

# **NC CLASP OUTPATIENT STEWARDSHIP YEAR 2, SESSION 7**

**Outpatient Antimicrobial Stewardship:  
Skin and Soft-Tissue Infections**

**March 27, 2024**

# CONFLICT OF INTEREST DISCLOSURES

- ▶ The views and opinions expressed in this series are those of the speakers and do not reflect the official policy or position of any agency of the US or NC government or UNC.
- ▶ Our speakers have the following financial relationships with the manufacturer(s) and/or provider(s) of commercial services discussed in this activity:
  - ▶ Dr. Willis has performed contracted research with: Pfizer (pediatric nirmatrelvir-ritonavir and maternal RSV vaccine), Novavax (pediatric COVID-19 vaccine), and Merck (monoclonal antibody for RSV prevention)
- ▶ The speakers do not intend to discuss an unapproved/investigative use of a commercial product/device in this series, and all COI have been mitigated.
- ▶ These slides contain materials from a variety of colleagues, as well as the CDC, WHO, AHRQ, etc.

# INTRODUCTIONS

Please put your name, clinic, and location in the chat!

# CME AND CE CREDIT



## ► CME & CE for participants

- Attendance and active participation per learning session
- Click the link in the chat during the session to document your attendance
- Complete surveys as requested

# OUTLINE: UPCOMING SESSIONS

Date	Topic
January 24 <sup>th</sup>	Pharyngitis, acute otitis media
February 28 <sup>th</sup>	UTI and STI
March 27 <sup>th</sup>	Skin and soft-tissue infections
April 24 <sup>th</sup>	Antibiotic Allergies
May Conference	TBD
June 26 <sup>th</sup>	Additional strategies to prevent antibiotic overuse

# TODAY'S OVERVIEW

- ▶ Quick Review:
  - ▶ Urinary Tract Infections
  - ▶ Sexually Transmitted Infections
- ▶ Skin and Soft-Tissue Infections
  - ▶ Cellulitis
  - ▶ Abscess
  - ▶ Diabetic foot infections (briefly)
  - ▶ Special exposures

# STEWARDSHIP OPPORTUNITIES: UTI

- ▶ *Never* send a urine culture without urinalysis
- ▶ Avoid urine testing in patients with high likelihood of asymptomatic bacteriuria AND no specific symptoms of UTI
- ▶ Use cephalexin preferentially for patients who:
  - ▶ Do not require hospital admission
  - ▶ Do not have significant history of antibiotic-resistant UTI
- ▶ Stop antibiotics if urine culture is negative or mixed flora
- ▶ If initial broad antibiotics, target antibiotics in response to urine culture

# UTI: ANTIMICROBIAL STEWARDSHIP RECOMMENDATIONS

- ▶ Review your antibiogram if available – focus on outpatient urine cultures
- ▶ Create your own treatment algorithm based on antibiogram
  - ▶ [UNC's UTI algorithm](#)
- ▶ Avoid urine testing if patient has high risk of asymptomatic bacteriuria (i.e., older adults) and does not have urine-specific symptoms
- ▶ No urine cultures without urinalysis
- ▶ Use urine culture results!
  - ▶ Negative: stop antibiotics
  - ▶ Positive: ensure antibiotic is adequate. Consider targeting if possible.
- ▶ Minimize durations
  - ▶ Cystitis: 3-5 days (depending on drug); pyelonephritis: 7 days usually



# THREE WAYS TO OVERUSE ANTIBIOTICS

1. Prescribing antibiotics when none are indicated
2. Using an antibiotic that is too broad for the infection (or otherwise suboptimal)
3. Using an excessive duration

# SSTI: STEWARDSHIP OPPORTUNITIES

- ▶ Correct diagnosis
  - ▶ Cellulitis has several mimics
- ▶ Use systemic antibiotics only when needed
- ▶ Optimize antibiotic selection based on:
  - ▶ Most likely pathogens for your patient's condition
  - ▶ Local susceptibility patterns
- ▶ Optimize duration of therapy

