Bronchiolitis 2013

Outpatient

Patient presents with Respiratory Distress

Does patient meet Bronchiolitis criteria?

No → Other diagnoses

Yes → Provide appropriate care

Write Bronchiolitis, Outpatient treatment orders
- Nasal suction
- Antipyretic dosing
- Oxygen therapy to maintain SpO2 > 90%
- Consider inhaled racemic epinephrine 0.5 ml, NEB, 1 time only

Initiate treatment

Evaluate response

Does patient meet discharge criteria?

No → Consider and initiate additional treatment

Yes → Discharge Patient

Evaluate response

Does patient meet discharge criteria?

No → Admit to PICU

Yes → Admit to General Pediatric Service

Evidence does not support routine use of the following:
- Hypertonic saline
- Albuterol
- Glucocorticosteroids
- Antibiotics
- Laboratory tests
- Chest x-rays

Review / revised: 9/23/04, 10/27/04, 11/10/04, 12/1/04, 12/7/04, 04/09/2013, 05/03/2013, 10/30/2013
**Epidemiology:** Bronchiolitis is the most common lower respiratory tract infection in infants. There is no specific diagnostic test for bronchiolitis. It is a viral disease whose causative agents include most prominently RSV, human meta-pneumovirus, adenovirus and parainfluenza virus, although other viruses have been implicated.

Diagnosis of bronchiolitis is made by a typical history and physical examination in the appropriate age group (infants and toddlers). It typically begins as an apparent upper respiratory tract infection with sneezing, cough and congestion.

There may be diminished appetite and fever. This is followed by the gradual onset of respiratory distress frequently including paroxysmal cough, wheezing, and tachypnea. Findings on physical examination often include wheezing and may include crackles, retractions, nasal flaring, grunting and a prolonged-expiratory phase.

**Objective of Guideline:** To standardize the care of children who present for the first time with symptoms typical of bronchiolitis.

**Target Users:** Emergency Department/ Urgent Care Center (ED/UCC) physicians, General Pediatricians, Pediatric Nurse Practitioners

**Guideline Inclusion Criteria:** The guideline includes infants who are 2-24 months of age presenting with the typical bronchiolitis presentation.

**Guideline Exclusion Criteria:** This guideline excludes infants with:

- Asthma
- Pneumonia
- Airway compromise from foreign body or anatomic stricture or laxity (vascular rings, tracheo- or bronchomalacia)
- Congestive heart failure
- Pertussis
- GERD
- Chronic aspiration
- Inhalation injury
- Cystic Fibrosis
- Chronic lung disease
- History of lower airway surgery
- Immunodeficiency

**Clinical Questions Answered by Guideline:**

1. For the child who presents with the symptoms of bronchiolitis should inhaled racemic epinephrine be used in the inpatient or outpatient settings?
2. For the child who presents with the symptoms of bronchiolitis should glucocorticoids be used in the inpatient or outpatient settings?
3. For the child who presents with the symptoms of bronchiolitis should short acting beta agonists be used in the inpatient or outpatient settings?
4. For the patient who presents with the symptoms of bronchiolitis should inhaled hypertonic saline be used?
5. For the child who presents with the symptoms of bronchiolitis should antibiotics be used in the inpatient or outpatient settings?
6. For the child being treated for the symptoms of bronchiolitis, what is the goal oxygen saturation that should be maintained?
7. For the child with bronchiolitis should laboratory tests be obtained?
8. For the child with bronchiolitis should a chest x-ray be obtained?
9. For the child with bronchiolitis when should nasal suctioning (with a bulb tip) or nasopharyngeal suctioning (with a catheter) be used to clear secretions?

**Differential Diagnosis:**

- Asthma
- Pneumonia
- Congestive heart failure
- Pertussis
- GERD
- Chronic aspiration
- Inhalation injury
- Cystic fibrosis
- Chronic lung disease
- History of lower airway surgery
- Immunodeficiency (specifically lymphocytes < 2,500)
- Obstructions involving large airways
  - Foreign body in trachea or bronchus
  - Vocal cord dysfunction
  - Vascular rings
  - Tracheomalacia, bronchomalacia

**Practice Recommendations:**

**Physical Exam:** The physical exam of a child presenting with suspected bronchiolitis focuses on respiratory symptoms including tachypnea, intercostals retractions and sub-costals retractions. An expiratory wheeze and crackles, both coarse and fine may be heard on auscultation (Piedra & Stark, 2012). Oxygen saturation may be < 95%. Upper respiratory congestion will be present.

**Diagnostics:** Bronchiolitis is diagnosed on the basis of the history and physical examination. There is no gold standard for diagnosing the disease. Although the viral etiology may be identified (e.g. by viral culture, nucleic amplification testing, or rapid antigen testing), there is no specific test that confirms the diagnosis of bronchiolitis itself. RSV rapid antigen testing, chest x-ray, complete blood counts, and basic metabolic panels may be indicated in specific clinical situations, though there is no evidence for routinely obtaining these tests. (American Academy of Pediatrics [AAP], 2006).

**Treatment:**
• Inpatient and Outpatient
  o Suction
  o Antipyretic dosing
  o Topical anesthetic prior to needle procedure
  o Oxygen therapy to maintain oxygen saturation above 90%

• Outpatient
  o Racemic epinephrine may be considered in the outpatient setting. Studies have shown a reduction in admissions for patients receiving inhaled racemic epinephrine compared to patients receiving placebo inhalations.

• Inpatient
  o Nebulized hypertonic (3%) saline as therapy for children who have increased need for mucociliary clearance. Discuss with the Respiratory Therapist to follow the Respiratory Care Services Policy and Procedure to administer inhaled hypertonic saline.

• Evidence does not support routine use of the following, for either the inpatient or outpatient management of bronchiolitis:
  o Glucocorticoids
  o Antibiotics
  o Laboratory tests
  o Chest x-rays

• PICU Criteria: non resolution or worsening of symptoms
  o Recurrent apnea requiring close monitoring
  o Severe respiratory distress
  o Respiratory failure
  o Hypoxemia (oxygen saturation < 90%) refractory to low flow oxygen therapy

• Discharge Criteria: Resolution of respiratory distress and infrequent respiratory care needs:
  o Respiratory rate for the infant is near 60 breaths per minute or less.
  o There is minimal to no increased work of breathing
  o Stable without the need for nasopharyngeal suctioning for an adequate length of time.

• Nutrition:
  o The patient is able to maintain adequate hydration with oral feedings.

• Medication/Durable medical equipment:
  o If the patient is receiving intravenous medications, convert to oral medications if the child will be going home on the medications.
  o If the patient responded to bronchodilators, consider similar medication for home use along with appropriate durable medical equipment (spacer with mask).
  o Bulb syringe.

• Social/Education:
  o Parental comfort with discharge plans.
  o Family or caregiver has the resources to care for the child.
  o Parent education on:
    ▪ How to use a bulb syringe with or without nasal saline.
    ▪ The expected course of illness - the course may be variable many children will have up to six weeks of cough and/or nasal congestion.
    ▪ The signs and symptoms of respiratory distress - increased respiratory rate or labored breathing (including abdominal breathing, retractions, tracheal tug or nasal flaring).
    ▪ Home intervention when distress occurs - suctioning, fever control.
- The signs and symptoms of dehydration - dry mouth, no tears, cool extremities, infrequent or small voids.
  - Explain Bronchiolitis Care Card (English version, Spanish version) to parents.
  - Contact the primary care physician about the discharge plans and arrange for follow up evaluation.

**Outcome Measures:**
By Division: % of children diagnosed with bronchiolitis where the Bronchiolitis PowerPlan was used.
By location
  - Number of children seen with ICD9 466.0, 466.11, and 466.19
  - Use of the following medications
    - Racemic epinephrine
    - Hypertonic saline
    - Albuterol
      - Intermittent
      - Continuous
    - Glucocorticoids
      - Prednisone
      - Prednisolone
      - Dexamethasone
  - Antibiotics

**Outcomes:**
PowerPlan usage
For all locations number of readmits to same or greater level of care
For ED/UCC length of time in ED/UCC (min)
For Outpatient locations, number admitted

**Potential Cost Implications:**
Potential cost savings with decreased use of medication and lab utilization.

**Potential Organizational Barriers:**
Training of staff on new procedures
- Use of hypertonic saline (inhaled) on inpatient units
- Change to nasal suction to preferred method, with nasopharyngeal as backup method to clear secretions
- New lower limit of oxygen saturation level for use of oxygen therapy
Clinical Questions Answered:
Question 1: For the child who presents with the symptoms of bronchiolitis should inhaled racemic epinephrine be used in the inpatient or outpatient settings?

