Provincial Clinical Knowledge Topic
Cellulitis, Adult – Emergency
V 1.0

Revision History

Version	Date of Revision	Description of Revision	Revised By

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.

Goals of Management

1. Select appropriate antimicrobial therapy for cellulitis
2. Recognize indications for treatment of cellulitis with parenteral antibiotics
3. Identify patients who are suitable for outpatient management
4. Recognize MRSA risk factors that warrant consideration of empiric MRSA treatment
5. Avoid treatment of chronic venous stasis dermatitis and other cellulitis mimics

Clinical Decision Support

Clinical features indicative of cellulitis:

- Warmth
- Erythema
- Swelling
- Pain
- UNILATERAL involvement

  No combination of clinical features has been shown to accurately identify cellulitis vs. other clinical mimics. Misdiagnosis is common and should be considered in non-responders to antimicrobial treatment.

Indications for parenteral antimicrobial therapy in cellulitis:

- Moderate or severe cellulitis / signs of systemic toxicity
- Lymphangitis
- Rapid progression of erythema
- Immunocompromise
- Proximity to an indwelling device or prosthetic
- Persistence or progression despite appropriate oral treatment for at least 48 hours

Indications for empiric MRSA treatment of skin / soft tissue infection:

- Prior episode of proven MRSA infection / colonization
- Presence of MRSA risk factors (see below risk factors list)
- Recurrent infection patient with predisposition to infection
- Purulent cellulitis (i.e. – abscess, furuncle / carbuncle)

Risk factors for methicillin-resistant *staphylococcus aureus* (MRSA) colonization

Hospital Acquired:

- Dialysis patient
- Nursing home residence
- Hospitalization in last 90 days
- MRSA outbreak setting
- Diabetes

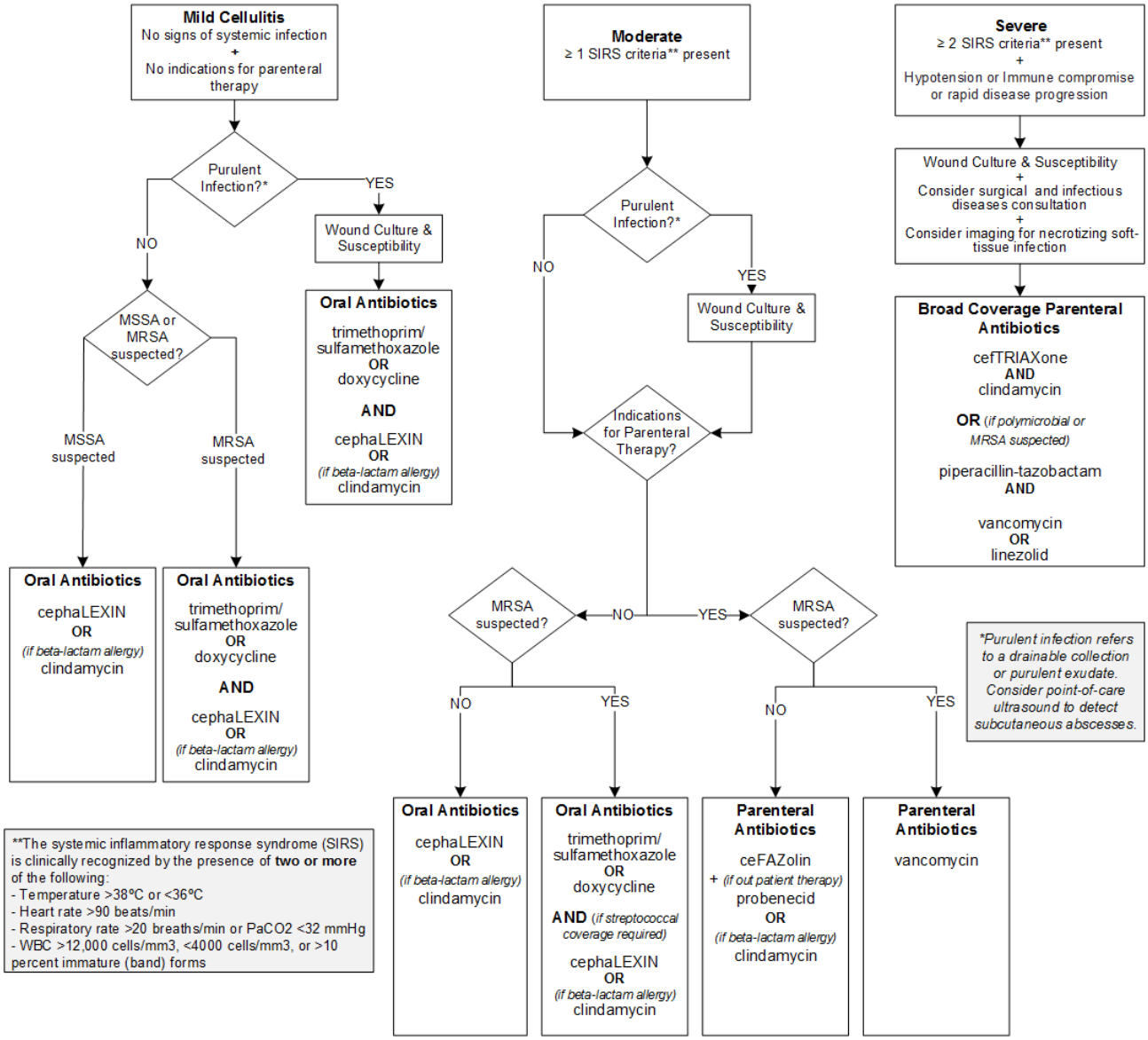
Community Acquired:

- Known contact (household member has MRSA)
- Homelessness
- Incarceration
- First Nations
- Hospital workers
- Athletes

Indications for antibiotic therapy in addition to incision & drainage (I&D) for skin abscess:

- Multiple lesions or single abscess greater than 2 cm
- Extensive surrounding cellulitis
- Associated comorbidities or immunosuppression
- Signs of systemic infection (e.g. fever above 38^{o}C)
- Inadequate clinical response to (I&D) alone
- Presence of indwelling medical device/prosthesis
- High risk of transmission to others (athlete, military personnel)

Figure 1: Treatment Algorithm for Empiric Treatment of Cellulitis



Adapted from Raff A, Kroshinsky D. Cellulitis: A Review. *JAMA*. 2016;316(3): 325-37.

Order Set Components

Name of Order Set: Cellulitis Adult Emergency Department Orders

Order Set Keywords: Skin and soft tissue infections (SSTI), Abscess, Necrotizing fasciitis
Order Set Requirements: algorithm available as reference (see Figure 1)

Goals of Care

Conversations leading to the ordering of a Goals of Care Designation (GCD), should take place as early as possible in a patient's course of care. The Goals of Care Designation is created, or the previous GCD is affirmed or changed resulting from this conversation with the patient or, where appropriate, the Alternate Decision-Maker.
Complete the Goals of Care Designation (GCD) Order Set within your electronic system, or if using paper process, complete the Provincial Goals of Care Designation (GCD) paper form (http://www.albertahealthservices.ca/frm-103547.pdf)

Intravenous Fluids

- ☐ Intravenous Cannula – Insert: Initiate IV
- ☐ IV Peripheral Saline Flush/Lock: Saline Lock

IV Bolus or Rapid infusion

- ☐ 0.9% NaCl infusion _____ mL as fast as possible

Maintenance IV Solutions

- ☐ 0.9% NaCl infusion at _____ mL/hour
- ☐ D5W - 0.9% NaCl infusion at _____ mL/hour
- ☐ D5W - 0.45% NaCl infusion at _____ mL/hour
- ☐ Other: _____ at _____ mL/hour

Laboratory Investigations - STAT

Hematology

- ☐ Complete Blood Count (CBC)
- ☐ PT INR

Transfusion Medicine

- ☐ Type and Screen

Chemistry

- ☐ Electrolytes (Na, K, Cl, CO2)
- ☐ Creatinine
- ☐ Glucose Random
- ☐ Urea
- ☐ Lactate

Blood Gases

- ☐ Blood Gas Venous
- ☐ Blood Gas Arterial

Microbiology (See Clinical Decision Making, above)

- ☐ Wound Bacterial Culture
  - Swab: Abscess or purulent drainage, Specify location: _____ *(specify anatomy)*
    Note: swabs of dried or intact skin are not indicated
- ☐ Blood Culture: 2 sets (*Indicated if signs of systemic illness, for instance 2 or more SIRS*

criteria; blood cultures are NOT routinely indicated in uncomplicated cellulitis)

Diagnostic Imaging

- GR (X-ray) _____ *(specify anatomy)*
- US (Ultrasound) Soft tissue _____ *(specify anatomy)*
- CT Extremity _____ *(specify anatomy)*

Medications

Antibiotics

Mild to Moderate cellulitis without indications for parenteral therapy (see Clinical Decision Making)
Recommended duration: 5 to 10 days, according to clinical response.

Choose ONE:

- cephaLEXIN 500 mg PO QID
  OR *for patients with higher BMI or more extensive infection*
- cephaLEXIN 1000 mg PO QID

OR *choose for erysipelas:*

- penicillin V potassium 300 mg PO every 6 hours
- amoxicillin 500 mg PO TID

OR *if beta-lactam allergy* (see AHS Beta Lactam Allergy Antimicrobial Stewardship Backgrounder for further details)

- clindamycin 300 mg PO QID

Mild to Moderate cellulitis requiring MRSA coverage but not parenteral therapy (see Clinical Decision Making)
Recommended duration: 5 to 10 days, or according to clinical response

Choose ONE:

- cephaLEXIN 500 mg PO QID

OR *for patients with higher BMI or more extensive infection:*

- cephaLEXIN _____ mg PO QID

OR *if beta-lactam allergy* (see AHS Beta Lactam Allergy Antimicrobial Stewardship Backgrounder for further details)*:*

- clindamycin 300 mg PO QID

AND *Choose ONE:*

- trimethoprim / sulfamethoxazole (Septra) 1 DS tab PO BID
- doxycycline 100 mg PO BID

Moderate cellulitis: Parenteral Therapy (see Clinical Decision Making)
Recommended duration: 5 to 10 days, according to clinical response

Choose ONE of the 3 options:
Option 1 (outpatient therapy):
- ceFAZolin 2 grams IV daily

AND
- probenecid 1 gram PO BID; initial dose to be given 30 minutes prior ceFAZolin, subsequent to be given 12 hours later

OR
- probenecid 2 grams PO daily; initial dose to be given 30 minutes prior to ceFAZolin (*Probenecid may cause nausea and vomiting; a once daily dose may be poorly tolerated by some patients)*

