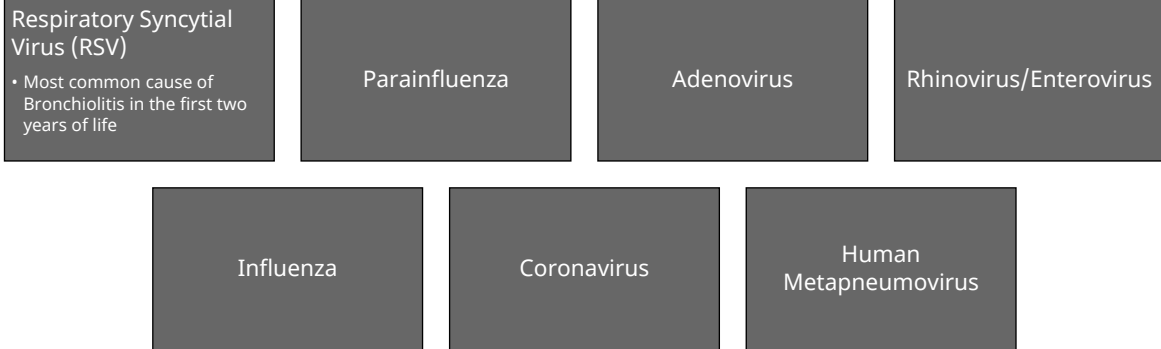
## Pathophysiology of Bronchiolitis

- Lower airway respiratory tract infection
  - Affecting primarily smaller airways
- Viral Pathogenesis
- Characteristics:
  - Airway Edema
  - Airway Inflammation
  - Increased mucus production
  - Necrosis of epithelial cells lining the small airways increasing debris



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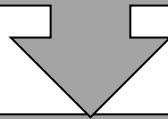
## Etiology of Bronchiolitis



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## Epidemiology of Bronchiolitis

2.1 million outpatient visits



58,000-80,000 hospitalizations



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## Incidence and Prevalence

- Age Peak Incidence: 2 to 6 months of age
  - Diagnostic Age Criteria per AAP: 0 days old through 23 months old
- Early Winter and Early Spring
  - Temperate Climates (North Carolina): Starts in November and persists through April
- By Age 2, 90% of children have had some viral infection causing bronchiolitis (RSV is the most common)



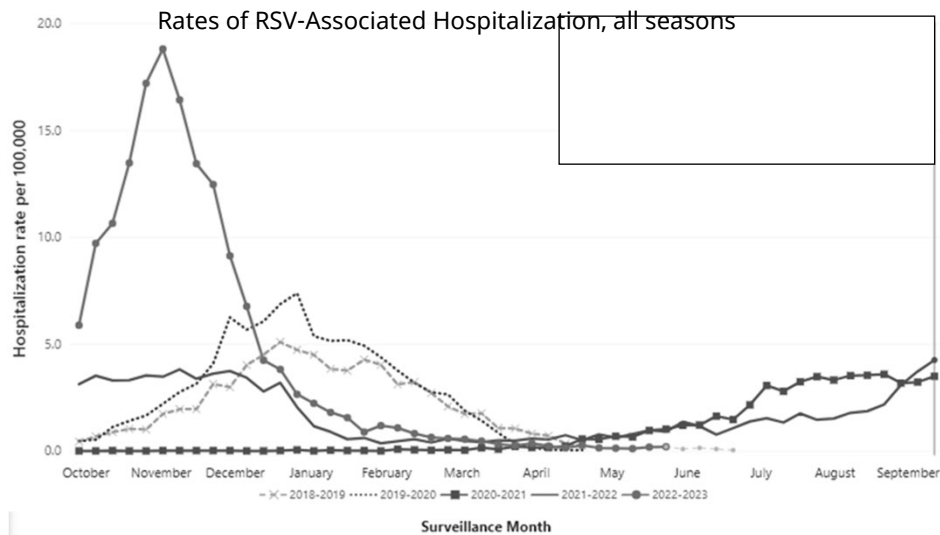
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(National Center for Immunization and Respiratory Diseases (NCIRD), Division of Viral Diseases, 2023) 7

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## Drastic increase in RSV hospitalizations in late 2022



Data last updated: 07/12/2023 | Accessibility: Hover over graph area to display options such as show data as table and copy visual.  
Note: AI/AN, American Indian or Alaska Native; A/PI, Asian and Pacific Islander.



