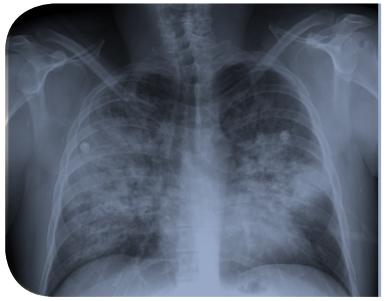

DIAGNOSIS AND MANAGEMENT OF

Community-Acquired Pneumonia (CAP)

June 2016 Update

This care process model (CPM) is maintained by Intermountain Healthcare's Lower Respiratory Tract Infection Team, a subgroup of the Intensive Medicine Clinical Program. The CPM summarizes and updates evaluation and treatment recommendations for community-acquired pneumonia (CAP) in immunocompetent patients 18 years and older. (A Pediatric CAP CPM is also available.) Recommendations are based on recent local susceptibility data and practice patterns, along with the most recent consensus guidelines of the Infectious Diseases Society of America (IDSA) and the American Thoracic Society (ATS).[MAN] The guidelines do not apply to healthcare-associated pneumonia (HCAP). **The concept of HCAP will be discarded in the next consensus IDSA/ATS guidelines.**

Why Focus ON PNEUMONIA?

- Pneumonia remains common, serious, and costly. In the U.S., influenza and pneumonia are the ninth leading cause of death overall.[CDC1] Pneumonia accounts for more than 1% of adults seen in Intermountain emergency departments (EDs). Of those adult ED patients who present with pneumonia, 60% are admitted to the hospital. [DEA1]
- Site-of-care decisions vary widely and can dramatically affect mortality and cost of care. In one study, unaided clinical judgment in deciding whether to hospitalize varied more than two-fold (38% vs. 79%) among ED physicians at Intermountain's LDS Hospital. The variance could not be explained by severity of illness, time or day of week, or patient demographic. Higher hospitalization rates were not associated with reduced mortality or fewer secondary admissions. [DEA2]
  - Lower-risk patients treated in the outpatient setting are able to resume normal activity faster than if hospitalized.[LAB]
  - Higher-risk patients not hospitalized can result in higher mortality (both for patients hospitalized after initial outpatient treatment[MIN] and for severely ill patients not initially admitted to the ICU[NEI]).
- Diagnosis and severity assessment cannot be made consistently and accurately using only the physical exam and clinical judgment. Chest x-ray and objective severity of illness scores (CURB-65) and pulse oximetry should be used to identify patients with CAP who are candidates for outpatient treatment.[MAN,LIM]
- Antibiotics should be administered as early as possible. In-hospital mortality, length of stay, and 30-day mortality decrease when antibiotics are administered within 4 to 6 hours of diagnosis.[HOU] Patients with moderate-to-severe CAP should receive their first dose of antibiotics before they leave the emergency room or clinic.[MAN]
- Well-designed and implemented local treatment guidelines decrease mortality and improve other clinical outcomes.[DEA3,DEA4] Data shows that Intermountain hospitals with the highest level of compliance with this CPM and associated order sets have the lowest mortality rates.[DEA3]

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The inside pages of this tool provide an algorithm and associated notes and can be folded open and posted in your office or clinic. The back page summarizes antibiotic recommendations and notes, references, and resources.

WHAT'S NEW in this update?

Updated antibiotic recommendations:

- **Use the Drug Resistance in Pneumonia (DRIP) score to identify inpatients at risk for MRSA, *pseudomonas*, and other bacteria resistant to usual CAP therapy.** ***(See page 4.)***
- For most outpatients, prescribe doxycycline alone or azithromycin plus amoxicillin (needed to address macrolide resistance) *(See page 3).*

GOALS

- Prompt and correct diagnosis, including a chest x-ray whenever possible
- Consistent use of objective, severity-of-illness criteria (CURB-65) to guide site-of-care decisions
- Prompt administration of appropriate antibiotics (varies by site of care and risk for resistant bacteria [DRIP])
- Influenza and pneumococcal vaccines for all appropriate inpatients and outpatients
- Venous thromboembolism (VTE) prophylaxis and early ambulation for all inpatients

MEASURES

- Compliance with antibiotic recommendations
- 30-day, all-cause mortality
- Length of hospital stay
- Appropriate site of care decisions
- Readmission rate

DIAGNOSIS AND MANAGEMENT OF

Community-Acquired Pneumonia (CAP)

Intermountain® Healthcare

DIAGNOSIS

ALGORITHM: DIAGNOSIS AND RISK ASSESSMENT

Symptoms suggestive of pneumonia (a)
in an immunocompetent adult presenting to physician office or ED

≥1 of the following?