Option 2:
- ceFAZolin 2 grams IV every 8 hours

*Option 3 if beta-lactam allergy (*see AHS Beta Lactam Allergy Antimicrobial Stewardship Backgrounder for further details*):*
- clindamycin 600 mg IV every 8 hours

Moderate cellulitis requiring parenteral MRSA coverage (see Decision Making)
- vancomycin (15 mg/kg) _____ mg IV (*also acceptable for beta-lactam allergy)*
  Note: Dosing interval is determined by CrCl and desired trough levels; see AHS vancomycin dosing policy for details

Severe Cellulitis with shock or suspected necrotizing infection (see Decision Making)
Recommended duration: 10 to 14 days, according to clinical response

Choose ONE of the 3 options:
Option 1 (if rapidly progressive infection such as necrotizing fasciitis):
- cefTRIAXone 2 grams IV daily

AND
- clindamycin 900 mg IV every 8 hours

Option 2 (if polymicrobial such as Fournier's gangrene or MRSA suspected):
- piperacillin / tazobactam 4.5 grams IV every 6 hours

AND
- vancomycin (25 mg/kg) _____ mg IV loading dose (no maximum); followed by maintenance dose of (15 mg/kg) _____ mg (maximum 2 grams / dose) *Note: Dosing interval is determined by CrCl and desired trough levels; see AHS vancomycin dosing policy for details*

OR
- linezolid 600 mg IV every 12 hours

*Option 3 (for polymicrobial infection and penicillin allergy; (*see AHS Beta Lactam Allergy Antimicrobial Stewardship Backgrounder for further details*):*

- ciprofloxacin 400 mg IV every 12 hours

AND

- metronidazole 500 mg IV every 12 hours

AND

- vancomycin (25 mg/kg) _____ mg IV loading dose (no maximum); followed by maintenance dose of (15 mg/kg) _____ mg (maximum 2 grams / dose) *Note: Dosing interval is determined by CrCl and desired trough levels; see AHS vancomycin dosing policy for details*

Diabetic Foot Infection complicated by ulcer / fistula / drainage

(For uncomplicated cellulitis, refer to recommendations above)

Mild Infection

Recommended duration: 7 to 14 days, according to clinical response

Choose ONE of the 4 options:

Option 1:

- cephaLEXIN 500 mg PO QID

OR *for patients with higher BMI or more extensive infection*

- cephaLEXIN 1000 mg PO QID

AND

- metroNIDAZOLE 500 mg PO BID

Option 2:

- amoxicillin / clavulanate 875 mg PO BID

Option 3 (if MRSA suspected):

- metroNIDAZOLE 500 mg PO BID

AND

- doxycycline 100 mg PO BID

OR

- trimethoprim / sulfamethoxazole (Septra) 2 tab DS PO BID *in addition to antibiotics listed as Option 1 or Option 2*

*Option 4 if true beta-lactam allergy (*see AHS Beta Lactam Allergy Antimicrobial Stewardship Backgrounder for further details*):*

- clindamycin 450 mg PO QID

AND

- ciprofloxacin 750 mg PO BID

Moderate to Severe Infection

Recommended duration: 14 to 21 days, according to clinical response

Choose ONE of the 3 options:

Option 1:

- ceFAZolin 2 grams IV every 8 hours

AND

- metroNIDAZOLE 500 mg PO BID

*Option 2 if true beta-lactam allergy (*see AHS Beta Lactam Allergy Antimicrobial Stewardship Backgrounder for further details; *treatment duration 14 to 21 days):*

- ☐ clindamycin 600 mg IV every 8 hours

AND

- ☐ ciprofloxacin 750 mg PO every 12 hours

Option 3 (if MRSA suspected; treat for 14 to 21 days):

- ☐ vancomycin (25 mg/kg) _____ mg IV loading dose (no maximum) followed by (15 mg/kg) _____ mg IV maintenance dosing (maximum 2 grams / dose)
  Note: Dosing interval is determined by CrCl and desired trough levels; see AHS vancomycin dosing policy for details

AND

- ☐ cefTRIAXone 1 gram IV daily

AND

- ☐ metroNIDAZOLE 500 mg PO BID

Limb-Threatening Infection

Recommended duration: 14 to 21 days, according to clinical response

Choose:

- ☐ vancomycin (25 mg/kg) _____ mg IV loading dose (no maximum) followed by (15 mg/kg) _____ mg IV maintenance dosing (maximum 2 grams / dose)
  Note: Dosing interval is determined by CrCl and desired trough levels; see AHS vancomycin dosing policy for details

AND *Choose ONE of:*

- ☐ piperacillin / tazobactam 3.375 grams IV every 6 hours
  OR
- ☐ imipenem 500 mg IV every 6 hours

Nonopiate Analgesia

Oral

- ☐ acetaminophen 975 mg OR 1000 mg PO once
- ☐ acetaminophen 325 mg to 1000 mg PO every 4 hours PRN for pain (maximum 3000 mg/day)
- ☐ acetaminophen tab _____ mg PO _____ (maximum 3000 mg/day)
  Suggest 325 mg to 650 mg for mild to moderate pain, 975 mg to 1000 mg for moderate to severe pain

- ☐ ibuprofen 400 mg PO once
- ☐ ibuprofen 200 to 400 mg PO every 6 hours PRN for pain (maximum 1200 mg/day)
- ☐ ibuprofen _____ mg PO _____ (maximum 1200 mg/day)
  Suggest 200 mg for mild to moderate pain, 400 mg for moderate to severe pain

Opiate Analgesia

For "susceptible patients" defined as elderly, frail, low body mass, systemically unwell, or on medications known to cause sedation or lower blood pressure we recommend decreasing narcotic dosing by 50%.

