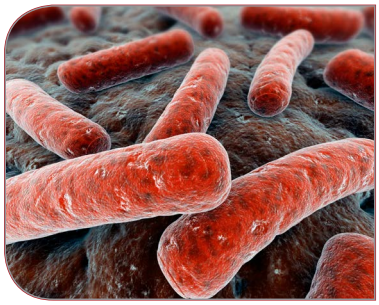


ASSESSMENT AND TREATMENT OF

Skin and Soft Tissue Infections (SSTI) in Adults

2018 Update

This CPM was created by the ED Development Team within the Intensive Medicine Clinical Program and the antibiotic stewardship service at Intermountain Healthcare. It guides the assessment and treatment of adult patients with purulent (i.e., abscess) and non-purulent cellulitis presenting to emergency departments, urgent care, or primary care clinics.

Why Focus ON SSTI?

- **SSTI are common and diverse.** Skin and soft tissue infections (SSTI) are infections of the skin and/or subcutaneous space. They are diverse in nature and can impact any body part. SSTI are the fifth most common diagnosis in Intermountain Emergency Departments.
- **SSTI are costly.** Hospitalization costs for SSTI average at least $8,000 per patient, which is two to four times more than outpatient care.[LOD] In addition, Intermountain data on antibiotic prescribing in the ED show significant use of several high-cost intravenous (IV) antibiotics—daptomycin and ertapenem—for the treatment of SSTI.
- **There is excessive variability in antibiotic prescribing.** A recent retrospective review of 1,500 patients presenting to Intermoutain EDs showed 95 different treatment regimens prescribed to treat patients with SSTI. This is more than what would be expected under consistent processes.

There is a need to standardize antibiotic prescribing for SSTI. Doing so will improve the rate of pathogen susceptibility to targeted treatment such that patients experience less treatment failure and fewer repeat visits to the ED. In parallel with improved patient outcomes, reducing the use of expensive medications will lower the overall cost of SSTI to Intermountain Healthcare.

What's new in this update?

- For patients with **non-purulent cellulitis,** the addition of an MRSA active agent (e.g., Bactrim) is **not** necessary. Monotherapy with cephalexin is recommended.[MOR, PAL]
- Patients presenting with **abscess do benefit from oral antibiotics to prevent recurrence of infection** in addition to incision and drainage, based on two large randomized controlled trials.[DAU, TAL1 , TAL2]
- Clindamycin and trimethoprim-sulfamethoxazole appear to be equally effective when treating wound infection, abscess, and cellulitis.[MIL, TAL3]
- **Linezolid** and vancomycin have similar cure rates for SSTI.[YUE] Historically, linezolid was cost prohibitive for most patients. Linezolid has recently become generic and is now covered by most insurance carriers and is relatively affordable.

WHAT'S INSIDE?

GOALS & MEASURES

Intermountain will track which antibiotics are prescribed for the most common SSTI as well as the proportion of patients who are admitted to the hospital vs. discharged for outpatient follow up. These data will support the following **system goals to reduce:**

- Daptomycin and ertapenem use in patients with SSTI by 75 %
- Combination therapy (trimethoprim-sulfamethoxazole AND cephalexin) by 50 %
- SSTI treatment failure (ED visits 72 hours after index visit) by ensuring appropriate follow up and standardized antibiotic therapy

Indicates an Intermountain measure

Intermountain® Healthcare

DIAGNOSTIC CONSIDERATIONS

Although clinically common, SSTI are often difficult to diagnose and treat because of the high incidence of mimicking conditions and rising antibiotic resistance rates. No accurate or reliable diagnostic studies for cellulitis are currently available, so providers (typically in the ED or clinic) rely on a history and physical examination for these signs and symptoms in order to diagnose SSTI. The clinical features of SSTI include patchy redness, swelling, warmth, and tenderness. Non-purulent vs. purulent cellulitis (including cutaneous abscess, furuncles, boils, carbuncles, and superficial surgical site or other wound infections) can be distinguished primarily by the presence or absence of purulent drainage.

Due in part to the non-specificity of SSTI signs, the accuracy of SSTI diagnoses is not reliable among providers. More than 30 % of patients given a diagnosis of cellulitis actually have an alternative condition that mimics SSTI (see sidebar).[LEV, WEN, JAI, FAL]

Misdiagnosis of other conditions as SSTI results in delay of effective care, unnecessary exposure to antibiotics, and inappropriate hospitalization. This CPM suggests when it is appropriate to consider the most common conditions that mimic SSTI (see sidebar).

CLINICAL PRESENTATION

Clinical characteristics and common pathogens typically associated with SSTI:

- Non-purulent cellulitis
  - Acute, spreading area of patchy redness (erythema)
  - Poorly demarcated
  - Lack of pus / drainage
  - Warm, tender skin
  - Lymphadenopathy and / or lymphangitis
  - Systemic signs and symptoms
  - Common pathogen: Group A *Streptococcus*
- Purulent cellulitis
  - Localized infection
  - Tenderness
  - Redness (erythema)
  - Pus within the dermis or subcutaneous space
  - Common pathogen: *Staphylococcus aureus*