- Fever ≥37.8°C/100°F **(b)**
- Heart rate ≥100 bpm
- RR ≥24
- SpO_2 ≤90%
- Focal rales

no → Consider influenza, bronchitis, or other diagnoses **(d)**

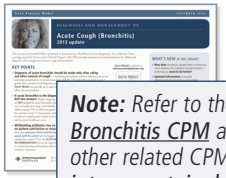
yes

ORDER chest x-ray (c)

no new infiltrate → Consider influenza, bronchitis, or other diagnoses **(d)**

new infiltrate

DIAGNOSE pneumonia



Note: *Refer to the Bronchitis CPM and other related CPMs at intermountainphysician.org/clinicalprograms*

ASSESS risk factors: CURB-65 (e)

- ☐ **C**onfusion: not oriented to person, place, or time
- ☐ **U**remia: BUN 20 mg/dL or greater
- ☐ **R**espiratory rate: 30 breaths or more per minute
- ☐ **B**lood pressure: SBP less than 90 mm Hg
- ☐ **65** years or older

0 to 1 CURB-65 factors

≥1 other factor present that affects decision to admit?

- ≤SpO_2 90%
- Severe sepsis
- Pleural effusion >5 cm on upright lateral chest film
- No caregiver available
- Uncontrolled comorbid illness

yes → **PLAN for NON-ICU hospital admission**

no → **OUTPATIENT treatment**

2 CURB-65 factors

PLAN for NON-ICU hospital admission

BEFORE the patient leaves the clinic or ED:

- **Consider blood cultures**; if done, draw **BEFORE giving antibiotic**.
- **Give the first dose of antibiotics** before transport or admission. *(See antibiotic guidance below in Treatment algorithm.)*

3 or more CURB-65 factors

PLAN for ICU hospital admission

BEFORE the patient leaves the clinic or ED:

- **Draw 2 sets of blood cultures BEFORE giving antibiotic**.
- **Give the first dose of antibiotics** before transport or admission. *(See antibiotic guidance below in Treatment algorithm.)*

(a) Symptoms suggestive of pneumonia:[MET]

- Fatigue 91%
- Chills 73%
- Cough 86%
- Dyspnea 72%
- Fever 74%
- Anorexia 71%
- Sweats 69%
- Pleuritic chest pain 46%
- Hemoptysis 16%
- Headache 58%
- Vomiting 25%
- Myalgia 51%
- Abdominal pain 16%

Note: In older patients, confusion is more common; fever, chills, sweats, headache, and myalgia are less common.

(b) Fever. During influenza season, fever alone may not require chest x-ray if no other signs or symptoms of pneumonia are present.

(c) Chest x-ray (CXR). Whenever possible, a chest x-ray should be used to confirm diagnosis of pneumonia. Either a positive CXR or CT scan is required to make the diagnosis per international guidelines. Keep in mind, however, that not everyone with a new radiographic shadow, cough, fever, and leukocytosis has CAP. Conversely, a negative x-ray is rarely followed by a subsequent positive film. If you suspect pneumonia despite a negative x-ray, begin treatment and repeat the x-ray in about 2 days.

(d) Alternate diagnoses. Influenza is probable if the patient is febrile, has severe myalgia, no rhinorrhea, and influenza is present in the community. Consider oseltamavir therapy. Other diagnoses to consider include:

- Acute bronchitis
- Acute exacerbation of chronic bronchitis
- Aspiration pneumonitis
- Hypersensitivity pneumonitis
- Lung cancer
- Pertussis
- Pulmonary embolism (with infarction)
- Pneumocystis, tuberculosis
- Hantavirus
- Sepsis with acute lung injury
- Travel-related infection

(e) CURB-65. About 75% of patients with pneumonia can be treated safely at home. Home treatment is significantly less costly than hospital treatment, and less-ill patients get better faster and have lower mortality rates at home.[JAC] The simple, 5-point, CURB-65 severity risk scoring system shown here can quickly and accurately predict mortality risk and triage the patient into the appropriate management group.[LIM]

TREATMENT

ALGORITHM: TREATMENT

Outpatient treatment

Previously healthy **AND** no antimicrobial use within the last 3 months

Comorbidities (COPD, CHF, diabetes, malignancy, or renal failure) **OR** antimicrobial use within the last 3 months

Mild pneumonia

Antibiotics (f):

- **Doxycycline**, 100 mg orally twice daily for 7 days (doxycycline monohydrate preferred)

  OR

- **Azithromycin**, 500 mg orally daily for 3 days *PLUS* **amoxicillin**, 1,000 mg 3 times daily for 7 days

  *(If pregnant or allergic to doxycycline, use **azithromycin**.)*

Vaccinations:
Screen for influenza and pneumococcal vaccines, and give if appropriate **(g)**

Moderate pneumonia

Antibiotics (f):

One of these:

- **Doxycycline**, 100 mg orally twice daily for 7 days (doxycycline monohydrate preferred)

