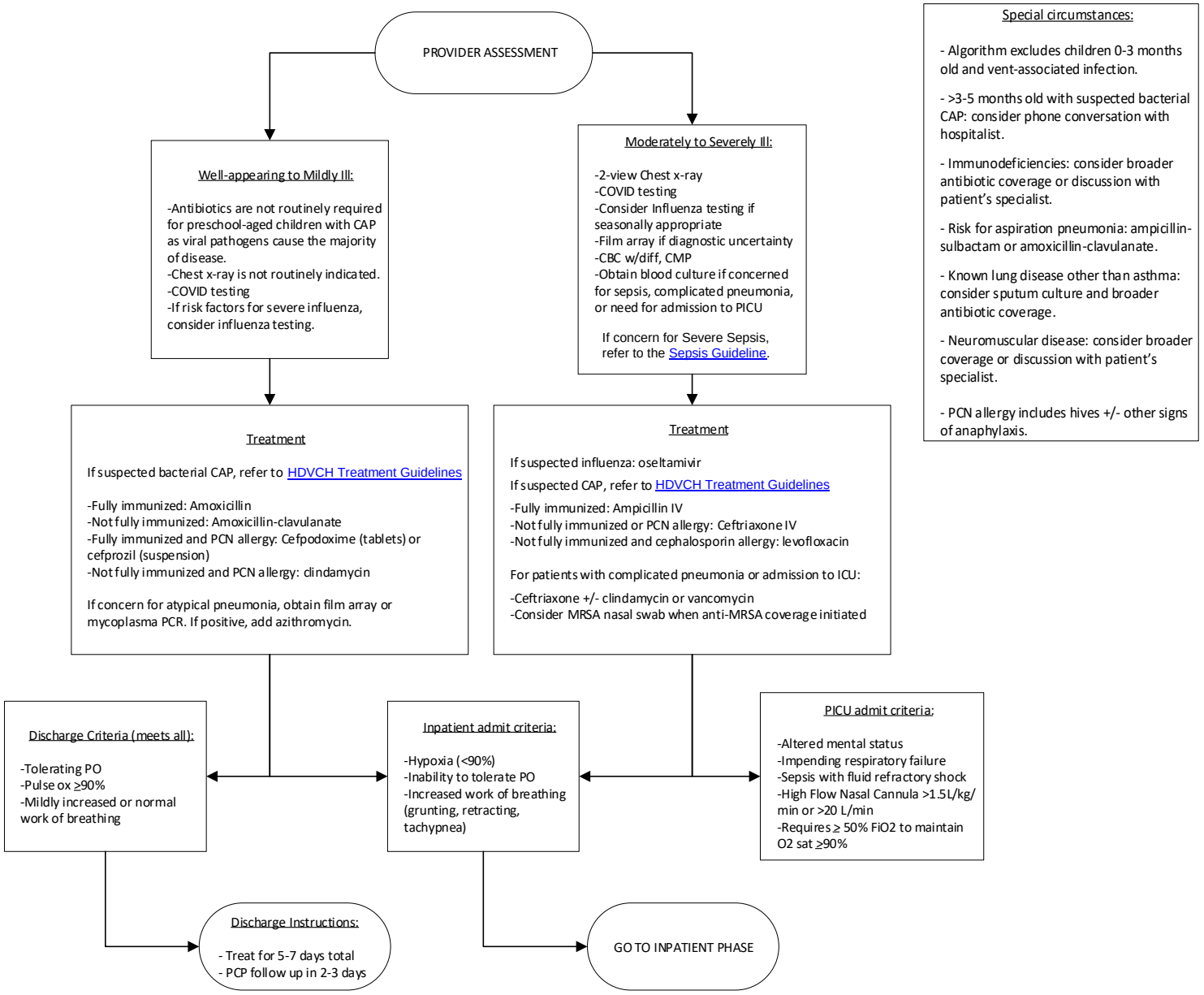
Clinical Pathways Program

Guideline: PEDIATRIC COMMUNITY ACQUIRED PNEUMONIA, ED AND INPATIENT

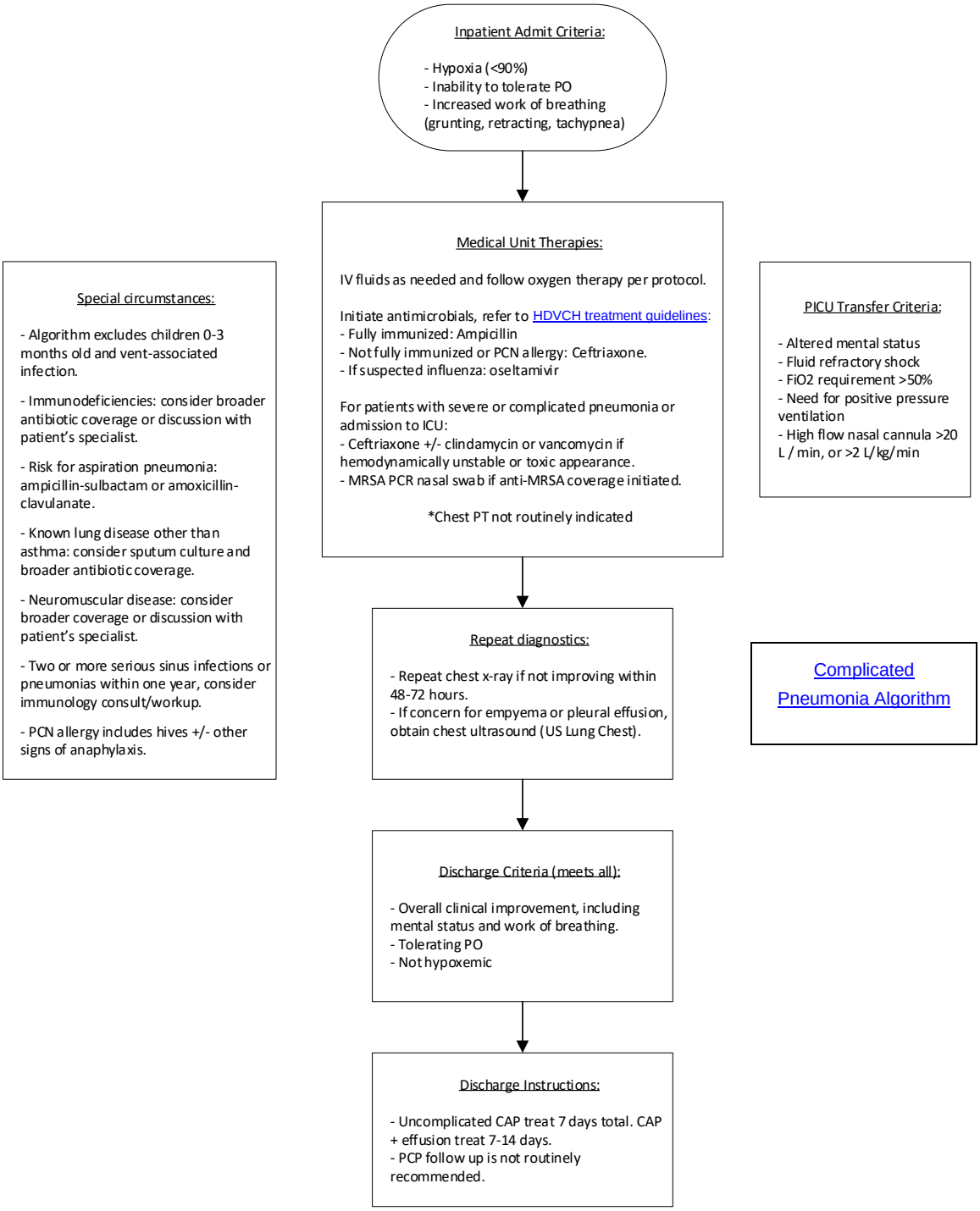
Updated: 4/13/2022

Clinical algorithms

PEDIATRIC COMMUNITY ACQUIRED PNEUMONIA: EMERGENCY DEPARTMENT PHASE



PEDIATRIC COMMUNITY ACQUIRED PNEUMONIA: INPATIENT PHASE



Clinical guideline summary

CLINICAL GUIDELINE NAME: Pediatric community acquired pneumonia

PATIENT POPULATION AND DIAGNOSIS: Any pediatric patient (less than 18 years of age) presenting with signs and symptoms of CAP and/or with a diagnosis of CAP that are seen in the Emergency Department and/or admitted to inpatient care. Exclude patients 0-3 months of age.