☑ Contact physician or nurse practitioner for reassessment if pain not controlled after administration of maximum prescribed dosage.

Oral

Maximum dosage of acetaminophen from all sources not to exceed 3000 mg per day

- ☐ acetaminophen 325 mg/caffeine 15 mg/codeine 30 mg 2 tabs PO once
- ☐ acetaminophen 325 mg/caffeine 15 mg/codeine 30 mg 1 to 2 tabs PO every 4 hours PRN for pain
- ☐ acetaminophen 325 mg/caffeine 15 mg/codeine 30 mg _____ tabs PO every _____ hours PRN for pain

- ☐ oxyCODONE 5 mg/acetaminophen 325 mg 2 tabs PO once
- ☐ oxyCODONE 5 mg/acetaminophen 325 mg 1 to 2 tabs PO every 4 hours PRN for pain
- ☐ oxyCODONE 5 mg/acetaminophen 325 mg _____ tabs PO every _____ hours PRN for pain

- ☐ HYDROmorphone 1 mg PO once
- ☐ HYDROmorphone 1 to 2 mg PO every 4 hours PRN for pain
- ☐ HYDROmorphone _____ mg PO every _____ hours PRN for pain
  Suggest 1 mg for moderate pain and 2 mg for severe pain

Parenteral

- ☐ HYDROmorphone 1 mg IV once
- ☐ HYDROmorphone 0.5 to 1 mg IV every 10 minutes PRN for pain (maximum 3 mg total)
- ☐ HYDROmorphone _____ mg IV every _____ minutes PRN for pain
  Suggest 0.5 mg for moderate pain and 1 mg for severe pain

- ☐ morphine 5 mg IV once
- ☐ morphine 2.5 to 5 mg IV every 10 minutes PRN for pain (maximum 15 mg total)
- ☐ morphine _____ mg IV every _____ minutes PRN for pain
  Suggest 2.5 mg for moderate pain and 5 mg for severe pain

- ☐ fentaNYL 50 mcg IV once
- ☐ fentaNYL 25 to 50 mcg IV every 5 minutes PRN for pain (maximum 200 mcg total)
- ☐ fentaNYL _____ mcg IV every _____ minutes PRN for pain
  Suggest 25 mcg for moderate pain and 50 mcg for severe pain

Antiemetics

Avoid dimenhyDRINATE in patients 65 years of age or older due to increased risk of side effects including delirium. Suggest 25 mg for mild/moderate nausea, 50 mg for moderate/severe nausea

- ☐ dimenhyDRINATE 50 mg PO once
- ☐ dimenhyDRINATE 25 to 50 mg PO every 4 hours PRN for nausea/vomiting
- ☐ dimenhyDRINATE _____ mg PO every _____ hours PRN for nausea/vomiting

- ☐ dimenhyDRINATE 50 mg IV once
- ☐ dimenhyDRINATE 25 to 50 mg IV every 4 hours PRN for nausea/vomiting
- ☐ dimenhyDRINATE _____ mg IV every _____ hours PRN for nausea/vomiting

Oral administration or slow infusion via IVPB are preferred for metoclopramide to reduce the risk of akathisia. Suggest 5 mg for mild/moderate nausea or if CrCl less than 40 mL/min; 10 mg for moderate/severe nausea, and CrCl over 40 mL/min

- metoclopramide 10 mg PO once
- metoclopramide 5 to 10 mg PO every 6 hours PRN for nausea/vomiting
- metoclopramide _____ mg PO every _____ hours PRN for nausea/vomiting

- metoclopramide 10 mg IVPB once
- metoclopramide 5 to 10 mg IVPB every 6 hours PRN for nausea/vomiting
- metoclopramide _____ mg IVPB every _____ hours PRN for nausea/vomiting

4 mg starting dose recommended for IV ondansetron
Avoid ondansetron in patients with prolonged QTc interval

- ondansetron 4 mg IV once
- ondansetron 4 mg IV every 8 hours PRN for nausea/vomiting
- ondansetron _____ mg IV every _____ hours PRN for nausea/vomiting

- ondansetron tab 8 mg PO every 8 hours PRN for nausea/vomiting
- ondansetron tab _____ mg PO every _____ hours PRN for nausea/vomiting

Due to high cost, recommend reserving ondansetron DISINTEGRATING tab for actively vomiting patients without an IV

- ondansetron DISINTEGRATING tab 8 mg PO every 8 hours PRN for nausea/vomiting
- ondansetron DISINTEGRATING tab _____ mg PO every _____ hours PRN for nausea/vomiting

Patient Care

Safety and Precautions

- Contact isolation precautions *(for MRSA, VRE)*

Transitions and Referrals

- Consult: Infectious Diseases
- Consult: Transition Services (re: Home care / Wound care referral)
- Home Parenteral Therapy Program (HPTP) Referral [if available]

Discharge

- MD to RN: Please give cellulitis information sheet to patient prior to discharge

Clinical Decision Support

1. Refer to the 'Bugs & Drugs' mobile app or Bugs & Drugs website www.bugsanddrugs.org for suggested antimicrobial regimens for simple cellulitis and specific clinical settings (abscess, suspected necrotizing infection, diabetic, vascular insufficiency, bites, immunocompromised patients).

