

Provincial Clinical Knowledge Topic
Community Acquired Pneumonia, Pediatric –
Emergency and Inpatient
V 1.0

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Revision History

Version	Date of Revision	Description of Revision	Revised By
1.0	August 2018	Document Complete	Theresa Wu

Important Information Before You Begin

The recommendations contained in this knowledge topic have been provincially adjudicated and are based on best practice and available evidence. Clinicians applying these recommendations should, in consultation with the patient, use independent medical judgment in the context of individual clinical circumstances to direct care. This knowledge topic will be reviewed periodically and updated as best practice evidence and practice change.

The information in this topic strives to adhere to Institute for Safe Medication Practices (ISMP) safety standards and align with Quality and Safety initiatives and accreditation requirements such as the Required Organizational Practices. Some examples of these initiatives or groups are: Health Quality Council Alberta (HQCA), Choosing Wisely campaign, Safer Healthcare Now campaign etc.

Guidelines

This Clinical Knowledge Topic is based on the following guidelines:

Guidelines Available on the AHS Internal Web

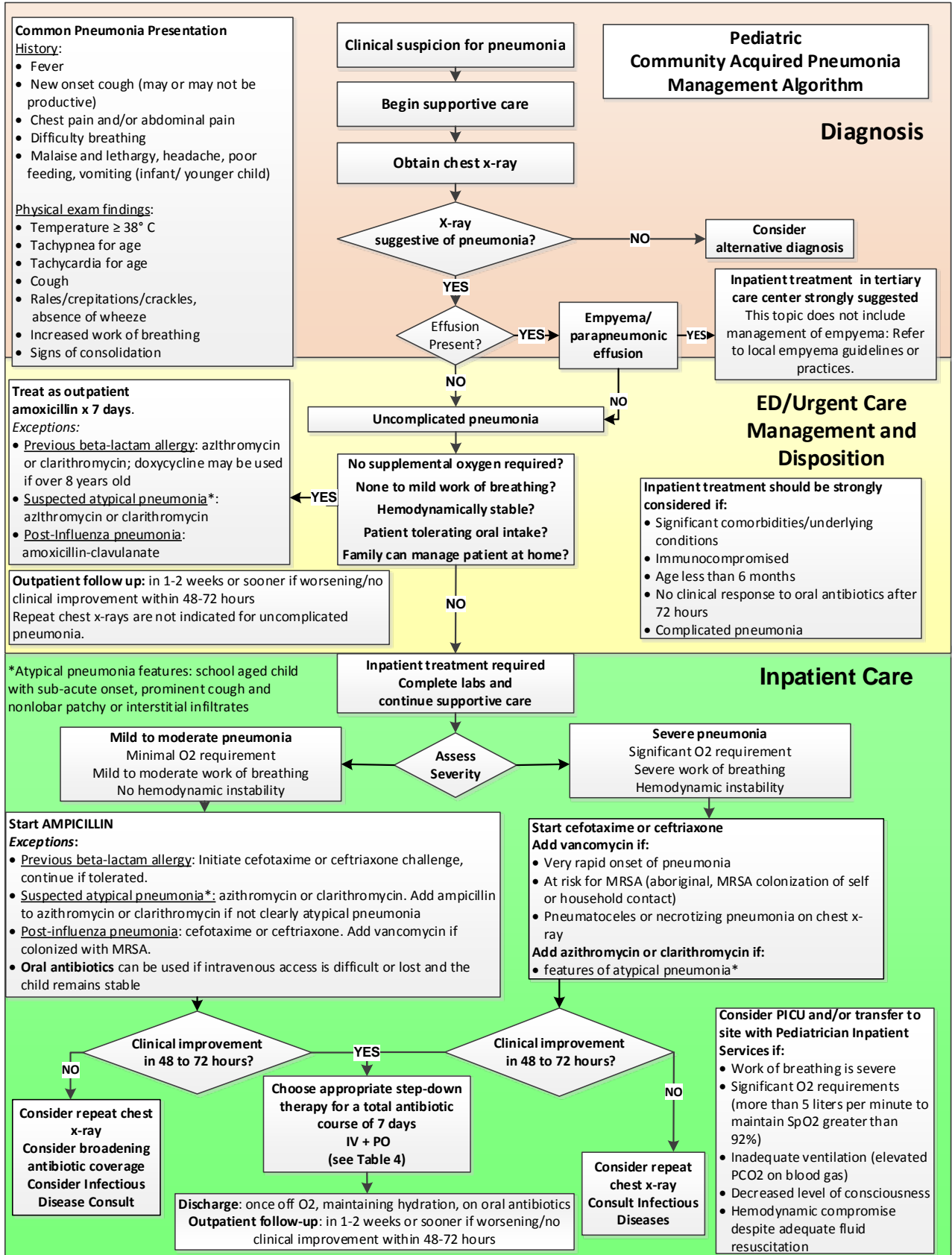
1. Alberta Children's Hospital Clinical Pathway for Bacterial Pneumonia in Children aged 3 months to 18 years (Algorithm). December 2015.
2. Wu TF, Constantinescu C, Rajapakse N, Vayalumkal J. Bacterial Pneumonia in Children 3 months to 18 years: Alberta Children's Hospital Clinical Care Guideline. Alberta Health Services: December 2015
3. Parsons, S, S Kuhn, C Stoian, M Anselmo, S Lopushinsky. Alberta Children's Hospital Empyema/ Parapneumonic Effusion Guideline.
4. Algorithm: Management of the Patient with Pneumonia and Suspected Empyema. Alberta Health Services (Edmonton Zone) Empyema Working Group, August 2013.

Guidelines Available Outside of AHS Network

5. Nicole Le Saux, Joan L Robinson. [Practice Point: Uncomplicated pneumonia in healthy Canadian children and youth: Practice points for management](#). Canadian Paediatric Society, Infectious Diseases and Immunization Committee. Paediatr Child Health 2015;20(8):441-45.
6. TK Chibuk, E Cohen, JL Robinson, S Mahant, DS Hartfield; Canadian Paediatric Society. [Practice Point: Pediatric Complicated Pneumonia: Diagnosis and Management of Empyema](#) (Reaffirmed 2015), Canadian Paediatric Society. Paediatr Child Health 2011;16(7):425-7

Keywords

- Child
- Children
- Community-acquired pneumonia
- CAP



Rationale

Community acquired pneumonia (CAP) is a lower respiratory tract infection that is acquired in the community, as opposed to in the hospital setting.¹ Etiology of CAP can include both viral and bacterial pathogens. Bacterial pneumonia is a common medical condition, and is a leading cause of morbidity and mortality worldwide.² Immunization has significantly decreased admission rates, however, pneumonia remains one of the common reasons for pediatric emergency visits and admission in the province. While national and other guidelines exist, it is essential to consider local antimicrobial susceptibilities and to practice Antimicrobial Stewardship³. This provincially developed clinical knowledge topic aims to support appropriate treatment in community acquired pneumonia and provide a guide to emergency/urgent care and care in hospital.

This guidance is intended for children aged 3 months to 17 years in the inpatient and outpatient setting diagnosed with community acquired bacterial pneumonia. This guidance is NOT intended for:

- Children with immunodeficiency or on immunosuppressive drugs
- Suspected aspiration pneumonia or recurrent pneumonia
- Children with underlying pulmonary pathology other than asthma
- Hospital-acquired pneumonia
- Complicated pneumonia (see [below](#) for definition)
- Suspected viral lower respiratory tract infections

Goals of Management

1. To increase the accuracy of diagnosis of bacterial pneumonia.
 - A chest x-ray should be performed on all patients with presentation suggestive of bacterial pneumonia whenever feasible to confirm the diagnosis, to rule-out complicated pneumonia and to provide a baseline image in case the child does not respond to treatment.
2. To optimize outcomes in children diagnosed with bacterial pneumonia by promoting best antibiotic choices based on current, local evidence.
 - Antibiotics are not indicated for viral pneumonia, bronchiolitis or for prevention of bacterial pneumonia.
 - For bacterial pneumonia choose the right antibiotic based on local susceptibilities and patient characteristics.
 - First line antibiotics for CAP are oral amoxicillin (standard dosing) or IV ampicillin.
 - For uncomplicated bacterial pneumonia a 7 day total course of antibiotics is recommended (5 days if using AZIthromycin).

3. To diagnose and initiate management in complicated pneumonia (empyema, lung abscess, pneumatoceles, or pulmonary necrosis). Refer to local pleural effusion guidelines or practices.
4. To provide optimal, evidence-based supportive care.
 - Oxygen therapy for hypoxemia.
 - Adequate hydration.
 - Analgesics/antipyretics for control of pain/fever.
 - Chest physiotherapy and cough suppressants are not indicated.

Decision Making

Microbiology and Etiology

Etiology of Community Acquired Pneumonia can include both viral and bacterial pathogens.

Viral CAP:

The most common cause of CAP in infants and preschool children are viruses such as respiratory syncytial virus, influenza, human metapneumovirus and others. In children under 2 years of age, viral etiologies of CAP have been documented in up to 80% of pneumonias.⁴ With the exception of influenza, viruses are much less likely to be the sole cause of pneumonia in older children⁴. Viral lower respiratory tract infections often present with signs and symptoms, and occasionally radiographic signs that can be difficult to differentiate from bacterial pneumonias. Thus viral pneumonia is commonly treated with antibiotics which will not benefit, and may harm the child. During annual influenza season, influenza as a cause of pneumonia should be strongly considered. Influenza infections may be heralded by the sudden onset of systemic symptoms such as myalgias and fever with cough, sore throat or other respiratory symptoms.

Bacterial CAP:

Typical Bacterial pneumonia:

The most common typical bacterial pathogen is *Streptococcus pneumoniae*.^{4,5} Group A streptococcus, *Moraxella catarrhalis*, and *Haemophilus influenzae* are less common pathogens, with *Haemophilus influenzae type B* almost disappearing due to vaccination. *Staphylococcus aureus* is an uncommon pathogen that causes severe CAP, often with necrotic lung and/or pneumatoceles.⁶ CAP caused by typical bacterial pathogens usually presents as airspace/alveolar opacities which may involve an entire lobe.