  OR

- **Azithromycin**, 500 mg orally daily for 3 days

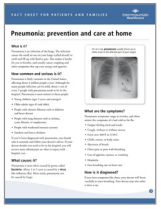
  *(If pregnant, or allergic to doxycycline, use **azithromycin**.)*

PLUS

Ceftriaxone, 1 g IV or IM daily until stable, then **amoxicillin**, 1,000 mg orally 3 times daily for 7 days

Other outpatient best practices

- **Patient education.** Use Intermountain's *Pneumonia: Prevention and Care at Home* fact sheet, available from i-printstore.com.
- **Follow-up visit or phone call** in 48 to 72 hours.
- **Follow up in 6 weeks:**
  - Repeat CXR in 6 weeks if smoker >35 years or for anyone age ≥60.
  - 6-week follow-up visit: Give influenza and pneumococcal vaccines if not already given **(g)**.
- **Provide smoking cessation advice/counseling** (if applicable). Use Intermountain's *Quitting Tobacco: your journey to freedom* booklet available from i-printstore.com.



Hospital treatment

If not already done, **consider blood cultures BEFORE starting antibiotic.** Do not wait for culture results before giving antibiotics.

If not already done, **draw 2 sets of blood cultures BEFORE starting antibiotic.** Do not wait for culture results before giving antibiotics.

Non-ICU care

Antibiotics (f):

- **Ceftriaxone**, 1 g IV every 24 hours until stable, then **amoxicillin**, 1,000 mg 3 times daily for a total course of 7 days

  PLUS

- **Azithromycin**, 500 mg IV first day, then 500 mg orally; total course 3 days, or **doxycycline**, 100 mg orally twice daily for 7 days

For antibiotic alternatives, refer to the *PNEUMONIA NON-ICU INPATIENT ORDER SET*. *(See page 4 for access directions.)*

ICU care

Antibiotics (f):

- **Ceftriaxone**, 1 g IV every 12 hours until stable, then **amoxicillin**, 1,000 mg 3 times daily for total course of 7 days

  PLUS

- **Azithromycin**, 500 mg IV daily for 3 days

For antibiotic alternatives, refer to the *PNEUMONIA ICU ORDER SET* *(See page 4 for access directions.)*

Other inpatient best practices

- **Patient education.** Use Intermountain's *Pneumonia: Guide to Hospital Care* fact sheet available from i-printstore.com.
- **Early ambulation.** Have patient sit in chair and/or ambulate for at least 20 minutes during the first 24 hours of hospitalization.
- **VTE prophylaxis.**
- **Provide smoking cessation advice/counseling** (if applicable). See left for patient education information.
- **Influenza and pneumococcal vaccines** before discharge. **(g)**

(f) Dosing notes. *See the Antibiotics Discussion on page 4.*

Antibiotic	Notes
doxycycline (doxycycline monohydrate preferred)	• Instruct patients to take with full glass of water and remain upright for 1 hour. • Has phototoxic side effect. • Contraindicated for children under 8 years old. • Category D in pregnancy. Use **azithromycin** for pregnant women. • **Doxycycline monohydrate** is lower cost than other compounds and has lower GI toxicity.
azithromycin	Z-Pak dosing is obsolete. Newer dosing is 500 mg daily for 3 days.
ceftriaxone	When stable (afebrile for 12 hours, WBC improving or normal, and patient feeling better), switch to **amoxicillin** to complete 7-day course.
amoxicillin	If beta-lactam allergic: Monotherapy with **levofloxacin** (Levaquin) 750 mg orally once daily for 5 days. Do **not** combine **levofloxacin** with **doxycycline** or **azithromycin**.
cefepime	Requires renal adjustment for subsequent dosing.
vancomycin	Requires renal adjustment for subsequent dosing.

(g) Vaccinations. All patients should be screened for need for an influenza or pneumococcal vaccine at outpatient clinic visits or before discharge (if hospitalized).[MAN,CDC2]

- **Influenza:** All patients ≥6 months should have an annual influenza vaccination to ensure appropriate protection against new antigenic types.
- **Pneumococcal vaccines:**
  - At age >65 years, give PCV13 (Prevnar)
  - At least 1 year later, give PPSV23 polysaccharide vaccine (Pneumovax)
  - Then, no further pneumococcal vaccines after age 65

If vaccine status is unknown, vaccination is recommended. Both vaccines can be given simultaneously, but each should be given at a separate site. Moderate-to-severe acute illness with or without a fever is a precaution for all vaccines, but the following are **not** considered precautions or contraindications (i.e., vaccines **can** be given): fever, mild disease with or without fever, convalescence phase of an illness.