APPLICABLE TO: All Spectrum Health sites treating pediatrics

BRIEF DESCRIPTION: Guidance on the treatment and management of pediatric patients diagnosed with community acquired pneumonia (CAP) that present to the Emergency Department or inpatient care areas.

OVERSIGHT TEAM LEADER(S): Allison Long MD, Dr. Erica Michaels MD, Rosey Olivero MD, Sara Ogrin PharmD

OWNING EXPERT IMPROVEMENT TEAM (EIT): Pediatric Hospitalist EIT

MANAGING CLINICAL PRACTICE COUNCIL (CPC): Children's Health

CPC APPROVAL DATE: April 21, 2022

OTHER TEAM(S) IMPACTED: Pharmacy

IMPLEMENTATION DATE: N/A

LAST REVISED: 4/13/2022

FOR MORE INFORMATION, CONTACT: Allison Long, MD

Clinical pathways clinical approach

TREATMENT AND MANAGEMENT:

This guideline was created to assist the clinician in the care of a child with CAP. It does not represent the only approach to diagnosis and therapy; there is considerable variation among children in the clinical course of pediatric CAP, even with infection caused by the same pathogen. Management of neonates and young infants through the first 3 months are beyond the scope of this guideline and are not discussed. Immunocompromised children, children receiving home mechanical ventilation, and children with chronic conditions or underlying lung disease, such as cystic fibrosis, are beyond the scope of this guideline and likely require discussion with their specialist, broader antibiotic coverage and/or increased testing. Pediatric ICU (PICU) management of CAP is not discussed.

Admission Criteria:

Children with CAP present with any of the following combination of signs and symptoms: tachypnea, fever, cough, hypoxemia, respiratory distress (grunting, retractions, dyspnea, nasal flaring), dehydration, altered mental status and apnea. Children and infants who have moderate to severe CAP, as defined by several factors, including respiratory distress and hypoxemia (sustained saturation of peripheral oxygen [SpO2], <90), should be hospitalized for management, including skilled pediatric nursing care. Children and infants who are unable to comply with therapy should also be hospitalized.

A child should be admitted to the PICU if any of the following criteria are met: the child requires invasive ventilation via permanent or nonpermanent tube; use of noninvasive positive pressure ventilation (eg, continuous positive airway pressure or bilevel positive airway pressure); impending respiratory failure; altered mental status; fluid refractory shock; if the pulse oximetry measurement is <90% on inspired oxygen of >/= 0.50.

Laboratory and Radiology:

Routine lab testing, other than COVID-19 testing, is not recommended in well appearing or mildly ill children with CAP who do not meet admission criteria. Chest x-ray and blood culture are recommended for those admitted with moderate to severe pneumonia, particularly if complicated pneumonia (effusion or empyema) is present. Repeat blood culture in children with clear clinical improvement is not necessary to document resolution of pneumococcal bacteremia. Repeated blood cultures to document resolution of bacteremia should be obtained in children with bacteremia caused by *S. aureus*, regardless of clinical status. Sputum samples for culture and gram stain are not routinely recommended. When initiating anti-MRSA therapy for CAP, a rapid MRSA nasal swab can be obtained. The data supporting rapid MRSA nasal testing are robust and when the nasal swab is negative, treatment against MRSA can be discontinued. However, the positive predictive value is not as high; therefore, when the nasal swab is positive, coverage for MRSA pneumonia may be initiated if indicated, but blood and sputum cultures should be sent and therapy de-escalated if cultures are negative. Urinary antigen detection tests are not recommended for the diagnosis of pneumococcal pneumonia in children; false-positive tests are common. Sensitive and specific tests for the rapid diagnosis of influenza virus and other respiratory viruses should be used in the evaluation of children with CAP. Antibacterial therapy is not necessary for children, either outpatients or inpatients, with a positive test for influenza virus in the absence of clinical, laboratory, or radiographic findings that suggest bacterial coinfection. Children with signs and symptoms suspicious for *Mycoplasma pneumoniae* should be tested to help guide antibiotic selection. Complete blood count and inflammatory marker (C-reactive protein and/or procalcitonin) are helpful in severe pneumonia, particularly complicated pneumonia. Repeated chest x-rays should be obtained in children who fail to demonstrate clinical improvement and in those who have progressive symptoms or clinical deterioration within 48–72 hours after initiation of antibiotic therapy.