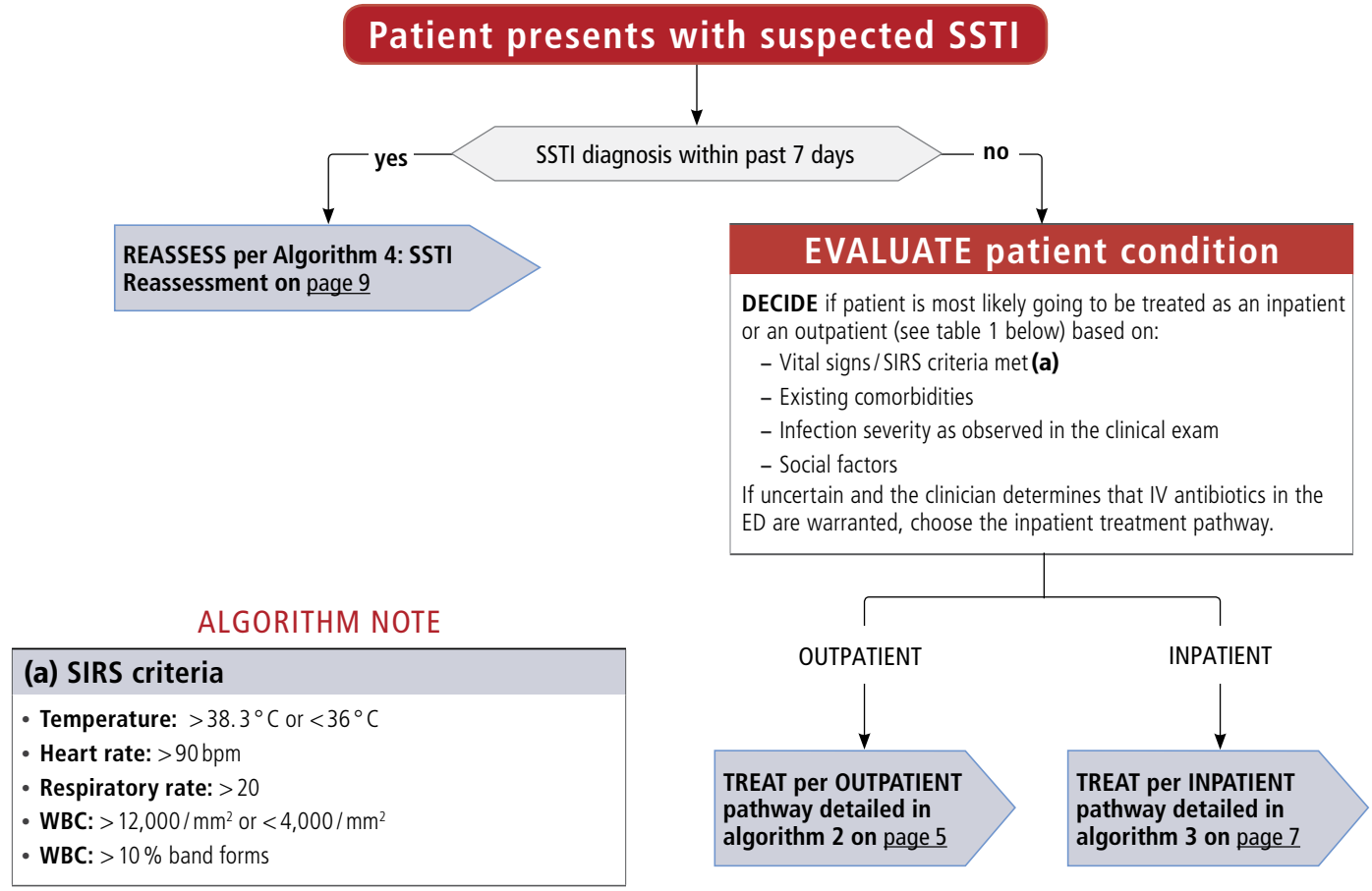
COMMON SSTI MIMICS

Antibiotics should **NOT be used** for the following conditions. The most common conditions are listed first:

- Venous stasis* (stasis dermatitis)
- Deep vein thrombosis
- Superficial thrombophlebitis
- Insect stings / bites
- Drug rash
- Uritcaria or angiodema
- Erythema nodosum
- Calciphylaxis
- Tinea
- Herpes zoster / shingles
- Contact or irritant dermatitis

* Bilateral cellulitis is extremely uncommon. Consider venous stasis as an explanation, especially if patient has any of the following signs: bilateral involvement; no fevers, chills, or leukocytosis; redness improved after elevation of legs; slow capillary refill.

ALGORITHM 1: INITIAL SSTI ASSESSMENT



ALGORITHM NOTE

(a) SIRS criteria

- **Temperature:** > 38.3 °C or < 36 °C
- **Heart rate:** > 90 bpm
- **Respiratory rate:** > 20
- **WBC:** > 12,000 / mm^2 or < 4,000 / mm^2
- **WBC:** > 10 % band forms

TABLE 1. Hospital Admission Guidelines for SSTI

ABSOLUTE CRITERIA (ADMIT IF PATIENT HAS ANY):	RELATIVE CRITERIA (CONSIDER ADMISSION* IF PATIENT HAS ANY):
• Hemodynamic instability (hypotension) • Possible necrotizing infection and rapid disease progression • Unstable comorbidities (e.g., decompensated heart failure, acute or chronic kidney injury) with ≥ 2 SIRS criteria • Neutropenia or severe immunosuppression** with ≥ 2 SIRS criteria **(a)**	• Failed outpatient therapy • Neutropenia or severe immunosuppression with a mild / localized infection • Extensive cellulitis and / or large abscess • Lymphedema with extensive cellulitis • Morbid obesity and extensive panniculitis • Infection in high risk locations that often require surgery (i.e., orbital cellulitis, hand infections, and perineal infections) • Abscess in difficult-to-drain location (groin, face) • ≥ 2 SIRS criteria **(a)** unresolved with ED management • Social and personal factors that interfere with outpatient care • Mild-to-moderate immunosuppression*** with ≥ 2 SIRS criteria **(a)**

* The decision to admit to the hospital is best approached as an opportunity for shared decision making between the patient, the ED / clinic provider, and the inpatient attending. Inform the patient about clinical recommendations, but also encourage the patient to weigh his or her own unique needs and preferences prior to making a treatment decision.

** Severe immunosuppression includes any of the following in the last year: Organ transplant, daily prednisone ≥ 20 mg, HIV infection with CD4 count < 200, or untreated HIV infection.

*** Mild-to-moderate immunosuppression includes end-stage organ dysfunction, diabetes, TNF inhibitor therapy, recent chemotherapy without neutropenia, daily prednisone ≤ 20 mg

MEDICATION TREATMENT

The medication tables for both outpatient and inpatient treatment pathways reflect evidence-based updates as highlighted in the "What's new" section on page 1.

TREATMENT CONSIDERATIONS

Treatment of SSTI varies based on clinical severity, patient comorbidities, allergies, admission status, and diagnosis. Despite existing panel recommendations and treatment guidelines,[STE] there are no specific risk stratification criteria for grading SSTI severity. This leads to a considerable variation in treatment approach.

