Cook Children's Medical Center
Clinical Excellence Committee and Antibiotic Stewardship Committee

Evidence based pathway for the diagnosis and management of bacterial skin and soft tissue infections (SSTI).

Goals:

-To deliver high quality, evidence-based care using the latest literature and national guidelines
-To recognize the causative organisms and clinical manifestations of skin and soft tissue infections
-To apply the appropriate methods for diagnosis and management and predict potential complications
-To reduce unnecessary interventions that may cause harm, increase cost or increase length of stay.
-To decrease variation in care between providers
-To have more judicious and appropriate use of antibiotics

Inclusion Criteria:

-Previously healthy children and adolescents from 3 months to 18 years of age with cellulitis, impetigo, abscess, scalded skin syndrome, toxic shock syndrome, necrotizing fasciitis and animal or human bites.

Exclusion Criteria:

-Patients < 3 months of age
-Immunocompromised patients
-Infections involving the following sites: Face, eyes, neck, perineum, bone or joints
-Staphylococcal or streptococcal bacteremia
-Patient with Surgical Site Infections (CNS, GI, GU, trauma)
-Pressure ulcers
-Dental abscesses
-Major trauma
-Hospital acquired skin infections
-Burns
-Fungal, viral, ectoparasites

Background:

This guideline is of utmost importance given the frequency and severity of skin infections and the emergence of resistance to many antimicrobial agents. Some patients have simple cellulitis that is easily treated with antibiotics, while others have more complicated infections that require incision and drainage or hospitalization.
Staphylococcus aureus is one of the most common organisms associated with these infections, and the emergence of methicillin resistant *S. aureus* (MRSA) represents a significant challenge in treatment [1] [2] [3].
Group *A streptococcus* (GAS), also known as S*treptococcus pyogenes,* is the second most common cause of skin infections [4].

There is wide variability in the practice and management of skin infections despite the 2014 Infectious Disease Society of America (IDSA) practice guidelines for the diagnosis and management of skin and soft tissue infections (SSTI) [1] [5] [6].

The intent of this guideline is to standardize, to the extent possible, the diagnosis and management of such infections at Cook Children's Medical Center. This is a guide and does not replace clinical judgement.

General Principles:
Cellulitis and abscesses or both are among the most common SSTI.

Basic Definitions [7] [8]:

- **Non-Purulent infections:**
  - **Cellulitis and Erysipelas:** Infection of the skin (erysipelas is more superficial while cellulitis is deeper). They are characterized by pain, erythema, edema and warmth. An example photo of this can be found on the Red Book by clicking here and here.

- **Purulent infections:**
  - **Impetigo:** Infection of the superficial layer of the skin. It classically has a honey crust appearance. An example photo of this can be found on the Red Book by clicking here or by referring to Appendix A.

  - **Bullous impetigo**: a form of impetigo that is primarily seen in young children. Initially, the vesicles enlarge to form bullae with clear yellow fluid. Over time the fluid becomes darker. Once the bullae rupture, they leave a thin brown crust [9]. An example photo of this can be found on the Red Book by clicking here or by referring to Appendix A.

  - **Folliculitis**: Infection of the hair follicles. An example photo of this can be found on the Red Book by clicking here or by referring to Appendix A.

  - **Purulent (suppurative) cellulitis**: cellulitis associated with drainage or exudate (currently or by history). It often develops around a wound, furuncle, abscess or carbuncle. An example photo of this can be found on the Red Book by clicking here.

  - **Abscess:** a cavity filled with pus that results from a bacterial infection. It can present with or without cellulitis. An example photo of this can be found on the Red Book by clicking here.
    - Abscesses involve the epidermis, dermis and deeper skin tissue
    - Furuncle (boil) is a small abscess of a deep hair follicle
    - Carbuncle is a larger/deeper abscess formed by coalescence of multiple furuncles

- Abscesses most commonly evolve by local extension of a primary infection in the epidermis or dermis (furuncle, carbuncle) or from a site of disease or injury, a foreign body or occasionally by hematogenous spread (ex: furuncles, carbuncles, cellulitis with sub cutaneous abscess)

Microbiology:

MRSA is the most common identifiable cause of SSTI in many communities and should be suspected in most children, along with methicillin susceptible *S. aureus* (MSSA) and GAS. The relative frequency of *S. aureus* compared to GAS depends upon the type of SSTI [4]:

- Non purulent cellulitis /erysipelas is usually due to GAS, although studies are limited due to the difficulty culturing from these infections and with blood cultures rarely positive [10]. Therefore, β- lactam therapy is optimal with high cure rates. See below for treatment recommendations.

- Purulent cellulitis and abscess may be caused by MSSA, MRSA or GAS. MRSA represents up to 36% of *Staphylococcus aureus* isolates cultured at Cook Children's, based on the or by referring to Appendix B.

- Consider risk for MRSA infection: [11]
  - History in the last 6 months of:
    - MRSA colonization/infection in the patient
    - MRSA in the family
    - Recent prolonged hospitalization
    - Recurrent skin infections: boils, pustules, "spider bites"
  - Sepsis

- MRSA prevalence in the community and in Cook Children's Medical center CMC antibiogram 2023 or by referring to Appendix B.

- Other considerations:
  - **Staphylococcal scalded skin syndrome (SSSS)**: Results in loss of keratinocyte cell adhesion and leads to blistering of upper layer of the skin. It is associated with *Staphylococcus aureus* with exotoxin production (MSSA predominantly reported in the literature). An example photo of this can be found on the Red Book by clicking here or by referring to Appendix A.