Bronchiolitis Team Recommendation:

**Outpatient**
Based on moderate quality evidence that nebulized racemic epinephrine reduces hospital admission in the 24 hours following the treatment, the Bronchiolitis CPG Team recommends that nebulized racemic epinephrine may be used in the outpatient setting. We placed high value on reducing the need for hospital admission. From six moderate quality studies, outpatients who received epinephrine had significantly less hospitalization at 24 hours following treatment (though not at 7 days) than those who received placebo.

**Inpatient**
Based on moderate quality evidence, the Bronchiolitis CPG Team recommends not using racemic epinephrine for prolonged or repeated doses for children hospitalized with bronchiolitis. We place high value on avoiding exposure to a medication without evidence to support its use. According to Hartley, et al., (2011) there is insufficient evidence to support the “use of epinephrine, with or without steroids, for the treatment of bronchiolitis at this time.”

Literature (See Appendix A) supporting this recommendation:
Thirty-five citations were found from the search with eight citations appearing to answer the question. However, five of the identified studies were included in the Hartling et al. (2011) meta-analysis. Therefore, the Hartling meta-analysis was analyzed using GRADEprofiler (GRADEpro) and single study analysis was completed using RevMan for Hariprakesh et al. (2003), Langley et al. (2005), and Walsh et al. (2008).
Question 2: For the child who presents for the symptoms of bronchiolitis should glucocorticosteriods be used in the inpatient or outpatient settings?

Bronchiolitis Team Recommendation:

**Outpatient**
Based on high quality evidence, the Bronchiolitis CPG Team recommends that glucocorticoid not be used for the outpatient treatment of the child who presents for the first time with the symptoms of bronchiolitis. We placed high value on avoiding exposure to a medication without evidence to support its use. This recommendation can apply to most patients in most circumstances. Ten studies, summarized in a Cochrane Review (Fernandes et al., 2010) showed that when glucocorticoids were given, hospitalization from the outpatient setting was not decreased. Children who received steroids and were then admitted to the hospital did not have a shorter length of stay. However, there is an exploratory report from a large, high quality trial that suggests combining systematic glucocorticoids (specifically dexamethasone) with epinephrine may significantly reduce hospital admissions. No short-term adverse effects noted, and the trial was not designed to evaluate long-term effects. Further research is likely to change our confidence in the estimate of the effect.

**Inpatient**
Based on high quality evidence, the Bronchiolitis CPG Team recommends that glucocorticoids not be used for inpatient treatment of the child who presents for the first time with the symptoms of bronchiolitis. We placed high value on avoiding exposure to a medication without evidence to support its use. This recommendation can apply to most patients in most circumstances. Further research is likely to change our confidence in the estimate of the effect.

**Literature (See Appendix B) supporting this recommendation:**
Sixty four citations were found from the literature search. One Cochrane Database of Systematic Reviews (CDSR) paper is included (Fernandes et al., 2010). Single studies identified in by the Bronchiolitis Team are included in the Fernandes 2010 CDSR, and are not reported upon separately.
Question 3: For the child who presents with the symptoms of bronchiolitis should short acting beta agonists be used in the inpatient or outpatient settings?

Bronchiolitis Team Recommendation:

**Outpatient**
Based on moderate to low quality evidence, the Bronchiolitis CPG Team recommends that SABA not be used for the outpatient treatment of the child who presents for the first time with the symptoms of bronchiolitis. We placed high value on avoiding exposure to a medication without evidence to support its use. This recommendation can apply to most patients in most circumstances. The Gadomski and Brower (2010) CDSR(included 15 low to moderate quality studies) reported that the use of bronchodilators did not improve oxygen saturation as measured by pulse oximetry, clinical score, decrease length of stay, or decrease time to resolution of illness

**Inpatient**
Based on high quality evidence, Bronchiolitis CPG Team recommends that SABA not be used for the inpatient treatment of the child who presents for the first time with the symptoms of bronchiolitis. We placed high value on avoiding exposure to a medication without evidence to support its use. This recommendation can apply to most patients in most circumstances. All studies identified by this CPG team were included in the Gadomski and Brower (2010) CDSR. Gadomski and Brower (2010) reported from seven moderate quality studies that clinical score did not improve with the use of beta- agonists. From 5 moderate quality inpatient studies, use of beta agonists did not decrease length of stay and from two moderate quality studies, use of beta agonists did not affect time to resolution of illness, measured in days.

**Literature (See Appendix C) supporting this recommendation:** Twenty one citations were found from the literature search. One CDSR paper is included (Gadomski and Brower, 2010). Single studies identified in by the Bronchiolitis Team are included in the CDSR, and are not reported upon separately.
Question 4. For the patient who presents with the symptoms of bronchiolitis should inhaled saline be used?

Bronchiolitis Team Recommendation

**Outpatient**
Based on high quality evidence, the Bronchiolitis CPG Team recommends not using hypertonic saline for the outpatient treatment of the child who presents for the first time with symptoms of bronchiolitis. We placed high value on avoiding exposure to a medication without evidence to support its use. This recommendation can apply to most patients in most circumstances. The Zhang Mendoza, Sassi, Wainwright and Klassen (2008) CDSR reported on two emergency department based studies that failed to show significant short-term effects (30-120 minutes) of up to two doses of nebulized hypertonic saline in improving clinical score and oxygen saturation.

**Inpatient**
Based on moderate quality evidence the Bronchiolitis CPG Team recommends the use of hypertonic saline in children who have increased need for mucociliary clearance. Four moderate quality studies included in the meta-analysis found the use of hypertonic saline reduced hospital length of stay, significantly improved clinical severity scores on hospital day two and decreased the rate of re-admission.

Literature (See Appendix D) supporting this recommendation: Ten citations were located by the PubMed search, four were located by the CINAHL search and one CDSR was located. Single studies identified in by the Bronchiolitis Team are included in the Zhang, et al.(2008) CDSR, and are not reported upon separately.

Synthesis Author(s): EBP Scholars, (Allen, N.H. Collum, K. E)
Date: 2012-06-26
Question 5: For the child who presents with the symptoms of bronchiolitis, should antibiotics be used in the inpatient or outpatient settings?

**Bronchiolitis Team Recommendation: Outpatient and Inpatient**

Based on high quality evidence, the Bronchiolitis CPG Team recommends that not be used routinely for the child who presents for the first time with the symptoms of bronchiolitis. The presence of secondary infection should be treated appropriately. The recommendation is based on the CDSR by Spruling, Doust, Del Mar and Eriksson (2011). It included five studies - two high quality and three of moderate quality. The use of antibiotics did not affect duration of symptoms, (at three days) length of stay for inpatients, re-admission rate or deaths.

**Literature (see Appendix E) supporting this recommendation: (See Appendix E)** Ninety-five citations were located by the PubMed search, no unique articles were added by the CINAHL search and one CDSR was located. The CDSR by Spruling, 2011 is included in this review. No single studies published since the CDSR were identified that answered this question.
Question 6: For the child being treated for the symptoms of bronchiolitis, what is the goal oxygen saturation that should be maintained?

Bronchiolitis Team Recommendation:
Outpatient and Inpatient
The Bronchiolitis Team recommends using supplemental oxygen to maintain an oxygen saturation $\geq 90\%$, based on the American Academy of Pediatrics (AAP, 2006) statement for the care of the patient with bronchiolitis. Per the AAP statement, tolerance of oxygen saturation in the low 90% is influenced by acidosis, some hemoglobinopathies, correct position of the O2 saturation probe, temporal relation to the last nasal clearance of secretions, and the infant's work of breathing. Oxygen supplementation may be administered when SaO2 is greater than 90% if any of these factors are present. We placed a high value on assuring the comfort of the infant.
Question 7: For the child with bronchiolitis should laboratory tests and/or chest x-ray be obtained?