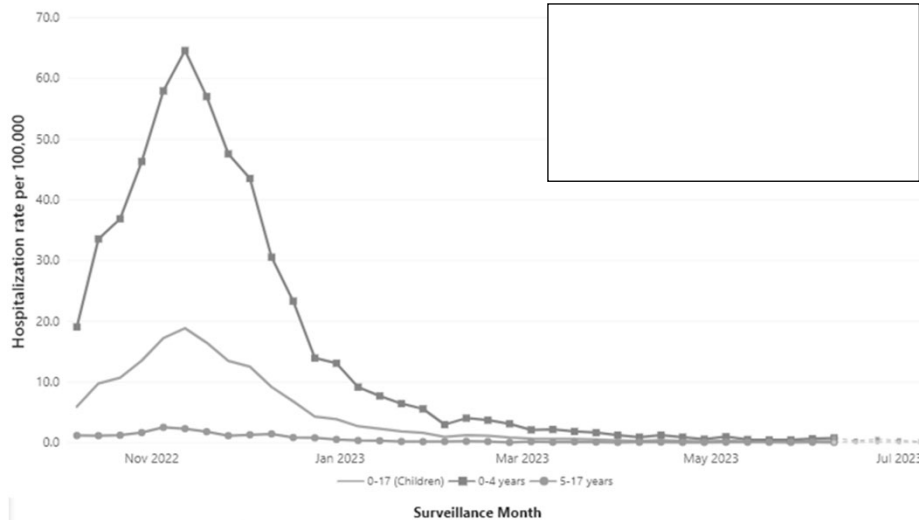
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(RSV-NET interactive dashboard, 2023) 8

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## Young children saw greatest increase in RSV hospitalizations



Data last updated: 07/12/2023 | Accessibility: Hover over graph area to display options such as show data as table and copy visual.



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(RSV-NET interactive dashboard, 2023) 9

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## Transmission

- Highly contagious
- Virus sheds for 3 to 8 days
  - Can be up to 30 days with underlying disease
- Spread by:
  - Droplet
    - Coughing
    - Sneezing
  - Contact
    - Nasopharyngeal secretions from infected person
- Virus Lifespan
  - Skin: ~20 minutes
  - Gowns/tissues: ~30-60 minutes
  - Hard surfaces: ~6 hours
- Reinfection occurs throughout life

(National Center for Immunization and Respiratory Diseases (NCIRD), Division of Viral Diseases, 2023)



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## Typical Clinical Presentation

- Viral URI
  - Rhinorrhea
  - Congestion
  - Cough
- Increased Work of Breathing – typically peaks on days 3 to 5 of illness
- Tachypnea
- Wheezing
- Coarse Rales
- Fever
  - Common finding
  - May need to consider infectious risk factors



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## Neonates and Young Infants

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### Clinical Practice Guideline: Evaluation and Management of Well-Appearing Febrile Infants 8 to 60 Days Old

Robert H. Pantell, MD, FAAP,\* Kenneth B. Roberts, MD, FAAP,\* William G. Adams, MD, FAAP,\* Benard P. Dreyer, MD, FAAP,\*  
Nathan Kuppermann, MD, MPH, FAAP, FACEP,\* Sean T. O'Leary, MD, MPH, FAAP,\* Kymika Okechukwu, MPA,\*  
Charles R. Woods Jr, MD, MS, FAAP\* SUBCOMMITTEE ON FEBRILE INFANTS

“Infants with clinical bronchiolitis, with or without positive test results for respiratory syncytial virus (RSV). A review by Ralston et al of 11 studies of bronchiolitis found no cases of meningitis, and researchers in 8 studies reported no cases of bacteremia.”



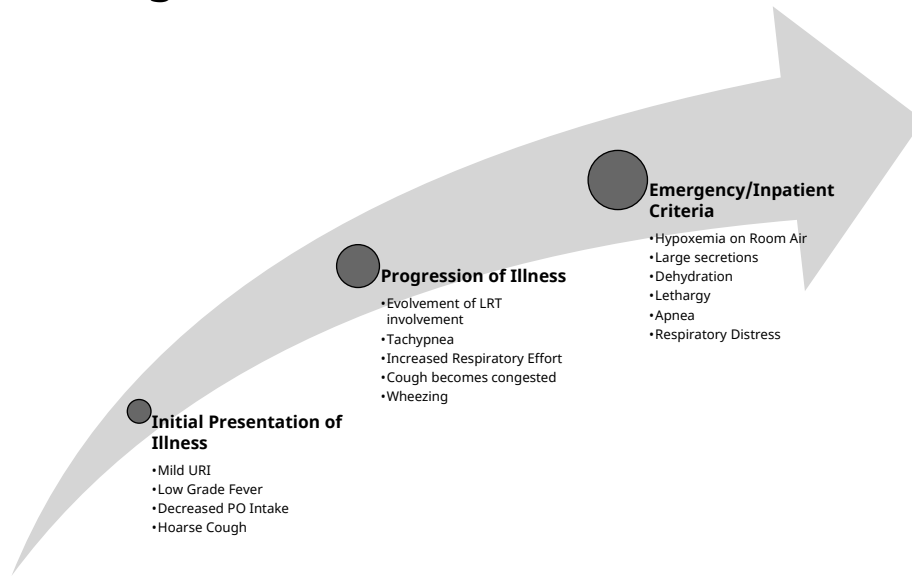
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(Pantell et al., 2021)