Atypical pneumonia:

Atypical pneumonia occurs primarily in school-aged children. It is occasionally referred to as “walking pneumonia” as patients are often not very sick. The term originated from the era when it was recognized that some pneumonias did not respond to penicillin. Patients present with subacute onset of respiratory symptoms and prominent non-productive cough. Rash, headaches and malaise are common. Chest x-ray typically shows non-lobar, bilateral infiltrates. When a pathogen is identified, *Mycoplasma pneumoniae* is the most common etiology.⁴

Post-Influenza Bacterial pneumonia:

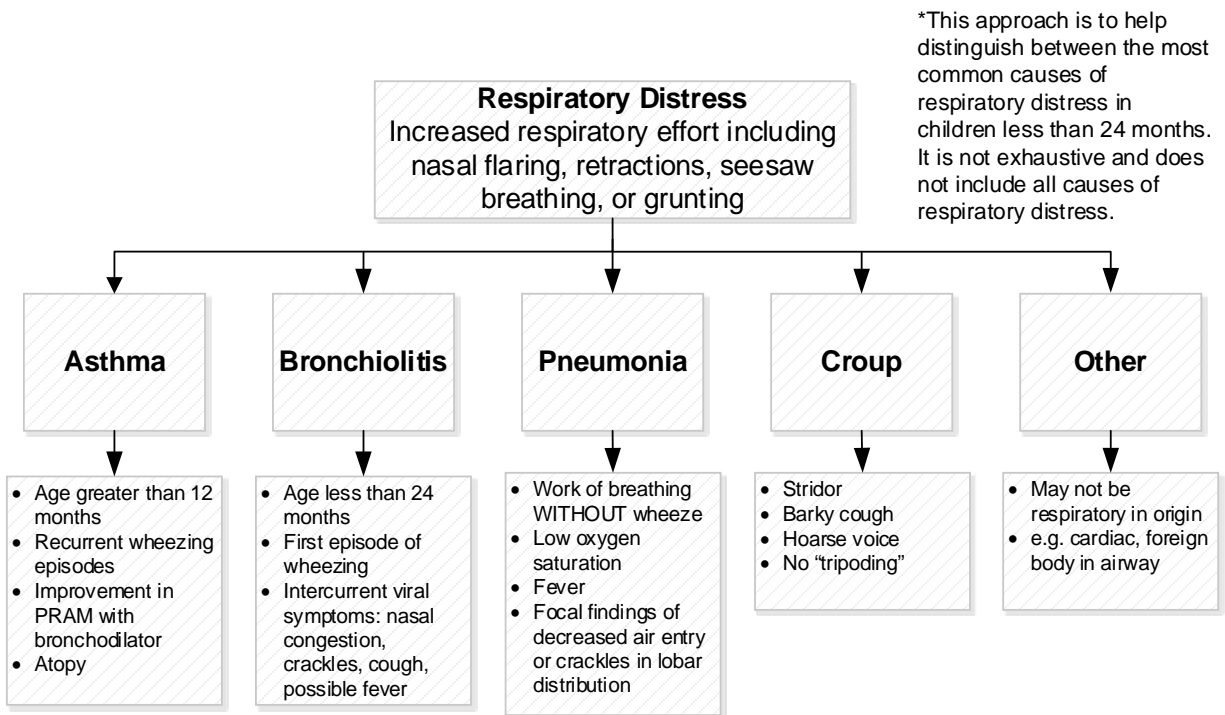
Post-influenza bacterial pneumonia is rare and should be differentiated from primary influenza pneumonia. Evidence for secondary bacterial infection can include a period of improvement post influenza infection, followed by clinical and radiographic deterioration (often with airspace consolidation or pleural fluid). *Streptococcus pneumoniae* remains the most important pathogen in post-influenza bacterial pneumonia. However, *Staphylococcus aureus* (both MSSA and MRSA) is also a prevalent pathogen in these patients.⁷

Complicated pneumonia:

Complicated pneumonia is defined as any pneumonia with evidence of empyema, lung abscess, pneumatoceles, or pulmonary necrosis. Empyema in previously well children is almost always due to *Streptococcus pneumoniae*, *Staphylococcus aureus* or group A streptococcus. For patients with effusion, refer to the local pleural effusion guidelines or practices for management options.

Diagnosis

Table 1. Differential Diagnosis for Respiratory Distress



History and physical features

The following history and physical exam features may be present in children with pneumonia, and can aid in the diagnosis.

- History of:
 - Fever +/- chills
 - New onset of cough (may or may not be productive)
 - Chest pain and/or abdominal pain
 - Difficulty breathing
 - Constitutional symptoms (malaise and lethargy, headache, nausea/vomiting, myalgia)
 - Poor feeding
 - Vomiting (in the infant/younger child)
- Physical exam findings of:
 - Temperature $\geq 38.0^{\circ}\text{C}$
 - Tachypnea for age (see [Clinical Decision Support #2](#))
 - Tachycardia for age (see [Clinical Decision Support #2](#))
 - Rales/crepitation/crackles
 - Increased work of breathing: tracheal tug, subcostal or intercostal retractions/indrawing, suprasternal indrawing, nasal flaring, grunting, abdominal breathing
 - Signs of consolidation: diminished chest expansion, tactile fremitus, localized dullness to percussion, diminished air entry, bronchial breath sounds, pleural rub, whispering pectoriloquy (over 10 years old)
 - Findings that are consistent with a pleural effusion including decreased breath sounds, decreased chest expansion and dullness to percussion of the affected side. This topic does not include management of pleural effusion: Refer to local pleural effusion guidelines or practices.
 - Wheeze makes diagnosis of bacterial pneumonia unlikely and suggests the possibility of bronchiolitis or mucus plugging from asthma

Not all children present with classic symptoms. Less typical presentations, such as fever and abdominal pain can occur. Note that young children often present with more subtle, non-specific symptoms, and clinicians should have a high index of suspicion for a serious infection in this age group.

Investigations

Chest X-Ray

Bacterial pneumonia is often over-diagnosed. Studies have shown that clinical assessment without radiological confirmation can lead to overtreatment⁸. Radiological confirmation by chest x-ray (PA and lateral), should be obtained in any patient with suspected bacterial pneumonia, whenever feasible.

- Chest x-ray findings in pneumonia can include:
 - Typical bacterial pneumonia: Areas of alveolar/airspace disease is typically seen as consolidation. This classically presents in a lobar distribution, but may also be subsegmental or nodular/round opacities.
 - Atypical bacterial pneumonia: Non-lobar, bilateral infiltrates that appear more extensive than the clinical picture.

- Complicated bacterial pneumonia: X-ray findings may be suggestive of a pleural effusion. Features of pleural effusion may include, air-fluid levels, blunting of costophrenic angle, extensive “white-out”. Mediastinal shift can be seen with large-volume effusions. If a pleural effusion is present, it may layer out when a chest x-ray is repeated in lateral decubitus position. Chest x-rays may also reveal findings suggestive of pulmonary abscesses, necrotizing lung, or pneumatoceles. If any of these findings are present, an ultrasound of the chest should be immediately obtained. This topic does not include management of pleural effusion: Refer to local pleural effusion guidelines or practices.
- Viral lower respiratory tract infection: Poorly defined patchy infiltrates or atelectasis or collapse of the right upper lobe are more in keeping with viral etiologies. Antibiotics are not indicated.
- Chest x-rays are useful for diagnosis of bacterial pneumonia. However, routine repeat chest x-rays to look for improvement are NOT indicated, as the x-ray findings will often persist for weeks beyond clinical improvement.

Other imaging modalities

- Ultrasound: Ultrasound is used to confirm the presence and characteristics of a pleural effusion if it is suspected on chest x-ray. Ultrasound can estimate the size of the effusion, and differentiate free-flowing effusions from those that are loculated. This topic does not include management of pleural effusion: Refer to local pleural effusion guidelines or practices. There is increasing evidence that ultrasound can also be used for diagnosis of CAP, but this is not yet being done in Alberta.
- Chest computed tomography is not indicated for diagnosing pneumonia.

Laboratory Investigations

Laboratory investigations are not necessary for patients who are well enough to be treated as outpatients but can be considered at the discretion of the physician, especially for patients deemed sick enough to warrant hospital admission. Some investigations to consider are listed below, but further investigations may be indicated depending on clinical presentation:

- Hematology:
 - CBC and differential. Leukocytosis with neutrophilia may be suggestive of a bacterial etiology.
- Chemistry:
 - Electrolytes: Indicated if history and/or physical exam are suggestive of dehydration or potential electrolyte imbalance. Note that patients with pneumonia are at risk for electrolyte disturbances such as hypernatremia or hyponatremia. If sodium disturbances are noted on labs, serum and urine osmolality, and serum and urine electrolytes are indicated in addition to careful clinical assessment. If the patient is admitted to hospital, electrolytes should be monitored daily if the patient is on full IV fluids. Electrolytes may need to be obtained more frequently if there were any initial abnormalities, and they are being actively managed.
 - Urea and creatinine: If history and/or physical exam suggest dehydration.

- CRP:
 - CRP is an acute phase reactant, and may be helpful to follow disease progression.
- Microbiology
 - Blood cultures: If done, should be collected prior to receiving antibiotics, and only in those who are sick enough to be admitted. Blood cultures are positive in a minority of cases (approximately 10%), but are very useful to guide antibiotic choice if positive. A larger volume of blood increases the yield, so ensure that an optimal volume for age is submitted.
 - Sputum culture is occasionally helpful if available, but is usually difficult to obtain in pre-teens.¹
 - When drainage of pleural fluid is clinically indicated, the fluid should be sent for bacterial detection, cell count, LDH, protein and glucose. This topic does not include management of pleural effusion: Refer to local pleural effusion guidelines or practices.
 - Nasopharyngeal Aspirate for influenza and other viruses
 - Nasopharyngeal Aspirate sample for Mycoplasma pneumoniae may be considered. NPA samples are routinely tested for Mycoplasma pneumoniae but results are not routinely reported. If the clinical picture fits with atypical pneumonia, it may be useful to call the Provincial Laboratory to obtain the result. However, a positive test does not necessarily prove that Mycoplasma is the cause of the pneumonia, and must be interpreted with caution.
 - Mycoplasma serology may be considered in children over 2 years of age, when atypical pneumonia is suspected, but false positive results are common, so the test is of limited value.

ED/Urgent Care Disposition Planning

1. Considerations for Admission

Most cases of bacterial pneumonia can be managed on an outpatient basis.

Admission to hospital is indicated in any one of the following settings:

- Respiratory Needs:
 - Need for supplemental oxygen to maintain oxygen saturation greater than or equal to 92%
 - Severe work of breathing: retractions, grunting, nasal flaring
- Hemodynamic Instability
 - Toxic appearance
 - Tachycardia, hypotension, poor perfusion
- Dehydration with inability to orally rehydrate
- Repeated vomiting with inability to tolerate oral antibiotics
- Home situation: Unable to manage patient at home, non-compliant patient/parent
- Complicated pneumonia

Admission should also be strongly considered in the following settings:

- Significant comorbidities/ underlying medical condition

- Immunocompromised or immunosuppressed
- Age < 6 months: may need more supportive care and monitoring, and it can be difficult to recognize subtle deterioration clinically
- No response to appropriate oral antibiotics after 72 hours

If a decision for admission has been made, the physician must determine whether the patient is suitable for inpatient wards, or if admission to a Pediatric Intensive Care Unit (PICU) is required.

Admission to PICU should be considered if:

- Severe work of breathing
- Significant oxygen requirements (more than 5 LPM in order to maintain oxygen saturations greater than 92%)
- Inadequate ventilation (an elevated pCO₂ on blood gas)
- Decreased level of consciousness
- Hemodynamically compromised despite adequate fluid resuscitation

2. Considerations for Outpatient Management

Antibiotics

Antibiotics should be chosen to cover the most likely causative organisms. Most bacterial pneumonia in previously well children over 3 months of age is due to *Streptococcus pneumoniae* (pneumococcus). *Mycoplasma pneumoniae* is a common organism if presenting with atypical pneumonia. Most pneumonia due to *M. pneumoniae* is self-resolving so the emphasis is on providing optimal coverage for pneumococcal pneumonia. Although pneumococci used to commonly be resistant to penicillin/ampicillin in Alberta, this is now very rare (probably as our infant pneumococcal vaccine program targeted these strains).