2. Button/Link: "Research has suggested that bilateral lower leg cellulitis is very rare. Patients with swelling and redness of both legs most likely have another condition, such as dermatitis resulting from leg swelling, varicose veins or contact allergies. To ensure appropriate treatment, doctors must consider the likelihood of diagnoses other than cellulitis when evaluating swelling and redness of the lower legs. Misdiagnosis of bilateral cellulitis can lead to overuse of antibiotics and subject patients to potentially unnecessary hospital stays." - Choosing Wisely, American Academy of Dermatology

3. Button/Link: "Avoid antibiotics and wound cultures in emergency department patients with uncomplicated skin and soft tissue abscesses after successful incision and drainage and with adequate medical follow-up. Skin and soft tissue infections are a frequent reason for visiting an emergency department. Some infections, called abscesses, become walled off and form pus under the skin. Opening and draining an abscess is the appropriate treatment; antibiotics offer no benefit. Even in abscesses caused by Methicillin-resistant Staphylococcus aureus (MRSA), appropriately selected antibiotics offer no benefit if the abscess has been adequately drained and the patient has a well-functioning immune system. Additionally, culture of the drainage is not needed as the result will not routinely change treatment." - Choosing Wisely, American College of Emergency Physicians

Rural Considerations

No specific rural considerations are required apart from access to imaging if required.

Disposition Planning

Cellulitis is a condition unlikely to require admission.

ALERT: Outpatient therapy is recommended for those without signs of sepsis or systemic infection, altered mental status, or hemodynamic instability. Hospitalization can be considered for those with: suspicion of deeper or necrotizing infection, poor adherence to therapy, severely immunocompromised patients, failing outpatient treatment.

Patient Handout:

- MyHealth.Alberta.ca: Cellulitis

Analytics

Outcome Measure#1

Name of Measure	# of times order set/protocol 'Cellulitis Adult Emergency Department Orders' used
Definition	For all patients with Cellulitis, number of times orderset 'Cellulitis Adult Emergency Department Orders' is used. Overall, by region, by sites, and by units Requires: ● Number (%) of ED patients triaged with cellulitis ● Number (%) of ED patients (by site/zone/hospital type or location [e.g. inner city]) for whom this order set is applied
Rationale	Intended to measure if the order set cited in the knowledge topic is being used and what % of time for the indicated disease or condition. May indicate areas with adoption issues or gaps in topic content.
Notes for Interpretation	Health record must have coding for disease/condition, consider timing of roll out of provincial CIS vs paper order sets.

Outcome Measure#2

Name of Measure	% of time cellulitis patients treated with IV vs PO antibiotics
Definition	What % of time where cellulitis patients treated with IV vs PO antibiotics
Rationale	Intravenous antibiotics can be warranted in complicated infections and susceptible hosts, including but not limited to the following circumstances: ● Moderate or severe cellulitis (one or more SIRS criteria) ● Signs of systemic toxicity ● Rapid progression of erythema ● Immunocompromise ● Proximity to an indwelling device or prosthetic ● Persistence or progression despite appropriate oral treatment for at least 48 hours

Outcome Measure#3

Name of Measure	% of time where cellulitis patients treated with MRSA coverage
Definition	What % of time where cellulitis patients treated with MRSA coverage Requires: • positive wound culture and susceptibility
Rationale	Consider empiric MRSA coverage for the following: 1. Prior episode of MRSA-proven infection 2. Presence of MRSA-risk factors (see below risk factors list) 3. Recurrent infection patient with predisposition to infection 4. Purulent cellulitis (until C&S available to guide further treatment)

Outcome Measure#4

Name of Measure	% of time where cellulitis patients treated with antibiotic regimens not included in order set
Definition	What % of time where cellulitis patients treated with antibiotic regimens not included in order set

Outcome Measure#5

Name of Measure	ED Cellulitis Patient Admit/Discharge/Transfer Measures
Definition	Emergency department length of stay, % of patients admitted (ward, ICU, OR), % patients were consulted, 72hr revisit for admission. Can be measured from the time a patient is registered, where they were registered and time to discharge/readmission.
Rationale	Shorter length of stay is likely associated with greater adherence to guidelines on the necessity of imaging and parenteral therapy for simple cellulitis.

Outcome Measure#6

Name of Measure	Proportion of patients failing initial antibiotic treatment
Definition	Proportion of patients with confirmed cellulitis that received a full course of prescribed antibiotics and cellulitis did not resolve.

Outcome Measure#7

Name of Measure	Proportion of patients referred to home parenteral therapy program (HPTP)
Definition	Proportion of patients referred to HPTP can be measured in terms of the number of overall cellulitis diagnosis (ICD codes from discharged ED MD charts) and the proportion of those that are referred to HPTP.
Rationale	Proportion of patients referred to HPTP is also a surrogate for the appropriateness of initiation of parenteral therapy for simple cellulitis.

Clinical Questions & Recommendations

Clinical Question #1: What is the microbiology of an uncomplicated cellulitis infection?
Clinical Recommendation #1: In immunocompetent hosts, the most common pathogens are beta-hemolytic streptococci and S. aureus, including MRSA. Gram negative bacilli are implicated in a minority of cases. Cultures of blood or cutaneous aspirates, biopsies, or swabs are not routinely recommended (IDSA). However, cellulitis marked by purulent drainage and pustules is associated with an increased probability of MRSA and should be swabbed and cultured.