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# Clinical Progression Timeline



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# Severity of Disease

	Mild	Moderate	Severe
Mental status	Alert and active	Alert and able to be consoled	Fussy, irritable, difficult to console
Feeding	Feeding well	Decreased feeding tolerance	Poor feeding tolerance
Respiratory status	Minimal retractions	Mild to moderate intercostal retractions	Moderate to severe intercostal retractions with expanding retractions (pan retractions)
Breathing	Respiratory rate is eupneic to slightly tachypneic	Mild to moderate tachypnea	Moderate to severe tachypnea

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CLINICAL PRACTICE GUIDELINE

## Clinical Practice Guideline: The Diagnosis, Management, and Prevention of Bronchiolitis

**“The recommendations in this report do not indicate an exclusive course of treatment or serve as a standards of medical care. Variations, taking into account individual circumstances, may be appropriate.”**

**“All clinical practice guidelines from the American Academy of pediatrics automatically expire 5 years after publication on the last reaffirm, revised, or retired at or before that time.”**



## Assessment and Diagnosis



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### Clinical Practice Guideline: The Diagnosis, Management, and Prevention of Bronchiolitis

Clinicians should diagnose bronchiolitis and assess disease severity **based on history and physical examination**. Clinicians should not routinely order laboratory and radiologic studies for diagnosis.





# General Management



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# General Approach to Care

- Supportive Care
  - Nasal Suctioning with Saline Spray or Drops
  - Fluids
    - Goal Intake: 50% of usual intake
    - Syringe, Smaller more frequent feeding
  - Antipyretics
    - Acetaminophen and Ibuprofen ( $\geq 6$  Months)
- Avoid Administration/Prescription:
  - Albuterol INH or NEB
  - Systemic Corticosteroids (Dexamethasone, Prednisone)
  - Inhaled or Nebulized Corticosteroids (Flovent, Pulmicort)
  - Chest Physiotherapy



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## Antigen and PCR Respiratory Viral Testing

- Not routinely indicated
- RT-PCR more sensitive than antigen
  - RT-PCR: Emergency Departments and Inpatient Clinical Settings
  - Antigen: Outpatient Settings
- When to Test “when the test result will change your management”:
  - High Risk for Respiratory Issues (Apnea and Respiratory Distress)
  - Premature Infants <6 months of age (GA: <32wk)
  - <1 Month of Age
  - Congenital Heart Disease
  - Kidney Disease
  - ED to Inpatient Admissions
    - Performed often for purposes of infection control
  - Acutely ill/Concern for Deterioration



## High Risk Considerations in Bronchiolitis

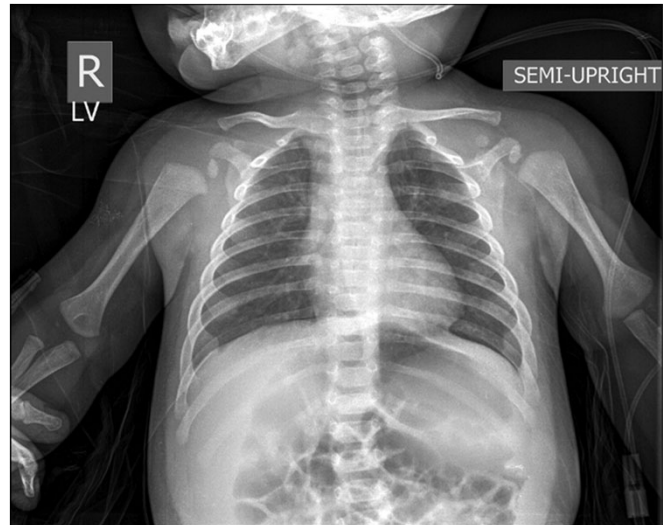
**These children will often require additional diagnostic and treatment modalities and interventions**

**Cardiac Disease  
Airway Anomalies  
Immunodeficiency  
Pre-Existing Lung Disease  
Complex/Chronic Medical Conditions**



## Utilization of Chest Radiography

- Rationale for Use: evaluation of secondary/superimposed infection or disease process
- Bronchiolitis Findings
  - Hyperinflation: Flattened diaphragm and increased lucency
  - Peri-bronchial thickening/cuffing
  - Increased interstitial markings
  - Subsegmental consolidation in the upper and middle lobes
    - Patchy atelectasis
    - Atelectatic consolidation