Antimicrobials:

Outpatient/ ED:

Antimicrobial therapy is not routinely required for preschool-aged children with CAP, because viral pathogens are responsible for the great majority of clinical disease. Amoxicillin should be used as first-line therapy for previously healthy, appropriately immunized infants up to adolescents with mild to moderate CAP suspected to be of bacterial origin. Amoxicillin provides appropriate coverage for *Streptococcus pneumoniae*, the most prominent invasive bacterial

pathogen. Treatment courses of 5-7 days are appropriate. Macrolide antibiotics should be prescribed for treatment of children (primarily school-aged children and adolescents) evaluated in an outpatient or ED setting with findings compatible with CAP caused by atypical pathogens. *M. pneumoniae* PCR testing should be performed if available in a clinically relevant time frame. Influenza antiviral therapy should be administered as soon as possible to children with moderate to severe CAP consistent with influenza virus infection during widespread local circulation of influenza viruses, particularly for those with clinically worsening disease. Treatment after 48 hours of symptomatic influenza infection may still provide clinical benefit to those with more severe disease.

Inpatient:
Ampicillin should be administered to the fully immunized infant up to adolescent age admitted with CAP. Empiric therapy with a third-generation parenteral cephalosporin (ceftriaxone) should be prescribed for hospitalized infants and children who are not fully immunized. Total treatment course of 7 days is adequate. Vancomycin or clindamycin should be provided in addition to beta-lactam therapy if clinical, laboratory, or imaging characteristics are consistent with infection caused by S. aureus. Treatment courses of 7-14 days are appropriate for CAP with pleural effusion.

<u>Pediatric CAP Antibiotics – Inpatient Phase</u>
*Assuming term neonates and normal renal function. Please consult drug-database or HDVCH pharmacy for patients with renal dysfunction for dose recommendations

Oseltamivir (suspension or capsule)
- *Use with caution in infants less than 3 months of age
- Infants < 8 months of age: 3 mg/kg per dose PO twice daily x 5 days
- Infants 9-12 months of age: 3.5 mg/kg per dose PO twice daily x 5 days
- Infants greater than 12 months AND less than 15 kg: 30 mg PO twice daily x 5 days
- Children 15.1-23 kg: 45 mg PO twice daily x 5 days
- Children 23.1-40 kg: 60 mg PO twice daily x 5 days
- Children greater than or equal to 40 kg: 75 mg PO twice daily x 5 days

Ampicillin
- Infants > 3 months, children and adolescents: 50 mg/kg per dose IV q6 hours

Ceftriaxone
- 50 mg/kg per dose IV q24 hours
    - Neonates who should not receive ceftriaxone include those requiring calcium containing products, hyperbilirubinemia, and premature neonates.

    A risk of using ceftriaxone in neonates is the potential development of calcium-ceftriaxone precipitates in the lungs and kidneys. Fatal reactions have been reported, even when calcium-containing solutions (eg. LR, TPN) are administered through separate sites or at different times. These reactions have only been described in the neonatal population, but the manufacturer recommends conservative management in all non-neonatal patients by avoiding simultaneous infusions of calcium-containing

IVF and ceftriaxone in the same line, and flushing the line between infusions if ceftriaxone and calcium-containing IVF are given sequentially.