Admission

A crucial point in the SSTI care pathway occurs on initial presentation when deciding whether a patient should be admitted to the hospital for intravenous (IV) antibiotic therapy or be treated as an outpatient. This CPM provides guidelines for making this decision, which is in part based on whether or not the patient has systemic inflammatory response syndrome (SIRS). In general, outpatients undergo more conservative treatment (algorithm 2 on page 5), while admitted patients undergo more aggressive treatment (algorithm 3 on page 7).

Antibiotics

Antibiotic treatment for SSTI presents a challenge with variation in antibiotic prescribing and hospital admission patterns. There is a lack of evidence-based agreement on antibiotic SSTI therapy in patients with more severe infections but whose condition does not necessarily warrant inpatient admission. A review of SSTI management across six Intermountain Healthcare emergency departments identified 95 different antibiotic regimens given to patients with SSTI in the ED.

This variation in antibiotic prescribing and hospital admission patterns has been seen elsewhere as well; a Cochrane review of 25 randomized controlled studies on the management of cellulitis found no cross-study agreement on recommendations for treatment regimen.[KIL]

This CPM outlines specific guidelines on preferred and alternative antibiotic regimens for patients based on the risks presented in algorithm 1 (page 3). Table 5 on page 13 provides recommended adjustments for compromised renal function.

ALGORITHM 2: OUTPATIENT SSTI TREATMENT PATHWAY

Patient presents with SSTI not requiring inpatient admission

CLASSIFY infection type and SIRS criteria (a)

- **RULE OUT** mimicking conditions **(see** sidebar on page 2)
- **DETERMINE** if patient has:
  - Purulent or non-purulent infection
  - SIRS criteria **(a)**

IDENTIFY and PERFORM appropriate treatment plan

- **IDENTIFY** the appropriate regimen based on the above classification (see table 2 on page 6)
- If possible, **GIVE** initial antibiotic dose in the clinic or ED
- PRESCRIBE the same antibiotic and reinforce compliance
- **COMPLETE** all other treatment actions as indicated in table 2 on page 6

ASSESS risk for treatment failure

DESIGNATE patient as high risk **if ANY** of the following:

- Fever on presentation
- ≥ 2 SIRS criteria **(a)**
- Recurrent cellulitis in the same location
- Infections due to chronic wounds / ulcers
- Any of the relative criteria for hospital admission (see table 1 on page 3)

Is patient at high risk?

no → **INSTRUCT PATIENT** to follow up with a primary care provider as needed

yes → **FLAG PATIENT** for phone follow-up protocol (see algorithm 5 on page 10)

ALGORITHM NOTE

(a) SIRS criteria

- **Temperature:** > 38.3 °C or < 36 °C
- **Heart rate:** > 90 bpm
- **Respiratory rate:** > 20
- **WBC:** > 12,000 / mm^2 or < 4,000 / mm^2
- **WBC:** > 10 % band forms

TABLE 2. Outpatient SSTI Treatment Regimens

Infection type	Treatment actions	Antibiotic and dose (preferred in **bold type**)
0 – 1 SIRS criteria met		
Purulent cellulitis, abscess, or wound infection	• Incision and drainage, if applicable • If surgical site infection, suture removal at the discretion of he surgeon • Obtain routine culture of pus • Elevate affected body part Cure rates with incision and drainage alone are 70 – 85 % in most studies. Incision and drainage alone is reasonable in patient at high risk for antibiotic-related adverse events (e.g., *C. difficile* infection).	• **Trimethoprim-sulfamethoxazole 1 DS PO BID x 7 d (2 DS if > 80 kg)** **OR** • **Doxycycline / minocycline 100 mg PO BO BID x 7 d** OR • Clindamycin* 300 mg PO QID x 7 d
Non-purulent cellulitis	• Consider soft tissue ultrasound to rule out occult abscesses • Elevate affected body part • Prescribe ibuprofen 400 mg PO Q6 hours x 5 days if no exclusions: Active GI ulcer or high risk for bleeding, decreased renal function, concomitant nephrotoxic agents	• **Cephalexin 500 mg PO QID x 7 d** **OR** • **Dicloxacillin 500 mg PO QID x 7 d** **OR** • **Clindamycin 300 mg PO QID x 7 d**
≥ 2 SIRS criteria met		
Purulent cellulitis, abscess, or wound infection	• Incision and drainage, if applicable • If surgical site infection, suture removal at the discretion of the surgeon • Obtain routine culture of pus • Elevate affected body part	• **Trimethoprim-sulfamethoxazole 1 DS PO BID x 7 d (2 DS if > 80 kg)** **OR** • **Linezolid** 600 mg PO BID x 7 d** OR • Clindamycin* 450 mg PO QID x 7 d
Non-purulent cellulitis	• Consider soft tissue ultrasound to rule out occult abscesses • Elevate affected body part • Prescribe ibuprofen 400 mg PO Q6 hours x 5 days if no exclusions: Active GI ulcer or high risk for bleeding, decreased renal function, concomitant nephrotoxic agents	• **Cephalexin 1 g PO QID x 7 d** **OR** • **Linezolid** 600 mg PO BID x 7 d** **OR** • **Clindamycin 450 mg PO QID x 7 d**

* Approximately 30 % MRSA resistance to clindamycin

** Administering linezolid concomitantly with other proserotonergic drugs may cause serotonin syndrome (incidence 0.24% – 4 %). Symptoms of serotonin syndrome include agitation, confusion, hallucinations, hyper-reflexia, myoclonus, shivering, and tachycardia, which typically resolve in 1 – 5 days after discontinuation. Avoid use in patients taking other pro-serotonergic medications unless clinically appropriate and under close monitoring for signs/symptoms of serotonin syndrome like reactions.[RAM] Linezolid therapy is reserved for patients with ≥ 2 SIRS criteria that would have otherwise been treated with IV antibiotics as an outpatient.