(Wagner, 2009)



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## Differential Diagnosis of Bronchiolitis



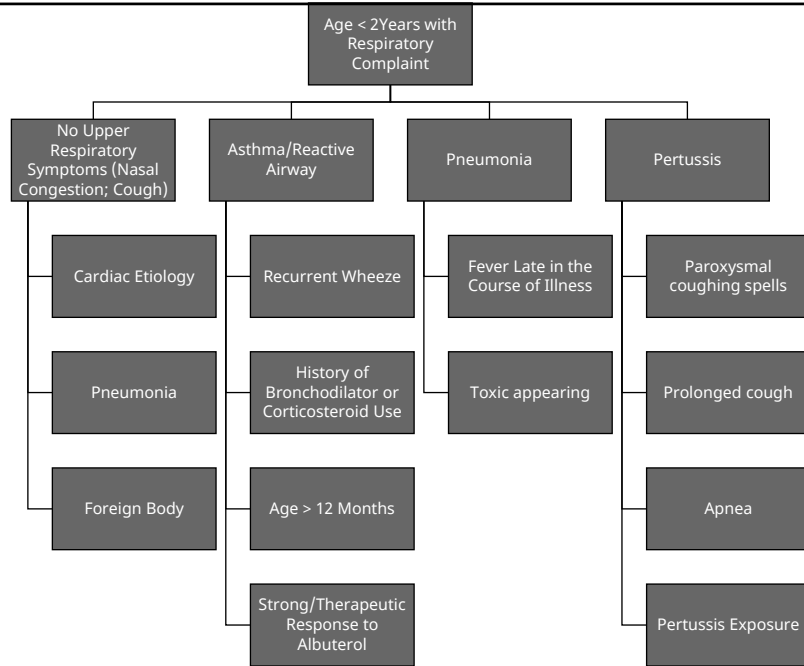
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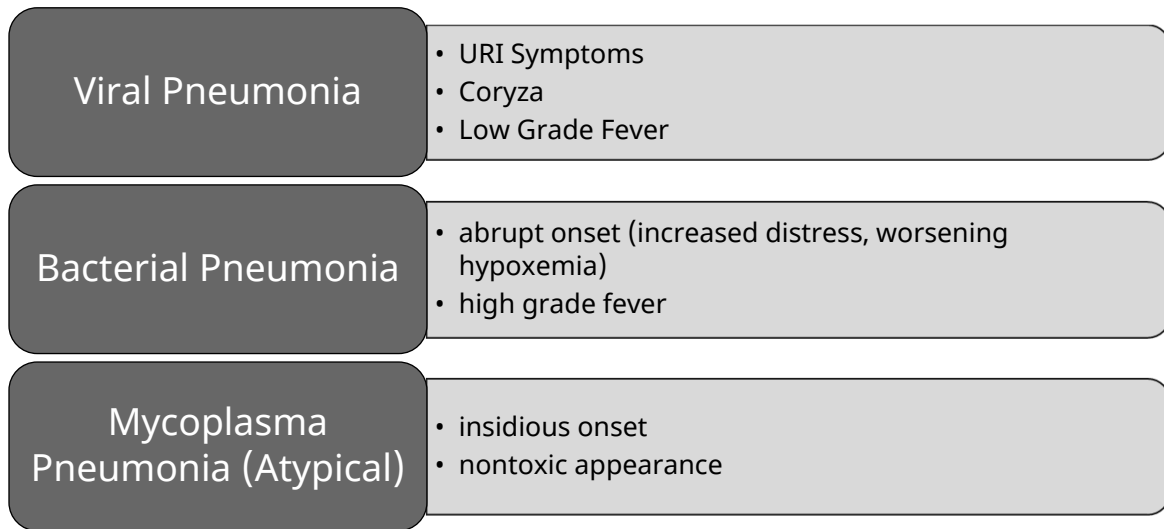
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## Expanding the Bronchiolitis Differential...