# SKIN ANATOMY / PATHOPHYSIOLOGY

<b>Epidermis</b>	Impetigo
<b>Dermis</b>	Folliculitis Furuncles Carbuncles Erysipelas Cellulitis
<b>Subdermal fat and fascia</b>	Necrotizing fasciitis
<b>Muscle/tissue below fascia</b>	Myositis Myonecrosis/gas gangrene

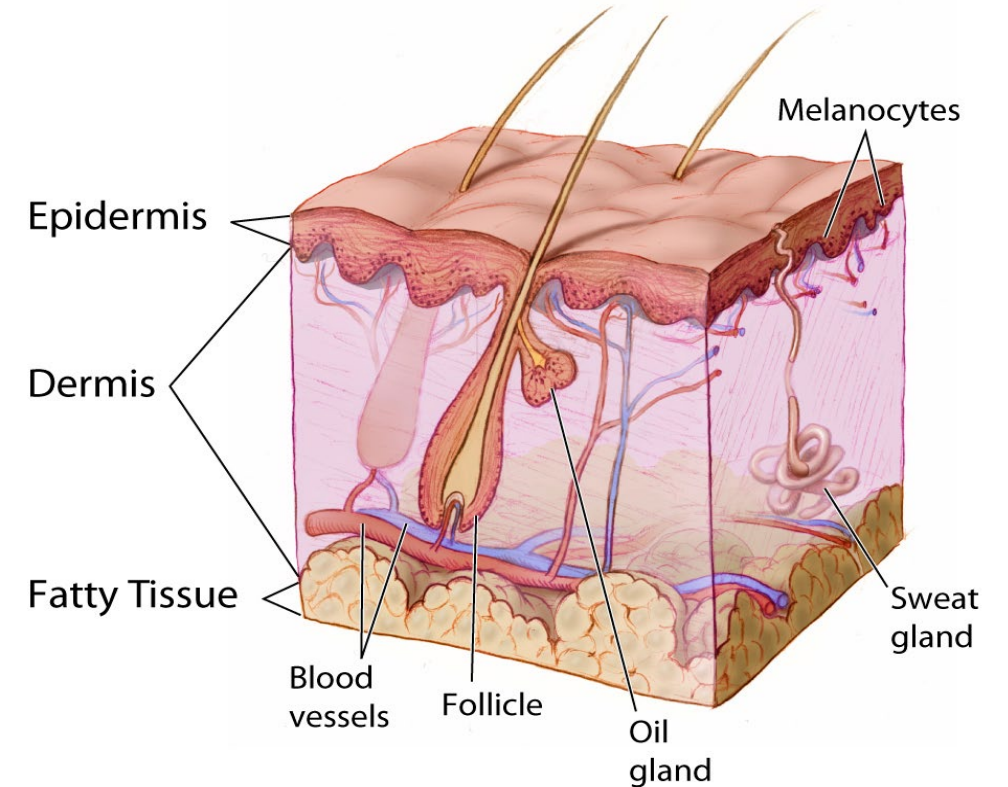


Image: National Cancer Institute, Illustrator Don Bliss. <https://visualsonline.cancer.gov/details.cfm?imageid=4604> (Public domain)  
Duane, et al. Surgical Infections 22: 2021

# IMPETIGO

- ▶ Superficial skin infections
- ▶ Nonbullous: classic golden crust
- ▶ Bullous: flaccid blisters filled with pus
- ▶ Usually with no or mild systemic symptoms
- ▶ Causes: Group A Strep and *Staphylococcus aureus*
- ▶ Treatment:
  - ▶ Limited disease: topical mupirocin 3x/day x 5 days
  - ▶ More extensive disease:
    - ▶ Culture to determine GAS vs MSSA vs MRSA
    - ▶ Empiric options: cephalexin or clindamycin x 7 days

Nonbullous impetigo



Perinasal erythema, erosions, and crusts in a child with nonbullous impetigo.

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UptoDate

Bullous impetigo



Bullae, erosions, and crusts in a patient with bullous impetigo on the neck.