  - **Necrotizing fasciitis**: This is an infection affecting the deep layer of the superficial fascia that spreads rapidly, resulting in high morbidity and mortality. It is often poly microbial (*Streptococcus sp*, *Staphylococcus sp*, gram negative, anaerobes). It can happen in patients that are

immunosuppressed, recently had surgery, have diabetes or are healthy. These patients appear ill with signs of systemic infection and will often have pain and toxicity that is out of proportion to their local findings. This is a surgical emergency. An example photo of this can be found on the Red Book by clicking here or by referring to Appendix A.

- **Toxic shock syndrome**: This could be secondary to GAS or *Staphylococcus aureus* (MSSA >> MRSA). It is characterized by rapid onset of fever, rash, hypotension and multi-organ system involvement. It is a toxin-mediated disease.

Diagnostic Testing:

1. Clinical presentation and physical exam
    a. Determine location of erythema, warmth and edema.
    b. Identify if induration or fluctuance are present. The latter is diagnostic of a fluid collection.
    c. Red streaking suggests lymphangitis.
    d. Determine signs of necrotizing infection:
        i. Very rapid spread and progression.
        ii. Bluish discoloration, blistering, pain out of proportion or beyond the edges of the lesion, skin anesthesia or gas in the tissue.
    e. When first examining, draw a line (mark date and time) around lesion's borders, if not already present.
    f. Vital signs (determine presence of fever, tachycardia, tachypnea, hypotension)
    g. Assess general appearance: signs of more serious infection versus localized.

2. Gram stain and culture of skin and subcutaneous suppurative lesions is recommended when feasible, for fluid containing lesions, to identify organisms and check for susceptibilities [5, 12]. No routine susceptibilities for anaerobes (Anaerobic antibiogram).

3. Routine labs including CBC, CRP and blood culture are not needed in most children, unless moderate or severe infection [1], [5]. (See disease severity definition below).

4. Consider photograph to be added to chart in media (Epic).

5. Consider soft tissue ultrasound to evaluate for fluid collections in indurated cellulitis if not clearly fluctuant/draining [13].

Disease severity:

SSTI can be categorized depending on severity as mild, moderate or severe depending on physical exam, systemic signs and symptoms [1]:

- **Mild infection**: no fever, small area of infection, does not include hands or face.

- **Moderate infection**: fever, progressive infection, treatment failure, infection on hands or face, surgical drainage required or patient looks ill.

- **Severe infection**: fever, rapidly progressive infection (within hours), clinical signs of deeper infection, organ dysfunction, toxic or septic appearance or limb threatening infection.

Treatment recommendations:

Consider disease severity and risk criteria to decide type of intervention, antibiotic therapy and need for inpatient care. The following recommendations are consistent with the guidelines from the American Academy of Pediatrics (AAP) and IDSA [1, 5, 12, 14]

Incision and Drainage:

- Always necessary for purulent infections that have not drained spontaneously. This may be the only therapeutic approach necessary in single lesions that are not associated with cellulitis or systemic symptoms[5], [8], [15].
- Application of moist heat may help promote drainage of small lesions that are not amenable for incision and drainage.
- While individual clinic resources and provider comfort should ultimately determine where an abscess is drained, strongly consider sending patients to ED for further evaluation and management in the following cases:
    i. Patients <6 months
    ii. Large (>5 cm) and/or deep abscesses
    iii. Abscesses that involve face, hand, perineum/genitalia or anterior abdominal wall.
    iv. Lesions near an implanted device
    v. Multiple sites of infection
    vi. History of underlying medical conditions such as cyanotic congenital heart disease
    vii. Signs of systemic infection
    viii. High patient anxiety

Low Risk Purulent Infections:[5], [8]

1. Patient ≥6 months of age
2. Simple abscess *(<2 cm)* in areas other than the face or neck
3. Adequate I&D
4. No fever
5. Well appearing
6. No significant comorbidities
7. Follow-up assured

Admission Criteria: [4]

1. Systemically ill
2. Unable to tolerate PO
3. Failed PO therapy > 48 hours (Consider adherence vs inadequate antimicrobial coverage)
4. Rapidly progressing lesions
5. Need pain control or wound care
6. Consider if patient < 6 months of age
7. Adequate follow-up not available
8. Concern for necrotizing fasciitis
9. Concern for Staphylococcus scalded skin syndrome
10. Concern for Toxic shock syndrome

Discharge Criteria: [4]

1. Clinical improvement
2. Improving fever curve
3. Tolerating PO (*Diet and able to take medications*)
4. Adequate follow-up

Antimicrobial recommendations:

1. **Empiric Ambulatory therapy: see table 1a and 1b.**
   a) **No antibiotics:** Consider not prescribing oral antibiotics for simple skin abscess (< 2 cm) that can be drained successfully with no concerning clinical signs [5], [16]. Please note that this is somewhat controversial and the provider should take into consideration the use of antibiotics while balancing the risk of side effects [17].
   b) **Topical antibiotic ointment (mupirocin)** can be used in the treatment of mild presentations of impetigo and folliculitis or along with oral antibiotics for more severe presentations.
   c) **Oral cephalexin** should be prescribed for outpatient simple cellulitis without an abscess or drainage or after failure of topical antibiotic ointment (>48 hours) [18], [19]. There is no benefit from adding trimethoprim sulfamethoxazole (TMP-SMX). Prescribe clindamycin if allergy to β- lactams or failure with cephalexin.
   d) **Oral clindamycin** should be prescribed for outpatient therapy of purulent cellulitis or cellulitis that has not responded to anti-MSSA antibiotics after 48 hours.
   e) **Oral clindamycin** should also be prescribed for outpatient treatment of abscesses that were unable to be completely drained.
   f) **Oral clindamycin** may be more effective than TMP-SMX in preventing recurrent MRSA SSTI [20].
   g) When using Clindamycin empirically, keep in mind that 20% of *Staphylococcus aureus* isolates at Cook Children's are resistant to clindamycin (MRSA and MSSA respectively). This percentage has been overall stable over the last several years. (CCMC antibiogram, 2023).

h) In general, caution is required when clindamycin is prescribed in patients with known community MRSA infection because of inducible or constitutive clindamycin resistance [10].
i) **Oral TMP-SMX or doxycycline** should be considered if clindamycin resistant MRSA is suspected.
j) **Tetracycline** is NOT generally recommended as sole empirical therapy for a non-purulent cellulitis of unknown cause because of concerns regarding resistance of GAS.
k) **Oral amoxicillin-clavulanate** should be prescribed for animal and human bites. Use extended spectrum cephalosporin (such as cefdinir) or TMP-SMX and clindamycin in patients with β- lactam allergy.