## Expanding Differential of Pneumonia



# Antibiotic Therapy



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***“Antibacterial medications should be used only in children with bronchiolitis who have specific indications of the coexistence of a bacterial infection. When present, bacterial infection should be treated in the same manner as in the absence of bronchiolitis”***



(Ralston et al., 2014)

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# Antibiotic Therapy Considerations for Pneumonia

<p><b>Common Pathogens</b></p>	<p><b>Streptococcal pneumoniae</b> Mycoplasma pneumoniae Staphylococcal pyrogenes Staphylococcal aureus Haemophilus influenzae Moraxella catarrhalis</p>
<p><b>Empiric Antibiotic Therapy</b></p>	<ul style="list-style-type: none"> <li>• <b>Empiric Coverage:</b> Amoxicillin OR Ampicillin (allergy: Clindamycin or Levofloxacin)</li> <li>• <b>Antibiotic Resistant:</b> Augmentin/Unasyn; Cefpodoxime (Vantin); Can consider Zosyn</li> <li>• <b>Acutely Hospitalized:</b> Ceftriaxone</li> <li>• <b>Pneumonia in Hospitalized Patient:</b> Consider MRSA – add Vancomycin OR Linezolid OR Clindamycin</li> <li>• <b>Atypical Bacteria (Myoplasma or Chlamydia):</b> Add Macrolide (Azithromycin)</li> </ul>
<p><b>Antibiotic Duration</b></p>	<ul style="list-style-type: none"> <li>• <b>Uncomplicated CAP:</b> 5 Days</li> <li>• <b>Extension of Duration:</b> Empyema, Necrotizing Pneumonia, Pulmonary Abscess</li> <li>• Consider hospitalization course</li> </ul>



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## Additional Considerations with Pneumonia

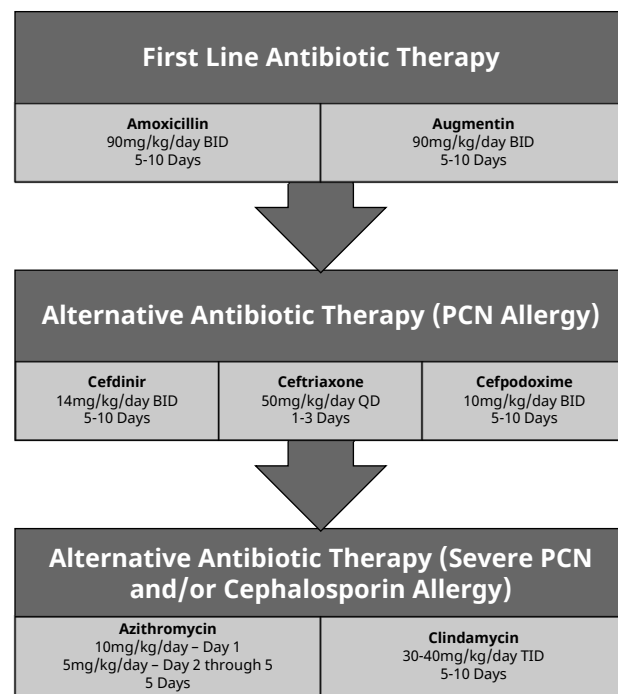
- Respiratory viruses often lead to CAP in young children
- Consider switch from IV to PO antibiotics as soon as oral medications can be tolerated and demonstrated clinical improvement
- If Influenza is present: need to consider staphylococcus aureus infection and expansion of empiric antibiotic coverage.
  - Vancomycin + Ceftriaxone

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## Acute Otitis Media

- Common Pathogens
  - Streptococcus pneumoniae
  - Non-typable haemophilus influenzae
  - Moraxella catarrhalis
- AAP Criteria for AOM
  - Hyperemia/Erythema of the TM
  - Moderate to Severe Bulging of TM
  - New Onset Otorrhea (excluding Otitis Externa)
- Consider treatment failure at 48 to 72 hours

(Lieberthal et al., 2013)



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## Respiratory Pharmacological Management Considerations



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## Bronchodilators

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***“Bronchodilators should not be used routinely in  
the management<sup>[BC32]</sup> of bronchiolitis”***

***“A carefully monitored trial of -adrenergic or -  
adrenergic medication is an option. Inhaled  
bronchodilators should be continued only if  
there is a documented positive clinical  
response to the trial using an objective means  
of evaluation”***



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(Ralston et al., 2014)

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# Racemic Epinephrine

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***Clinicians should not administer  
epinephrine to infants and  
children with a diagnosis of  
bronchiolitis***



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(Ralston et al., 2014)

# Nebulized Hypertonic Saline

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***Nebulized hypertonic saline  
should not be administered to  
infants with a diagnosis of  
bronchiolitis in the emergency  
department***

***Clinicians may administer  
nebulized hypertonic saline to  
infants and children hospitalized  
for bronchiolitis***



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(Ralston et al., 2014)



# Corticosteroids



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***“Corticosteroid medications should not  
be used routinely in the management of  
bronchiolitis”***