Bronchiolitis Team Recommendation:
Outpatient and Inpatient
The Bronchiolitis CPG Team recommends not routinely obtaining laboratory tests such as CBC & Diff w/platelets, Basic Metabolic Panel, Blood Culture, RSV antigen detection, Flu A &B antigen, or chest x-ray for the infant who is presenting for the first time with symptoms of bronchiolitis. The recommendation concurs with the AAP (2006) and Scottish Intercollegiate Guidelines Network (SIGN, 2009) bronchiolitis guidelines. RSV antigen testing may be obtained if applied to cohorting infants on inpatient units. Bronchiolitis is diagnosed based on history and physical examination (AAP, 2006). We placed high value on avoiding unnecessary medical testing and reduction of discomfort to the patient.
**Question 8:** For the child with bronchiolitis, when should nasal suctioning (with a bulb tip) or nasopharyngeal suctioning (with a catheter) be used to clear secretions?

**Bronchiolitis Team Recommendation:**

**Outpatient and Inpatient**

Based on low quality evidence, the Bronchiolitis CPG Team recommends the use of nasal suctioning as the primary route for removing respiratory secretions. Nasopharyngeal (NP) suctioning may be used if signs of labored breathing continue after nasal suctioning. We placed high value on amelioration of labored breathing and decreasing potential adverse effects of deep suctioning. One low quality study reports reduction in visible and audible secretions with NP suctioning. However, a QI project completed at Children's Mercy South by Jarvis et al (2012) showed similar hospital readmission rates, admissions to the PICU, parental satisfaction, and average length of stay when nasal suctioning increased by 13% and NP suctioning decreased by 15% over two bronchiolitis seasons. This recommendation may change when higher quality evidence becomes available.

**Literature (See Appendix F) supporting this recommendation:** No citations were found on searches of PubMed or CINAHL on bronchiolitis and deep suctioning. However, 13 citations were located when searching CINAHL searching on just Bronchiolitis and suctioning. Of these articles, two articles are included in this review. Additionally, a QI project conducted at Children’s Mercy South informed this review.
Supporting Tools

Care Cards:
1. Bronchiolitis, English and Spanish
2. Using a Blub Syringe English and Spanish
3. Fever, English and Spanish

Procedures:
1. Nebulized #5 Hypertonic Saline for Bronchiolitis, CMH Respiratory Care Policy and Procedure

**Guideline Preparation:** This guideline was prepared by The Office of Evidence Based Practice (EBP) in collaboration with content experts at Children’s Mercy Hospitals and Clinics. Development of this guideline supports the Department of Clinical Effectiveness’s initiative to promote care standardization that builds a culture of quality and safety that is evidenced by measured outcomes. If a conflict of interest is identified the conflict will be disclosed next to the team members name.

**Bronchiolitis Clinical Practice Guideline Team Members:**
**Team Leaders:**
- Lisa Avery, MD
- Chris Day, MD
- Jeff Michael, DO
- Kirsten Weltmer, MD

**Team Members**
- Rachael Dameron RRT
- Adria Donn, RRT
- Bob John, Pharm D
- Howard McCullough, RRT
- Daniela Pirvu, RN
- Diana Yu, Pharm D
- Peggy Stokes, IS Analyst

**Office of EBP Team Members:**
- Nancy Allen, MS, MLS, RD, LD, CNSC Evidence Based Research Specialist
- Tina Franklin, Executive Assistant
- Kimberley Rose, MBA, Administrative Assistant
- Keri Swaggart, MLIS, AHIP Medical Librarian
- Evidence Based Practice Scholars

**Guideline development funded by:**
No external funding was obtained in the development of this guideline.

**Development Process:**
The review summary documents the following steps:
1. Review of existing internal and external guidelines and standards
   b. External guidelines:


2. Review preparation
   a. PICOT (Patient, Intervention, Comparison, Outcome, Type of question) questions established
   b. Team leaders confirmed search terms employed by the Health Science Medical librarians, reviewed article titles and abstracts from the search, and identified articles to be read and synthesized by the Evidence Based Practice Scholars.

3. Databases searched
   a. AHRQ National Guideline Clearinghouse
   b. Medline
   c. CDSR
   d. CINAHL

4. Critically analyze the evidence
   a. Guidelines
      i. AGREE criteria were used to analyze published clinical guidelines
   b. Literature
      i. For single studies, the EBP Scholars used the Cochrane Collaborative’s electronic software, RevMan, to produce systematic reviews of the evidence of the effects of healthcare and delivered these documents to the team for review. RevMan allowed the EBP Scholars to build the tables of study characteristics, tables of study biases, and analyze study data in a meta-analysis. In instances when RevMan could not be used, CASP (Critical Appraisal Skills Programme) tools were utilized to analyze the literature.
      ii. The CASP tools were used to analyze the literature (e.g. study limitations, consistency of results, directness of evidence, precision and reporting bias) for single studies that were not amenable to be entered into RevMan. This included therapy and diagnostic studies. Systematic reviews without meta-analysis were analyzed with the CASP tools.
      iii. When a meta-analysis was found in the literature search, or created in RevMan, the GRADE criteria evaluated the literature using GRADEpro to assesses the meta-analysis for:
         a. Limitations in study design and execution
         b. Inconsistency between studies
         c. Indirectness of study outcomes
         d. Imprecision
         e. Publication bias
         f. The balance between desirable and undesirable effects
         g. Patient values and preferences
         h. Resource utilization
      c. Table 1 defines how the quality of the evidence is rated and how the recommendation is established based on the type of evidence.
<table>
<thead>
<tr>
<th>Grade of Recommendation</th>
<th>Confidence in Clarity of Benefits vs Harms, Burden, and Cost</th>
<th>Quality of Supporting Evidence</th>
<th>Implications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strong recommendation High quality evidence</td>
<td>Desirable effects clearly outweigh undesirable effects or vice versa</td>
<td>Consistent evidence from well-performed RCTs or exceptionally strong evidence from unbiased observational studies</td>
<td>Recommendation can apply to most patients in most circumstances. Further research is unlikely to change our confidence in the estimate of effect.</td>
</tr>
<tr>
<td>Strong recommendation Moderate-quality evidence</td>
<td>Desirable effects clearly outweigh undesirable effect or vice versa</td>
<td>Evidence from RCTs with important limitations (inconsistent results, methodological flaws, indirect evidence, or imprecise results) or unusually strong evidence from unbiased observational studies</td>
<td>Recommendation can apply to most patients in most circumstances. Further research (if performed) is likely to have an important effect on our confidence in the estimate of effect and may change the estimate.</td>
</tr>
<tr>
<td>Strong recommendation Low-quality evidence</td>
<td>Desirable effects clearly outweigh undesirable effect or vice versa</td>
<td>Evidence for at least 1 critical outcome from observational studies, from RCTs with serious flaws or indirect evidence</td>
<td>Recommendation may change when higher-quality evidence becomes available. Further research (if performed) is likely to have an important influence on our confidence in the estimate of effect and is likely to change the estimate.</td>
</tr>
<tr>
<td>Strong recommendation Very-low-quality evidence (Very rarely applicable)</td>
<td>Desirable effects clearly outweigh undesirable effect or vice versa</td>
<td>Evidence for at least 1 of the critical outcomes from unsystematic clinical observations or very indirect evidence</td>
<td>Recommendation may change when higher-quality evidence becomes available; any estimate of effect, for at least 1 critical outcome, is uncertain.</td>
</tr>
<tr>
<td>Recommended High-quality evidence</td>
<td>Desirable effects closely balanced with undesirable effects</td>
<td>Consistent evidence from well-performed RCTs or exceptionally strong evidence from unbiased observational studies</td>
<td>The best action may differ, depending on circumstances or patients or societal values. Further research is unlikely to change our confidence in the estimate of effect.</td>
</tr>
<tr>
<td>Recommended Moderate-quality evidence</td>
<td>Desirable effects closely balanced with undesirable effects</td>
<td>Evidence from RCTs with important limitations (inconsistent results, methodological flaws, indirect evidence, or imprecise results) or unusually strong evidence from unbiased observational studies</td>
<td>Alternative approaches likely to be better for some patients under some circumstances. Further research (if performed) is likely to have an important influence on our confidence in the estimate of effect and may change the estimate.</td>
</tr>
<tr>
<td>Recommended Low-quality evidence</td>
<td>Desirable effects closely balanced with undesirable effects</td>
<td>Evidence for at least 1 critical outcome from observational studies, from RCTs with serious flaws or indirect evidence</td>
<td>Other alternatives may be equally reasonable. Further research is likely to have an important influence on our confidence in the estimate of effect and is likely to change the estimate.</td>
</tr>
<tr>
<td>Recommended Very-low-quality evidence</td>
<td>Desirable effects closely balanced with undesirable effects</td>
<td>Evidence for at least 1 critical outcome from unsystematic clinical observations or very indirect evidence</td>
<td>Other alternatives may be equally reasonable. Any estimate of effect, for at least 1 critical outcome, is uncertain.</td>
</tr>
</tbody>
</table>
5. Recommendations for the guideline were developed by a consensus process incorporating the three principles of EBP (current literature, content experts, and patient and family preference [when possible]).

