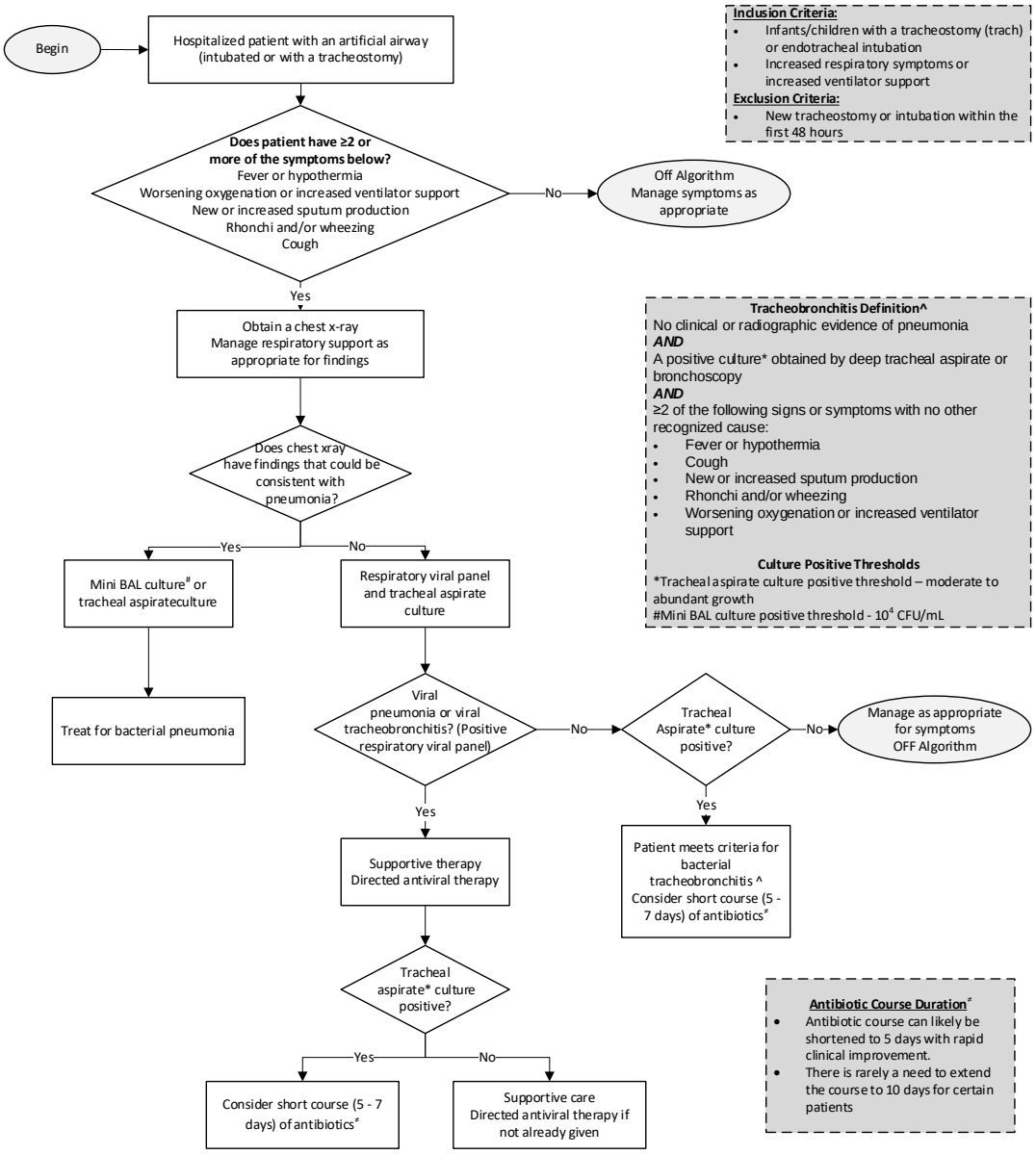
TEXAS CHILDREN'S HOSPITAL
EVIDENCE-BASED OUTCOMES CENTER
Management of Respiratory Symptoms and Possible Infectious Complications in Patients With an Artificial Airway
Evidence-Informed Pathway