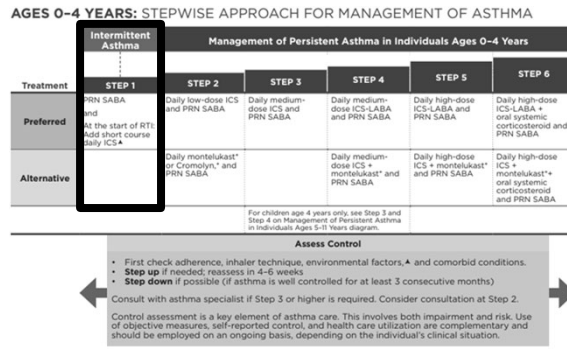


(Ralston et al., 2014)

## Bronchiolitis and Wheezing Associated Respiratory Infection (WARI)



# WARI – Wheezing Associated Respiratory Infection National Institutes of Health 2020 Focused Updates to the Asthma Management Guidelines



**Abbreviations:** ICS, inhaled corticosteroid; LABA, long-acting beta<sub>2</sub>-agonist; SABA, inhaled short-acting beta<sub>2</sub>-agonist; RTI, respiratory tract infection; PRN, as needed.

\* Updated based on the 2020 guidelines.

<sup>†</sup> Cromolyn and montelukast were not considered for this update and/or have limited availability for use in the United States. The FDA issued a Boxed Warning for montelukast in March 2020.

The full-length report, 2020 Focused Updates to the Asthma Management Guidelines: A Report from the National Asthma Education and Prevention Program Coordinating Committee Expert Panel Working Group, can be accessed at [www.nhlbi.nih.gov/asthmaupdates](https://www.nhlbi.nih.gov/asthmaupdates).

## Recurrent Wheezing during RTI Wheezing Associated Respiratory Infection (WARI)

- Defining Recurrent Wheeze:
  - 3 or more episodes with apparent infection in lifetime
  - Two episodes in past year – no symptoms between infections
  - Not on daily asthma/RAD treatment
- There is institutional variation
  - Two reviewed studies: Budesonide (Pulmicort) NEB – 1mg BID 7 days
  - Other Methods: Flovent 44 2 puffs BID via spacer
- Benefit: reduction in WARI exacerbation from viral RTI
- Risk: growth restriction
- Future Considerations: initiate low dose ICS at home at onset of RTI to potentially avoid HCP evaluation

## Quick Relief Medications for WARI

- SABA – Albuterol with Spacer
  - Green Zone: No SABA Use Indicated
  - Yellow Zone: Albuterol INH with Spacer 2 to 4 puffs every 4 hours as needed for cough/wheeze/increased respiratory effort
  - Red Zone: Albuterol INH with Spacer 4 to 6 puffs every 20 minutes, repeat up to 3 times for cough/wheeze/respiratory distress
- Systemic Steroids (consider history of severe exacerbations)
  - Dexamethasone 0.6mg/kg/dose (2 doses) spaced 24 to 36 hours apart
  - Methylprednisolone 2mg/kg/day IV BID
    - For Severe Presentations: 1mg/kg q6hrs IV and then space as clinically improved
    - IV to PO Transition
  - Prednisone (Orapred) 2mg/kg/day BID for 5 to 7 days



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## Acute Care Management (Inpatient, ED, ICU)



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## General Acute Care Overview

- Supplemental oxygen
- Spot check SpO<sub>2</sub> (not continuous) unless on continuous supplemental oxygen
- NG vs. IV vs. PO feeding and hydration
- HFNC vs. NIPPV



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## Supplemental Oxygen



### CLINICAL PRACTICE GUIDELINE

#### Clinical Practice Guideline: The Diagnosis, Management, and Prevention of Bronchiolitis

- Supplemental oxygen is indicated if SpO<sub>2</sub> falls persistently below 90% in previously healthy infants.
- If the SpO<sub>2</sub> does persistently fall below 90%, adequate supplemental oxygen should be used to maintain SpO<sub>2</sub> at or above 90%.
- Oxygen may be discontinued if SpO<sub>2</sub> is at or above 90% and the infant is feeding well and has minimal respiratory distress
- As the child's clinical course improves, continuous measurement of SpO<sub>2</sub> is not routinely needed



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# Hydration: Oral vs. Intravenous



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and Prevention of Bronchiolitis

***“Clinicians should assess  
hydration and ability to take  
fluids orally”***

***“Clinicians should administer  
nasogastric or intravenous fluids for  
infants with a diagnosis of  
bronchiolitis who cannot maintain  
hydration orally”***



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## Routes of Fluid Administration in Acute Care

### **Intravenous or Nasogastric**

- When the respiratory rate exceeds 60 to 70 breaths per minute, feeding may be compromised,
  - if nasal secretions are copious
- Infants with respiratory difficulty
  - nasal flaring
  - increased intercostal or sternal retractions
  - prolonged expiratory wheezing