ALGORITHM 3: INPATIENT SSTI TREATMENT PATHWAY

Patient presents with SSTI requiring possible hospital admission

CLASSIFY infection type and SIRS criteria (a)

- RULE OUT mimicking conditions (see page 2)
- DETERMINE if patient has:
  - Purulent or non-purulent infection
  - SIRS criteria **(a)**
  - Severe sepsis **(b)**

Does patient have severe sepsis?

no

IDENTIFY and FOLLOW appropriate treatment plan for patients WITHOUT severe sepsis

- **IDENTIFY** the appropriate regimen (see table 3 on page 8)
- If possible, **GIVE** initial antibiotic dose
- **COMPLETE** all other treatment actions as indicated in table 3 on page 8.

yes

IDENTIFY and FOLLOW appropriate treatment plan for patients WITH severe sepsis

- **IDENTIFY** appropriate antibiotic regimen (see table 3 on page 8)
- If in ED, **GIVE initial antibiotic** doses **within 3 HOURS** of severe sepsis determination
- If in urgent care or clinic, **GIVE initial IV antibiotic** and **REFER** to ED
- **COMPLETE** all other treatment actions as indicated in table 3 on page 8

RE-EVALUATE patient condition

DETERMINE if hospital admission is warranted.
See admission criteria (table 1 on page 3). Also consider:

- Changes in vital signs while under observation
- Clinical progression of infection while in the ED / clinic

Patient being admitted?

yes

ADMIT PATIENT, and **CONTINUE** antibiotic treatment as indicated in table 3 on page 8

no

PRESCRIBE antibiotic

- **PRESCRIBE** based on recommendations in table 2 on page 6
- **ENCOURAGE** compliance

ASSESS risk for treatment failure

DESIGNATE patient as high risk if **ANY** of the following:

- Fever on presentation
- ≥ 2 SIRS criteria **(a)**
- Recurrent cellulitis in the same location
- Infections due to chronic wounds / ulcers
- Any of the relative criteria for hospital admission (see table 1 on page 3)

Patient at high risk for treatment failure?

yes

FLAG PATIENT for phone follow-up protocol (see algorithm 5 on page 10)

no

INSTRUCT PATIENT to follow up with a primary care provider as needed

See page 8 for algorithm notes.

ALGORITHM NOTES

(a) SIRS criteria

- **Temperature:** > 38.3 °C or < 36 °C
- **Heart rate:** > 90 bpm
- **Respiratory rate:** > 20
- **WBC:** > 12,000 / mm^2 or < 4,000 / mm^2
- **WBC:** > 10 % band forms

(b) Severe sepsis assessment (Patient must meet at least 2 SIRS criteria **AND** at least 1 sign of organ dysfunction*)

SIRS criteria

- Temperature > 38.3 °C or < 36 °C
- Heart rate > 90 bpm
- Respiratory rate > 20
- WBC: > 12,000 / mm^2 or < 4,000 / mm^2
- WBC: > 10 % band forms

Organ dysfunction*

- SpO_2 < 90% on room air or supplemental O_2
- Systolic blood pressure < 90 mmHg
- Systolic blood pressure decrease > 40 mmHg from known baseline
- Mean arterial pressure < 65 mmHg
- Creatinine > 2 mg / dL
- Urine output < 0.5 ml / kg / hr for > 2 hours
- Bilirubin > 2 mg / dL
- Platelets < 100,000 / mm^3
- INR > 1.5 or PTT > 60 secs
- Acutely altered mental status
- Lactate > 2 mmol / L

***Not due to chronic conditions**

TABLE 3. Inpatient SSTI Treatment Regimens

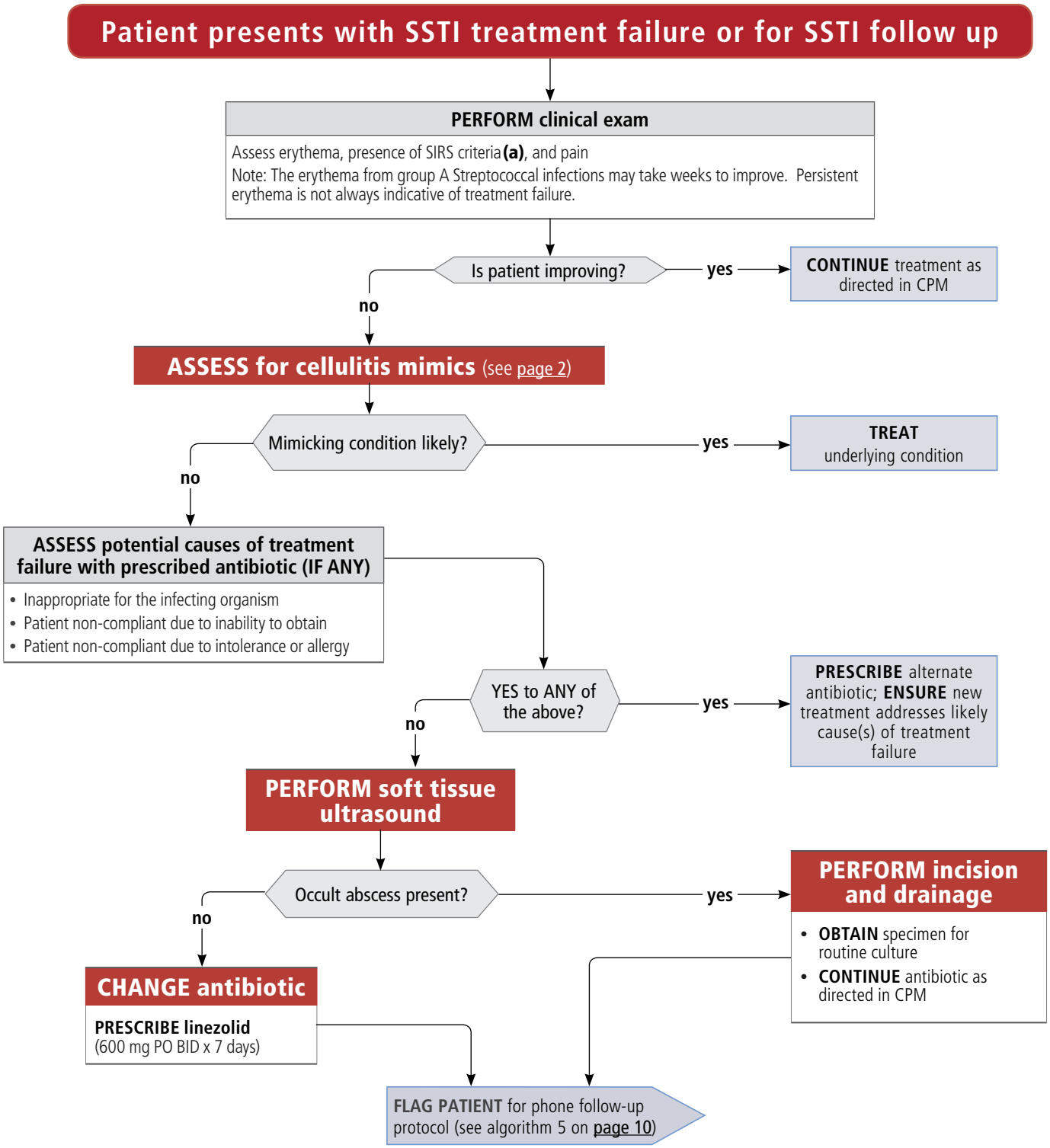
Infection type	Treatment actions	Antibiotic and dose (preferred in **bold type**)	Notes
NO SEVERE SEPSIS			
Purulent cellulitis, abscess, or wound infection	• Incision and drainage / surgical debridement, if applicable • If surgical site infection, suture removal at the discretion of the surgeon • Obtain routine culture of pus*	• **Vancomycin (pharmacy to manage; goal trough concentration 10–15 mg / L)** OR • Linezolid** 600 mg PO or IV BID	Change to targeted therapy after culture results are available (see below)***
Non-purulent cellulitis	• Empiric antibiotic therapy (see right) • Consider soft tissue ultrasound to rule out occult abscesses	• **Cefazolin 2 g IV Q8 hours** OR • Clindamycin 600 mg IV Q8 hours OR • Vancomycin (pharmacy to manage; goal trough concentration 10–15 mg / L)	If suspicious of necrotizing infection, treat as if patient has severe sepsis
SEVERE SEPSIS			
Purulent cellulitis, abscess, or wound infection	• Incision and drainage / surgical debridement, if applicable • If surgical site infection, suture removal at the discretion of the surgeon • Obtain routine culture of pus*	• **Vancomycin (pharmacy to manage; goal trough concentration 10-15 mg / L) AND ceftriaxone 2 g IV daily** • Linezolid** 600 mg PO or IV BID may be substituted for vancomycin • Aztreonam 2 g IV Q8 hours may be substituted for ceftriaxone in patients with severe allergy	Change to targeted therapy after culture results are available (see below)***
Non-purulent cellulitis	• Empiric antibiotic therapy (see right) • Consider soft tissue ultrasound to rule out occult abscesses	• **Vancomycin (pharmacy to manage; goal trough concentration 15-20 mg / L) AND cefepime 2 g IV Q8 hours** • Linezolid** 600 mg IV may be substituted for vancomycin • Meropenem 500 mg IV Q6 hours may substitute for cefepime in patients with severe allergy	If suspicious of necrotizing infection, add clindamycin 900 mg IV Q8 hours x 3 days