- Oral Antibiotics (Refer to [Clinical Decision Support #3](#) for antibiotic doses)
 - amoxicillin PO (40 to 50 mg/kg/day divided TID) x 7 days is first line, except in the following circumstances:
 - a. If there are risk factors for resistant *Streptococcus pneumoniae* (Unimmunized or incompletely immunized, attends daycare, use of amoxicillin in preceding 3 months, failure of initial therapy), use high dose amoxicillin PO (80 to 100 mg/kg/day divided TID) x 7 days
 - b. History of penicillin allergy, use AZIthromycin PO x 5 days, or clarithromycin PO x 7 days. Doxycycline PO x 7 days is a suitable alternative if patient greater than 8 years of age. Note that there is significant resistance of *S. pneumoniae* to macrolides. Consider Infectious Diseases consult. (Refer to [Clinical Decision Support #1](#))
 - c. If atypical pneumonia, use AZIthromycin x 5 days, or clarithromycin PO x 7 days
 - d. If post-influenza bacterial pneumonia, use amoxicillin-clavulanate for additional coverage of Methicillin Susceptible *Staphylococcus aureus* (standard dose of amoxicillin component, unless there are risk factors for pneumococcal resistance)
 - e. If post-influenza bacterial pneumonia, with history of penicillin allergy, use cefuroxime or cefPROZil x 7 days. First dose must be given in an observed setting. Consider Infectious Diseases consult, (Refer to [Clinical Decision Support #1](#))

- Intravenous Antibiotics (Refer to [Clinical Decision Support #4](#) for antibiotic doses)
 - For patients who require parenteral antibiotics, but otherwise do not meet criteria for admission to hospital, consideration should be given to use of the Ambulatory Parenteral Therapy Program in regions where this program is available
 - Ampicillin remains the best parenteral antibiotic choice, but requires every 6 hour dosing.
 - cefTRIAxone can be used as it can be dosed every 12 to 24 hours, and is more feasible when ambulatory parenteral antibiotics are being used.

3. Follow-up for patients discharged from ED

- Children should be followed after discharge until they have clinically recovered. First follow up should occur within 1 to 2 weeks
- In patients with uncomplicated pneumonia, repeat chest x-rays looking for radiographic improvement are not indicated
- If respiratory symptoms persist in follow up, after full course of antibiotics, an alternative diagnosis should be considered, and a repeat chest X-ray should be considered

4. Patient and Family education/discharge instructions from ED

- [MyHealth.Alberta.ca Health Information and Tools - Pneumonia](#)

Inpatient Care

Isolation

- Contact and droplet isolation is required for all patients admitted with cough and fever. Isolation should be continued throughout the child's hospitalization if they remain symptomatic. Airborne precautions are required if there is concern for possible Tuberculosis.

Monitoring

- Vital signs (heart rate, respiratory rate, temperature, blood pressure, oxygen saturations) are indicated every 1 to 4 hours.
- Neurovitals are not indicated unless there is evidence of decreased level of consciousness.
- Continuous pulse oximetry may be considered in any child with significant respiratory distress or high oxygen requirements during the acute illness phase.
- Cardiorespiratory monitoring should be considered in severe pneumonia. Monitors can be removed once clinically improving.

Respiratory Support

- Supplemental oxygen is indicated for patients who are hypoxic (the usual criteria is oxygen saturations less than 92%). Oxygen should be delivered to keep saturations greater than 92%, however, transient saturations less than 92% that are self-resolving should not lead to prolongation of hospitalization as the level of 92% is not evidence-based.

- There is no clinical evidence for chest physiotherapy in a previously healthy child with community acquired pneumonia.

Diet

- Use PO fluids and diet as tolerated if work of breathing is mild to moderate. If PO is not tolerated or work of breathing is severe, use IV fluids (see section below).
- Initiate oral fluids and age appropriate diet once PO tolerated and work of breathing improves.

IV Fluids

- Fluid resuscitation is clinically indicated if there is evidence of hemodynamic instability (tachycardia for age, poor perfusion, hypotension, See [Clinical Decision Support #2](#)). Fluid boluses (normal saline 20 mL/kg) can be given until hemodynamically stable. Reassess vital signs and peripheral perfusion following any fluid bolus administration. If more than 3 fluid boluses are required, consider seeking additional medical advice from the Pediatric Intensive Care Unit.
- If the patient is unable to tolerate oral fluids, or has poor oral intake, ongoing intravenous fluids may be required. Choose isotonic intravenous fluids at rate of 75-100% maintenance, depending on the patient's oral intake, volume status and serum electrolytes (if that information is available). Isotonic fluids include Normal Saline, Plasmalyte, and Ringer's Lactate. Intravenous fluid rates should be reduced as soon as oral intake improves. Potassium containing fluids should be considered if adequate urine output, normal renal function, and low to normal serum potassium.
- Note that patients with pneumonia are at risk for both hypernatremia and hyponatremia. SIADH. Accurate fluid assessments including clinical assessments, measurements of fluids balance, and measurement of serum electrolytes, urine electrolytes and osmolality will help to guide use of IV fluids. Both fluid type, and fluid rate should be chosen judiciously, and will need ongoing adjustment depending on clinical status and laboratory results.

Laboratory Investigations

- If not already collected in the ED, laboratory investigations can be considered. Refer to above section ([Diagnosis; Investigations; Laboratory Investigations](#)) for details.

Imaging

- Chest x-rays are indicated for initial diagnosis. See above section ([Diagnosis; Investigations; Chest x-rays](#))
- Repeat chest x-ray should not be routinely ordered. Indications for repeat chest x-rays includes:
 - Clinical deterioration
 - Patient is not responding to therapy within 48 to 72 hours (persistent fever, persistent or worsening respiratory distress and/or hypoxia, or new clinical findings suggestive of a pleural effusion). Repeat clinical assessment and a chest radiograph should be obtained to look for empyema/ lung abscess.

Antibiotics

Antibiotics are chosen based on clinical findings, chest x-ray findings, as well as the severity of the clinical presentation. There are no specific criteria to categorize patients in to the mild, moderate or severe pneumonia categories. Clinical judgment is required in deciding how sick the patient is. In general, severe pneumonia means patients with significant oxygen requirement, severe respiratory distress or respiratory failure, or evidence of hemodynamic instability indicative of septic shock.

1. **Mild to Moderate Community Acquired Pneumonia – Oral Antibiotics** (Refer to [Clinical Decision Support #4](#) for antibiotic doses)

For most patients who are sufficiently ill to require hospitalization, parenteral antibiotics are required. However, there may be patients who are admitted to hospital, but are well enough to tolerate oral antibiotics (e.g. Patients who are clinically well, but require hospitalization for supplemental O₂). Antibiotic therapy should be targeted to cover *Streptococcus pneumoniae*. If a patient has mild to moderate typical pneumonia, local *Streptococcus pneumoniae* susceptibility data suggests that standard dose amoxicillin provides excellent coverage.

- amoxicillin (40 to 50 mg/kg/day divided TID) should be used as first line oral therapy. Exceptions include the following:
 - a. Risk factors for pneumococcal resistance (Unimmunized or incompletely immunized, attends daycare, amoxicillin use in preceding 3 months, failure of initial therapy): amoxicillin (80 to 100 mg/kg/day divided TID) x 7 days should be used.
 - b. History of penicillin allergy, use AZIthromycin PO or clarithromycin PO. Doxycycline PO is a suitable alternative if patient greater than 8 years of age. Note that there is significant resistance of *S. pneumoniae* to macrolides. Consider Infectious Diseases consult. (Refer to [Clinical Decision Support #1](#))
 - c. If atypical pneumonia: Antibiotics should be chosen to cover *Mycoplasma pneumoniae*. Use AZIthromycin x 5 days, or clarithromycin PO x 7 days.
 - d. If post-influenza bacterial pneumonia: Antibiotics should still be chosen to cover *Streptococcus pneumoniae*, but additional coverage of Methicillin Susceptible *Staphylococcus aureus* is indicated. Use amoxicillin-clavulanate (standard dose of amoxicillin component unless there are risk factors for *Streptococcus pneumoniae* resistance).
 - e. If post-influenza bacterial pneumonia, with history of penicillin allergy, use cefuroxime or cefPROZil x 7 days. First dose must be given in an observed setting. Consider Infectious Diseases consult, (Refer to [Clinical Decision Support #1](#))

2. **Mild to Moderate Community Acquired Pneumonia – Intravenous Antibiotics** (Refer to [Clinical Decision Support #4](#) for antibiotic doses)

Antibiotic therapy should be targeted to cover *S. pneumoniae* in mild to moderate community acquired pneumonia. Ampicillin provides excellent coverage for *S. pneumoniae*. Even in the presence of risk factors for pneumococcal resistance, almost all cases will still respond to intravenous ampicillin.

- Ampicillin IV should be the first line parenteral. Exceptions include the following:

- a. History of anaphylaxis to any beta-lactam (other than cefTRIAxone, cefoTAXime or ceFOXitin): Use cefTRIAxone (or cefoTAXime if cefTRIAxone is not available) IV, following a test dose (discuss test doses with pharmacy and/or ID. Clinicians should ensure that IM epinephrine is available and the dose calculated ahead of time in case the patient develops anaphylaxis. In patients with documented history of severe non-IgE mediated reaction to a beta-lactam (Eg. Steven Johnson syndrome), Infectious Diseases consultation is strongly recommended as beta lactams should usually be avoided (Refer to [Clinical Decision Support #1](#))
- b. If atypical pneumonia: Antibiotics should be chosen to cover *Mycoplasma pneumoniae*. Use AZIthromycin x 5 days. This can be given IV or PO.
- c. If post-influenza bacterial pneumonia: Antibiotics should still be chosen to cover *Streptococcus pneumoniae*, but additional coverage of methicillin-susceptible *taphylococcus aureus* is indicated. Use cefTRIAxone IV (cefotaxime is a suitable substitute if cefTRIAxone is not available). Vancomycin should be added if the patient is known to be colonized with methicillin-resistant *Staphylococcus aureus* (MRSA). (Refer to [Clinical Decision Support #3](#))

3. Severe Pneumonia – Intravenous Antibiotics (Refer to [Clinical Decision Support #4](#) for antibiotic doses)

Oral antibiotics are not indicated in severe pneumonia, and clinicians should always choose a parenteral form of antimicrobial. Antibiotics should be chosen to cover *Streptococcus pneumoniae*, including potentially resistant strains. Although *Streptococcus pneumoniae* remains the most likely organism, coverage should also be broadened to include other potential pathogens such as methicillin-susceptible *Staphylococcus aureus* (MSSA), *Haemophilus influenzae*, *Moraxella catarrhalis*, and other less common pathogens in bacterial pneumonia, simply because one cannot afford to omit coverage of any potential pathogen in a critically ill child.