### **Oral**

- Infants with mild respiratory distress may require only observation



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# Chest Physiotherapy

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***“Chest physiotherapy should  
not be used routinely in the  
management of bronchiolitis”***

- Bronchiolitis is associated with airway edema and sloughing of the respiratory epithelium into airways, which results in generalized hyperinflation of the lungs.
- Lobar atelectasis is not characteristic of this disease

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(Ralston et al., 2014)

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# Supplemental Oxygen– Dealing with Hemodynamically Significant Heart or Lung Defects/Disease

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**Infants with a known history of hemodynamically significant heart or lung disease and premature infants require close monitoring as the oxygen is being weaned**

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(Ralston et al., 2014)

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# When to Consider HFNC or NIPPV

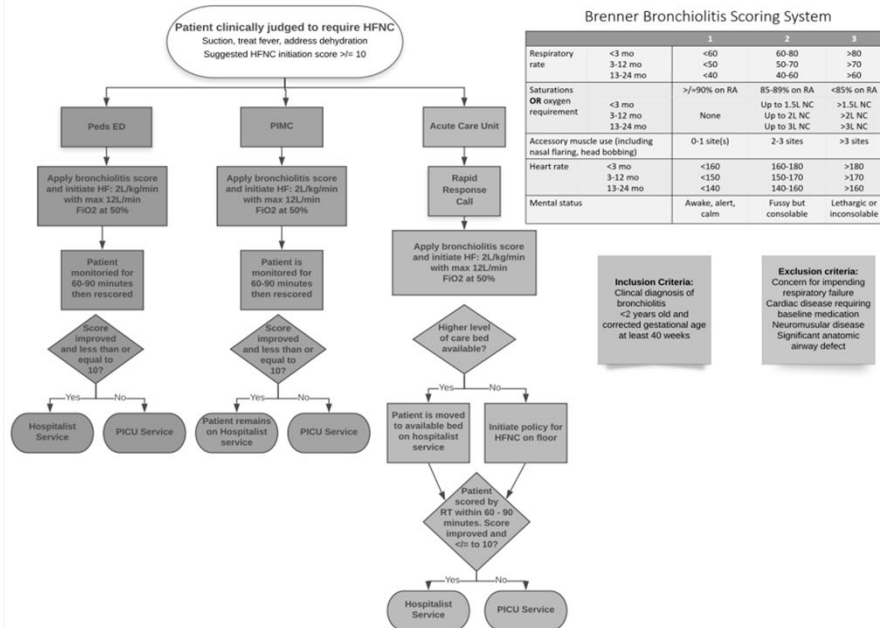
- Severe Bronchiolitis
  - Airway obstruction
  - Hypoxemia
  - Increased work of breathing
  - Respiratory distress
- Requiring multimodal support
  - Hydration
  - Oxygen Support
  - Need for assisted ventilation
- Trigger/Clinical Decision Support Tools
  - Bronchiolitis Scoring System



<https://commons.wikimedia.org/wiki/User:Bobjgalindo>

## Example of Bronchiolitis HFNC Decision Support Tool

### Bronchiolitis High Flow Nasal Cannula Initiation Protocol



## High Flow Nasal Cannula

- Helps to maintain functional residual capacity (FRC) with positive airway pressure (PAP)
  - Overcomes expiratory flow
  - Small amount of PEEP provided (~2 to 4cm H2O)
- Facilitates breathing
  - Overcomes nasopharyngeal resistance
    - Edema
    - Secretions
  - Physiologic dead space washout (nasopharynx, trachea, bronchi)
    - Clears out CO<sub>2</sub>
- Reduce work of breathing → improve comfort
  - Mucociliary clearance via humidification (37C – optimal temperature for ciliary movement)



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ORIGINAL ARTICLE

## A Randomized Trial of High-Flow Oxygen Therapy in Infants with Bronchiolitis

Donna Franklin, B.N., M.B.A., Franz E. Babl, M.D., M.P.H., Luregn J. Schlapbach, M.D., Ed Oakley, M.B., B.S., Simon Craig, M.B., B.S., M.H.P.E., M.P.H., Jocelyn Neutze, M.B., Ch.B., Jeremy Furyk, M.B., B.S., M.P.H.&T.M., John F. Fraser, M.B., Ch.B., Ph.D., Mark Jones, Ph.D., Jennifer A. Whitty, B.Pharm., Grad.Dip.Clin.Pharm., Ph.D., Stuart R. Dalziel, M.B., Ch.B., Ph.D., and Andreas Schibler, M.D.