2. **Empiric Inpatient therapy: see table 2.**
   a) **IV cefazolin** should be used for simple cellulitis without an abscess or drainage or after failure of PO antibiotics (>48 hour). Start clindamycin vs vancomycin in patients with β- lactam allergy.
   b) **IV clindamycin** should be used for inpatient treatment of purulent cellulitis or cellulitis that has not responded to anti-MSSA therapy, such as a β- lactam, after 48 hours. When using Clindamycin empirically, keep in mind that 20% of *Staphylococcus aureus* isolates at Cook Children's are resistant to clindamycin (MRSA and MSSA respectively). This percentage has been overall stable over the last several years. (CCMC antibiogram, 2023).
   c) **IV vancomycin** should be used for inpatient treatment of cellulitis in patients that are systemically ill or have failed other antibiotics that cover MRSA.
   d) **IV Linezolid** should be used in patients with β- lactam allergies or in those who are unable to use clindamycin/vancomycin.
   e) **IV Cefazolin, Vancomycin and Clindamycin** should be considered as simultaneous therapy if toxic shock syndrome is suspected. Consulting the Infectious Disease (ID) service is also recommended.
   f) **IV Ampicillin-Sulbactam** should be prescribed for animal or human bites. Use ceftriaxone or TMP-SMX and clindamycin in patients with β- lactam allergy.

3. **Alternate antibiotic choices:**
   a. If fresh or saltwater wounds, or other special circumstance, see table 3. Specific pathogens are suggested when infections follow exposure to seawater (*Vibrio vulnificus*), fresh water (*Aeromonas hydrophilia*) or aquaculture fish (*Streptococcus iniae*) [21]. Consider contacting infectious disease for further recommendations.

Detailed Antimicrobial Therapy:

- Table 1.a. Summary and recommendations for bacterial SSTI in the outpatient setting
- Table 1.b. Summary and recommendations for wound bites in the outpatient setting

- Table 2. Summary and recommendations for bacterial SSTI and wound bites in the inpatient setting.
- Table 3. Summary and recommendations for bacterial SSTI associated with water exposure

Treatment Duration: This is not well studied and depends on disease severity and clinical response**.** 5-7 day treatment courses are generally adequate for mild to moderate infections [4], [5] [22], while 7-14 day treatment courses can be considered for more severe infections [5, 10].
Clinical failure to an antibiotic should not be declared until 48-72 hours after initiation of that antibiotic [10].

Other patient care considerations for both outpatient and inpatient care:

a) Adjust antibiotics based on culture results and clinical course.
b) Reevaluate treatment if worsening symptoms or fever.
c) Provide wound care teaching, if needed.
d) Consider ID consult for severe infections.
e) Patient education, see patient handouts.
f) Ensure follow-up (in-person, telephone, telemedicine, MyChart, etc) within 48-72 hours for ambulatory patients.

Caregivers should be counseled regarding oral analgesics, warm compresses in the area and elevation of the affected area. Caregivers should also be counseled to contact their pediatrician or present to the emergency room (ER) if there are signs of worsening infection.

Recurrent skin infection and abscesses:
Recurrent SSTI associated with MRSA can pose a significant burden with publications reporting recurrent SSTI in 20 to 60% of patients treated for SSTI despite appropriate therapy [4],[23],[24] [25].

It is not clear whether recurrence represents auto-inoculation or a new infection. Recurrent episodes are usually treated the same way as the initial episode. Clindamycin therapy when MRSA isolates are susceptible has been shown to decrease the risk of recurrent disease, though the reasons for this are unclear [26], [27].

Decolonization is frequently recommended for recurrent staphylococcal infections, although neither the indication for its use nor its effectiveness in reducing risk of recurrent infection is clear [28], [11].

There are different decolonization methods described in the literature including nasal mupirocin, 4% chlorhexidine and/or dilute bleach baths [27]. The role of oral antibiotics for prophylaxis is limited [29]. Consider a staphylococcal decolonization regimen of twice daily intranasal mupirocin, daily chlorhexidine washes and daily decontamination of personal items such as towels, sheets and clothes for recurrent *S. aureus* [1]. Family

members should also be encouraged to undergo the decolonization protocol since MRSA household colonization has been reported to be a predictor of recurrence [30] [31]. A prescription for mupirocin can be given to the caregivers with the discharge instructions. See decolonization handout attached.

A recurrent abscess in a site of a previous infection should prompt consideration of other causes such as a pilonidal cyst and other skin conditions such as hidradenitis suppurativa, epidermolysis bullosa, acne conglobate or retained foreign material. Patients with recurrent abscesses since early childhood should undergo evaluation for an immunodeficiency such as a neutrophil disorder or hyper IgE syndrome, among others [1], [8].