- cefTRIAxone IV is first line in patients who have a severe presentation of community acquired (cefotaxime is a suitable substitute if cefTRIAxone is not available). Additional antibiotics should be considered in the following circumstances:
 - a. The addition of AZIthromycin should be considered for added coverage of potential atypical pathogens.
 - b. Vancomycin should be added if the patient is at high risk for MRSA and *Staphylococcus aureus* is suspected, in rapidly progressive disease, if there is evidence for pneumatoceles or abscess on chest x-ray, or if the patient has features of septic shock. (Refer to [Clinical Decision Support #3](#))
- If a patient with severe pneumonia has a history of anaphylaxis to cefotaxime or cefTRIAxone, Infectious Diseases should be consulted to help guide further therapy. If they have a history of anaphylaxis to other beta lactams, cefotaxime or cefTRIAxone can be given following a test dose (starting with 1% of the therapeutic dose), but clinicians should ensure that intramuscular epinephrine is available. Infectious Diseases and/or pharmacy consultation is suggested. In patients with documented history of severe non-IgE mediated reaction to a beta-lactam (Eg. Steven Johnson syndrome), Infectious Diseases consultation is strongly recommended (Refer to [Clinical Decision Support #1](#))

4. **Antibiotics for empyema, pending cultures** Refer to local pleural effusion guidelines or practices. (Refer to [Clinical Decision Support #4](#) for antibiotic doses)

IV antibiotics should be used for initial therapy of complicated pneumonia. Antibiotics should be chosen to cover *Streptococcus pneumoniae*, including potentially resistant strains. Although *Streptococcus pneumoniae* remains the most likely organism, coverage should also be broadened to include other potential pathogens such as methicillin-susceptible *Staphylococcus aureus* (MSSA), *Haemophilus influenzae*, *Moraxella catarrhalis*, and other less common pathogens in bacterial pneumonia.

- cefTRIAxone IV is first line in patients who have a complicated pneumonia (cefoTAXime is a suitable substitute if cefTRIAxone is not available). Additional antibiotics should be considered in the following circumstances:
 - a. The addition of AZIthromycin should be considered for added coverage of potential atypical pathogens (and may also add some additional coverage for *Streptococcus pneumoniae*).
 - b. Vancomycin should be added if the patient is at high risk for MRSA and *Staphylococcus aureus* is suspected, in rapidly progressive disease, if there is evidence for pneumatoceles or abscess on chest x-ray, or if the patient has features of septic shock. (Refer to [Clinical Decision Support #3](#))
5. **Antibiotic switch from Intravenous to Oral** (Refer to [Clinical Decision Support #4](#) for antibiotic doses; Refer to [Clinical Decision Support #4](#) for guidance when switching from intravenous to oral antibiotics)
- Antibiotics should be adjusted and/or the spectrum narrowed if a pathogen is detected. (Refer to [Clinical Decision Support #4](#))
 - Continue IV antibiotics until the patient is clinically improving. If IV access becomes difficult, oral antibiotics will generally work in non-severe pneumonia. Patients showing signs of clinical improvement (afebrile, clinically improving, tolerating oral intake, no further supplemental oxygen requirement) can be discharged on oral antibiotics. Oral antibiotics can be considered even when the patient remains hospitalized.
 - Continue antibiotics for total of 7 days (IV+PO) in uncomplicated pneumonia; some experts recommend a longer course (typically 10 days) with bacteremia. The course will need to be extended further in empyema or a lung abscess, with duration depending on clinical severity (typically aim for about 3 weeks).
6. **Oral antibiotic switch from IV Ampicillin:**
- amoxicillin PO (40 to 50 mg/kg/day). TID amoxicillin dosing is recommended for pneumonia.
 - If there are risk factors for resistant *Streptococcus pneumoniae* (Unimmunized or incompletely immunized, attends daycare, use of amoxicillin use in preceding 3 months, failure of initial therapy): High-dose amoxicillin PO (80 to 100 mg/kg/day).

7. Oral antibiotic switch from cefTRIAxone / cefoTAXime OR cefTRIAxone and vancomycin

- amoxicillin-clavulanate PO (40 mg/kg/day of amoxicillin component) divided TID.
- If there are risk factors for resistant *Streptococcus pneumoniae* (Unimmunized or incompletely immunized, attends daycare, use of amoxicillin use in preceding 3 months, failure of initial therapy): High-dose amoxicillin-clavulanate PO (80 to 100 mg/kg/day of amoxicillin component)
- History of penicillin allergy, use AZIthromycin PO or clarithromycin PO. Doxycycline PO is a suitable alternative if patient greater than 8 years of age. Infectious Diseases consultation may be considered. Note that there is significant resistance of *S. pneumoniae* to macrolides (Refer to [Clinical Decision Support #1](#))
- If MRSA coverage is still required
 - trimethoprim-sulfamethoxazole PO
 - OR**
 - clindamycin PO
 - OR**
 - linezolid PO
 - Infectious Diseases may be consulted for optimal antibiotic choice, and must be consulted for consideration of linezolid use

8. Oral antibiotic switch from IV AZIthromycin

- AZIthromycin PO x 5 days

Antipyretics/ analgesia

- Provide for comfort only. It is not vital that the fever be controlled.
- Acetaminophen: Can be dosed every 4 to 6 hours as needed. Use with caution in any patient with evidence of liver disease (elevated liver enzymes or abnormal liver function tests).
- Ibuprofen: Can be dosed every 6 hours as needed. Use with caution in any patient with evidence of kidney injury, and in patients who are receiving other potentially renal-toxic medications (eg. vancomycin). Avoid use in any patient with evidence of bleed, or who is significantly thrombocytopenic.

Consults

- Pediatric Infectious Diseases consult should be considered if:
 - No clinical improvement in 48 to 72 hours
 - Patient has a history of type I allergy, or other severe reaction to the recommended antibiotics
 - Complicated pneumonia. This topic does not include management of pleural effusion: Refer to local pleural effusion guidelines or practices.
- Respiriology consult may be considered if:
 - Patient has underlying respiratory condition other than asthma (e.g. Tracheostomy, congenital pulmonary anomaly, chronic lung disease, etc.)
 - Complicated pneumonia
 - PICU care is required

Inpatient Disposition Planning

1. Considerations for Discharge from Inpatient Unit

- Discharge home when off O₂, maintaining hydration and on oral antibiotics. Continue antibiotics to complete 7 days course of antibiotics (total IV plus oral = 7 days).
- Oral antibiotic therapy (rather than intravenous) is appropriate once the patient is clinically improved, afebrile, and tolerating oral intake. Refer to [Clinical Decision Support #4](#).
- For patients who require parenteral antibiotics, but otherwise do not meet criteria for admission to hospital, consideration should be given to use of the Ambulatory Parenteral Therapy Program in regions where this program is available.

2. Follow-up from inpatient unit

- Children should be followed after discharge until they have clinically recovered. First follow up should be within 1 to 2 weeks.
- In patients with uncomplicated pneumonia, repeat chest x-rays are not indicated. Radiographic resolution in most uncomplicated pneumonia cases may take up to 4 to 6 weeks.
- For complicated pneumonia, a follow up chest x-ray should be done in 6 to 8 weeks.
- If respiratory symptoms persist in follow up, after full course of antibiotics, an alternative diagnosis should be considered, and a repeat chest x-ray should be considered.

3. Patient and Family education/discharge from inpatient unit instructions

- MyHealth.Alberta.ca [Health Information and Tools - Pneumonia](#)

Clinical Decision Support

1. Beta-Lactam Allergy

All penicillins and cephalosporins are beta lactams. History of reactions to beta-lactams deserves special attention when selecting appropriate antimicrobial therapy. Readers are encouraged to refer to their local allergy guidelines or consult Infectious Diseases or Allergy/Immunology for further assistance.

a. Type 1 allergic reactions (anaphylaxis): Most serious beta lactam allergies are IgE mediated, and present with urticarial rash, pruritus, erythema, hyperperistalsis, angioedema, laryngeal edema, bronchospasm, arrhythmias, or hypotension, typically within 1 hour of drug administration. If a child has had a suspected IgE mediated reaction to any beta lactam in the past, caution with all beta lactams is advised, as there is a very small risk of cross-reactivity and a subsequent reaction may be more severe. The child with allergy to a penicillin will usually tolerate a cephalosporin (cefoTAXime, cefTRIAXone, or cefuroxime) as there is negligible cross-reactivity. Ideally, a test dose of the antibiotic should be given first in an observed setting, with epinephrine available to treat a reaction. The patient should be observed for 30-60 minutes

before proceeding with any additional antibiotic. **Consultation with Infectious Diseases and Pharmacy is strongly recommended to help guide the steps required for an antibiotic challenge.**

The pneumonia algorithm recommends use of macrolides (AZIthromycin or clarithromycin), or doxycycline in outpatients with possible IgE mediated reactions to a penicillin as there is no cross-reactivity between macrolides and beta lactams. However, there is significant pneumococcal macrolide resistance in Alberta. Therefore, if a child is sufficiently ill, a beta lactam should be used in most cases as it is more likely to be effective.

b. Non-urticarial rash: If the child had only a non-urticarial rash related to a beta lactam, they are at no higher risk than is any other child of having a serious reaction to a beta lactam and should not be considered to have a beta lactam allergy. If there is any concern about a reaction, the child should be observed for 30 minutes following the first dose of the beta lactam. Families must be advised to seek medical attention if symptoms suggestive of possible allergy develops with subsequent doses.

c. Other severe non-IgE mediated reactions: These include severe cutaneous reactions such as Stevens-Johnson syndrome and Toxic Epidermal Necrolysis, interstitial nephritis, hepatitis, serum sickness, hemolytic anemia, and drug-rash with eosinophilia and systemic symptoms (DRESS). In patients with a history of severe non-Ig-E mediated reactions, all beta-lactams should be avoided, including for graded challenges. **Infectious Diseases consultation is strongly recommended to guide further antibiotic choices.**

2. Pediatric Vital Signs

Tachypnea (Reference PALS Guidelines, 2015)

Table #2a Age-specific criteria for tachypnea (breaths per minute)

Age	Approximate normal respiratory rates	Upper limit that should be used to define tachypnea
<2 months	34–50	60
2–12 months	25–40	50
1–5 years	20–30	40
>5 years	15–25	30

Tachycardia (Reference PALS Guidelines, 2015)

Table #2b Age-specific criteria for tachycardia (beats per minute)

Age	Awake Rate	Sleeping rate
Neonate (<28 days)	100-205	90-160
Infant (1 month-1year)	100-190	90-160
Toddler (1-2 years)	98-140	80-120
Preschool (3-5 years)	80-120	65-100
School age (6-11 years)	75-118	58-90
Adolescent (>12 years)	60-100	50-90

Blood Pressure (Reference: PALS Guidelines, 2015)
Table #2c Normal Blood Pressure by Age (mm Hg)

Age	Systolic Pressure	Diastolic Pressure	Systolic Hypotension
Birth (12 h, <1000 g)	39-59	16-36	<40-50
Birth (12 h, 3 kg)	60-76	31-45	<50
Neonate (96 h)	67-84	35-53	<60
Infant (1-12 mo.)	72-104	37-56	<70
Toddler (1-2 y)	86-106	42-63	<70 + (age in years x 2)
Preschooler (3-5 y)	89-112	46-72	<70 + (age in years x 2)
School-age (6-9 y)	97-115	57-76	<70 + (age in years x 2)
Preadolescent (10-11 y)	102-120	61-80	<90
Adolescent (12-15 y)	110-131	64-83	<90

3. Vancomycin dosing

The starting dose for vancomycin is 60 mg/kg/day IV divided every 6 hours. Note: Dosing interval is determined by CrCl and desired trough levels; the target trough level is 15 – 20 mg/L for the treatment of pneumonia. Refer to [Bugs and Drugs](#) or the AHS Parenteral Drug Monograph for details. Clinicians unfamiliar with Therapeutic Drug Monitoring of vancomycin are encouraged to consult with a pharmacist.