Inpatient Algorithm



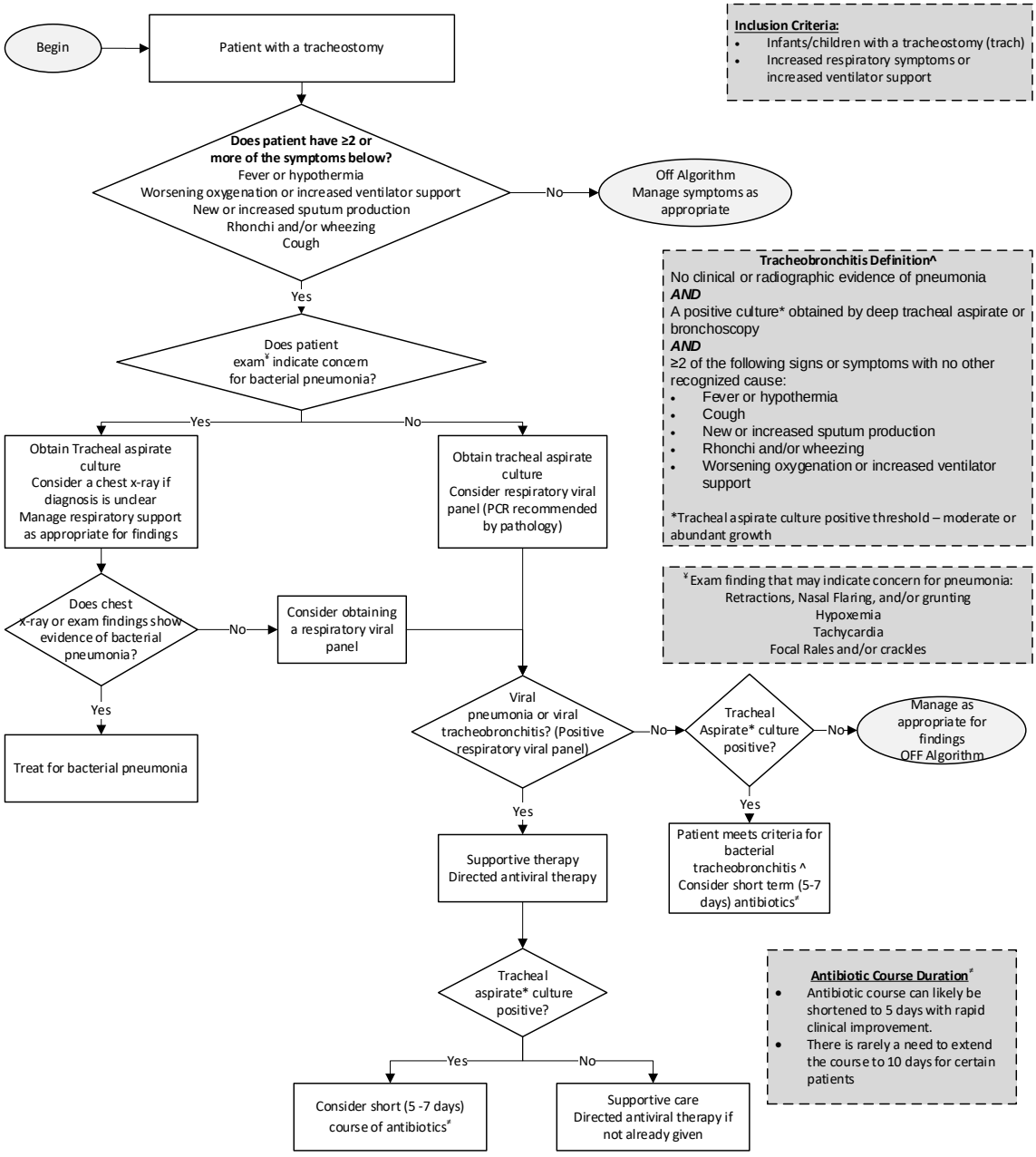
INPATIENT Empiric and Directed Antibiotic Therapy for Suspected Tracheobronchitis
(Choose empiric antibiotic based on previous organism grown within 6 months; Narrow based on known susceptibilities)

Drug	Route	Age and Weight Parameters	Dose and Frequency
Amoxicillin	PO	Infants ≥ 3 months up to adults	45 mg/kg/dose every 12 h; **MAX** 2,000 mg/dose
Amoxicillin/clavulante#	PO	Infants ≥ 3 months up to adults	45 mg/kg/dose every 12 h; **MAX** 2,000 mg of amoxicillin/dose < 40 kg: Augmentin ES 600-42.9mg/5mL suspension (Augmentin ES-600) ≥ 40 kg: Augmentin XR 1000-62.5mg tabs (cannot crush) OR Augmentin ES 600-42.9mg/5mL suspension (Augmentin ES-600)
Ceftazidime*	IV	Infants ≥ 1 month up to adults	50 mg/kg/dose every 8 h; **MAX** 2,000 mg/dose
Ceftriaxone‡	IV	Infants ≥ 1 month up to adults	50 mg/kg/dose every 24 h; **MAX** 2,000 mg/dose
Cefepime^	IV	Infants ≥ 3 months up to adults	50 mg/kg/dose every 8 h ; **MAX** 2,000 mg/dose
Clindamycin†	PO	Infants ≥ 1 month up to adults	10 mg/kg/dose every 8 h; **MAX** 600 mg/dose
	IV	Infants ≥ 1 month up to adults	10 mg/kg/dose every 8 h; **MAX** 900 mg/dose
Vancomycin	IV	Infants >1 month up to adults	15 mg/kg/dose every 8 h; **MAX** 1,500 mg/dose **OR** 4,000 mg/DAY