Education for patients about decolonization:
- MRSA decolonization
-MRSA decolonization-maintenance

Noninfectious diseases differential diagnosis of subcutaneous tissue infections in infants and children to be considered in some cases [8]:

- **Acne conglobate (AC)**: This is an uncommon and severe form of acne. It is characterized by linking nodules, abscesses and cysts. It primarily affects the face, back and chest. Over time, it can cause significant scarring and disfiguring. An example photo of this can be found on Visual DX by clicking here or by referring to Appendix A.

- **Acne fulminans**: Also known as acne maligna. This is a rare, painful ulcerative form of acne with an abrupt onset and systemic symptoms. Its incidence is decreasing, possibly because of better treatments for acne. An example photo of this can be found on Visual DX by clicking here or by referring to Appendix A.

- **Hidradenitis suppurativa (HS)**: Also known as acne inversa. This is a painful, chronic, suppurative process involving the skin and subcutaneous tissue. It results from infra-infundibular follicular occlusion and secondary rupture of sebofollicular junction of the folliculopilosebaceous units, resulting in an inflammatory cascade. HS is neither contagious nor due to poor hygiene. HS occurs mostly in intertriginous areas (axillae, perineal, perianal, mammary and buttocks). It presents as recurrent painful nodules with purulent drainage and sinus formation. An example photo of this can be found on Visual DX by clicking here or by referring to Appendix A.

- **Majocchi's granuloma (MG):** This is a rare fungal infection of the dermis that is mainly caused by dermatophytes such as Tricophyton rubrum (>95%) or occasionally by Aspergillus species. It presents as a deep and persistent suppurative and granulomatous folliculitis that is mainly in exteremities. It can affect healthy individuals or immunocompromised hosts. It can be diagnosed by biopsy. An

example photo of this can be found on Visual DX by clicking here or by referring to Appendix A.

- **Factitial skin disease:** This is characterized by unusual patterns of skin lesions that do not conform to any known dermatologic condition and are consciously or subconsciously self-inflicted. Neurotic excoriations, acne exoriee, trichotillomania and dermatitis artefacta are the most common causes of this. It is usually associated with a psychiatric disorder and will require dermatological and psychiatric management.

- **Panniculitis**: This is a group of conditions associated with inflammation of the subcutaneous fat. It can have many different causes and the diagnosis is established by skin biopsy. An example photo of this can be found on Visual DX by clicking here or by referring to Appendix A.

- **Polyarteritis nodosa (PAN):** This is a blood vessel disease characterized by inflammation of small and medium sized arteries (vasculitis). Patients typically present with systemic symptoms involving the skin, kidneys, joints, muscles, nerves and/or gastrointestinal tract. Most cases are idiopathic. An example photo of this can be found on Visual DX by clicking here or by referring to Appendix A.

- **Purpura fulminans:** This involves intravascular thrombosis and hemorrhagic infarctions of the skin. It is rapidly progressive and is accompanied by vascular collapse and disseminated intravascular coagulation. It can be classified as: neonatal, idiopathic or infectious. An example photo of this can be found on Visual DX by clicking here or by referring to Appendix A.

- **Pyoderma gangrenosum** (PG): This is an uncommon neutrophilic dermatosis that most commonly presents with inflammatory ulcers of the skin. It can present at any age. The underlying factors that cause this disease are not well understood but possible aberrant neutrophil function, genetic susceptibility and/or dysregulation of the immune system could be contributing factors. The most common presentation is as a rapidly developing, painful purulent ulcer with a violaceous and undermined border. Other presentations include bullous, pustular or vegetative presentations. More than 50% of cases have an associated systemic disease, with the strongest associations being inflammatory bowel disease, hematologic disorders and arthritis. An example photo of this can be found on Visual DX by clicking here or by referring to Appendix A.

- **Sweet syndrome (i.e., acute febrile neutrophilic dermatosis):** This is an inflammatory disorder characterized by inflammatory papules, plaques or nodules in the skin, systemic symptoms and neutrophilic infiltration of the skin. Fever, leukocytosis and internal organ involvement can also occur. It has been associated with infection, malignancy and drug exposure. An example photo of this can be found on Visual DX by clicking here or by referring to Appendix A.

- **Pseudo-cellulitis:** Cellulitis that does not improve with antibiotics: This is a non-infectious inflammatory condition of the dermis and hypodermis. It can be associated with stasis, connective tissue disorders, leukemia cutis, contact dermatitis, drug reactions, bites (Jellyfish, scorpion, snake or spider bites) and some of the above conditions (panniculitis, sweet syndrome)[10].

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This guideline is intended to assist providers in decision making by providing the current state of evidence and recommendations for the management of pediatric Skin and Soft Tissue Infections (SSTI). This guideline is not meant to replace clinical judgement and will not be appropriate for all cases of pediatric SSTI.