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UptoDate

SPICE

A 54-year-old man presents to clinic with pain and swelling of his right lower leg. He has a history of mild venous insufficiency and ankle swelling at the end of the day; he has never had pain like this. He has fever to 38.1 but is nontoxic. He has not had any recent travel or injuries.

Recommended treatment could include which of the following:

- ▶ Piperacillin-tazobactam
- ▶ Doxycycline
- ▶ Cephalexin
- ▶ Levofloxacin



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# CELLULITIS

- ▶ Superficial infection of the epidermis and dermis
- ▶ Generally diffuse and spreading; may expand rapidly
- ▶ No purulent collection
  - ▶ Erythema around an abscess is not cellulitis
- ▶ Exam
  - ▶ Erythematous, edematous, tender
  - ▶ May have petechiae, bruising, orange-peel appearance, bullae
  - ▶ Can feel the borders with eyes closed
- ▶ Pathogenesis:
  - ▶ Bacterial invasion through break in skin
  - ▶ Could be surgical incision, minor cut, penetrating trauma, inflamed skin; may not be apparent



Cellulitis with erythema and edema



An extensive edematous and erythematous plaque on the arm.

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# INFECTION OR NOT?

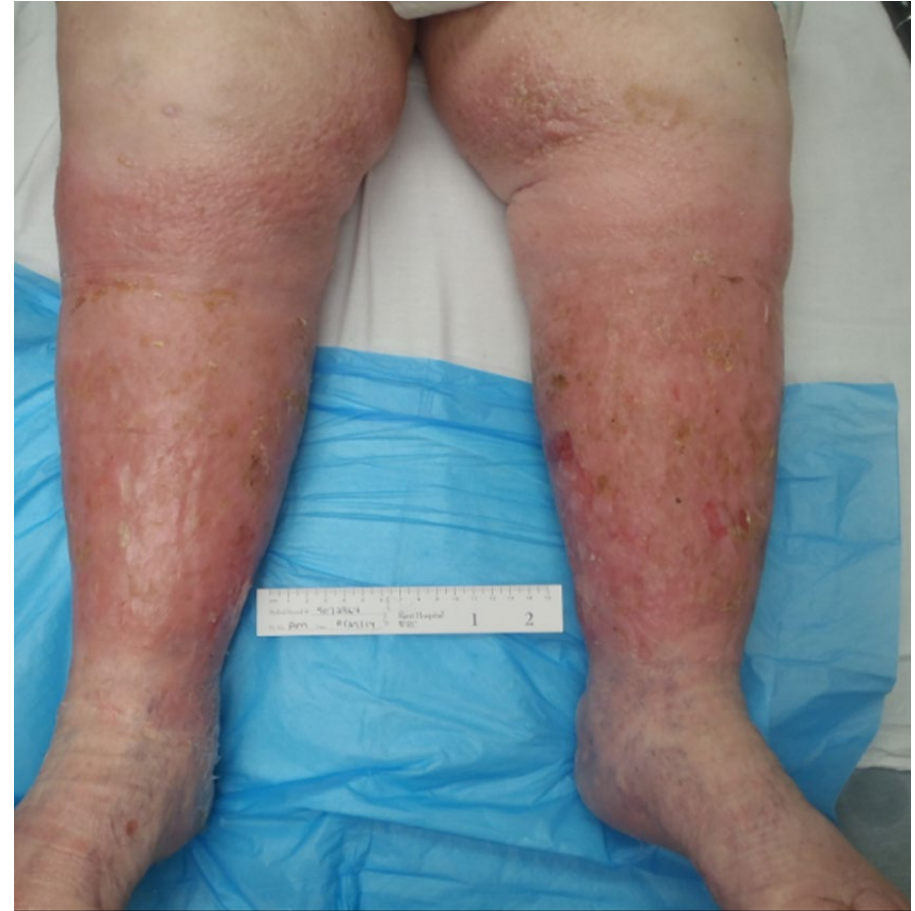




# Diagnosis: Bilateral Stasis Dermatitis



Bilateral swollen, red legs after antibiotics in hospital



2 weeks later, after elevation, compression, and steroid ointment



# CELLULITIS DIAGNOSIS

## Cellulitis SHOULD:

- ▶ Be unilateral
- ▶ Have acute onset
- ▶ Be painful
- ▶ Have shiny appearance (often)
- ▶ May have fever, systemic symptoms
- ▶ May have local lymphadenopathy