Clindamycin

- Infants > 3 months, children and adolescents: 13.3 mg/kg per dose IV/PO q8 hours

Vancomycin

- For infants greater than 3 months – 13 years: 20 mg/kg per dose IV q6 hours
- For adolescents greater than or equal to 14 years: 20 mg/kg per dose IV q8 hours (maximum 2000 mg per dose)

Ampicillin-Sulbactam

- Infants, children and adolescents: 75 mg/kg per dose (= 50 mg ampicillin/kg per dose) IV q6 hours

Amoxicillin-Clavulanate

- Infants less than 3 months: 15 mg/kg per dose PO twice daily
    - For infants < 3 months of age, use amoxicillin-clavulanate 400 mg/5mL standard suspension
- Infants greater than or equal to 3 months: High-dose amoxicillin-clavulanate 45 mg/kg per dose PO twice daily (max: 2000 mg per dose)
    - For infants ≥ 3 months of age, use amoxicillin-clavulanate 600 mg/5mL ES suspension
- Note, per Lexi for patients ≥ 40 kg the XR 1000 mg tablets can be considered. We do NOT carry these on formulary and there are typically a few challenges with availability and prior authorizations, so please be sure the team is aware if pursuing.

Amoxicillin

- Infants less than 3 months: 15 mg/kg per dose PO twice daily
- Infants greater than or equal to 3 months: High-dose amoxicillin 45 mg/kg per dose PO twice daily (max: 2000 mg per dose)

Levofloxacin

- Infants greater than or equal to 3 months: High-dose amoxicillin 45 mg/kg per dose PO twice daily (max: 2000 mg per dose)
- Children greater than or equal to 5 years of age: 10 mg/kg per dose IV/PO daily (max: 750 mg per dose)

- Levofloxacin has excellent oral bioavailability and if the child can take oral medications, we encourage utilizing oral levofloxacin
- Risk and benefit should be weighed by the primary treating service when utilizing fluoroquinolones in pediatrics. Black box warnings and major side effects to evaluate and discuss with the patient and/or caregiver include, but are not limited to, tendonitis/tendon rupture, QTc prolongation, aortic rupture/dilation, lowering of seizure threshold, altered mental status, hypoglycemic events (notably in patients on oral

antidiabetic agents), and risk of C.difficile infection. Notable drug-drug interactions include divalent and trivalent cations (dairy foods, milk, yogurt) and mineral supplements (e.g. iron, zinc, calcium). For tube feedings, hold tube feedings at least 2 hours before and 2 hours after administration.

References:

Bradley, J.S. et al. (2011). The management of community-acquired pneumonia in infants and children older than 3 months of age: Clinical practice guidelines by the pediatric infectious disease society and the infectious disease society of America. Clinical Infectious Disease Advance Access. doi: 10.1093/cid/cir531

Cincinnati Children's Hospital Medical Center (2012). Community-Acquired Pneumonia- Anti-Infective Selection from IDSA & BTS Guidelines, 1-6. Retrieved from https://www.cincinnatichildrens.org/health/p/pneumonia

Dangerfield B, Chung A, Webb B, Seville MT. Predictive value of methicillin-resistant Staphylococcus aureus (MRSA) nasal swab PCR assay for MRSA pneumonia. Antimicrobial Agents and Chemotherapy. 2014;58(2):859-864. doi:10.1128/aac.01805-13

Neuman MI, Hall M, Lipsett SC, Hersh AL, Williams DJ, Gerber JS, Brogan TV, Blaschke AJ, Grijalva CG, Parikh K, Ambroggio L, Shah SS; Pediatric Research in Inpatient Settings Network. Utility of Blood Culture Among Children Hospitalized With Community-Acquired Pneumonia. Pediatrics. 2017 Sep;140(3):e20171013. doi: 10.1542/peds.2017-1013. Epub 2017 Aug 23. PMID: 28835382; PMCID: PMC5574722.

Seattle Children's Hospital. (2016). Community- acquired pneumonia clinical practice guideline. Retrieved from https://www.seattlechildrens.org/pdf/pneumonia-pathway.pdf