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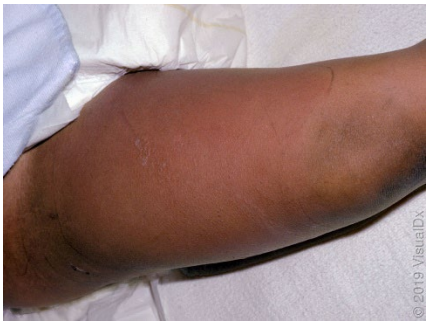
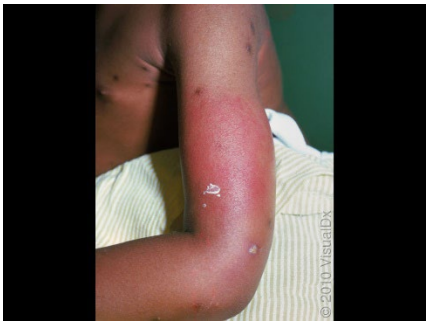
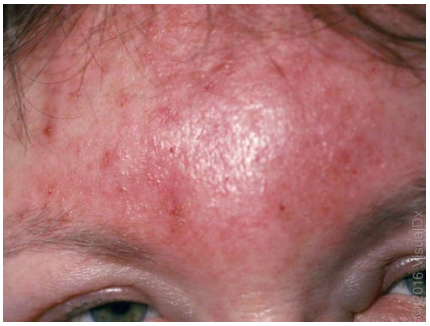
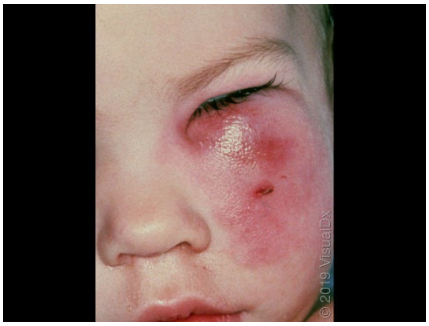
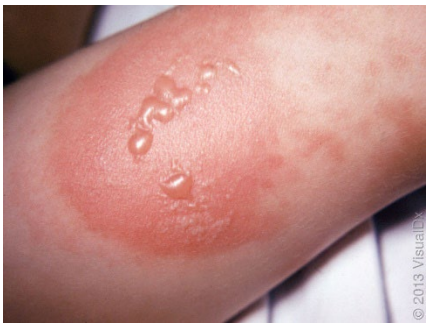
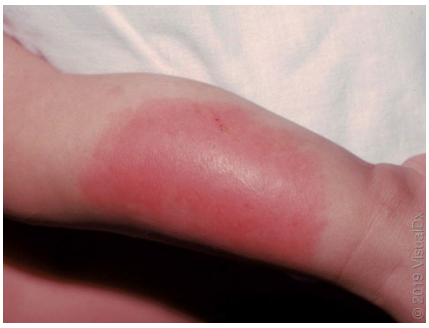
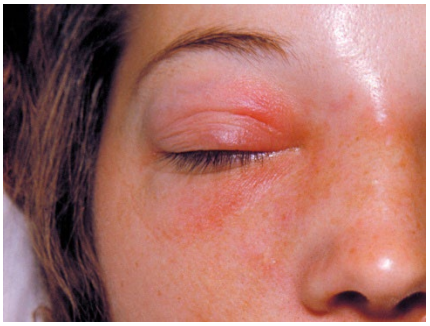
Appendix A – Visual Examples of Diagnoses
Image source: Visual Dx (www.visualdx.com)