**Approval Process:** Guidelines are reviewed and approved by internal and external expert reviewers, Content Expert Team, the Office of EBP, and other appropriate hospital committees as deemed suitable for the guidelines intended use. Guidelines are reviewed and updated as necessary every 3 years within the Office of EBP at CMH&C. Content expert teams will be involved with every review and update.

**Disclaimer:**
The content experts and the Office of EBP are aware of the controversies surrounding the Bronchiolitis Clinical Practice Guideline. When evidence is lacking or inconclusive, options in care are provided in the guideline and the power plans that accompany the guideline.

These guidelines do not establish a standard of care to be followed in every case. It is recognized that each case is different and those individuals involved in providing health care are expected to use their judgment in determining what is in the best interests of the patient based on the circumstances existing at the time.

It is impossible to anticipate all possible situations that may exist and to prepare guidelines for each. Accordingly these guidelines should guide care with the understanding that departures from them may be required at times.
References:

Included


**Excluded**


*Reason for exclusion:* Included in Hartling et al. (2011) CDSR


*Reason for exclusion:* Included in Fernandes et al. (2010).


*Reason for exclusion:* Included in Fernandes et al. (2010).


Reason for exclusion: Included in Hartling et al. (2011) CDSR


Reason for exclusion: Included in Hartling et al. (2011) CDSR

*Reason for exclusion:* Included in Hartling et al. (2011) CDSR


*Reason for exclusion:* Did not answer a question


*Reason for exclusion:* Included in Hartling et al. (2011) CDSR
Appendix A

Question 1: For the child who presents with the symptoms of bronchiolitis should inhaled racemic epinephrine be used in the inpatient or outpatient settings?

**GRADEpro Table:**

<table>
<thead>
<tr>
<th>Quality assessment</th>
<th>No of patients</th>
<th>Effect</th>
<th>Quality</th>
<th>Impactance</th>
</tr>
</thead>
<tbody>
<tr>
<td>No of studies</td>
<td>Design</td>
<td>Risk of bias</td>
<td>Inconsistency</td>
<td>Indirectness</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Length of Stay (inpatients only) (range of scores: 2.45-2.9; Better indicated by lower values)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2 randomize d trials</td>
<td>serious</td>
<td>no serious inconsistency</td>
<td>no serious indirectness</td>
<td>no serious imprecision</td>
</tr>
<tr>
<td>Admission at enrollment or &lt;24 hours (outpatient only (assessed with: Count))</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6 randomize d trials</td>
<td>serious</td>
<td>no serious inconsistency</td>
<td>no serious indirectness</td>
<td>no serious imprecision</td>
</tr>
<tr>
<td>Admissions overall up to 7 days (outpatient only) (assessed with: Count)</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3 randomize d trials</td>
<td>no serious risk of bias</td>
<td>serious</td>
<td>no serious indirectness</td>
<td>serious</td>
</tr>
<tr>
<td>Outpatient clinical score at 60 minutes (Better indicated by lower values)</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6 randomize d trials</td>
<td>no serious risk of bias</td>
<td>no serious inconsistency</td>
<td>no serious indirectness</td>
<td>no serious imprecision</td>
</tr>
</tbody>
</table>

1. One study had high risk for selective reporting bias.
2. Poorly reported allocation concealment
3. Poorly reported blinding technique
4. Chose the mean baseline risk as the variation in risk was similar across studies (~20%), except one study where it was 75%. (Ralston 2005a)
5. One study varied the saline conc of the epinephrine carrier as well
6. Low number of events

**Synthesis Author(s):** EBP Scholars (Allen, N. H., Menown, J., Pirvu, D., Shubat, S. J., Tobin, T.,)
Date: 2011-11-30

**Forest Plots of Comparisons**

Epinephrine versus placebo, outcome: Hospital admission after 2 hours.
Racemic epinephrine versus salbutamol, outcome: Change in wheezing score on hospital day 2.

<table>
<thead>
<tr>
<th>Study or Subgroup</th>
<th>Experimental Mean</th>
<th>SD</th>
<th>Total</th>
<th>Control Mean</th>
<th>SD</th>
<th>Total</th>
<th>Weight</th>
<th>Mean Difference IV, Fixed, 95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Langley 2005</td>
<td>1.59</td>
<td>2.5</td>
<td>20</td>
<td>2.65</td>
<td>4.2</td>
<td>20</td>
<td>100.0%</td>
<td>-0.6 [-3.2, 1.08]</td>
</tr>
<tr>
<td>Total (95% CI)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>20</td>
<td></td>
<td></td>
<td>20</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Heterogeneity: Not applicable</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Test for overall effect: Z = 0.97 (P = 0.33)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Racemic epinephrine versus salbutamol, outcome: Adverse effects—(mild, moderate & severe)

<table>
<thead>
<tr>
<th>Study or Subgroup</th>
<th>EPI Events</th>
<th>Total</th>
<th>salbutamol Events</th>
<th>Total</th>
<th>Weight</th>
<th>Risk Ratio M-H, Fixed, 95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Langley 2005</td>
<td>14</td>
<td>31</td>
<td>16</td>
<td>31</td>
<td>100.0%</td>
<td>0.88 [0.52, 1.47]</td>
</tr>
<tr>
<td>Total (95% CI)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>31</td>
<td></td>
<td>31</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Heterogeneity: Not applicable</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Test for overall effect: Z = 0.51 (P = 0.61)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Racemic epinephrine versus salbutamol, outcome: Length of stay.

<table>
<thead>
<tr>
<th>Study or Subgroup</th>
<th>Experimental Mean</th>
<th>SD</th>
<th>Total</th>
<th>Control Mean</th>
<th>SD</th>
<th>Total</th>
<th>Weight</th>
<th>Mean Difference IV, Fixed, 95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Langley 2005</td>
<td>2.6</td>
<td>1.63</td>
<td>31</td>
<td>3.4</td>
<td>2.18</td>
<td>31</td>
<td>100.0%</td>
<td>-0.80 [-1.76, 0.16]</td>
</tr>
<tr>
<td>Total (95% CI)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>31</td>
<td></td>
<td></td>
<td>31</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Heterogeneity: Not applicable</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Test for overall effect: Z = 1.64 (P = 0.10)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Racemic epinephrine versus salbutamol, outcome: Feeding difficulty—(less intake than normal) 1 week post discharge.

<table>
<thead>
<tr>
<th>Study or Subgroup</th>
<th>Epi Events</th>
<th>Total</th>
<th>Salbutamol Events</th>
<th>Total</th>
<th>Weight</th>
<th>Risk Ratio M-H, Fixed, 95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Langley 2005</td>
<td>15</td>
<td>30</td>
<td>13</td>
<td>31</td>
<td>100.0%</td>
<td>1.19 [0.69, 2.06]</td>
</tr>
<tr>
<td>Total (95% CI)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>30</td>
<td></td>
<td>31</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Heterogeneity: Not applicable</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Test for overall effect: Z = 0.63 (P = 0.53)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Racemic epinephrine versus salbutamol, outcome: Hospital admission from the ED.