#Known colonization of organisms susceptible to amoxicillin/clavulanate or mixed flora; *Known colonization of gram negative organisms resistant to ceftriaxone; ‡Knowns colonization with gram negative organisms susceptible to ceftriaxone; ^ Known colonization of gram negative organisms resistant to ceftazidime; †Known colonization of *Staphylococcus spp.*

Clinical standards are developed for 80% of the patient population with a particular disease. Each practitioner must use his/her clinical judgment in the management of any specific patient.

Outpatient Algorithm



OUTPATIENT Empiric and Directed Antibiotic Therapy for Suspected Tracheobronchitis

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Cefdinir	PO	Infants ≥ 6 months up to adults	7 mg/kg/dose every 12 h; **MAX** 300 mg/dose
Cefixime*	PO	Infants ≥ 6 months up to adults	4 mg/kg/dose every 12 h; **MAX** 200 mg/dose
Clindamycin†	PO	Infants ≥ 1 month & children	10 mg/kg/dose every 8 h; **MAX** 600 mg/dose
		Adults	600 mg/dose every 8 h; **MAX** 600 mg/dose
Ciprofloxacin‡	PO	Infants > 3 months up to adults	10 mg/kg/dose every 12 h; **MAX** 500 mg/dose
Levofloxacin^	PO	Infants ≥ 6 months & children < 5 years	10 mg/kg/dose every 12 hours; **MAX** 500 mg/dose
		Children ≥ 5 years & adults	10 mg/kg/dose every 24 hours; **MAX** 750 mg/dose

#Known colonization of organisms susceptible to amoxicillin/clavulanate or mixed flora; *For patients with non-public insurance; †Known colonization of *Staphylococcus spp.*; ‡Known colonization of gram negative organisms resistant to oral beta-lactam antibiotics; ^Alternative agent for ciprofloxacin for patients with enteral tube or for oral beta-lactams for patients with beta-lactam allergy

Clinical standards are developed for 80% of the patient population with a particular disease. Each practitioner must use his/her clinical judgment in the management of any specific patient.

Critical Points of Evidence

Evidence Supports

- Tracheobronchitis should be diagnosed based upon the criteria below. - Strong recommendation, low quality evidence [1,2]
  - No clinical or radiographic evidence of pneumonia
    AND
  - A positive culture obtained by deep tracheal aspirate or bronchoscopy
    AND
  - ≥2 of the following signs or symptoms with no other recognized cause:
    - Fever or hypothermia
    - Cough
    - New or increased sputum production
    - Rhonchi and/or wheezing
    - Worsening oxygenation or increased ventilator support
- Consider the use a short course (5 - 7 days) of systemic antibiotics for the treatment of tracheobronchitis. – Weak recommendation, low quality evidence [1, 3-5]
- Inhaled antibiotics should not be used for inpatient treatment of tracheobronchitis. – Strong recommendation, low quality evidence [6-11]

  Remarks – Chronic inhaled antibiotics may be utilized in the outpatient population to decrease bacteria load and prevent acute illness.
- Viral testing should be utilized for patients with suspected tracheobronchitis. – Strong recommendation, very low quality evidence [1,12-14]
- Diagnostic testing for tracheobronchitis should be initiated in patients with ≥2 of the following symptoms. – Strong recommendation, low quality evidence [1,2,14,15]
  - Fever or hypothermia
  - Cough
  - New or increased sputum production
  - Rhonchi and/or wheezing
  - Worsening oxygenation or increased ventilator support

*NOTE: The references cited represent the entire body of evidence reviewed to make each recommendation.