Vancomycin is nephrotoxic, and dosing must be adjusted if there is any evidence of renal impairment. For patients with renal impairment, a pre-3rd level must be done to ensure levels are not too high, followed by a pre-5th level for steady state.

For patients with no evidence of renal impairment, a pre-vancomycin trough level, urea and creatinine should be drawn immediately before the 5th dose of vancomycin is given (the 5th dose does not need to be held while awaiting results).

- If a pre-3rd level is too high, the next vancomycin dose should be held, and a pharmacist should be consulted to guide further dosing. If a pre-3rd level is low, no further action needs to be taken as the drug level is not yet at steady state. A pre-5th level should be checked.
- If the pre-5th level is too low, the dose should be adjusted in consultation with a pharmacist. A pre-vancomycin level, urea and creatinine should be drawn again pre-5th dose since adjustment
- If the pre-5th level is too high, the next dose should be held, and pharmacist should be consulted to guide further dosing.

A pharmacist from a pediatric hospital can be consulted to assist in dosing.

4. Antibiotic Switch from Intravenous to Oral

Antibiotics should be adjusted if a pathogen is detected. Continue IV antibiotics until the patient is clinically improving. If IV access becomes difficult, oral antibiotics will generally work in non-severe pneumonia. Patients showing signs of clinical improvement (afebrile, improved work of breathing, tolerating oral intake, no further supplemental oxygen requirement) can be discharged on oral antibiotics. Oral antibiotics can be considered even when the patient remains hospitalized.

Continue antibiotics for total of 7 days (IV+PO) in uncomplicated pneumonia; some experts recommend a longer course (typically 10 days) with bacteremia. The course will need to be extended further in empyema or a lung abscess, with duration depending on clinical severity (typically aim for about 3 weeks).

See [Table 4](#) for guidance on switching from intravenous to oral antibiotic choices.

Table #3. Antibiotic Doses

Antibiotic ⁱ	Route	Regimen
amoxicillin ⁱⁱ	PO	Standard dose: 40 to 50 mg/kg/day divided TID ⁱⁱⁱ Maximum 1 gram TID High dose: 80 to 100 mg/kg/day divided TID ⁱⁱⁱ Maximum 1 gram TID
amoxicillin-clavulanate ⁱⁱ	PO	Standard dose: 40 to 50 mg/kg/day of amoxicillin component, divided TID ⁱⁱⁱ Maximum 1 gram TID of amoxicillin, Maximum 10mg/kg/day of clavulanate High dose: 80 to 100 mg/kg/day of amoxicillin component divided TID ⁱⁱⁱ ,. (May be prescribed as amoxicillin 40 to 50 mg/kg/day PLUS amoxicillin-clavulanate 7:1 40 to 50 mg/kg/day of amoxicillin

component divided TID so as not to exceed 10 mg/kg/day of clavulanate) Maximum 1 gram TID of amoxicillin

ampicillin	IV	200 mg/kg/day divided every 6 hours. Maximum 2 grams every 6 hours
AZlthromycin	IV/PO	10 mg/kg once daily, day 1; 5 mg/kg once daily, days 2 to 5 Maximum 500 mg day 1; 250 mg days 2 to 5
cefoTAXime	IV	200 mg/kg/day divided every 6 or 8 hours. Maximum 2 grams per dose.
cefTRIAxone	IV	50 to 100 mg/kg/day divided every 12 or 24 hours. Maximum 2 grams daily.
clarithromycin	PO	15 mg/kg/day divided BID. Maximum 500 mg BID.
clindamycin	PO	20 to 40 mg/kg/day divided TID. Maximum 450 mg TID.
clindamycin	IV	40 mg/kg/day divided every 8 hours. Maximum 600 mg every 8 hours.
doxycycline	PO	2 to 4 mg/kg/day divided every 12 hours. Maximum 200 mg/day
trimethoprim-sulfamethoxazole	PO	10 mg/kg/day of trimethoprim component divided BID. Maximum 160 mg of trimethoprim component BID.
vancomycin	IV	60 mg/kg/day divided every 6 hours. ^{iv} Maximum INITIAL dose of 1000 mg every 6 hours.

i. Continue antibiotics for total of 7 days, with a longer course (10 days) for bacteremia. Patients with empyema or a lung abscess will warrant an even longer course of antibiotics.

*ii. High does amoxicillin should be used if there are risk factors for resistant *Streptococcus pneumoniae* (Unimmunized or incompletely immunized, attends daycare, use of amoxicillin in preceding 3 months, failure of initial therapy)*

iii. Three times daily (TID) dosing is recommended for pneumonia.

iv. Target trough vancomycin level should be 15-20 mg/L.

Refer to [Bugs and Drugs](#) or Spectrum if further details are required.

Table #4. Suggested antibiotics when switching from intravenous to oral

If a pathogen is not identified:

IV Antibiotic	PO Antibiotic
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ampicillin	amoxicillin
AZithromycin	AZithromycin
cefTRIAxone / cefoTAXime	amoxicillin-clavulanate
cefTRIAxone + vancomycin	amoxicillin-clavulanate

If MRSA coverage is still required, options are trimethoprim-sulfamethoxazole, clindamycin or linezolid. Consult ID about the optimal choice.

Analytics

Outcome Measure #1

Name of Measure	Frequency of CXR use in patients with the diagnosis of "pneumonia"
Definition	Of the total number of patients admitted with a diagnosis of: A. Uncomplicated pneumonia B. Complicated pneumonia (empyema or parapneumonic effusion, lung abscess, pneumatoceles, or pulmonary necrosis) How many receive repeat chest x-rays after initial diagnosis?
Rationale	Radiological confirmation by chest x-ray should be obtained in any patient with suspected bacterial pneumonia, whenever feasible. Routine repeat chest x-rays to look for improvement are NOT indicated in patients with uncomplicated pneumonia. Radiographic resolution in most uncomplicated pneumonia cases may take up to four to six weeks. For complicated pneumonia, a follow up chest x-ray should be done in 6-8 weeks.

Outcome Measure #2

Name of Measure	Total duration of antibiotic therapy for pediatric patients with Community Acquired Pneumonia
Definition	For patients admitted with a diagnosis of: C. Uncomplicated pneumonia D. Complicated pneumonia (empyema or parapneumonic effusion, lung abscess, pneumatoceles, or pulmonary necrosis) What is duration of antibiotic therapy, including oral switch?
Rationale	In uncomplicated pneumonia antibiotics should be given for a total of 7 days (IV+PO); some experts recommend a longer course (typically 10 days) with bacteremia. The course will need to be extended further in empyema or a lung abscess, with duration depending of clinical severity (typically aim for about 3 weeks).

Outcome Measure #3

Name of Measure	Frequency of amoxicillin use, and dosage (standard vs high dose)
Definition	<p>A. Of the total number of patients seen in emergency with a diagnosis of uncomplicated pneumonia, how many patients receive standard dose of amoxicillin, and how many patients receive high dose amoxicillin?</p> <p>B. Of the total number of patients seen in emergency with a diagnosis of complicated pneumonia (empyema, lung abscess, pneumatoceles, or pulmonary necrosis), how many patients receive standard dose of amoxicillin, and how many patients receive high dose amoxicillin?</p>
Rationale	<p>First line antibiotics for CAP are PO amoxicillin (standard dosing) or IV Ampicillin.</p> <p>Standard dose of amoxicillin is 40 mg/kg/day PO, divided TID.</p> <p>High dose amoxicillin dose is 80 to 100 mg/kg/day PO divided TID, to be used if there are risk factors for resistant <i>Streptococcus pneumoniae</i> (Unimmunized or incompletely immunized, attends daycare, use of amoxicillin in preceding 3 months, failure of initial therapy)</p>

Outcome Measure #4

Name of Measure	Frequency of 3rd generation cephalosporin use pre and post-guideline implementation
Definition	<p>Of the total number of patients admitted with a diagnosis of pneumonia, how many received a 3rd generation cephalosporin antibiotic?</p> <p>A. cefTRIAxone</p> <p>B. cefoTAXime</p>
Rationale	<p>The pneumonia algorithm recommends use of Ampicillin for mild to moderate pneumonia. This narrow spectrum antibiotic is sufficient for treatment of most CAP. 3rd generation cephalosporins should be used only in complicated pneumonia, or in severe pneumonia (hemodynamic instability). Most patients admitted to hospital should be started on ampicillin.</p>

Outcome Measure #5

Name of Measure	Frequency of vancomycin use pre and post-guideline implementation
Definition	Of the total number of patients admitted with a diagnosis of pneumonia, how many received vancomycin antibiotic?
Rationale	vancomycin is indicated for pneumonia with MRSA colonization of self or household contact, very rapid onset of pneumonia, indigenous, pneumatoceles or necrotizing pneumonia on CXR.

Outcome Measure #6

Name of Measure	Number of patients noted to have "penicillin allergy", and what antibiotics were chosen
Definition	<p>A. Of the total number of patients admitted with a diagnosis of pneumonia, how many were noted to have:</p> <ul style="list-style-type: none"> i. Beta lactam allergy Type 1 ii. Non-type 1 reaction <p>B. For patients with identified Beta lactam allergy Type 1, how many received the following antibiotics:</p> <ul style="list-style-type: none"> i. AZIthromycin ii. clarithromycin iii. doxycycline iv. Cefuroxime v. cefPROZil <p>C. For patients with non-Type 1 reaction (urticarial), how many received the following antibiotics:</p> <ul style="list-style-type: none"> i. AZIthromycin ii. clarithromycin iii. doxycycline iv. Cefuroxime v. cefPROZil
Rationale	<p>All penicillins and cephalosporins are beta lactams. True beta lactam allergies are IgE mediated reaction, and can present with urticarial rash, pruritus, erythema, hyperperistalsis, angioedema, laryngeal edema, bronchospasm, arrhythmias, or hypotension. If a child has had an IgE mediated reaction to a penicillin in the past, caution with all beta lactams is advised, as there is a very small risk of cross-reactivity and a subsequent reaction may be more severe. A history of parental allergy is not a reason to avoid a beta lactam.</p> <p>Beta lactam allergy Type 1 (<i>previous urticarial rash, pruritus, erythema, hyperperistalsis, angioedema, laryngeal edema, bronchospasm arrhythmias or hypotension from a beta lactam</i>) can be treated with alternatives such as AZIthromycin, clarithromycin, doxycycline or cephalosporins in an observed setting.</p> <p>Non-type 1 reactions (e.g. non-urticarial rash) should NOT be considered an allergy. The first dose of any beta lactam should be given in an observed setting.</p>

Outcome Measure #7

Name of Measure	Length of stay in ED
Definition	<p>Of the total number of patients presenting to ED and diagnosed with "pneumonia"</p> <p>A) What is the length of stay in the ED?</p>

Rationale	Does availability of a provincial community acquired pneumonia clinical guidance tool kit decrease LOS in the ED?
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Outcome Measure #8

Name of Measure	Hospital Admission Rate
Definition	Of the total number of patients presenting to ED and diagnosed with “pneumonia,” how many patients are admitted to inpatient units?
Rationale	Most cases of bacterial pneumonia can be managed on an outpatient basis. Refer to “Decision to Admit” for considerations for hospital admission and risk factors for severe disease requiring hospital admission.