<table>
<thead>
<tr>
<th>Study or Subgroup</th>
<th>Racemi EPI Events</th>
<th>albuterol Events</th>
<th>Total</th>
<th>Weight</th>
<th>Risk Ratio M-H, Fixed, 95% CI</th>
<th>Risk Ratio M-H, Fixed, 95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.5.1 Walsh 2008 Severe</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Walsh 2008</td>
<td>2</td>
<td>21</td>
<td>26</td>
<td>5</td>
<td>0.50 [0.11, 2.30]</td>
<td></td>
</tr>
<tr>
<td>Subtotal (95% CI)</td>
<td>2</td>
<td>26</td>
<td>26</td>
<td>2.6%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total events</td>
<td>2</td>
<td>5</td>
<td>5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Heterogeneity: Not applicable</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Test for overall effect: Z = 0.90 (P = 0.37)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| 2.5.2 Walsh 2008 Moderate |                  |                  |       |        |                             |                             |
| Walsh 2008        | 63                | 192              | 227   | 49.6%  | 0.80 [0.62, 1.03]           |                             |
| Subtotal (95% CI) | 192               | 227              | 227   | 49.6%  |                             |                             |
| Total events      | 63                | 93               | 93    |         |                             |                             |
| Heterogeneity: Not applicable |
| Test for overall effect: Z = 1.70 (P = 0.09) |

| 2.5.3 Walsh 2008 Mild |                  |                  |       |        |                             |                             |
| Walsh 2008        | 66                | 97               | 78    | 40.6%  | 0.84 [0.71, 1.00]           |                             |
| Subtotal (95% CI) | 97                | 78               | 78    | 40.6%  |                             |                             |
| Total events      | 66                | 63               | 63    |         |                             |                             |
| Heterogeneity: Not applicable |
| Test for overall effect: Z = 1.93 (P = 0.05) |

| 2.5.4 Mull 2004 |                  |                  |       |        |                             |                             |
| Mull 2004        | 16                | 34               | 32    | 7.2%   | 1.25 [0.71, 2.22]           |                             |
| Subtotal (95% CI) | 34              | 32               | 32    | 7.2%   |                             |                             |
| Total events      | 16                | 12               | 12    |         |                             |                             |
| Heterogeneity: Not applicable |
| Test for overall effect: Z = 0.78 (P = 0.44) |

| Total (95% CI) | 344               | 363              | 100.0%|        | 0.84 [0.72, 0.98]           |                             |
| Total events      | 147               | 173              |       |         |                             |                             |
| Heterogeneity: Chi² = 2.47, df = 3 (P = 0.48); I² = 0% |
| Test for overall effect: Z = 2.18 (P = 0.03) |
| Test for subgroup differences: Chi² = 2.47, df = 3 (P = 0.48), I² = 0% |
Hariprakesh 2003

Methods randomized double-blind placebo controlled study. Study was done in the "pediatric admission unit" This unit accepts patients form general practitioners and from the main Accident and Emergency Department. United Kingdom

Participants Seventy-five infants aged 1 month to 1 year with a clinical diagnosis of acute bronchiolitis defined as presence of inspiratory crackles in an infant with otherwise predominantly upper respiratory tract illness

Interventions treated with either two doses of 2 ml of 1:1000 nebulized adrenaline or two doses of 5 ml of 0.9% saline

Outcomes Primary outcome--hospital admission after 2 hrs- criteria for admission- oxygen saturation > 92%, if they are lethargic, or unable to feed due to respiratory distress. Secondary outcomes were reductions in the RDAI score, respiratory rate and the heart rate and an increase in SaO2. Any adverse events or side-effects were also recorded.

Notes Excluded those who presented in the ED from 2200-0800. Score < 3 on the Respiratory Distress Assessment Instrument (RDAI) and born with extreme prematurity < 30 weeks, chronic cardiopulmonary disease, immunosuppressed or had received steroids within the previous 24 hours. Those who required more than supplemental oxygen were also excluded.

Risk of bias table

<table>
<thead>
<tr>
<th>Bias</th>
<th>Scholars’ judgment</th>
<th>Support for judgment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Random sequence generation (selection bias)</td>
<td>Low risk</td>
<td>The pharmacy department, using sealed envelopes according to a random numbered sequence, performed the randomization.</td>
</tr>
<tr>
<td>Allocation concealment (selection bias)</td>
<td>Low risk</td>
<td>Staff was unaware of which group the subject was assigned.</td>
</tr>
<tr>
<td>Blinding of participants and personnel (performance bias)</td>
<td>Low risk</td>
<td>Both medicines were packaged in identical syringes identified only by the study number.</td>
</tr>
<tr>
<td>Blinding of outcome assessment (detection bias)</td>
<td>Low risk</td>
<td>Staff was unaware of which group the subject was assigned.</td>
</tr>
<tr>
<td>Incomplete outcome data (attrition bias)</td>
<td>Low risk</td>
<td>They did not enroll subjects who presented from 2200-0800. 2 screened subjects were &quot;too unwell&quot; to be included in the study, and 13 were not enrolled for organizational factors that were not described. None of the above subjects were enrolled.</td>
</tr>
<tr>
<td>Selective reporting (reporting bias)</td>
<td>Low risk</td>
<td>they do report criteria for selection and dropping out from the study</td>
</tr>
<tr>
<td>Other bias</td>
<td>Low risk</td>
<td></td>
</tr>
</tbody>
</table>
Langley 2005

**Methods**  randomized, double blind controlled clinical trial, Emergency Department Rochester MN USA

**Participants**  Children diagnosed with bronchiolitis age 6 weeks to <=2 years, diagnosed by admitting physician. Definition - wheezing further characterized by high-pitched, musical, continuous respiratory sound. Parent able to read and write English have a phone in the home and not expected to move in the next month. Only enrolled between 0800-2000 in the ED or within 24 hours of admission.

**Interventions**  Use of aerosolized racemic epinephrine (0.5 ml of 2.25%) vs. salbutamol respirator solution by aerosol every 4 hours. Salbutamol dosing was weight based- > 10 kg received 1.5 mg; >6 kg and < 10 kg received 1.25 mg and < 6 kg received 0.75 mg.

**Outcomes**  Primary improved RDAI (Respiratory Score), secondary. LOS, total adverse effects, report of abnormal feeding symptoms by parents on telephone interview

**Notes**  Testing for RSV was routine for cohorting subjects if admitted. A bright red nasal discharge was found to be a known effect of administration of epinephrine, protocol was changed so the subject's nose was wiped by the bedside nurse prior to the study nurse

**Risk of bias table**

<table>
<thead>
<tr>
<th>Bias</th>
<th>Scholars’ judgment</th>
<th>Support for judgment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Random sequence generation (selection bias)</td>
<td>Low risk</td>
<td>Randomized in blocks of four, double blinded, computer generated random numbers table.</td>
</tr>
<tr>
<td>Allocation concealment (selection bias)</td>
<td>Low risk</td>
<td>Pharmacy dept. prepared study drugs in identical multi-dose vials, label study drug with code numbers.</td>
</tr>
<tr>
<td>Blinding of participants and personnel (performance bias)</td>
<td>Low risk</td>
<td>Participants were allocated by numbers that correlated with drug code numbers. A standard order sheet used. Research nurses used to enroll participants.</td>
</tr>
<tr>
<td>Blinding of outcome assessment (detection bias)</td>
<td>Low risk</td>
<td>the adverse effect of red nasal discharge on the first two enrollees, was later found to be effect of RA-- this was not known to study investigators at the start, this lend to un blinding of treatment allocation- hence an amendment to study protocol was made for subsequent patients, and he subject's nose was wiped by the bedside nurse prior to the study nurse.</td>
</tr>
<tr>
<td>Incomplete outcome data (attrition bias)</td>
<td>Unclear risk</td>
<td>All 62 participants 31 in each arm completed the inpatient portion of the study. One parent from the epinephrine group could not be contacted for follow up. insufficient information of adverse</td>
</tr>
</tbody>
</table>
Selective reporting (reporting bias) High risk Each arm had same number of participants -- however the study did not meet power, there should have been 33 in each group not 31.