Measures

Process

- Length of stay (LOS)
- Use of viral testing when prevalence of virus in the community is low
- Number of tracheal aspirate cultures with contaminants
- Number of patients returning to the EC for repeat blood cultures
- Use of inhaled antibiotic therapy
- Parenteral antibiotic use
- Usefulness of past tracheal aspirates to aid in diagnosis/disposition of patient

Outcome

- Incidence of tracheobronchitis
- Incidence of pneumonia
- Incidence of patients admitted with a misdiagnosis of tracheobronchitis

Empiric Antibiotic Therapy

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Clinical Standards Preparation

This clinical standard was prepared by the Evidence-Based Outcomes Center (EBOC) team in collaboration with content experts at Texas Children's Hospital. Development of this clinical standard supports the TCH Quality and Patient Safety Program initiative to promote clinical standards and outcomes that build a culture of quality and safety within the organization.

Management of Respiratory Symptoms and Possible Infectious Complications in Patients With an Artificial Airway Content Expert Team

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No relevant financial or intellectual conflicts to report.

Development Process

This clinical standard was developed using the process outlined in the EBOC Manual. The literature appraisal documents the following steps:

1. Review Preparation
   - PICO questions established
   - Evidence search confirmed with content experts
2. Review of Existing External Guidelines
   - Management of Adults with Hospital Acquired and Ventilator-Associated Pneumonia: 2016 Clinical Guidelines by the Infectious Disease Society of America and the American Thoracic Society; CDC/NHSN Surveillance Definition of Health Care-Associated Infection and Criteria for Specific Types of Infections in the Acute Care Setting, 2008; European Society of Microbiology and Infectious Diseases, Use of Nebulized Antimicrobials for the Treatment of Respiratory Infections in Invasively Ventilated Adults: A position pater, 2017
3. Literature Review of Relevant Evidence
   - Searched: PubMed, Cochrane Collaboration, CINAHL
4. Critically Analyze the Evidence
   - Two meta-analyses, one randomized controlled trial, and nine nonrandomized studies
5. Summarize the Evidence
   - Materials used in the development of the clinical standard, literature appraisal, and any order sets are saved within EBOC files.

Evaluating the Quality of the Evidence

Published clinical guidelines were evaluated for this review using the **AGREE II** criteria. The summary of these guidelines are included in the literature appraisal. AGREE II criteria evaluate Guideline Scope and Purpose, Stakeholder Involvement, Rigor of Development, Clarity and Presentation, Applicability, and Editorial Independence using a 4-point Likert scale. The higher the score, the more comprehensive the guideline.

This clinical standard specifically summarizes the evidence *in support of* or *against* specific interventions and identifies where evidence is *lacking/inconclusive*. The following categories describe how research findings provide support for treatment interventions.
"Evidence Supports" provides evidence to support an intervention
"Evidence Against" provides evidence against an intervention.
"Evidence Lacking/Inconclusive" indicates there is insufficient evidence to support or refute an intervention and no conclusion can be drawn *from the evidence.*
The **GRADE** criteria were utilized to evaluate the body of evidence used to make practice recommendations. The table below defines how the quality of the evidence is rated and how a strong versus weak recommendation is established. The literature appraisal reflects the critical points of evidence.

Recommendation	
STRONG	Desirable effects clearly outweigh undesirable effects or vice versa
WEAK	Desirable effects closely balanced with undesirable effects
Quality	**Type of Evidence**
High	Consistent evidence from well-performed RCTs or exceptionally strong evidence from unbiased observational studies
Moderate	Evidence from RCTs with important limitations (e.g., inconsistent results, methodological flaws, indirect evidence, or imprecise results) or unusually strong evidence from unbiased observational studies
Low	Evidence for at least 1 critical outcome from observational studies, RCTs with serious flaws or indirect evidence
Very Low	Evidence for at least 1 critical outcome from unsystematic clinical observations or very indirect evidence

Recommendations

Practice recommendations were directed by the existing evidence and consensus amongst the content experts. Patient and family preferences were included when possible. The Content Expert Team and EBOC team remain aware of the controversies in the management of respiratory symptoms and possible infectious complications in patients with an artificial airway. When evidence is lacking, options in care are provided in the clinical standard and the accompanying order sets (if applicable).

Approval Process

Clinical standards are reviewed and approved by hospital committees as deemed appropriate for its intended use. Clinical standards are reviewed as necessary within EBOC at Texas Children's Hospital. Content Expert Teams are involved with every review and update.

Disclaimer

Practice recommendations are based upon the evidence available at the time the clinical standard was developed. Clinical standards (guidelines, summaries, or pathways) do not set out the standard of care and are not intended to be used to dictate a course of care. Each physician/practitioner must use his or her independent judgment in the management of any specific patient and is responsible, in consultation with the patient and/or the patient's family, to make the ultimate judgment regarding care.

Version History

Date	Comments
July 2022	Clinical Standard Originally Completed
Aug 2022	Algorithm Wording Revised