## Cellulitis should NOT:

- ▶ Be bilateral
- ▶ Be chronic with exacerbations
- ▶ Be itchy

# CELLULITIS: RED FLAGS (OUT OF SCOPE)

## ▶ Important to rule out:

- ▶ Toxic shock syndrome
- ▶ Sepsis
- ▶ Necrotizing soft tissue infection (severe pain, rapid progression, often severe systemic illness)
- ▶ Involvement of joint or graft prosthesis
- ▶ Compartment syndrome

## ▶ Inciting injuries:

- ▶ Bite wound, contaminated wound (water or soil)
- ▶ Diabetic wound

# CELLULITIS: MICROBIOLOGY AND TREATMENT

- ▶ Most cases: beta-hemolytic streptococci (Group A, also B, C, G, F)
  - ▶ Second place: *Staphylococcus aureus* – but actually quite uncommon

## Skin and Soft-Tissue Infection – Cellulitis

Pneumococcus	<i>H. flu, Moraxella</i>	Atypicals
Group A Strep	Oral anaerobes	
MSSA	MRSA	
<i>E. coli, K. pneumoniae</i>	<i>Pseudomonas</i>	

# CELLULITIS: TREATMENT

~100% (Always active)
90-99% (Almost always active)
50-89% (Resistance more frequent)
<50% (Usually or always inactive)

## Cephalexin

Pneumococcus	<i>H. flu, Moraxella</i>	Atypicals
Group A Strep	Oral anaerobes	
MSSA	MRSA	
<i>E. coli, K. pneumoniae</i>	<i>Pseudomonas</i>	

## Clindamycin

Pneumococcus	<i>H. flu, Moraxella</i>	Atypicals
Group A Strep	Oral anaerobes	
MSSA	MRSA	
<i>E. coli, K. pneumoniae</i>	<i>Pseudomonas</i>	

## Trimethoprim-Sulfamethoxazole

Pneumococcus	<i>H. flu, Moraxella</i>	Atypicals
Group A Strep	Oral anaerobes	
MSSA	MRSA	
<i>E. coli, K. pneumoniae</i>	<i>Pseudomonas</i>	

## ► Treatment (no severe signs or strange exposures):

- Always cover beta-hemolytic strep and MSSA
  - Options: **cephalexin**, TMP-SMX, clindamycin
- MRSA risk factors (known colonization, purulent wound drainage, healthcare exposure)
  - Options: TMP-SMX +/- amoxicillin, Amoxicillin plus doxycycline
    - Second-line: linezolid or clindamycin
- Duration: 5 days (assuming improvement)

# CELLULITIS: STEWARDSHIP OPPORTUNITIES

- ▶ Narrow spectrum of therapy
  - ▶ Without MRSA risk factors, cephalexin highly effective
- ▶ 5-day duration as effective as 10 days
- ▶ Awareness of cellulitis mimics

A 33-year-old man presents with a painful, swollen lesion on his medial thigh. He first noticed it when he woke up yesterday and thought he'd been bitten by a spider. It has become increasingly painful and started to drain a little bit. The next best step in management is:

- ▶ Needle aspiration
- ▶ Warm compresses
- ▶ Incision and drainage
- ▶ Trimethoprim-sulfamethoxazole





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- ▶ Needle aspiration
- ▶ Warm compresses
- ▶ **Incision and drainage**
- ▶ Trimethoprim-sulfamethoxazole