Other bias Unclear uncertain how authors separated adverse effects between groups,

Walsh 2008

Methods Randomized controlled trial. Emergency Department California USA

Participants 703 children up to 18 months presenting to ED with a clinical diagnosis of bronchiolitis ill enough to warrant treatment but not need immediate intubation. Included those with prior wheezing episodes.

Interventions Racemic albuterol: 0.625mg for infants weighing <5 kg, 1.25 mg for children weighing ≥5 kg. Racemic epinephrine: 11.25 mg (0.5 mL of 2.25% solution)

Outcomes "Successful discharge" defined as discharge following study drug administration, not requiring additional bronchodilators in the ED and not resulting in admission within 72 hours of discharge.

Notes Crude results did not show a difference between drugs, but after adjusting for severity, there was found to be a lower risk of admission with albuterol compared to epinephrine. Used National Children's Hospital (NCH) severity-of-illness tool. Data tables could not be filled out because the only outcome data provided was sample size and means.

Risk of bias table

<table>
<thead>
<tr>
<th>Bias</th>
<th>Scholars' judgment</th>
<th>Support for judgment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Random sequence generation (selection bias)</td>
<td>Low risk</td>
<td>Randomization of patients done via computer-generated random number series.</td>
</tr>
<tr>
<td>Allocation concealment (selection bias)</td>
<td>Low risk</td>
<td>Patients randomized in blocks of 50.</td>
</tr>
<tr>
<td>Blinding of participants and personnel (performance bias)</td>
<td>Low risk</td>
<td>Participants and personnel (physicians, nurses, research assistants) were blinded. The pharmacist had sole, secure access to patient code list.</td>
</tr>
<tr>
<td>Blinding of outcome assessment (detection bias)</td>
<td>Low risk</td>
<td>Participants and personnel (physicians, nurses, and research assistants) were blinded. The pharmacist had sole, secure access to patient code list.</td>
</tr>
<tr>
<td>Incomplete outcome data (attrition bias)</td>
<td>Unclear risk</td>
<td>Power analysis required 374 patients and study included 352 patients in the epinephrine treatment arm and 351</td>
</tr>
</tbody>
</table>
Incomplete data in 62 of 703 (8.8%) cases. Intent to treat analysis performed. Neither excluding these cases nor using multiple imputations changed the results. The study protocol is available and all of the study’s pre-specified (primary and secondary) outcomes that are of interest in the review have been reported in the pre-specified way.

Selective reporting (reporting bias) Low risk

Other bias Unclear risk

All patients received saline mist during the consent process prior to randomization. If saline mist has a benefit, this would bias the study to the null. Saline also followed the epinephrine treatment to maintain blinding, again possibly biasing the study to the null. Also, control for discharge medications was not possible, potentially impacting the number of patients requiring admission within 72 hours of discharge.

Search strategy implemented:

PubMed Search performed on November 11, 2011:


http://www.ncbi.nlm.nih.gov/pubmed?term=((%22Bronchiolitis%2Fdrug%20therapy%22%5BMesh%5D%20OR%22Bronchiolitis%2Ftherapy%22%5BMesh%5D)%20NOT%20(%22Bronchiolitis%20Obliterans%22%5BMesh%5D%20OR%22%20Respiration%2C%20Artificial%22%5BMesh%5D))%20AND%20(%22racemic%20epinephrine%20%5BTIAB%5D%20OR%22nebulized%20epinephrine%22%5BTIAB%5D%20OR%22Epinephrine%20%5BTIAB%5D)AND%20(%22humans%22%5BMeSH%5D%20NOT%20(Editorial%5Bptyp%5D%20OR%20Letter%5Bptyp%5D%20OR%20Case%20Reports%5Bptyp%5D%20OR%20Comment%5Bptyp%5D)%20AND%20(English%5Blang%5D%20OR%22infant%22%5BMeSH%5D%20OR%22child%22%5BMeSH%5D))
Appendix B

**Question 2: For the child who presents for the symptoms of bronchiolitis should glucocorticoids be used in the inpatient or outpatient settings?**

**GRADEpro Table:**

<table>
<thead>
<tr>
<th>No of studies</th>
<th>Design</th>
<th>Risk of bias</th>
<th>Inconsistency</th>
<th>Indirectness</th>
<th>Imprecision</th>
<th>Other consideration</th>
<th>Glucocorticoids (systemic and inhaled)</th>
<th>Control</th>
<th>Relative (95% CI)</th>
<th>Absolute</th>
<th>Quality</th>
<th>Importance</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Outpatient- Admission by day 1 (follow-up mean 1 days; assessed with: count)</strong></td>
<td>10 randomized trials</td>
<td>no serious risk of bias</td>
<td>no serious inconsistency</td>
<td>no serious indirectness</td>
<td>no serious imprecision</td>
<td>none</td>
<td>Glucocorticoids (systemic and inhaled)</td>
<td>Control</td>
<td>20%</td>
<td>RR 0.92 (0.78 to 1.08)</td>
<td>16 fewer per 1000 (from 44 fewer to 16 more)</td>
<td>⊗⊗⊗⊗</td>
</tr>
<tr>
<td><strong>Outpatient- Admission by day 7 (follow-up 7 days; assessed with: count)</strong></td>
<td>6 randomized trials</td>
<td>no serious risk of bias</td>
<td>no serious inconsistency</td>
<td>no serious indirectness</td>
<td>no serious imprecision</td>
<td>none</td>
<td>Glucocorticoids (systemic and inhaled)</td>
<td>Control</td>
<td>251/743 (33.8%)</td>
<td>RR 0.86 (0.7 to 1.06)</td>
<td>47 fewer per 1000 (from 101 fewer to 20 more)</td>
<td>⊗⊗⊗⊗</td>
</tr>
<tr>
<td><strong>Inpatient- Length of stay (follow-up 0.6-7 days; measured with: days; range of scores: 0.5-7; Better indicated by lower values)</strong></td>
<td>8 randomized trials</td>
<td>serious</td>
<td>no serious inconsistency</td>
<td>no serious indirectness</td>
<td>no serious imprecision</td>
<td>none</td>
<td>Glucocorticoids (systemic and inhaled)</td>
<td>Control</td>
<td>322</td>
<td>-</td>
<td>-</td>
<td>MD 1.08 lower (0.39 lower to 0.04 higher)</td>
</tr>
</tbody>
</table>

1 Two of the studies (inclusive of ~7% of the subjects) did not report on all outcomes.
2 Two of the studies for this outcome (inclusive of ~16% of subjects) did not report on all outcomes.
3 Three of the eight studies had risk of bias (inclusive of ~36% of subjects)

**Synthesis Author(s):** EBP Scholars (Allen, N. H.)
**Date:** 2011-11-30
Appendix C

Question 3: For the child who presents with the symptoms of bronchiolitis should short acting beta agonists be used in the inpatient or outpatient settings?