Outcome Measure #9

Name of Measure	Length of stay in inpatient unit/ward
Definition	Of the total number of patients admitted to hospital with a diagnosis of “pneumonia:” A) What is the length of stay in inpatient unit(s)?
Rationale	Does availability of a provincial community acquired pneumonia clinical guidance tool kit decrease LOS in hospital?

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Appendix A: Order Sets

Order Set: Emergency /Urgent Care Community Acquired Pneumonia Initial Management Pediatric Orders

Restrictions for use of this set of orders: For use in Emergency Department, Urgent Care

Order Set Requirements: Weight

Order Set Keywords: Child, community-acquired, CAP

Patient Care

- Goals of Care Designation: utilize appropriate Goal of Care
- Isolation: Contact and droplet
- Measure height
- Measure weight

Monitoring

Vital signs indicated every 1 to 4 hours depending on age, severity of presentation, oxygen requirements and work of breathing. Neuro vital signs not indicated unless level of consciousness is altered.

- Vital Signs: Heart rate, blood pressure, respiratory rate, temperature, O2 saturation every _____ hours
- Neuro vital signs: every _____ hours
- Monitor CardioRespiratory - Peds
- Oxygen Saturation Monitoring: Continuous in any child with signs of tachypnea or clinical hypoxemia.
- Intake and Output: Strictly monitor clinical fluid status, fluid volume intake and output every _____ hours

Diet

If oral intake is tolerated and work of breathing is mild to moderate:

- Regular diet (age appropriate).

If oral intake is not tolerated or work of breathing is severe:

- NPO
- Other Diet: _____
- Clinical Communication: Initiate oral fluids and age appropriate diet once PO tolerated and work of breathing improves (see Diet order)

Respiratory Care

- O₂ Therapy to maintain oxygen saturation greater than or equal to 92%

Labs

To be considered in children receiving IV antibiotics

Hematology

- CBC with Differential

Chemistry

- Electrolytes
- Urea
- Creatinine

Microbiology

- Blood cultures prior to receiving antibiotics
- Nasopharyngeal swab or aspirate for respiratory viruses
- Mycoplasma IgM (*may be considered in children over 2 years of age*)

Diagnostic Imaging

- Chest X-Ray 2 projections (GR Chest, 2 projections)

If Chest X-Ray suggestive of pleural fluid:

- Chest Ultrasound

IV Fluids

Fluid Resuscitation

On initial presentation: administer fluid resuscitation as clinically indicated until hemodynamically stable. Reassess vital signs and peripheral perfusion following any bolus fluid administration.

- sodium chloride 0.9% infusion (20 mL/kg) _____ mL IV rapidly (over 5 to 10 minutes); (*Dose: Weight in kg _____ x 20 mL/kg = _____ mL*)
- Repeat sodium chloride 0.9% infusion (20 mL/kg) _____ mL IV rapidly (over 5 to 10 minutes) if no improvement in heart rate or blood pressure, as necessary to restore adequate perfusion

After Fluid Resuscitation

If oral fluid intake is not tolerated or work of breathing is severe:

Choose isotonic intravenous fluids at IV rate of 75-100% maintenance. Potassium containing fluids should be considered if adequate urine output, normal renal function, and low to normal serum potassium.

Note that patients with pneumonia are at risk for electrolyte disturbances including hyponatremia from SIADH. Consider serum and urine electrolytes if SIADH suspected.

- dextrose 5% - sodium chloride 0.9% IV at _____ % maintenance rate = _____ mL/hour; Decrease IV fluid rate as oral intake improves
- lactated ringer's IV at _____ % maintenance rate = _____ mL/hour; Decrease IV fluid rate as oral intake improves
- potassium chloride 20 mmol/L in dextrose 5% - sodium chloride 0.9% at _____ % maintenance rate = _____ mL/hour; Decrease IV fluid rate as oral intake improves.

Medications

Mild/ moderate pneumonia

(Hemodynamically stable, mild to moderate work of breathing, minimal to moderate oxygen requirement, ICU care not required)

Oral Antibiotics

Based on chest x-ray and clinical features: If suggestive of bacterial pneumonia, determine if fits best with

- (i). *Typical pneumonia*
- (ii). *Atypical pneumonia*
- (iii). *Post-influenza bacterial pneumonia.*

(i). If typical bacterial pneumonia: amoxicillin is first line

Standard dose amoxicillin: 40 to 50 mg/kg/day divided TID, maximum 1 gram TID

amoxicillin _____ mg PO TID

OR

High dose amoxicillin: 80 to 100 mg/kg/day divided TID, maximum 1 gram TID

*To be used if there are risk factors for resistant *Streptococcus pneumoniae*: Unimmunized or incompletely immunized, attends daycare, use of amoxicillin in preceding 3 months, failure of initial therapy)*

amoxicillin _____ mg PO TID

OR

Exceptions to using amoxicillin:

- a. History of beta lactam allergy:** (Refer to [Clinical Decision Support #1](#))

AZithromycin: 10 mg/kg once daily on day 1 AND THEN 5 mg/kg once daily on days 2 to 5, maximum dose 500 mg on day 1; max dose 250 mg on days 2 to 5

AZithromycin _____ mg PO daily on day 1 **AND THEN** _____mg PO once daily on days 2 to 5

OR

clarithromycin: 15 mg/kg/day PO divided BID, maximum 500 mg bid

clarithromycin _____mg PO BID

OR

doxycycline: 2 to 4 mg/kg/day divided BID, maximum dose 200 mg/day; may be considered if greater than 8 years of age

doxycycline _____mg PO BID

(ii.) Atypical pneumonia:

AZithromycin: 10 mg/kg once daily on day 1 AND THEN 5 mg/kg once daily on days 2 to 5, maximum dose 500 mg on day 1; max dose 250 mg on days 2 to 5

AZithromycin _____mg PO once daily on day 1 **AND THEN** _____ mg PO once daily on days 2 to 5

OR

clarithromycin: 15 mg/kg/day PO divided BID, maximum 500 mg bid

- clarithromycin _____mg PO BID

(iii.) Post-influenza bacterial pneumonia:

Standard dose amoxicillin-clavulanate: 40 to 50 mg/kg/day divided TID of amoxicillin component, maximum 1 gram TID of amoxicillin component, maximum 10 mg/kg/day of clavulanic acid

- amoxicillin-clavulanate _____ mg PO TID (7:1 product preferred)

OR

*High dose amoxicillin-clavulanate: ordered as amoxicillin 40 to 50 mg/kg/day TID PLUS amoxicillin-clavulanate 40 to 50 mg/kg/day of amoxicillin component. Maximum 1 gram TID of amoxicillin component; maximum 10 mg/kg/day of clavulanic acid. To be used if there are risk factors for resistant *Streptococcus pneumoniae*: Unimmunized or incompletely immunized, attends daycare, use of amoxicillin in preceding 3 months, failure of initial therapy).*

- amoxicillin _____ mg PO TID plus amoxicillin-clavulanate _____ mg PO TID (7:1 product preferred)

OR

Post-Influenza bacteria pneumonia with beta-lactam allergy (other than allergy to cefuroxime or cefPROZil) (Refer to [Clinical Decision Support #1](#))

cefuroxime axetil: 30mg/kg/day divided BID, maximum dose 500 mg BID

- cefuroxime axetil _____ mg PO BID. First dose must be given in an observed setting

OR

cefPROZil: 30 mg/kg/day divided BID, maximum dose 500 mg BID

- cefPROZil _____ mg PO BID. First dose must be given in an observed setting

Mild/ moderate pneumonia

(Hemodynamically stable, mild to moderate work of breathing, minimal to moderate oxygen requirement, ICU care not required)

Intravenous antibiotics

Based on CXR and clinical features: If suggestive of bacterial pneumonia, determine if fits best with

(i). Typical pneumonia

(ii). Atypical pneumonia

(iii). Post-influenza bacterial pneumonia.

(i.) If typical bacterial pneumonia: ampicillin is first line

200 mg/kg/day divided every 6 hours, maximum 2 grams every 6 hours:

- ampicillin _____ mg IV every 6 hours

OR

Exceptions to using ampicillin:

- a. History of beta lactam reaction (other than ceftriaxone, cefotaxime, or ceFOXitin) :** (Refer to [Clinical Decision Support #1](#))

cefTRIAxone: 100 mg/kg/day divided every 12 or 24 hours, maximum 2 grams daily

- cefTRIAxone _____mg IV every_____ hours

If cephalosporin induces an allergic reaction, choose:

AZithromycin: 10 mg/kg once daily on day 1 AND THEN 5 mg/kg once daily on days 2 to 5, maximum dose 500 mg on day 1; max dose 250 mg on days 2 to 5

- AZithromycin _____mg IV once daily on day 1 **AND THEN** _____ mg IV once daily on days 2 to 5

Further options include doxycycline PO. Further guidance can be provided by Pediatric Infectious Diseases.

(ii.) Atypical pneumonia:

AZithromycin: 10 mg/kg once daily on day 1 AND THEN 5 mg/kg once daily on days 2 to 5, maximum dose 500 mg on day 1; max dose 250 mg on days 2 to 5

- AZithromycin _____mg IV once daily on day 1 **AND THEN** _____mg IV once daily on days 2 to 5

(iii.) Post-influenza pneumonia:

cefTRIAxone: 50-100 mg/kg/day divided every 12 hours or every 24 hours, maximum 2 grams daily

- cefTRIAxone _____mg IV every_____ hours

AND

Vancomycin: 60 mg/kg/day IV divided every 6 hours. Note: Dosing interval is determined by CrCl and desired trough levels; the target trough level is 15 – 20 mg/L for the treatment of pneumonia. Refer to

[Bugs and Drugs](#) or the AHS Parenteral Drug Monograph for details. Clinicians unfamiliar with Therapeutic Drug Monitoring of vancomycin are encouraged to consult with a pharmacist.

Refer to [Clinical Decision Support #3](#).