* Send pus in sterile container if possible. If not, send sample on a swab.

** Administering linezolid concomitantly with other proserotonergic drugs may cause serotonin syndrome (incidence 0.24%–4%). Symptoms of serotonin syndrome include agitation, confusion, hallucinations, hyper-reflexia, myoclonus, shivering, and tachycardia, which typically resolve in 1–5 days after discontinuation. Avoid use in patients taking other pro-serotonergic medications unless clinically appropriate and under close monitoring for signs/symptoms of serotonin syndrome like reactions.[RAM] Linezolid therapy is reserved for patients with ≥ 2 SIRS criteria that would have otherwise been treated with IV antibiotics as an outpatient.

*** Targeted therapy: If MRSA grows, continue vancomycin or linezolid. If MSSA grows, change to cefazolin 2 g IV Q8 hours (alternatives are vancomycin or clindamycin).

ALGORITHM 4: SSTI REASSESSMENT



ALGORITHM NOTE

(a) SIRS criteria

- **Temperature:** > 38.3 °C or < 36 °C
- **Heart rate:** > 90 bpm
- **Respiratory rate:** > 20
- **WBC:** > 12,000 / mm^2 or < 4,000 / mm^2
- **WBC:** > 10 % band forms

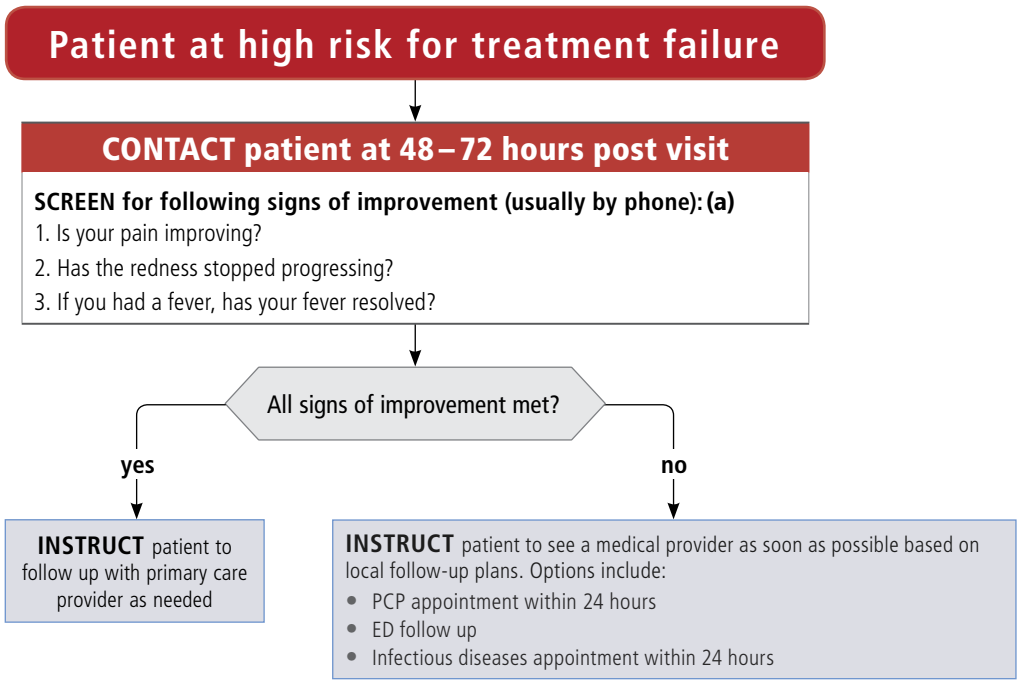
SSTI FOLLOW UP

Patients with SSTI typically respond to therapy within 72 hours when treated appropriately. However, some patients can worsen, and erythema can spread in the first 48 hours even with appropriate antibiotic therapy. (Patients presenting with fever, recurrent cellulitis, infection of chronic wounds or ulcers, and immunosuppression are known to be at a high risk of treatment failure.) Based on these considerations, this CPM defines specific guidelines for identifying patients who should be flagged (in either the outpatient or inpatient treatment pathway) as "high risk for treatment failure." These patients will enter a follow-up protocol defined in algorithm 5 below).