**GRADEProTable:**

<table>
<thead>
<tr>
<th>No of studies</th>
<th>Design</th>
<th>Risk of bias</th>
<th>Inconsistency</th>
<th>Indirectness</th>
<th>Imprecision</th>
<th>Other considerations</th>
<th>Short acting bronchodilators</th>
<th>Control</th>
<th>Relative (95% CI)</th>
<th>Absolute</th>
<th>Quality</th>
<th>Importance</th>
</tr>
</thead>
<tbody>
<tr>
<td>15</td>
<td>randomized trials</td>
<td>no serious risk of bias</td>
<td>serious³</td>
<td>no serious indirectness</td>
<td>serious³</td>
<td>none</td>
<td></td>
<td>636</td>
<td>546</td>
<td>-</td>
<td>MD 0.45 lower (0.96 lower to 0.05 higher)</td>
<td>@@@ LOW</td>
</tr>
<tr>
<td>10</td>
<td>randomized trials</td>
<td>serious³</td>
<td>serious³</td>
<td>no serious indirectness</td>
<td>no serious imprecision</td>
<td>none</td>
<td></td>
<td>230</td>
<td>208</td>
<td>-</td>
<td>MD 0.29 lower (1.1 lower to 0.51 higher)</td>
<td>@@ LOW</td>
</tr>
<tr>
<td>9</td>
<td>randomized trials</td>
<td>serious³</td>
<td>serious³</td>
<td>no serious indirectness</td>
<td>very serious³</td>
<td>none</td>
<td></td>
<td>406</td>
<td>350</td>
<td>-</td>
<td>MD 0.57 lower (1.13 lower to 0 higher)</td>
<td>@@@ VERY LOW</td>
</tr>
<tr>
<td>7</td>
<td>randomized trials</td>
<td>no serious risk of bias</td>
<td>serious³</td>
<td>no serious indirectness</td>
<td>no serious imprecision</td>
<td>none</td>
<td></td>
<td>239</td>
<td>157</td>
<td>-</td>
<td>SMD 0.20 lower (0.43 lower to 0.03 higher)</td>
<td>@@@@ MODERATE</td>
</tr>
</tbody>
</table>

Oxygen Saturation by pulse oximetry inpatient and outpatient (follow-up 40-2880 Minutes³; measured with: SpO2; range of scores: 88.54-98.8; Better indicated by higher values)

Oxygen saturation by pulse oximetry, inpatients only (follow-up 40-2880 minutes; measured with: SpO2; range of scores: 93-97.2; Better indicated by higher values)

Oxygen saturation by pulse oximetry in outpatients (follow-up 60-120 minutes³; measured with: SpO2; Better indicated by lower values)

No improvement in clinical score inpatient (measured with: improvement in clinical score; range of scores: 0.58-6.17; Better indicated by lower values)
| Duration of hospitalization (follow-up 4.5-2.17 days; measured with: hours; range of scores: 2.17-4.5; Better indicated by lower values) |
|---|---|---|---|---|---|---|---|---|
| 5 randomized trials | no serious risk of bias | serious² | no serious indirectness | no serious imprecision | none | 220 | 129 | - MD 0.06 higher (0.27 lower to 0.39 higher) ⊕⊕⊕Ο MODERATE CRITICAL |

| Time to resolution of illness (measured with: days; range of scores: 5-8.9; Better indicated by lower values) |
|---|---|---|---|---|---|---|---|---|
| 2 randomized trials | no serious risk of bias | no serious inconsistency | no serious indirectness | serious³ | none | 134 | 135 | - MD 0.29 higher (0.43 lower to 1 higher) ⊕⊕⊕Ο MODERATE CRITICAL |

¹ Six of ten inpatient studies gave the time outcomes were assessed.
² Wide range of time to assessment, varying intervals between doses, different doses
³ There is greater precision in the inpatient studies than in the outpatient studies. Confidence intervals are wider in the outpatient studies.
⁴ Only two outpatient studies described length of follow up
⁵ Only two studies, low number of subjects

**Synthesis Author(s):** EBP Scholar, (Allen, N. H)
**Date:** 2012-06-20
Appendix D

**Question 4**: For the patient who presents with the symptoms of bronchiolitis should inhaled hypertonic saline be used?

**GRADEpro Table**

<table>
<thead>
<tr>
<th>Quality assessment</th>
<th>No of patients</th>
<th>Effect</th>
<th>Quality</th>
<th>Importance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hypertonic saline</td>
<td>Control</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reliability (95% CI)</td>
<td>Absolute</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No of studies</td>
<td>Design</td>
<td>Risk of bias</td>
<td>Inconsistency</td>
<td>Indirectness</td>
</tr>
<tr>
<td>4</td>
<td>randomized trials</td>
<td>no serious risk of bias</td>
<td>serious</td>
<td>no serious indirectness</td>
</tr>
</tbody>
</table>

Length of hospital stay (days) (follow-up mean 4 days; measured with: days; Better indicated by lower values)

| Clinical severity score, day one (follow-up mean 1 days; measured with: Post-treatment (various scores)); range of scores: 0-10; Better indicated by lower values) |
| No of studies | Design | Risk of bias | Inconsistency | Indirectness | Imprecision | Other considerations |
| 4 | randomized trials | no serious risk of bias | serious | no serious indirectness | no serious imprecision | none | 131 | 120 | - | MD 0.82 lower (1.52 to 0.39 lower) | ⊕⊕⊕Ο | MODERATE |

Clinical severity score day two (follow-up mean 2 days; measured with: Post-treatment (various scores); range of scores: 0-10; Better indicated by lower values)

| Rate of hospitalization (assessed with: percent) |
| No of studies | Design | Risk of bias | Inconsistency | Indirectness | Imprecision | Other considerations |
| 3 | randomized trials | no serious risk of bias | serious | no serious indirectness | no serious imprecision | none | 11/132 (8.3%) | 17/130 (13.1%) | RR 0.63 (0.34 to 1.17) | 48 fewer per 1000 (from 86 fewer to 22 more) | ⊕⊕⊕Ο | CRITICAL |

Rate of readmission (follow-up mean 7 days; assessed with: count)

| Search Strategies Implemented: |
| PubMed performed 2011-10-25 |
| CINAHL performed 2011-10-25 |
| CDSR performed 2011-10-25 |

(("Saline Solution, Hypertonic"[Mesh] AND "Administration, Inhalation"[Mesh]) OR ("nebulized saline"[All Fields] OR "nebulized hypertonic saline"[All Fields])) AND ("Bronchiolitis"[Mesh] OR "Bronchiolitis, Viral"[Mesh])

**Synthesis Author(s):** (Allen, N. H.)

**Date:** 2012-06-06
Appendix E

**Question 5:** For the child who presents with the symptoms of bronchiolitis, should antibiotics be used in the inpatient or outpatient settings?

**GRADEPro Table**

<p>| Duration of symptoms (follow-up 3-10 days; measured with: days; range of scores: 4.62-9.7; Better indicated by lower values) |</p>
<table>
<thead>
<tr>
<th>No of studie s</th>
<th>Design</th>
<th>Risk of bias</th>
<th>Inconsistenc y</th>
<th>Indirectnes s</th>
<th>Imprecisio n</th>
<th>Other consideration s</th>
<th>Antibiotic s</th>
<th>Contro l</th>
<th>Relativ e (95% CI)</th>
<th>Absolut e</th>
<th>Quality</th>
<th>Importanc e</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>randomize d trials</td>
<td>no serious risk of bias</td>
<td>no serious inconsistency</td>
<td>no serious indirectness</td>
<td>no serious imprecision</td>
<td>none</td>
<td>Antibiotic s</td>
<td>Control</td>
<td>Relative (95% CI)</td>
<td>Absolute</td>
<td>Quality</td>
<td>Importance</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>60</td>
<td>63</td>
<td>MD 0.32 higher (1.14 lower to 1.78 higher)</td>
<td>HIGH</td>
<td>CRITICAL</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<p>| Length of stay (follow-up 2-6 days; measured with: days; range of scores: 2.13-5.82; Better indicated by lower values) |</p>
<table>
<thead>
<tr>
<th>No of studie s</th>
<th>Design</th>
<th>Risk of bias</th>
<th>Inconsistenc y</th>
<th>Indirectnes s</th>
<th>Imprecisio n</th>
<th>Other consideration s</th>
<th>Antibiotic s</th>
<th>Contro l</th>
<th>Relativ e (95% CI)</th>
<th>Absolut e</th>
<th>Quality</th>
<th>Importanc e</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>randomize d trials</td>
<td>serious</td>
<td>no serious inconsistency</td>
<td>no serious indirectness</td>
<td>no serious imprecision</td>
<td>none</td>
<td>Antibiotic s</td>
<td>Control</td>
<td>Relative (95% CI)</td>
<td>Absolute</td>
<td>Quality</td>
<td>Importance</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>143</td>
<td>145</td>
<td>MD 0.34 higher (0.71 lower to 1.38 higher)</td>
<td>MODERATE</td>
<td>CRITICAL</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<p>| Re-admissions (follow-up 3 weeks; assessed with: Count) |</p>
<table>
<thead>
<tr>
<th>No of studie s</th>
<th>Design</th>
<th>Risk of bias</th>
<th>Inconsistenc y</th>
<th>Indirectnes s</th>
<th>Imprecisio n</th>
<th>Other consideration s</th>
<th>Antibiotic s</th>
<th>Contro l</th>
<th>Relativ e (95% CI)</th>
<th>Absolute</th>
<th>Quality</th>
<th>Importance</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>randomize d trials</td>
<td>serious</td>
<td>no serious inconsistency</td>
<td>no serious indirectness</td>
<td>no serious imprecision</td>
<td>none</td>
<td>Antibiotic s</td>
<td>Control</td>
<td>Relative (95% CI)</td>
<td>Absolute</td>
<td>Quality</td>
<td>Importance</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1/12 (8.3%)</td>
<td>4/9 (44.4%)</td>
<td>OR 0.11 (0.01 to 1.29)</td>
<td>MODERATE</td>
<td>CRITICAL</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<p>| Deaths (assessed with: Count) |</p>
<table>
<thead>
<tr>
<th>No of studie s</th>
<th>Design</th>
<th>Risk of bias</th>
<th>Inconsistenc y</th>
<th>Indirectnes s</th>
<th>Imprecisio n</th>
<th>Other consideration s</th>
<th>Antibiotic s</th>
<th>Contro l</th>
<th>Relativ e (95% CI)</th>
<th>Absolute</th>
<th>Quality</th>
<th>Importance</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>randomize d trials</td>
<td>serious</td>
<td>no serious inconsistency</td>
<td>no serious indirectness</td>
<td>no serious imprecision</td>
<td>none</td>
<td>Antibiotic s</td>
<td>Control</td>
<td>Relative (95% CI)</td>
<td>Absolute</td>
<td>Quality</td>
<td>Importance</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0/331 (0%)</td>
<td>212/0 (0%)</td>
<td>-^2 (0%)</td>
<td>MODERATE</td>
<td>CRITICAL</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Synthesis Author(s):** EBP Scholars (Allen, N. H.)