DRUG RESISTANCE IN PNEUMONIA (DRIP) SCORING

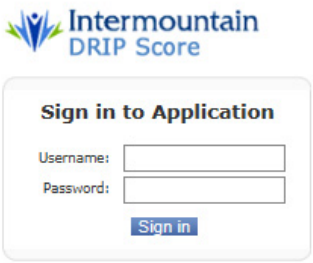
DRIP scoring identifies patients at risk for infection with MRSA, *Pseudomonas*, and other bacteria resistant to usual CAP therapy. *(DRIP replaces the HCAP criteria, which do not accurately identify at-risk patients or improve mortality.)*[WEB]

To calculate the DRIP score for a patient, sum the points for applicable risk factors shown in the table below. A score ≥4 indicates an increased risk of drug-resistant pneumonia. In such cases, consider using an anti-pseudomonal betalactam (cefepime or piperacillin-tazobactam) plus a macrolide (azithromycin), and an anti-MRSA agent (vancomycin or linezolid).

	Risk Factors	Points
Major	Antibiotic use <60 days	2
	Long-term care resident	2
	Tube feeding	2
	Prior drug-resistant pneumonia (DRP) (1 year)	2
Minor	Hospitalization <60 days	1
	Chronic pulmonary disease	1
	Poor functional status	1
	Gastric acid suppression	1
	Wound care	1
	MRSA colonization (1 year)	1

Use Intermountain's e-tool for calculating DRIP.

Click here or from Intermountain.net, type "DRIP" into the address bar.

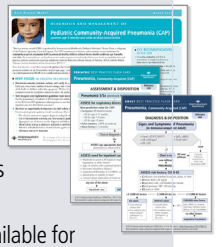


ANTIBIOTICS DISCUSSION

- **Increased macrolide resistance appeared in 2013 and 2014.** Macrolide resistance (azithromycin, erythromycin, and clarithromycin) among *Streptococcus pneumoniae* isolates has increased at all Utah Intermountain hospital microbiology labs. Resistance has increased among **respiratory pneumococcal isolates** to 60% in northern Utah and 32% in St. George. Among **blood isolates** from adults, resistance is now 15% to 35% in northern Utah and 21% in St. George.
- **Why has resistance increased?** Increased resistance results from Z-Pak (azithromycin) prescribing for chest colds and sinus infections and perhaps under-vaccination with PCV13 (Prevnar) in children. Children vaccinated with PCV13 have greatly reduced carriage of most multi-drug-resistant pneumococcal strains. Pneumococcus remains the most common and deadly bacteria that causes pneumonia.
- **What antibiotics provide coverage?** Pneumococcal activity remains very high for ceftriaxone and amoxicillin. (Clavulanate in Augmentin contributes nothing against streptococci.) Azithromycin remains effective for treatment of other pathogens that cause pneumonia, such as *Mycoplasma*, *Chlamydia*, *Haemophilus influenzae*, and *Moraxella*.
- **Generic, first-line antibiotics should be used whenever possible.** All recommended first-line antibiotics are available in generic form. They are as effective as brand-name antibiotics.
- **Quinolones should NOT be used as first-line therapy** due to documented immune-modulating effects of macrolides and lower mortality with combined therapy versus quinolone monotherapy in sicker patients. Overuse of quinolones has led to increased resistance. If a quinolone *is* used, the recommended dose of levofloxacin (Levaquin) remains at 750 mg for 5 days; adjust subsequent doses if creatinine clearance less than 30. Longer courses increase cost, drive resistance, and increase the likelihood of secondary *C. difficile*.

RESOURCES

The following Intermountain resources are available on the Pneumonia topic page at intermountainphysician.org/clinicalprograms or intermountain.net/clinicalprograms:



- **Care process models.** CPMs are available for related diagnoses such as *Bronchitis*, *Asthma*, and *COPD*. A Pediatric *Community-Acquired Pneumonia CPM* is also available.
- **Flash cards.** *Adult* and *Pediatric* CAP flash cards summarize key decision points from the CPMs.
- **Patient education.** Patient fact sheets are available for Pneumonia (*at Home* and *in the Hospital*), Colds and Coughs (*Adult* and *Children/Adolescents*), and other topics. A smoking cessation booklet is also available. All patient education can be accessed and ordered at i-printstore.com.
- **Order sets.** Both ICU and NON-ICU ORDER SETS are available on the Pneumonia topic page of intermountainphysician.org/clinicalprograms as well as in the Clinical Forms library.

The materials will also appear in the iCentra EMR as suggested patient education items.

REFERENCES

Citations are available on the Pneumonia topic page of intermountainphysician.org/clinicalprograms.

LOWER RESPIRATORY INFECTION TEAM

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This CPM is based on best evidence at the time of publication. It is not meant to be a prescription for every patient. Clinical judgment based on each patient's unique situation remains vital. We welcome your feedback. Contact Nathan Dean, MD, at 801-507-4696 or Nathan.Dean@imail.org.

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CPM012 - 09/16 Not intended to replace physician judgment with respect to individual variations and needs.