At a minimum, patients at high risk of failure should receive a phone call from a healthcare provider within 72 hours of being diagnosed and treated for an SSTI. If patients are not responding to therapy within 72 hours, they should be seen by a medical provider for reassessment (see algorithm 4 on page 9). In addition to CPM-concordant antibiotics, providers should:

- Assess the patient for SSTI-mimicking conditions
- Consider ibuprofen as an adjunctive therapy to decrease inflammation
- Promote elevation of the affected limb to decrease the risk of treatment failure

ALGORITHM 5: SSTI PHONE FOLLOW-UP PROTOCOL



ALGORITHM NOTE

(a) Site-specific, follow-up protocols

Follow-up protocols are expected to differ by treatment facility according to staff and other resources available on site. The physician or other caregiver should arrange contact according to the patient's preferred contact method and make recommendations based on the patient's ability to obtain follow up for urgent care.

SPECIAL POPULATIONS

A number of SSTI are unique and require special attention as treatment can be especially challenging. See table 4 (below and continued on page 12) for clinical diagnostic guidelines and treatment recommendations for these types of infections.

TABLE 4. Special Populations Presenting with SSTI: Features, Pathogens, and Treatments

Infection type	Clinical features and diagnosis	Pathogens	Treatment and antibiotics (if preferred antibiotics, shown in **bold type**)	Key considerations
Orbital infections				
Preseptal cellulitis (infection anterior to the septum of the eyelid)	Unilteral ocular pain, eyelid swelling, erythema, NO PAIN with eye movement	*S. aureus, S. pneumoniae*, other streptococci	• **Trimethoprim-sulfamethoxazole** 1 DS PO BID (2 DS PO BID if > 80 kg) **AND** • **Cephalexin** 500 mg PO QID OR • Clindamycin 300 mg PO QID (monotherapy)	Recommend telephone follow up at 72 hours (see page 12)
Orbital cellulitis (infection of the contents of the fat and ocular muscles of the orbit).	Unilateral ocular pain, eyelid swelling, erythema, pain with eye movement, proptosis, ophthalmoplegia with diplopia Contrast-enhanced CT scan of orbit to rule out abscess	*S. aureus*, beta-hemolytic *S. pyogenes*, *S. viridans*	Consult ENT and/or ophthalmology. Hospital admission with IV antibiotics (see below) **IV antibiotics** • **Vancomycin:** 15–20 mg/kg IV, one dose, then pharmacy to manage for goal trough concentration 15–20 mg/L. (Alternative: linezolid* 600 mg IV Q12 hours) **PLUS one of these:** • Ceftriaxone: 2 g IV daily • Ampicillin-sulbactam: 3 g IV Q6 hours • Piperacillin-tazobactam: 4.5 g IV once, followed by 4.5 g over 4 hours Q8 hours	Severe infection: May cause permanent disability
Bite infections				
Animal (dog/cat) bites	Fever, erythema, swelling, tenderness, purulent drainage, and lymphangitis	Most polymicrobial. *Pasteurella* is present in cat bites more than dog bites; *Capnocytophaga canimorsus* is common in patients without a spleen	1. Consider x-ray to evaluate bony structures 2. Aggressive wound care 3. Evaluate for tetanus and rabies vaccinations 4. Antibiotic therapy as follows: **ORAL antibiotics:** • **Amoxicillin/clavulanate** 875 mg PO BID OR • Doxycycline 100 mg PO BID OR Trimethoprim-sulfamethoxazole 1 DS BID AND Metronidazole 500 mg PO TID **IV antibiotics (deep or severe infections):** • **Ampicillin-sulbactam** 3 g IV Q6 hours OR • Ceftriaxone 2 g IV daily PLUS metronidazole 500 mg IV/PO Q8 hours	Prophylactic antibiotics x 3–5 days recommended in patients who are immunocompromised or asplenic or who have: • Advanced liver disease • Pre-existing or resultant edema of the affected area • Moderate-to-severe injuries (especially of hand/face) including wounds that: – Are deep – Require surgical repair – Are close to a bone or joint • Injuries that may have penetrated the periosteum or joint capsule
Human bites and clenched fist injuries	Fever, erythema, swelling, tenderness, purulent drainage, and lymphangitis		See above (same treatment as for animal bite infections).	Prophylactic antibiotics x 3–5 days should be given for all bites or injuries where the dermis is compromised

* Administering linezolid concomitantly with other proserotonergic drugs may cause serotonin syndrome (incidence 0.24%–4%). Symptoms of serotonin syndrome include agitation, confusion, hallucinations, hyper-reflexia, myoclonus, shivering, and tachycardia, which typically resolve in 1–5 days after discontinuation. Avoid use in such patients unless clinically appropriate and under close monitoring for signs/symptoms of serotonin syndrome like reactions.