**Date:** 2012-12-02

**Search Strategy performed:**

((("Anti-Bacterial Agents"[Mesh] OR "Anti-Bacterial Agents"[Pharmacological Action]) OR "Macrolides"[Majr]) OR "Penicillins"[Mesh]) OR "Tetracyclines"[Mesh]) OR "Cephalosporins"[Majr]) AND ("Bronchiolitis"[Mesh] OR "Bronchiolitis, Viral"[Mesh]) AND ("child"[MeSH Terms] OR "child"[All Fields])
**Question 8:** For the child with bronchiolitis, when should nasal suctioning (with a bulb tip) or nasopharyngeal suctioning (with a catheter) be used to clear secretions?

**Critically Appraised Topic (CAT)**

**Synthesis of relevant studies:**

<table>
<thead>
<tr>
<th>Author, date, country, and industry of funding</th>
<th>Patient Group</th>
<th>Level of Evidence (Oxford) / Research design</th>
<th>Significant results</th>
<th>Limitations</th>
</tr>
</thead>
</table>
| Conway-2004 Guide-line Infants <= to 1 yr old with first-time admits of Bronchiolitis | Differentia| Guideline Implementation: Respiratory Care for patients was considered “Perfect” if bronchodilator administration was PRECEDED by nasal suctioning and the post-suctioning score was \( \geq 3 \) on an internal scoring tool (scoring range 0-8).

Prior to guide-line implementation only 2% of the patients received “perfect” respiratory care—following guideline implementation “perfect care” increased to 19%.

14% of the time SUCTIONING lowered the Respiratory Score from \( \geq 3 \) to <3. | Only infants <= to one year old –first time episode of uncomplicated bronchiolitis. Exceptions patients with history of cystic fibrosis, immunodeficiency, CHD, BPD, congenital airway issues, or need for mechanical ventilation or other intensive therapies warrant of PICU admission. Premature infants are included as long as they had not underlying exceptions stated above. |
<table>
<thead>
<tr>
<th>Jarvis, K., 2012 USA</th>
<th>Comparison of suctioning practices before and after the implementation of a suctioning protocol</th>
<th>4</th>
<th>QI report</th>
<th>Measures</th>
<th>2010-2011 Season</th>
<th>2011-2012 Season</th>
<th>Number of patients in each group varied due to a light bronchiolitis season 2011-2012. Retrospective Compliance to protocol use was not measured. Quality project.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td># Patients</td>
<td>894</td>
<td>483</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>% NP suction</td>
<td>30</td>
<td>16.6</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>% times nasal suction</td>
<td>70</td>
<td>83.4</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Readmit rate</td>
<td>4.28</td>
<td>3.93</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>% pts on IV fluid</td>
<td>46.5</td>
<td>35.1</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Admission to PICU</td>
<td>2</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Parental satisfaction (range 0-3, 3 best)</td>
<td>2.94</td>
<td>2.94</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Avg. LOS (d)</td>
<td>3.39</td>
<td>3.29</td>
<td></td>
</tr>
</tbody>
</table>

| Mallory, 2003 USA | None | Decision analysis level 5 | Survey completed by 519 physicians who are members of the AAP Section of Emergency Medicine and living in the US. Survey contained 1 of 4 vignettes of an infant | Use of Therapeutic Options:
| o 96% of respondents would treat with a bronchodilator. Variation in vignette SpO2 or RR did not significantly affect this decision. |
| o 82% would attempt to remove nasal secretions for therapeutic reasons. Variation in vignette SpO2 or RR did not significantly affect this decision. |
| o 57% would administer supplemental oxygen. Decision to administer oxygen was more likely with the lower SpO2 (92%) and the |
| o A survey is not an assessment of actual clinical practice |
| o Subjects received no incentive for participation |
with moderately severe bronchiolitis followed by 17 questions about the physician’s diagnostic and treatment preferences and perceptions of the importance of potential treatments. Vignettes were identical except for given \( \text{SpO}_2 \) (94% or 92%) and RR (50/min or 65/min).

- higher RR (65).
  - 9% would treat with a decongestant. Variation in vignette \( \text{SpO}_2 \) or RR did not significantly affect this decision.
  - 8% would treat with a corticosteroid.
  - 9% would treat with an antibiotic.

Comparison of Therapeutic Options – respondents were asked to rank the given therapeutic options from 1 to 6, 1 having the highest expected potential for positive clinical effect.

- Nasal suction received the greatest number of first-place rankings
- Bronchodilators 2nd place
- Supplemental oxygen 3rd place

Laboratory Tests:

- 61% of respondents would order a CXR
- 47% would order an RSV test
- 11% would order a CBC
- 5% would order a blood gas analysis
- 4% would order a blood culture
- 4% would order serum electrolytes
- 3% would order a urinalysis
- 2% would order a urine culture
- 29% would not order any tests
- Respondents who received a vignette with \( \text{SpO}_2 \) of 92% were slightly more likely to order tests than those who received a vignette with 94%.
with Spo2 of 94%.

Admission:
- 67% of all respondents indicated that they would recommend admission.
- Respondents who received a vignette with Spo2 of 92% were much more likely to recommend admission.
- Respiratory rate was significantly associated with admission preference only when the vignette Spo2 was 94% but not when the Spo2 was 92%.

**Synthesis Author(s):** EBP Scholars (Menown, J., Thompson, L., & Tobin, T.)

**Date:** 2012-05-03

**CINAHL Search Strategy performed**

AARC GUIDELINE: NASOTRACHEAL SUCTIONING (full text attached)

**NTS 5.0 CONTRAINDICATIONS:**
Listed contraindications are relative unless marked as absolute.

- **5.1** Occluded nasal passages1,6
- **5.2** Nasal bleeding1
- **5.3** Epiglottitis or croup (absolute)1,6
- **5.4** Acute head, facial, or neck injury1,2,6
- **5.5** Coagulopathy or bleeding disorder1,3,6
- **5.6** Laryngospasm1,3,6
- **5.7** Irritable airway1
- **5.8** Upper respiratory tract infection1
- **5.9** Tracheal surgery6
- **5.10** Gastric surgery with high anastomosis6
- **5.11** Myocardial infarction6
- **5.12** Bronchospasm2