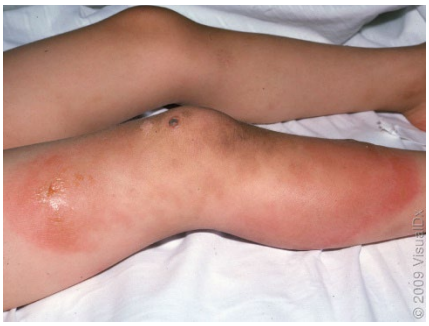
Cellulitis

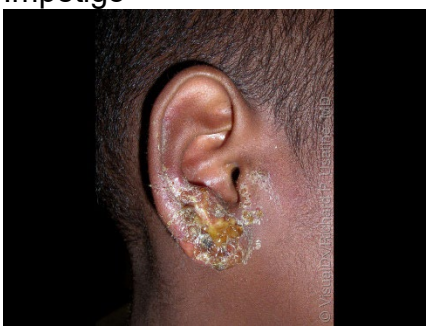
Erysipelas

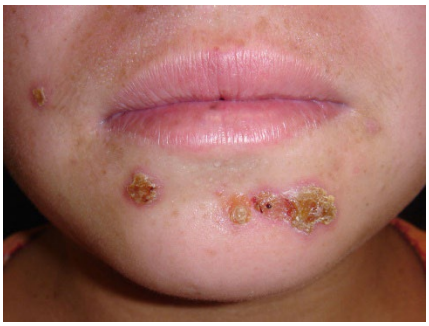





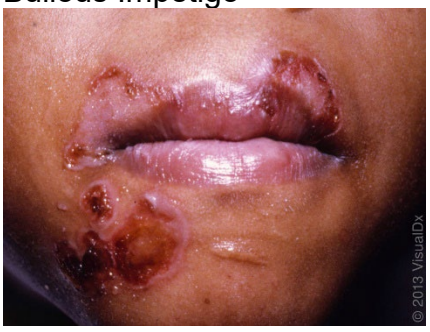


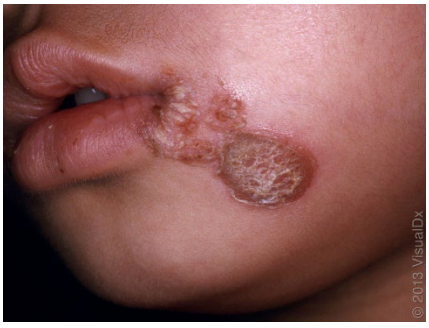
Impetigo



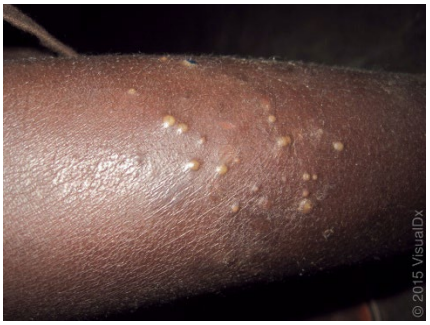


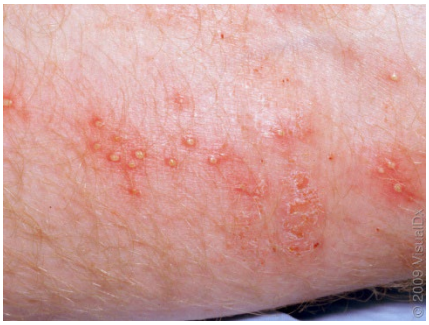
Bullous Impetigo



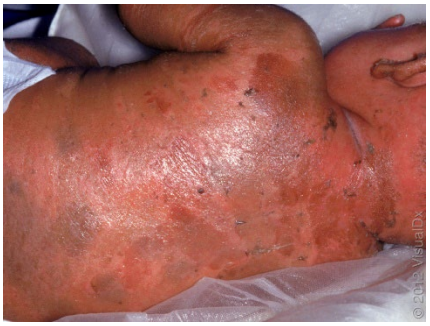
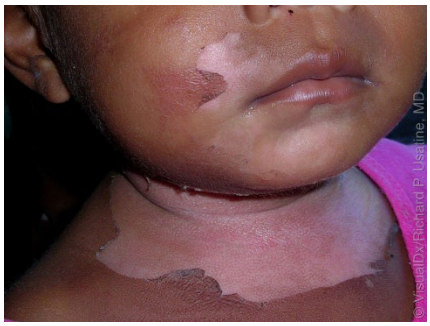


Folliculitis

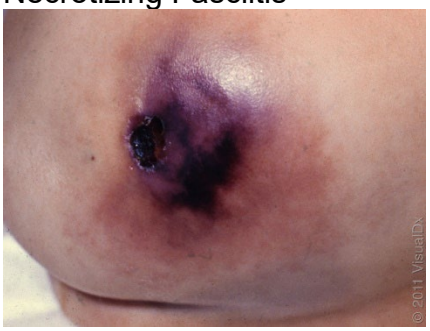
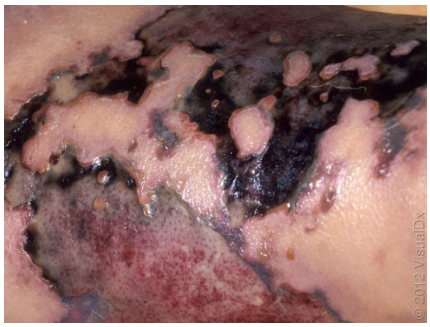




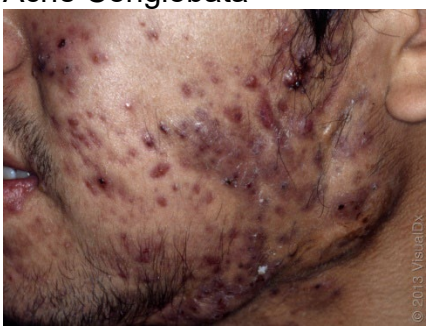
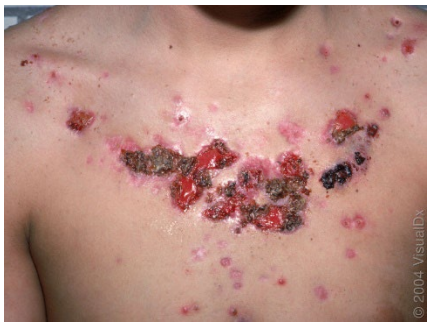
Staph Scalded Skin Syndrome

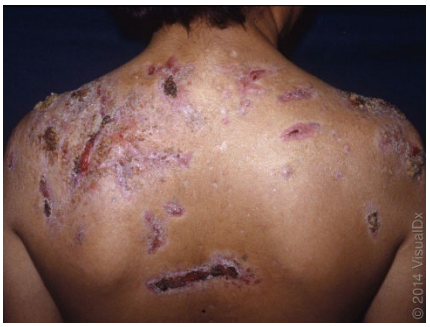
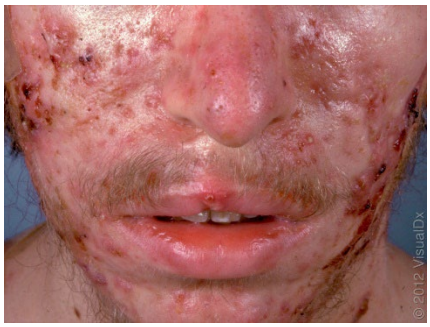
Necrotizing Fasciitis