TABLE 4, CONTINUED. Special Populations Presenting with SSTI: Features, Pathogens, and Treatments

Infection type	Clinical features and diagnosis	Pathogens	Treatment and antibiotics (if preferred antibiotics, shown in **bold type**)	Key considerations
Mastitis				
Lactational mastitis	Breast is painful, swollen, firm, and red, often with fever > 38.3 °C, decreased milk secretion, and systemic complaints	*S. aureus* and beta-hemolytic streptococci; *E. coli* and bacteroides species are less common	1. Culture breast milk 2. Nonsteroidal anti-inflammatories and cold compresses 3. Complete emptying of the breast via ongoing breastfeeding or pumping 4. Antibiotic therapy (see below) 5. Consider ultrasound to evaluate for abscess if infection does not respond to 48–72 hours of antibiotic therapy **Oral Antibiotics (duration of therapy is 7–10 days):** • Cephalexin 500 mg PO QID OR dicloxacillin 500 mg PO QID OR • **If MRSA risk:** Trimethoprim-sulfamethoxazole 1 DS PO BID OR clindamycin 300 mg PO QID	Lactational mastitis is most common during the first 3 months of breast feeding
Necrotizing fasciitis				
Necrotizing fasciitis	• Severe, constant pain • Bullae related to occlusion of deep blood vessels that traverse the fascia or muscle compartments • Skin necrosis • Gas in the soft tissue • Edema that extends beyond the margin of erythema • Systemic toxicity • Rapid spread while on antibiotic therapy • Cutaneous anesthesia • Wooden-hard feel of subcutaneous tissue	Beta-hemolytic streptococci and polymicrobial infections Also consider anaerobic streptococcal myositis, pyomyositis, Fournier's gangrene, clostridial myonecrosis	1. Urgent surgical consultation 2. Obtain blood cultures before starting IV antibiotics 3. Antibiotic therapy (see below) **IV Antibiotics**: • **Vancomycin:** 15–20 mg/kg IV once, followed by pharmacy to manage for goal trough concentration 15–20 mg/L OR • Linezolid* 600 mg IV Q12 hours **PLUS** • **Cefepime:** 2 g IV Q8 hours OR • Meropenem 500 mg IV Q6 hours **PLUS** • **Clindamycin**: 900 mg IV Q8 hours	CT or MRI can be performed to demonstrate gas and necrosis only if patient is stable
Diabetic foot infection (DFI)				
Diabetic foot infection	Redness, warmth, swelling, pain, or purulent secretions; atypical signs of infection include non-purulent secretions, discolored/friable granulation tissue, undermining, or foul odor Plain radiograph and/or MRI may be performed to evaluate for osteomyelitis Ankle brachial index may be performed to evaluate vascular supply	Most are polymicrobial; staphylococci and streptococci are the most common causative organisms Gram-negative bacilli are frequently co-pathogens in infections that are chronic or follow antibiotic treatment Anaerobes may be co-pathogens in ischemic or necrotic wounds	• Most DFIs require some surgical intervention, ranging from minor debridement to major resection or amputation. • For infected wounds, obtain a post-debridement specimen (preferably of deep tissue) for aerobic and anaerobic culture. **Superficial wound swabs are NOT recommended.** • For mild-to-moderate infections in patients who have not recently received antibiotic treatment, therapy targeting staphylococci and streptococci is sufficient. Options include: dicloxacillin, clindamycin, cephalexin, doxycycline, and sulphamethoxazole/trimethoprim. • For all other infections, consult with podiatry or infectious diseases.	Infections are classified as: 1. Mild (superficial and limited in size and depth) 2. Moderate (deeper/more extensive) 3. Severe (accompanied by systemic signs of infection). Note that wounds without evidence of soft tissue or bone infection **DO NOT** require antibiotic therapy

* Administering linezolid concomitantly with other proserotonergic drugs may cause serotonin syndrome (incidence 0.24%–4%). Symptoms of serotonin syndrome include agitation, confusion, hallucinations, hyper-reflexia, myoclonus, shivering, and tachycardia, which typically resolve in 1–5 days after discontinuation. Avoid use in patients taking other pro-serotonergic medications unless clinically appropriate and under close monitoring for signs/symptoms of serotonin syndrome like reactions.[RAM] Linezolid therapy is reserved for patients with ≥ 2 SIRS criteria that would have otherwise been treated with IV antibiotics as an outpatient. .

TABLE 5. Antibiotic Adjustments for Compromised Renal Function

Medication	If CrCL is:	Recommended adjustment
Aztreonam	10–30 mL/min	2,000 mg load IV, then 1,000 mg IV Q8 hours
	< 10 mL/min or hemodialysis	2,000 mg load IV, then 500 mg IV Q8 hours
Cefepime	30– 60 ml/min	2,000 mg load, then 1,000 mg IV Q8 hours
	11–29 ml/min	2,000 mg load, then 1,000 mg IV Q12 hours
	≤ 10 ml/min or hemodialysis	2,000 mg load, then 1,000 mg IV Q24 hours
Cefazolin	11–34 mL/min	2,000 mg IV load, then 1,000 mg IV Q12 hours
	<11 mL/min or hemodialysis	2,000 mg IV load, then 1,000 mg IV Q24 hours
Cephalexin	10–50 mL/min	500 mg PO Q8 hours
	< 10 mL/min or hemodialysis	500 mg PO Q12 hours
Meropenem	26–50 mL/min	500 mg IV Q8 hours
	10–25 mL/min	500 mg IV Q12 hours
	<10 mL/min or hemodialysis	500 mg IV Q24 hours
Trimethoprim-sulfamethoxazole	10–30 mL/min	1 DS PO BID if weight > 80 kg; 1 SS PO BID if weight < 80 kg
	< 10 mL/min or hemodialysis	Not recommended
Vancomycin	Adjust IV interval; consult clinical pharmacist	
Clindamycin, dicloxacillin, doxycycline, minocycline, linezolid, ceftriaxone	No adjustments required	

ANTIBIOGRAMS

Antibiograms for each Intermountain hospital are available within Intermountain.net. If you're logged in and within the Intermountain firewall, you can access the antibiogram tool with up-to-date information by typing "antibiogram" in the address bar of your browser. The tool provides custom antibiogram reports for pathogen, patient type, infection type, facility, and / or service for any given time period.

Printable antibiograms can be found on GermWatch:

https://phy.intermountain.net/germWatch/Pages/Home.aspx#/

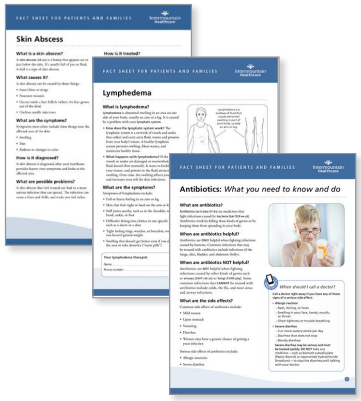
RESOURCES

Patient resources

Clinicians can order Intermountain patient education booklets and fact sheets for distribution to their patients from Intermountain's Online Library and Print Store, iprintstore.org.