Quality of Evidence: moderate
Strength of Recommendation: strong

References:

1. UpToDate: Cellulitis and Erysipelas (Accessed January 19, 2017) https://www.uptodate.com/contents/cellulitis-and-erysipelas-skin-infections-the-basics
2. Baron EJ, Miller JM, Weinstein MP, et al. A guide to utilization of the microbiology laboratory for diagnosis of infectious diseases: 2013 recommendations by the Infectious Diseases Society of America (IDSA) and the American Society for Microbiology (ASM). *Clin Infect Dis*. 2015;57(4):e22-e121.IDSA and American Society for Microbiology (ASM): A guide to utilization of the microbiology laboratory for diagnosis of infectious diseases (2013)
3. Sartelli M, Malangoni MA, May AK, et al.World Society of Emergency Surgery (WSES): Guidelines for management of skin and soft tissue infections. *World J Emerg Surg*. 2014;9(1):57
4. Raff A, Kroshinsky D. (2016) Cellulitis: A Review. *JAMA*. 2016; 316(3): 325-337.

Clinical Question #2: What is the recommendation for treating “bilateral leg cellulitis”?
Clinical Statement #2: Research has suggested that bilateral lower leg cellulitis is very rare. Patients with swelling and redness of both legs most likely have another condition, such as dermatitis resulting from leg swelling, varicose veins or contact allergies. To ensure appropriate treatment, doctors must consider the likelihood of diagnoses other than cellulitis when evaluating swelling and redness of the lower legs. Misdiagnosis of bilateral cellulitis can lead to overuse of antibiotics and subject patients to potentially unnecessary hospital stays.

Quality of Evidence: moderate
Strength of Recommendation: strong

References:

1. American Academy of Dermatology. Don't routinely use antibiotics to treat bilateral swelling and redness of the lower leg unless there is clear evidence of infection. Choosing Wisely. Published 2015. Updated 2016. Accessed June 21, 2017.

Clinical Question #3: How can cellulitis be diagnosed and classified?
Clinical Question #3: Cellulitis can initially be dichotomized as purulent or non-purulent, with the clinical importance being that purulent cellulitis has a significantly higher prevalence of staphylococcus aureus (MSSA or MRSA) as the causative agent. Purulent cellulitis should have purulent drainage sent for bacterial culture to diagnose MRSA.

Both purulent and non-purulent cellulitis can then be classified as mild, moderate, or severe based on the presence and number of traditional SIRS criteria.
(see Figure 1)

Quality of Evidence: moderate
Strength of Recommendation: strong

References:

1. Raff A, Kroshinsky D. (2016) Cellulitis: A Review. *JAMA*. 2016; 316(3): 325-337.

Clinical Question #4: What antibiotics, duration of treatment, and route of administration are recommended for the treatment of mild, non-purulent cellulitis?
Clinical Statement #4: Document the baseline exam findings. A helpful practice is to demarcate the area of erythema directly on the patient with a dark marker.

Mild, non-purulent cellulitis requires approximately 5 days of oral therapy, but duration can be tailored to clinical response. Extension to up to 14 days may be required for slow responders.

TABLE 1: Empiric antimicrobial therapy for mild, nonpurulent cellulitis (including beta-hemolytic streptococci and MSSA but not MRSA)

Medication	**Adult Dosing**
cephaLEXIN	500 to 1000 mg PO QID x 5 - 10 days
clindamycin (if beta-lactam allergy)	300 to 600 mg PO QID x 5 - 10 days

Quality of Evidence: moderate
Strength of Recommendation: strong

References:

1. Bugs & Drugs, wwwbugsanddrugs.org (Accessed *date*)
2. Stevens DL, Bisno A, Chambers HF, et al; for Infectious Diseases Society of America (IDSA). Practice guidelines for the diagnosis and management of skin and soft tissue infections. *Clin Infect Dis*. 2014;59(2):e10-52.
3. UpToDate: Cellulitis and Erysipelas (Accessed January 19, 2017) https://www.uptodate.com/contents/cellulitis-and-erysipelas-skin-infections-the-basics
4. Sartelli M, Malangoni MA, May AK, et al.World Society of Emergency Surgery (WSES): Guidelines for management of skin and soft tissue infections. *World J Emerg Surg*. 2014;9(1):57
5. Calgary Spectrum Mobile App (Accessed January 2017)

Clinical Question #5: What clinical features are typical of erysipelas and how is it treated?
Clinical Statement #5: Erysipelas is a more superficial infection of the dermis and lymphatics compared to cellulitis, which affects the deeper dermis and subcutaneous tissues. Erysipelas is characterized by acute onset, fever and/or chills, a well-demarcated and elevated edge, as well as

ear involvement (the ear contains no deeper dermis). The antibiotic treatment of erysipelas differs slightly.