- vancomycin _____mg IV every 6 hours

If colonized with MRSA (Refer to [Clinical Decision Support #1](#))

Severe Pneumonia

(Severe hemodynamic instability, signs suggestive of septic shock, in or being transferred to intensive care)

Intravenous antibiotics:

cefTRIAxone: 50 to 100 mg/kg/day divided every 12 or 24 hours, maximum 2 grams daily

- cefTRIAxone _____mg IV every _____ hours

AND

If very rapid onset of pneumonia, indigenous, MRSA colonization of self or household contact, pneumatoceles or necrotizing pneumonia on chest x-ray ADD:

vancomycin: 60 mg/kg/day IV divided every 6 hours. Note: Dosing interval is determined by CrCl and desired trough levels; the target trough level is 15 – 20 mg/L for the treatment of pneumonia. Refer to [Bugs and Drugs](#) or the AHS Parenteral Drug Monograph for details. Clinicians unfamiliar with Therapeutic Drug Monitoring of vancomycin are encouraged to consult with a pharmacist. Refer to [Clinical Decision Support #3](#).

- vancomycin _____mg IV every 6 hours.

AND

Consider addition of:

AZithromycin: 10 mg/kg once daily on day 1 AND THEN 5 mg/kg once daily on days 2 to 5, maximum dose 500 mg on day 1; max dose 250 mg on days 2 to 5

- AZithromycin _____mg IV once daily on day 1 **AND THEN** _____mg IV once daily on days 2 to 5

OR

clarithromycin: 15 mg/kg/day divided BID, maximum 500 mg BID

- clarithromycin _____mg PO BID

Empyema

Intravenous antibiotics: Refer to local pleural effusion guidelines or practices.

cefTRIAXone: 50 to 100 mg/kg/day divided every 12 or 24 hours, maximum 2 grams daily

cefTRIAXone _____mg IV every_____ hours

AND

If very rapid onset of pneumonia, indigenous, MRSA colonization of self or household contact, pneumatoceles or necrotizing pneumonia on chest x-ray ADD:

vancomycin: 60 mg/kg/day IV divided every 6 hours. Note: Dosing interval is determined by CrCl and desired trough levels; the target trough level is 15 – 20 mg/L for the treatment of pneumonia. Refer to [Bugs and Drugs](#) or the AHS Parenteral Drug Monograph for details. Clinicians unfamiliar with Therapeutic Drug Monitoring of vancomycin are encouraged to consult with a pharmacist. Refer to [Clinical Decision Support #3](#).

vancomycin _____mg IV every 6 hours.

AND

Consider addition of:

AZithromycin: 10 mg/kg once daily on day 1 AND THEN 5 mg/kg once daily on days 2 to 5, maximum dose 500 mg on day 1; max dose 250 mg on days 2 to 5

AZithromycin _____mg IV once daily on day 1 **AND THEN** _____mg IV once daily on days 2 to 5

OR

clarithromycin: 15 mg/kg/day divided BID, maximum 500 mg BID

clarithromycin _____mg PO BID

Antipyretics/ Analgesics

acetaminophen (*recommended dose 15 mg/kg/dose*) _____ mg PO/PR every 4 hours PRN for fever or discomfort. (*Maximum 75 mg/kg/day, 1000 mg/dose AND 4 grams/day whichever is less*)

ibuprofen (*recommended dose 10 mg/kg/dose*) _____ mg PO every 6 hours PRN for fever or discomfort. (*Maximum 400 mg/dose, less than 6 months, acetaminophen is preferred*)

Additional Medication Orders if Required

- _____
- _____
- _____

□

Order Set: Inpatient Community Acquired Pneumonia Pediatric Ongoing Management Orders

Restrictions for use of this set of orders: For use in inpatient units

Order Set Requirements: Weight

Order Set Keywords: Child, community-acquired, CAP

Admission/ Discharge/ Transfer

- Admit to unit _____ under care of _____

Patient Care

- Goals of Care Designation: utilize appropriate Goal of Care
- Isolation: Contact and droplet
- Measure height once
- Measure weight once, then _____

Diet

If oral intake is tolerated and work of breathing is mild to moderate:

- Regular diet (age appropriate)

If oral intake is not tolerated or work of breathing is severe:

- NPO
- Clinical Communication: Initiate oral fluids and age appropriate diet once PO tolerated and work of breathing improves
- Other Diet: _____

Respiratory Care

- O₂ Therapy to maintain oxygen saturation greater than or equal to 92%

Monitoring

Vital signs indicated every 1 to 4 hours depending on age, severity of presentation, oxygen requirements and work of breathing. Neuro vital signs not indicated unless level of consciousness is altered.

- Vital Signs: Heart rate, blood pressure, respiratory rate, temperature, O₂ saturation every _____ hours
- Monitor CardioRespiratory - Peds
- Oxygen Saturation Monitoring: Continuous in any child with signs of tachypnea or clinical hypoxemia.
- Discontinue cardiorespiratory monitoring once clinically improving.
- Fluid Monitoring: Monitor (record) fluid volume intake (IV and PO) and fluid output (urine output, emesis, diarrhea) every 6 to 12 hours

Laboratory Investigations

(To be collected if not already done in ED)

- **Hematology**
 - CBC with Differential
- **Chemistry**
 - Electrolytes daily
 - Urea daily
 - Creatinine daily
- **Microbiology (if not already collected in ED)**
 - Blood culture** prior to receiving antibiotics:
 - Mycoplasma IgM (*may be considered in children over 2 years of age*)
- **Drug Levels**
 - Vancomycin Level Pre 3rd dose
 - Vancomycin Level Pre 5th dose

Diagnostic Imaging:

If not already done in ED:

- Chest X-Ray 2 projections (GR Chest, 2 projections)

Consider repeat Chest X-ray for indications listed below:

- Chest X-Ray 2 projections (GR Chest, 2 projections). Indication:
 - Clinical deterioration
 - Patient is not responding to therapy within 48 h to 72 h (persistent fever, persistent or worsening respiratory distress and/or hypoxia, or new clinical findings suggestive of a pleural effusion).
- Ultrasound chest (*if pleural effusion present on chest x-ray*).

IV Fluids

Fluid Resuscitation

Administer fluid resuscitation as clinically indicated until hemodynamically stable.

Reassess vital signs and peripheral perfusion following any bolus fluid administration.

- sodium chloride 0.9% infusion (20 mL/kg) _____ mL IV rapidly (over 5 to 10 minutes); (*Dose: Weight in kg _____ x 20 mL/kg = _____ mL*)
- Repeat sodium chloride 0.9% infusion (20 mL/kg) _____ mL IV rapidly (over 5 to 10 minutes) if no improvement in heart rate or blood pressure, as necessary to restore adequate perfusion

After fluid resuscitation

Choose isotonic intravenous fluids at rate of 75-100% maintenance. Potassium containing fluids should be considered if adequate urine output, normal renal function, and low to normal serum potassium.

Note that patients with pneumonia are at risk for electrolyte disturbances including SIADH. Consider serum and urine electrolytes if SIADH suspected.

- dextrose 5% - sodium chloride 0.9% IV at ____ % maintenance rate = _____ mL/hour; Decrease IV fluid rate as oral intake improves.
- lactated ringer's IV at _____ % maintenance rate = _____ mL/hour; Decrease IV fluid rate as oral intake improves.
- potassium chloride 20 mmol/L in dextrose 5% - sodium chlorid 0.9% at _____ % maintenance rate = _____ mL/hour; Decrease IV fluid rate as oral intake improves.

Medications

Mild/ moderate pneumonia

(Hemodynamically stable, mild to moderate work of breathing, minimal to moderate oxygen requirement, ICU care not required)

Intravenous antibiotics

Based on CXR and clinical features: If suggestive of bacterial pneumonia, determine if fits best with

(i). Typical pneumonia

(ii). Atypical pneumonia

(iii). Post-influenza bacterial pneumonia.

(i). If typical bacterial pneumonia : ampicillin is first line

ampicillin: 200mg/kg/day divided every 6 hours, maximum 2 grams every 6 hours

- ampicillin _____mg IV every 6 hours

OR

Exceptions to using Ampicillin:

- a. History of beta lactam reaction (other than ceftriaxone, cefotaxime, or ceFOXitin):** Refer to [Clinical Decision Support #1](#).

cefTRIAxone: 50 to 100 mg/kg/day divided every 12 or 24 hours, maximum 2 grams daily

- cefTRIAxone _____mg IV every _____ hours

If cephalosporin induces an allergic reaction, choose:

AZithromycin: 10 mg/kg once daily on day 1 AND THEN 5 mg/kg once daily on days 2 to 5, maximum dose 500 mg on day 1; max dose 250 mg on days 2 to 5

- AZIthromycin _____mg IV once daily on day 1 **AND THEN** _____ mg IV once daily on days 2 to 5

(ii). Atypical pneumonia:

AZithromycin: 10 mg/kg once daily on day 1 AND THEN 5 mg/kg once daily on days 2 to 5, maximum dose 500 mg on day 1; max dose 250 mg on days 2 to 5

- AZithromycin _____mg IV once daily on day 1 **AND THEN** _____mg IV once daily on days 2 to 5

AND

If not clearly atypical pneumonia, consider addition of:

- ampicillin (200 mg/kg/day divided every 6 hours) _____ mg IV every 6 hours (maximum 2 grams every 6 hours)

(iii). Post-influenza pneumonia:

cefTRIAxone: 50-100 mg/kg/day divided every 12 hours or every 24 hours, maximum 2 grams daily

- cefTRIAxone _____mg IV every _____ hours

AND

vancomycin: 60 mg/kg/day IV divided every 6 hours. Note: Dosing interval is determined by CrCl and desired trough levels; the target trough level is 15 – 20 mg/L for the treatment of pneumonia. Refer to [Bugs and Drugs](#) or the AHS Parenteral Drug Monograph for details. Clinicians unfamiliar with Therapeutic Drug Monitoring of vancomycin are encouraged to consult with a pharmacist. Refer to [Clinical Decision Support #3](#).

- vancomycin _____mg IV every 6 hours.

If colonized with MRSA (Refer to [Clinical Decision Support #1](#))

Oral antibiotics:

Intravenous antibiotics should generally be given initially if children are sufficiently ill to require hospitalization and IV access can be readily obtained.