- Multicenter RCT
- Infants <12 Months
- Bronchiolitis with Supplemental Oxygen Need
- 2 Groups
  - HFNC (n=739)
  - Standard/LFNC (n=733)
- Definition of Standard/LFNC Treatment Failure
  - Clinical Criteria (≥3)
    - Tachycardia – persistent
    - Tachypnea
    - Hypoxemia
    - Medical Review/PEWS Trigger
- Results/Conclusion
  - “No significant differences were observed in the duration of hospital stay or the duration of oxygen therapy”
  - “The percentage of infants receiving escalation of care was
    - 12% (87 of 739 infants) in the high-flow group
    - 23% (167 of 733) in the standard-therapy group”
  - 167 infants in the standard-therapy group had treatment failure
    - 102 (61%) therapeutic response to high-flow rescue therapy.



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## Considerations in HFNC and NIPPV

### HFNC

- Therapeutics
  - Reduce dead space and resistance
    - Increase laminar flow
  - Decrease WOB
  - Provide humidity and temperature
- More comfortable and accepted by pediatric patients better

### NIPPV (example: Nasal CPAP)

- Superior to standard treatment
- Higher risk of mucosal/nasal injury
- Lower treatment failure
  - “providing positive end-expiratory pressure (PEEP), resulting in distending airway pressure on the distal airway. This effect may decrease the airways’ resistance and help prevent alveolar collapse and obstructive apnea”



## Escalation of Treatment



## Discharge Education and Primary Prevention



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### PROTECT YOUR CHILD from RSV

Avoid close contact with sick people

Wash your hands often

Cover your coughs  
& sneezes

Clean & disinfect surfaces

Avoid touching your face  
with unwashed hands

Stay home when you're sick



[www.cdc.gov/rsv](http://www.cdc.gov/rsv)

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## Objective and Quantifiable Return Criteria and Guidance

- Treatment is supportive – No antibiotics
- Goals of Supportive Care
  - Management of Nasal Congestion
  - Use of OTC Analgesics and Antipyretics- offer weight-based dosing
    - Acetaminophen 15mg/kg/dose q6hrs
    - Ibuprofen 10mg/kg/dose q6hrs (Remember ONLY ≥6 Months)
- Anticipatory Education
  - Guidelines for feeding and urine output-
    - Urine/Wet Diapers: Every 8 hours (~3 per 24 hours)
    - PO Intake: 50% fluids (try Pedialyte)
  - **Clinical syndrome will get worse but usually peak around day 4 of illness**
- Recognition of worsening respiratory distress
- When to call PCP or go to the ED:
  - Tachypnea/respiratory distress
  - Concerns of hypoxia
  - Unable to PO
  - Decreased or absent urine output
  - Fever that cannot be managed with acetaminophen and/or ibuprofen



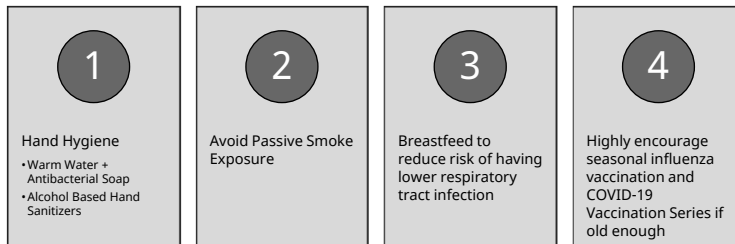
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## Additional Supportive Care and Prevention



- Follow up in PCP office in around 4 days
  - Can consider telehealth modalities
- Supportive Care
  - Honey for cough (> 1 year old)
  - Humidification
  - Nasal Suctioning with Saline drops or spray



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## Prophylaxis - Palivizumab

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**should not administer palivizumab to otherwise healthy infants with a gestational age of 29 weeks, 0 days or greater**

**administer palivizumab during the first year of life to infants with hemodynamically significant heart disease or chronic lung disease of prematurity defined as preterm infants 21% oxygen for at least the first 28 days of life**

**administer a maximum 5 monthly doses (15 mg/kg/dose) of palivizumab during the respiratory syncytial virus season to infants who qualify for palivizumab in the first year of life**



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(Ralston et al., 2014)

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## The Don'ts of Bronchiolitis Anticipatory Guidance



**Cough and Cold Medications**  
**Cough Suppressants**  
**Antihistamines**  
**Inhaled Nasal Corticosteroids**



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## Summary

- Drastic increase in bronchiolitis illness in second half of 2022
- AAP Guidelines are currently out of date (have not been re-affirmed).
- In infants and toddlers that have recurrent viral wheeze with LRTI, considerations should be made for albuterol, ICS, and systemic steroids.
- HFNC can provision increase respiratory comfort in acute bronchiolitis illness
- Be mindful of the need for potential expansion of the differential diagnosis (Pneumonia, AOM, Cardiac, Pertussis etc.)

**-- Take the whole child into consideration --**



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# References

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