TABLE 2: Antimicrobial therapy for erysipelas	
Medication	**Adult Dosing**
Mild or no systemic symptoms: penicillin V potassium **OR** amoxicillin **Beta-lactam allergy:** clindamycin	 300 to 600 mg PO QID x 5 days 500 mg PO TID x 5 days 300 mg PO QID x 5 days
Moderate-severe systemic symptoms: penicillin G **OR** ampicillin **Beta-lactam allergy:** clindamycin **OR** vancomycin	 2 to 4 million units IV q4h or q6h x 5 - 10 days 1 to 2 grams IV q6h x 5 - 10 days 600 mg IV q8h x 5 - 10 days 15 mg/kg IV q12h x 5 - 10 days

Quality of Evidence: moderate
Strength of Recommendation: moderate

References:

1. UpToDate: Cellulitis and Erysipelas (Accessed January 19, 2017) https://www.uptodate.com/contents/cellulitis-and-erysipelas-skin-infections-the-basics
2. Bugs & Drugs App, accessed July 6, 2017

Clinical Question #6: When is parenteral therapy warranted in the treatment of cellulitis?
Clinical Statement #6: Intravenous antibiotics can be warranted in complicated infections and susceptible hosts, including but not limited to the following circumstances:

- Moderate or severe cellulitis (one or more SIRS criteria)
- Signs of systemic toxicity
- Rapid progression of erythema
- Immunocompromise
- Proximity to an indwelling device or prosthetic
- Persistence or progression despite appropriate oral treatment of over 48 hours
- Moderate to severe facial or preseptal/periorbital cellulitis

TABLE 3: Parenteral antimicrobial therapy for treatment of skin and soft tissue infections (MSSA and streptococcus)	
Medication	**Adult Dosing**
Inpatient Therapy: ceFAZolin	2 grams IV every 8 hours x 5 - 10 days
Outpatient Therapy: ceFAZolin **AND** probenecid	2 grams IV once 2 grams PO daily (given 30 minutes prior to ceFAZolin) OR 1 gram PO BID (first dose given 30 minutes prior to ceFAZolin and 2nd dose given 12 hours later)
Beta-lactam allergy: clindamycin	600 mg IV every 8 hours

Quality of Evidence: moderate
Strength of Recommendation: strong

References:

1. Stevens DL, Bisno A, Chambers HF, et al; for Infectious Diseases Society of America (IDSA). Practice guidelines for the diagnosis and management of skin and soft tissue infections. *Clin Infect Dis*. 2014;59(2):e10-52.
2. UpToDate: Cellulitis and Erysipelas (Accessed January 19, 2017) https://www.uptodate.com/contents/cellulitis-and-erysipelas-skin-infections-the-basics

Clinical Question #7: What factors should prompt empiric MRSA coverage in cellulitis?

Clinical Statement #7:

Consider empiric MRSA coverage for the following:

1. Prior episode of MRSA-proven infection
2. Presence of MRSA-risk factors (see below risk factors list)
3. Recurrent infection patient with predisposition to infection
4. Purulent cellulitis (until C&S available to guide further treatment)

Risk factors for methicillin-resistant staphylococcus aureus (MRSA) colonization

Hospital Acquired:

1. Dialysis patient
2. Nursing home residence
3. Hospitalization in last 90 days
4. MRSA outbreak setting
5. Diabetes

Community Acquired:

1. Known contact (household member has MRSA)
2. Homelessness
3. Incarceration
4. First Nations
5. Hospital worker

Quality of Evidence: moderate

Strength of Recommendation: strong

References:

1. Stevens DL, Bisno A, Chambers HF, et al; for Infectious Diseases Society of America (IDSA). Practice guidelines for the diagnosis and management of skin and soft tissue infections. *Clin Infect Dis*. 2014;59(2):e10-52.
2. UpToDate: Cellulitis and Erysipelas (Accessed January 19, 2017) https://www.uptodate.com/contents/cellulitis-and-erysipelas-skin-infections-the-basics

Clinical Question #8: What are the oral and parenteral treatment recommendations for MRSA-suspected cellulitis?
Clinical Statement #8: Clindamycin and trimethoprim-sulfamethoxazole (TMP-SMX) have comparable efficacy for the treatment of uncomplicated skin infections. Options such as linezolid should be reserved for severe or refractory cases, generally requiring the input of infectious diseases, as careful monitoring is required.

TABLE 4: Options for oral treatment of suspected methicillin-resistant Staphylococcus aureus (MRSA)

Medication	**Adult Dosing**
ONE OF: cephaLEXIN **OR** clindamycin (if beta-lactam allergy)	 500 to 1000 mg PO QID x 5 - 10 days 300 to 600 mg PO QID x 5 days
AND ONE OF: trimethoprim-sulfamethoxazole DS (Septra) *(Each tab contains: sulfamethoxazole 800 mg and trimethoprim 160 mg)* **OR** doxycycline	 1 to 2 DS tab(s) PO BID 100 mg PO BID

TABLE 5: Parenteral antimicrobial therapy for treatment of skin and soft tissue infections due to methicillin-resistant staphylococcus aureus (MRSA) in adults

Medication	**Adult dosing**
vancomycin	15 mg/kg IV every 8 to 12 hours x 5 - 10 days

Quality of Evidence: moderate
Strength of Recommendation: strong

References:

1. Stevens DL, Bisno A, Chambers HF, et al; for Infectious Diseases Society of America (IDSA).: Practice guidelines for the diagnosis and management of skin and soft tissue infections. *Clin Infect Dis*. 2014;59(2):e10-52.
2. UpToDate: Cellulitis and Erysipelas (Accessed January 19, 2017) https://www.uptodate.com/contents/cellulitis-and-erysipelas-skin-infections-the-basics

Clinical Question #9: What non-antibiotic treatment considerations are there for cellulitis?
Clinical Statement #9:

- Demarcate the affected area prior to treatment to monitor progress
- Elevate the affected limb to decrease edema
- Hydrate the skin to avoid dryness and skin cracks
- Diagnose and treat predisposing conditions such as chronic fungal infections (tinea pedis), lymphedema, and chronic venous insufficiency
    - Compressive therapy and diuretic therapy may be beneficial