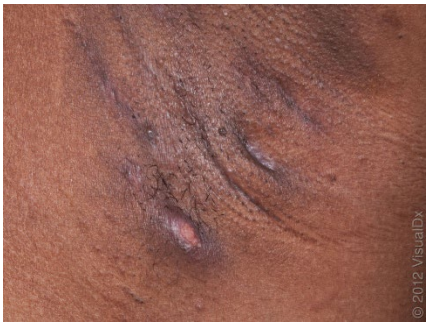
Acne Conglobata

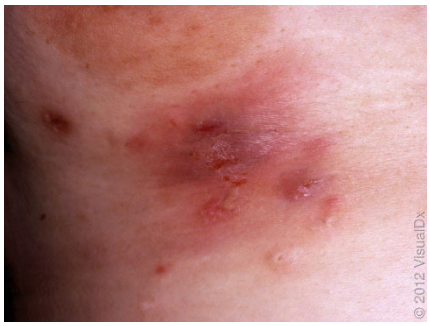



Acne Fulminans

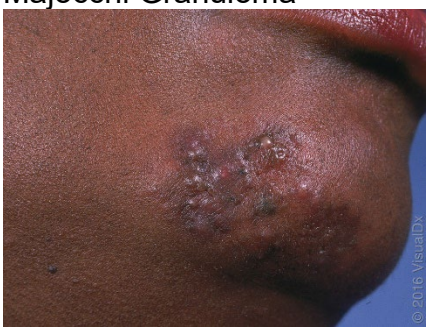



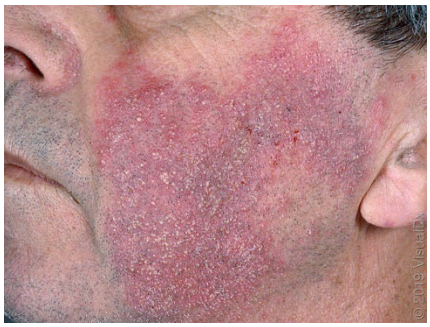
Hidradenitis Suppurativa



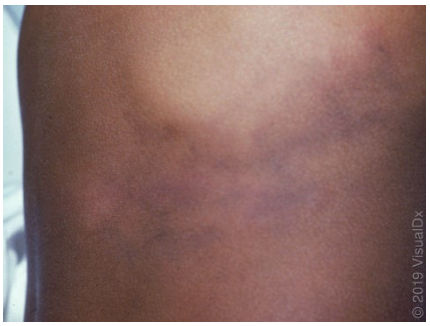


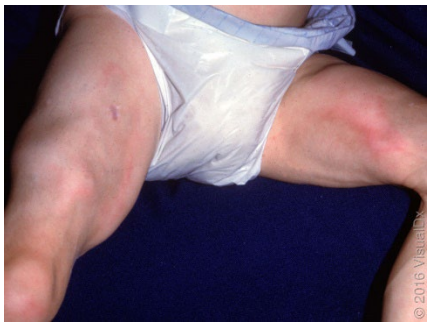
Majocchi Granuloma



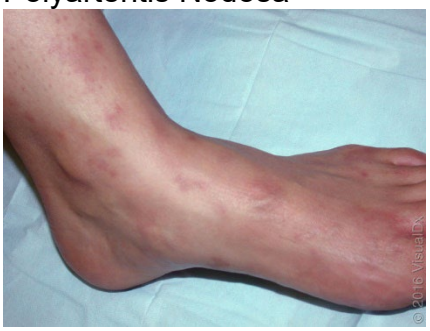


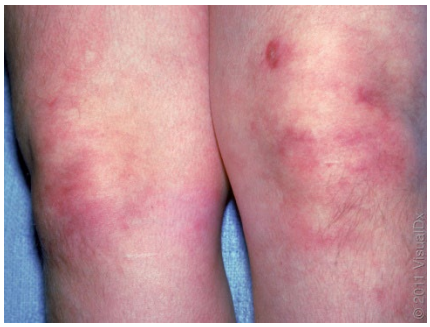
Panniculitis



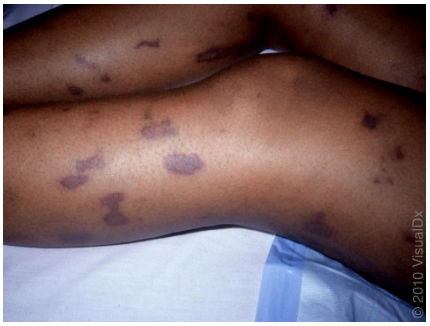


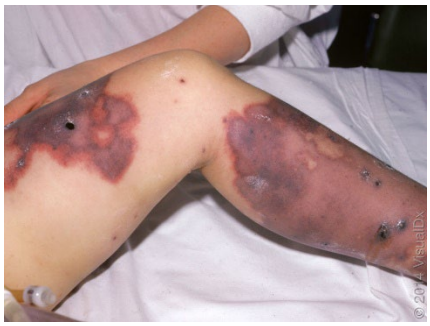
Polyarteritis Nodosa



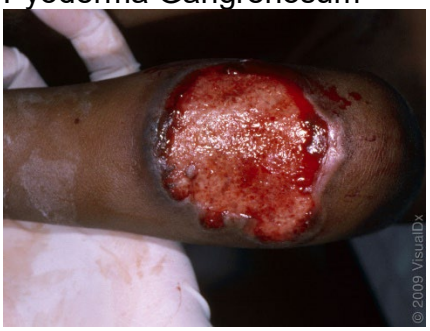


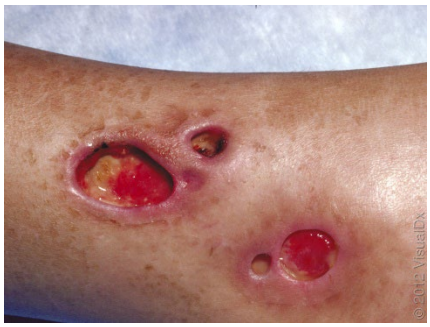
Purpura Fulminans



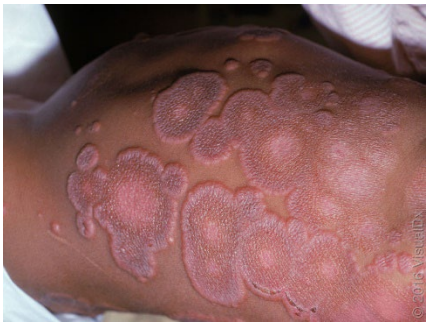


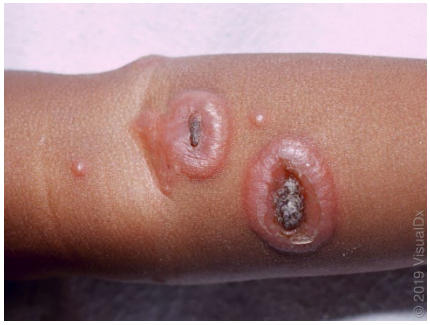
Pyoderma Gangrenosum





Acute Febrile Neutrophilic Dermatosis





Appendix B – Cook Children's Antibiogram 2023

[2023 Antibiogram.pdf (cookchildrens.org);'](#)