Oral antibiotics are appropriate if children:

- a) present initially with mild symptoms, tolerate oral intake and are clinically stable,*
- b) lose IV access and are clinically improving, or*
- c) clinical presentation allows for discharge from hospital if patient tolerates oral antibiotics*

(i). If typical bacterial pneumonia: amoxicillin is first line

(i). If typical bacterial pneumonia: amoxicillin is first line

Standard dose amoxicillin: 40 to 50 mg/kg/day divided TID, maximum 1 gram TID

- amoxicillin _____ mg PO TID

OR

High dose amoxicillin: 80 to 100 mg/kg/day divided TID, maximum 1 gram TID

*To be used if there are risk factors for resistant *Streptococcus pneumoniae*: Unimmunized or incompletely immunized, attends daycare, use of amoxicillin in preceding 3 months, failure of initial therapy)*

amoxicillin _____ mg PO TID

OR

Exceptions to using amoxicillin:

b. History of beta lactam allergy: (Refer to [Clinical Decision Support #1](#))

AZithromycin: 10 mg/kg once daily on day 1 AND THEN 5 mg/kg once daily on days 2 to 5, maximum dose 500 mg on day 1; max dose 250 mg on days 2 to 5

AZithromycin _____ mg PO daily on day 1 **AND THEN** _____ mg PO once daily on days 2 to 5

OR

clarithromycin: 15 mg/kg/day PO divided BID, maximum 500 mg bid

clarithromycin _____ mg PO BID

OR

doxycycline: 2 to 4 mg/kg/day divided BID, maximum dose 200 mg/day; may be considered if greater than 8 years of age

doxycycline _____ mg PO BID

(ii). Atypical pneumonia:

AZithromycin: 10 mg/kg once daily on day 1 AND THEN 5 mg/kg once daily on days 2 to 5, maximum dose 500 mg on day 1; max dose 250 mg on days 2 to 5

AZithromycin _____ mg PO once daily on day 1 **AND THEN** _____ mg PO once daily on days 2 to 5

OR

clarithromycin: 15 mg/kg/day PO divided BID, maximum 500 mg bid

clarithromycin _____ mg PO BID

(iii). Post-influenza bacterial pneumonia:

Standard dose amoxicillin-clavulanate: 40 to 50 mg/kg/day divided TID of amoxicillin component, maximum 1 gram TID of amoxicillin component, maximum 10 mg/kg/day of clavulanic acid

amoxicillin-clavulanate _____ mg PO TID (7:1 product preferred)

OR

*High dose amoxicillin-clavulanate: ordered as amoxicillin 40 to 50 mg/kg/day TID PLUS amoxicillin-clavulanate 40 to 50 mg/kg/day of amoxicillin component. Maximum 1 gram TID of amoxicillin component; maximum 10 mg/kg/day of clavulanic acid. To be used if there are risk factors for resistant *Streptococcus pneumoniae*: Unimmunized or incompletely immunized, attends daycare, use of amoxicillin in preceding 3 months, failure of initial therapy).*

- amoxicillin _____ mg PO TID plus amoxicillin-clavulanate _____ mg PO TID (7:1 product preferred)

OR

Post-Influenza bacteria pneumonia with beta-lactam allergy (other than allergy to cefuroxime or cefPROZil) (Refer to [Clinical Decision Support #1](#))

cefuroxime axetil: 30mg/kg/day divided BID, maximum dose 500 mg BID

- cefuroxime axetil _____ mg PO BID. First dose must be given in an observed setting.

OR

cefPROZil: 30 mg/kg/day divided BID, maximum dose 500 mg BID

- cefPROZil _____ mg PO BID. First dose must be given in an observed setting.

Severe Pneumonia

(Severe hemodynamic instability, signs suggestive of septic shock, in or being transferred to intensive care), intravenous antibiotics)

Intravenous antibiotics:

cefTRIAxone: 50 to 100 mg/kg/day divided every 12 or 24 hours, maximum 2 grams daily

- cefTRIAxone _____mg IV every_____ hours

AND

If very rapid onset of pneumonia, indigenous, MRSA colonization of self or household contact, pneumatoceles or necrotizing pneumonia on chest x-ray ADD:

vancomycin: 60 mg/kg/day IV divided every 6 hours. Note: Dosing interval is determined by CrCl and desired trough levels; the target trough level is 15 – 20 mg/L for the treatment of pneumonia. Refer to [Bugs and Drugs](#) or the AHS Parenteral Drug Monograph for details. Clinicians unfamiliar with Therapeutic Drug Monitoring of vancomycin are encouraged to consult with a pharmacist. Refer to [Clinical Decision Support #3](#).

- vancomycin _____mg IV every 6 hours.

AND

Consider addition of:

AZithromycin: 10 mg/kg once daily on day 1 AND THEN 5 mg/kg once daily on days 2 to 5, maximum dose 500 mg on day 1; max dose 250 mg on days 2 to 5

- AZithromycin _____mg IV once daily on day 1 **AND THEN** _____mg IV once daily on days 2 to 5

OR

clarithromycin: 15 mg/kg/day divided BID, maximum 500 mg BID

- clarithromycin _____mg PO BID

Empyema, intravenous antibiotics:

cefTRIAxone: 50 to 100 mg/kg/day divided every 12 or 24 hours, maximum 2 grams daily

- cefTRIAxone _____mg IV every _____ hours

AND

If very rapid onset of pneumonia, indigenous, MRSA colonization of self or household contact, pneumatoceles or necrotizing pneumonia on chest x-ray ADD:

vancomycin: 60 mg/kg/day IV divided every 6 hours. Note: Dosing interval is determined by CrCl and desired trough levels; the target trough level is 15 – 20 mg/L for the treatment of pneumonia. Refer to [Bugs and Drugs](#) or the AHS Parenteral Drug Monograph for details. Clinicians unfamiliar with Therapeutic Drug Monitoring of vancomycin are encouraged to consult with a pharmacist. Refer to [Clinical Decision Support #3](#).

- vancomycin _____mg IV every 6 hours.

AND

Consider addition of:

AZithromycin: 10 mg/kg once daily on day 1 AND THEN 5 mg/kg once daily on days 2 to 5, maximum dose 500 mg on day 1; max dose 250 mg on days 2 to 5

- AZithromycin _____mg IV once daily on day 1 **AND THEN** _____mg IV once daily on days 2 to 5

OR

clarithromycin: 15 mg/kg/day divided BID, maximum 500 mg BID

- clarithromycin _____mg PO BID

Antipyretics/ Analgesics

- acetaminophen (*recommended dose 15 mg/kg/dose*) _____ mg PO/PR every 4 hours PRN for fever or discomfort. (*Maximum 75 mg/kg/day, 1000 mg/dose AND 4 grams/day whichever is less*)
- ibuprofen (*recommended dose 10 mg/kg/dose*) _____ mg PO every 6 hours PRN for fever or discomfort. (*Maximum 400 mg/dose, less than 6 months, acetaminophen is preferred*)

Additional Medication Orders if Required

- _____
- _____
- _____
- _____

Consults

- Pediatric Infectious Diseases consult
Indication:
 - No clinical improvement in 48-72 hours
 - Patient has beta-lactam allergy, and a documented allergic reaction to a cephalosporin
 - Linezolid use is being considered
 - Complicated pneumonia
- Respiriology consult
Indication:
 - Patient has underlying respiratory condition other than asthma (e.g. Tracheostomy, congenital pulmonary anomaly, chronic lung disease, etc.)
 - Complicated pneumonia
 - Requires PICU care
- General Surgery consult
Indication:
 - Complicated pneumonia requiring chest tube or other surgical intervention

- Interventional radiology consult
Indication:
 - Complicated pneumonia requiring chest tube

Order Set: Community Acquired Pneumonia, Pediatric – Inpatient Switch to Oral Antibiotic Therapy Orders

Order Set Keywords: Child, community-acquired, oral antibiotics, CAP

Warnings and Cautions: Antibiotics should be adjusted if a pathogen is detected. Continue IV antibiotics until clinically improving. If IV access becomes difficult, oral antibiotics will generally work in non-severe pneumonia.

Patients showing signs of clinical improvement (afebrile, tolerating oral intake, no further supplemental O₂ requirement) can be discharged on oral antibiotics. Oral step-down can be considered even when the patient remains hospitalized.

Continue antibiotics for total of 7 days (IV+PO) in uncomplicated pneumonia; some experts recommend a longer course (typically 10 days) with bacteremia. The course will need to be extended further in empyema or lung abscess, with duration depending of clinical severity (typically aim for about 3 weeks).

Select **one** from options below:

I. Switch from IV ampicillin:

Standard dose amoxicillin: 40 to 50 mg/kg/day divided TID, maximum 1 gram TID

amoxicillin _____ mg PO TID

OR

High dose amoxicillin: 80 to 100 mg/kg/day divided TID, maximum 1 gram TID

To be used if there are risk factors for resistant *Streptococcus pneumoniae*: Unimmunized or incompletely immunized, attends daycare, use of amoxicillin in preceding 3 months, failure of initial therapy)

amoxicillin _____ mg PO TID

II. Switch from cefTRIAxone/ cefoTAXime OR cefTRIAxone and vancomycin

Standard dose amoxicillin-clavulanate: 40 to 50 mg/kg/day divided TID of amoxicillin component, maximum 1 gram TID of amoxicillin component, maximum 10 mg/kg/day of clavulanic acid

amoxicillin-clavulanate _____ mg PO TID (7:1 product preferred)

OR

High dose amoxicillin-clavulanate: ordered as amoxicillin 40 to 50 mg/kg/day TID PLUS amoxicillin-clavulanate 40 to 50 mg/kg/day of amoxicillin component. Maximum 1 gram TID of amoxicillin component; maximum 10 mg/kg/day of clavulanic acid. To be used if there are risk factors for resistant *Streptococcus pneumoniae*: Unimmunized or incompletely immunized, attends daycare, use of amoxicillin in preceding 3 months, failure of initial therapy).

amoxicillin _____ mg PO TID plus amoxicillin-clavulanate _____ mg PO TID (7:1 product preferred)

III. Switch from IV AZithromycin

AZithromycin: 10 mg/kg once daily on day 1 AND THEN 5 mg/kg once daily on days 2 to 5, maximum dose 500 mg on day 1; max dose 250 mg on days 2 to 5

- AZIthromycin _____ mg PO once daily, stop after ____ days

iv. Switch from IV cefTRIAXone and vancomycin if MRSA coverage is still required

Consult infectious diseases for optimal antibiotic choice or for consideration of linezolid use

sulfamethoxazole-trimethoprim: 10 mg/kg/day of trimethoprim component, maximum 160 mg of trimethoprim component BID

- sulfamethoxazole-trimethoprim _____ mg PO BID

OR

clindamycin: 20 to 40 mg/kg/day, maximum 450 mg TID (If proven to be susceptible)

- clindamycin _____ mg PO TID

Additional Medication Orders if Required

- _____
- _____
- _____
- _____

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Name	Title	Zone
<i>Knowledge Lead</i>		
Katharine Smart / Troy Turner	Provincial Clinical Knowledge Lead	Provincial
Michelle Bailey	Provincial Clinical Knowledge Lead	Provincial
<i>Topic Lead</i>		
Theresa Wu	Pediatrician	Calgary Zone
<i>Working Group Members</i>		
Cora Constantinescu	Infectious Diseases Physician	Calgary Zone
Karen Forbes	Pediatrician	Edmonton Zone
Joan Robinson	Infectious Diseases Physician	Edmonton Zone
Minati Devi	Pediatrician	South Zone
<i>Clinical Support Services</i>		
Marcel Romanick	Pharmacy Information Management Governance Committee (PIM-GC) <i>on behalf of</i> Pharmacy Services	Provincial
James Wesenberg	<i>on behalf of</i> Laboratory Services - Provincial Networks	Provincial
Bill Anderson	<i>on behalf of</i> Diagnostic Imaging Services	Provincial
Carlota Basualdo-Hammond & Kim Brunet Wood	<i>on behalf of</i> Nutrition & Food Services	Provincial
<i>SCN or Provincial Committee</i>		
<i>Maternal, Newborn, Child and Youth Strategic Clinical Network</i>		Provincial
<i>Clinical Informatics Lead</i>		
Megan Courtney	Registered Nurse	Provincial
Erin Hayward	Registered Nurse	Provincial
Karin Domier	Registered Nurse	Provincial

Additional Contributors

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