Quality of Evidence: weak
Strength of Recommendation: moderate

References:

1. Stevens DL, Bisno A, Chambers HF, et al; for Infectious Diseases Society of America (IDSA). Practice guidelines for the diagnosis and management of skin and soft tissue infections. *Clin Infect Dis*. 2014;59(2):e10-52.
2. UpToDate: Cellulitis and Erysipelas (Accessed January 19, 2017) https://www.uptodate.com/contents/cellulitis-and-erysipelas-skin-infections-the-basics

Clinical Question #10: After incision and drainage, which abscesses require antibiotic treatment?
Clinical Statement #10: For the majority of abscesses, Choosing Wisely Canada recommends the following: Avoid antibiotics and wound cultures in emergency department patients with uncomplicated skin and soft tissue abscesses after successful incision and drainage and with adequate medical follow-up.

Incision and drainage is adequate for the majority of abscesses under 2 cm in size. Consider antibiotic therapy in the following clinical circumstances:

- Multiple lesions or single abscess larger than 2 cm
- Extensive surrounding cellulitis
- immunosuppression
- Signs of systemic infection (e.g. fever > 38^{o}C)
- Inadequate clinical response to incision and drainage (I&D) alone
- Presence of indwelling medical device
- High risk of transmission to others (athlete, military personnel)

Clinicians should be aware that one large randomized controlled trial showed modest benefit of trimethoprim-sulfamethoxazole for the treatment of abscesses after I&D (absolute risk reduction 7% for cure at 7 to 14 days); however, the small benefit must be weighed against risks of antibiotics in general.
Gram stain and culture of pus from carbuncles and abscesses are recommended, but treatment without these studies is reasonable in typical cases.

Quality of Evidence: weak
Strength of Recommendation: strong

References:

1. American College of Emergency Physicians. Choosing Wisely. Published 2013. Accessed: June 21, 2017.

2. Talan DA, Mower WR, Krishnadasan A, Abrahamian M, Lovecchio F, Karras DJ, Steele MT, Rothman RE, Hoagland R, Moran GJ. Trimethoprim-sulfamethoxazole versus placebo for uncomplicated skin abscess. N Engl J Med. 2016;374(9):823-32.
3. http://www.choosingwisely.org/clinician-lists/american-college-emergency-physicians-antibiotics-wound-cultures-in-emergency-department-patients/

Clinical Question #11: Is irrigation or packing necessary for the treatment of abscesses?
Clinical Statement #11: Small studies have shown no benefit to irrigating simple abscesses, and that packing abscesses increases pain, requires more monitoring, and has not been shown to improve outcomes. It should be noted that the evidence in this area is weak, and clinical judgment and expert opinion continues to prevail in this area. Abscess wounds should generally be left to heal by secondary intention l.

Quality of Evidence: weak
Strength of Recommendation: weak

References:

1. Downey, KA. Technique for Incision and Drainage of Abscesses. UpToDate. https://www.uptodate.com/contents/technique-of-incision-and-drainage-for-skin-abscess. Accessed January 27, 2017.

Clinical Question #12: Which patient groups can be treated as outpatients?
Clinical Statement #12: Outpatient therapy is recommended for those with mild cellulitis, e.g. those without signs of sepsis or systemic infection, altered mental status, or hemodynamic instability (mild cellulitis). Hospitalization can be considered for those with: suspicion of deeper or necrotizing infection, poor adherence to therapy, severely immunocompromised patients, failing outpatient treatment.

Quality of Evidence: moderate
Strength of Recommendation: strong

References:

1. Stevens DL, Bisno A, Chambers HF, et al; for Infectious Diseases Society of America (IDSA).: Practice guidelines for the diagnosis and management of skin and soft tissue infections. *Clin Infect Dis*. 2014;59(2):e10-52.
2. UpToDate: Cellulitis and Erysipelas (Accessed January 19, 2017) https://www.uptodate.com/contents/cellulitis-and-erysipelas-skin-infections-the-basics

Clinical Question #13: For outpatient treatment, what is the role of probenecid?
Clinical Statement #13: Several clinical studies have shown that probenecid (1000 mg PO) can be given 15 to 30 minutes prior to ceFAZolin (1 to 2 grams IV) to increase the duration of action of the antibiotic. Thus, cefazolin and probenecid can be administered once daily with efficacy equal to that of a once daily cephalosporin for uncomplicated skin and soft-tissue infections.

The efficacy of probenecid is dose dependent, and higher antibiotic serum levels are demonstrated with 2 grams PO daily dosing compared to 1 gram PO daily dosing. If tolerated, patients should receive a total of 2 grams PO daily, either as a single dose if tolerated, or two 1 gram doses every 12 hours, with the initial dose given approximately 30 minutes prior to ceFAZolin.

Clinicians should be aware of probenecid's contraindications, which include but are not limited to renal failure (creatinine clearance is below 50 mL/min), and concomitant acute gout episode. Drug interactions include, and are not limited to: sulfonylureas, methotrexate, NSAIDs, quinolones. For complete drug information, clinicians can refer to Alberta Health Services endorsed drug information guides, LexiComp or Micromedex.

Quality of Evidence: strong
Strength of Recommendation: moderate

References:

1. Alberta Health Services, Drug Utilization & Stewardship, Pharmacy Services.: Antimicrobial Stewardship Backgrounder, Issue 11, April 2016.

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