Fact Sheets related to skin and soft tissue infection include:

- *Skin Abscess*
- *Lymphedema*
- *Antibiotics: What you need to know and do*

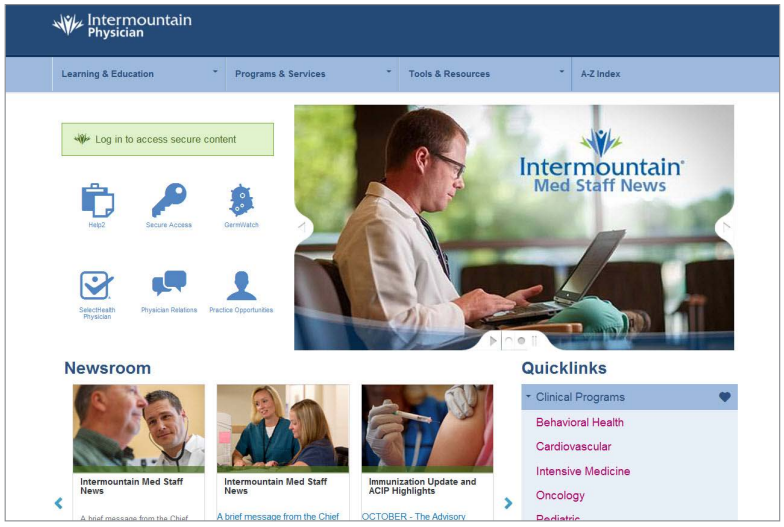


Provider resources

To find this CPM, clinicians can go to intermountainphysician.org/clinicalprograms and click on "Clinical Topics A - Z" on the left side of the screen. Then, select "Skin and Wound Problems" under "S."

OR

Go to intermountain.net, click on the "Clinical" banner on the top. Select "Care Processes Models" under Clinical Programs. Open the "Intensive Medicine CPMs and Related Tools" menu, and select "Skin and Soft Tissue Infections in Adults."



CPM DEVELOPMENT TEAM

Angie Adams, RN

Todd Allen, MD

Jeremy Bair, PharmD

Joseph Bledsoe, MD

Whitney Buckel, PharmD

Laura Sittig, PhD (Medical Writer)

Eddie Stenehjem, MD MSc

Michael Woodruff, MD

REFERENCES

DAU Daum RS, Miller LG, Immergluck L, et al. A placebo-controlled trial of antibiotics for smaller skin abscesses. *N Engl J Med.* 2017;376(26):2545-2555.

FAL Falagas ME, Vergidis PI. Narrative review: Diseases that masquerade as infectious cellulitis. *Ann Intern Med.* 2005;142(1):47-55.

JAI Jain SR, Hosseini-Moghaddam SM, Dwek P, et al. Infectious diseases specialist management improves outcomes for outpatients diagnosed with cellulitis in the emergency department: A double cohort study. *Diagn Microbiol Infect Dis.* 2017;87(4):371-375.

KIL Kilburn SA, Featherstone P, Higgins B, Brindle R. Interventions for cellulitis and erysipelas. In: Kilburn SA, ed. *Cochrane Database of Systematic Reviews.* Chichester, UK: John Wiley & Sons, Ltd; 2010:CD004299.

LEV Levell NJ, Wingfield CG, Garioch JJ. Severe lower limb cellulitis is best diagnosed by dermatologists and managed with shared care between primary and secondary care. *Br J Dermatol.* 2011;164(6):1326-1328.

LOD Lodise TP, Fan W, Sulham KA. Economic impact of oritavancin for the treatment of acute bacterial skin and skin structure infections in the emergency department or observation setting: Cost savings associated with avoidable hospitalizations. *Clin Ther.* 2016;38(1):136-148.

MIL Miller LG, Daum RS, Creech CB, et al. Clindamycin versus trimethoprim-sulfamethoxazole for uncomplicated skin infections. *N Engl J Med.* 2015;372(12):1093-1103.

MOR Moran GJ, Krishnadasan A, Mower WR, et al. Effect of cephalexin plus trimethoprim-sulfamethoxazole vs cephalexin alone on clinical cure of uncomplicated cellulitis: A randomized clinical trial. *JAMA.* 2017;317(20):2088-2096.

PAL Pallin DJ, Binder WD, Allen MB, et al. Clinical trial: Comparative effectiveness of cephalexin plus trimethoprim-sulfamethoxazole versus cephalexin alone for treatment of uncomplicated cellulitis: A randomized controlled trial. *Clin Infect Dis.* 2013;56(12):1754-1762.

RAM Ramsey TD, Lau TT, Ensom MH. Serotonergic and adrenergic drug interactions associated with linezolid: A critical review and practical management approach. *Ann Pharmacother.* 2013;47(4):543-560.

STE Stevens DL, Bisno AL, Chambers HF, et al. Executive summary: Practice guidelines for the diagnosis and management of skin and soft tissue infections: 2014 Update by the Infectious Diseases Society of America. *Clin Infect Dis.* 2014;59(2):147-159.

TAL1 Talan DA, Mower WR, Krishnadasan A, et al. Trimethoprim-sulfamethoxazole versus placebo for uncomplicated skin abscess. *N Engl J Med.* 2016;374(9):823-832.

TAL2 Talan DA, Moran GJ, Krishnadasan A, et al. Subgroup analysis of antibiotic treatment for skin abscesses. *Ann Emerg Med.* 2018;71(1):21-30.

TAL3 Talan DA, Lovecchio F, Abrahamian FM, et al. A randomized trial of clindamycin versus trimethoprim-sulfamethoxazole for uncomplicated wound infection. *Clin Infect Dis.* 2016;62(12):1505-1513.

WEN Weng QY, Raff AB, Cohen JM, et al. Costs and consequences associated with misdiagnosed lower extremity cellulitis. *JAMA Dermatology.* 2016;153(2):141.

YUE Yue J, Dong BR, Yang M, Chen X, Wu T, Liu GJ. Linezolid versus vancomycin for skin and soft tissue infections. In: Dong BR, ed. *Cochrane Database of Systematic Reviews.* Chichester, UK: John Wiley & Sons, Ltd; 2013:CD008056.