CCMC Fort Worth Antibiogram 2023 Data	Penicillins						Cephalosporins 1st	Cephamycins	Cephalosporins 3rd			Cephalosporins 4th	Quinolones		Aminoglycosides			Monobactams	Carbapenems		Macrolides								
ORGANISM	Ampicillin	Oxacillin	Penicillin	Ampicillin/ Sulbactam	Piperacillin/ Tazobactam	Ceftazidime/ Avibactam	Cefazolin	Cefoxitin	Cefotaxime	Ceftazidime	Ceftriaxone	Cefepime	Ciprofloxacin	Levofloxacin	Amikacin	Gentamicin	Tobramycin	Aztreonam	Imipenem	Meropenem	Erythromycin	Clindamycin	Fosfomycin	Nitrofurantoin	Rifampin	TMP/SMX	Vancomycin	Total # of Isolates
Gram-Positive																												
S. pneumoniae meningitis/ non-meningitis	---	---	60* 94*	---	---	---	---	---	90* 99*	---	86* 99*	---	---	100	---	---	---	---	---	---	59	92	---	---	---	63	100	139
Staphylococcus aureus (MSSA)	---	100	---	---	---	---	---	---	---	---	---	---	93	---	---	97	---	---	---	---	65	80***	---	100	99	97	100	687
Staphylococcus aureus (MRSA)	R	0	R	R	R	---	R	R	R	R	R	R	50	---	---	97	---	R	R	R	27	80***	---	100	99	94	100	295
Staphylococcus epidermidis	---	29	---	---	---	---	---	---	---	---	---	---	69	---	---	78	---	---	---	---	28	50***	---	100	96	68	100	76
Other coag neg staphylococci	---	63	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	57	62***	---	---	100	83	100	35
Streptococcus anginosus grp#	100	---	100	---	---	---	---	---	100	---	100	---	---	---	---	---	---	---	---	---	58	87	---	---	---	---	100	62
Streptococcus mitis/oralis grp	67	---	71	---	---	---	---	---	73	---	73	---	---	---	---	---	---	---	---	---	29	93	---	---	---	---	100	41
Enterococcus faecalis	100	---	98	---	---	---	R	R	R	R	R	R	---	---	R	R	R	---	---	---	---	R	---	99	---	R	100	98
Enterococcus faecium	51	---	37	---	---	---	R	R	R	R	R	R	---	---	R	R	R	---	---	---	---	R	---	26	---	R	91	35^
Gram-Negative																												
Escherichia coli - all isolates systemic/uncomplicated UTI	40	---	---	51	95	---	78** 87**	96	---	88	88	89	86	87	100	87	85	---	---	100	R	R	100	98	R	63	R	1052
Escherichia coli - ESBLs only	R	---	---	30 Consult ID	93 Consult ID	---	R	85 Consult ID	---	R	R	R	44	47	98	64	53	---	---	100	R	R	100	94	R	40	R	167
Klebsiella pneumoniae	R	R	R	74	89	---	82	93	---	84	84	84	91	94	100	93	89	---	---	99	R	R	---	34	R	82	R	122
Klebsiella oxytoca	R	R	R	76	---	---	58	97	---	89	89	89	92	97	100	94	91	---	---	100	R	R	---	94	R	84	R	38
Enterobacter species & *Klebsiella aerogenes*	R	R	R	R	82	---	R	R	---	85****	85****	98	97	99	98	92	92	---	---	100	R	R	---	54	R	89	R	80
Serratia marcescens	R	R	R	R	---	---	R	R	---	97	97	100	100	100	---	100	---	---	---	100	R	R	---	R	R	97	R	36
Citrobacter freundii complex	R	R	R	R	76	---	R	R	---	80****	78****	100	95	95	100	91	94	---	---	100	R	R	---	98	R	98	R	40^^
Proteus mirabilis	97	---	---	97	100	---	94	97	---	100	100	100	100	100	100	98	97	---	---	100	R	R	---	R	R	93	R	68
Salmonella species	92	---	---	---	---	---	R	R	---	---	97	98	---	99	---	---	---	---	---	---	---	R	---	---	R	95	R	216
Shigella species	52	---	---	---	---	---	R	R	---	---	84	100	---	82	---	---	---	---	---	---	---	R	---	---	R	21	R	33^^
Acinetobacter species	R	R	R	94	77	---	R	R	---	83	49	90	91	93	---	95	94	R	---	95	R	R	---	R	R	98	R	41
Pseudomonas aeruginosa	R	R	R	R	98	94	R	R	R	94	R	95	95	90	99	R	96	83	89	96	R	R	---	R	R	R	R	222
Pseudomonas aeruginosa CF	R	R	R	R	96	---	R	R	R	88	R	---	67	---	---	R	83	76	---	83	R	R	---	R	R	R	R	42
Mucoid *P.aeruginosa* CF	R	R	R	R	93	---	R	R	R	88	R	---	61	---	---	R	82	90	---	90	R	R	---	R	R	R	R	51
Stenotrophomonas maltophilia	R	R	R	R	R	---	R	R	R	---	R	R	R	88	R	R	R	R	R	R	R	R	---	R	R	100	R	84

Numbers indicate percent susceptible —Not tested R=intrinsic resistance #*S. anginosus* group includes *S. anginosus*, *S. constellatus* and *S. intermedius* *Meningitis and non-meningitis break point used per CLSI **Systemic and uncomplicated UTI breakpoint used per CLSI

***Includes isolates with inducible clindamycin resistance ****Due to presence of an inducible beta-lactamase, treatment failure may occur even when the organism tests susceptible. ^Includes 2020-2023 data ^^Includes 2022-2023 data

*Based on when this document if used, there may be a newer version of the Cook Children's Antibiogram available. Searching "Antibiogram" on CookNet will take users to the most current Antibiogram.