# CUTANEOUS ABSCESSES

- ▶ Pus collections within the dermis
  - ▶ May be associated with cellulitis
  - ▶ May occur at wound sites (surgical, minor trauma) or hair follicles (furuncles)
- ▶ Generally minimal/no systemic illness
- ▶ Most common cause: *Staphylococcus aureus*

## Skin and Soft-Tissue Infection - Abscess

Pneumococcus	<i>H. flu, Moraxella</i>	Atypicals
Group A Strep	Oral anaerobes	
MSSA	MRSA	
<i>E. coli, K. pneumoniae</i>	<i>Pseudomonas</i>	

# CUTANEOUS ABSCESS: TREATMENT

- ▶ Most important: incision and drainage
  - ▶ Send cultures!
  - ▶ Sometimes drainage facilitated by warm compresses
- ▶ Antibiotics indicated if:
  - ▶ Fever or signs of sepsis (tachypnea, tachycardia, leukocytosis, leukopenia)
  - ▶ Immunocompromised patients
  - ▶ Extremes of age (young infants, older adults)
  - ▶ Multiple abscesses

# ABSCCESS: ANTIBIOTIC SELECTION

~100% (Always active)
90-99% (Almost always active)
50-89% (Resistance more frequent)
<50% (Usually or always inactive)

Cephalexin

Pneumococcus	<i>H. flu, Moraxella</i>	Atypicals
Group A Strep	Oral anaerobes	
MSSA	MRSA	
<i>E. coli, K. pneumoniae</i>	<i>Pseudomonas</i>	

Trimethoprim-Sulfamethoxazole

Pneumococcus	<i>H. flu, Moraxella</i>	Atypicals
Group A Strep	Oral anaerobes	
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<i>E. coli, K. pneumoniae</i>	<i>Pseudomonas</i>	

Clindamycin

Pneumococcus	<i>H. flu, Moraxella</i>	Atypicals
Group A Strep	Oral anaerobes	
MSSA	MRSA	
<i>E. coli, K. pneumoniae</i>	<i>Pseudomonas</i>	

Doxycycline

Pneumococcus	<i>H. flu, Moraxella</i>	Atypicals
Group A Strep	Oral anaerobes	
MSSA	MRSA	
<i>E. coli, K. pneumoniae</i>	<i>Pseudomonas</i>	

- ▶ MSSA and MRSA coverage warranted
- ▶ Highly reliable: TMP-SMX, doxycycline; clindamycin a little less so
- ▶ Target based on cultures (as appropriate)
- ▶ Duration: **5 days**

# DIABETIC FOOT INFECTION

## ▶ Risk factors for infection:

- ▶ Neuropathy (failure to recognize wounds)
- ▶ Peripheral vascular disease (impaired wound healing)
- ▶ Poor glycemic control (impairs neutrophil function)

## ▶ Microbiology

- ▶ Most are polymicrobial
- ▶ Superficial: generally Gram-positive cocci (Staphylococci, GAS, GBS)
- ▶ Deep, chronically infected, and/or previously treated: Gram-positive cocci above plus enterococci, Gram-negative enterics, *Pseudomonas*, anaerobes
- ▶ Extensive infection, gangrene, systemic sepsis: all of the above and presume anaerobes

# IWGDF/IDSA Guidelines on the Diagnosis and Treatment of Diabetes-related Foot Infections (IWGDF/IDSA 2023)

Éric Senneville,<sup>1,2</sup> Zaina Albalawi,<sup>3</sup> Suzanne A. van Asten,<sup>4</sup> Zulfiqarali G. Abbas,<sup>5</sup> Geneve Allison,<sup>6</sup> Javier Aragón-Sánchez,<sup>7</sup> John M. Embil,<sup>8</sup> Lawrence A. Lavery,<sup>9</sup> Majdi Alhasan,<sup>10</sup> Orhan Oz,<sup>11</sup> Ilker Uçkay,<sup>12</sup> Vilma Urbančič-Rovan,<sup>13</sup> Zhang-Rong Xu,<sup>14</sup> and Edgar J. G. Peters<sup>15,16,17</sup>

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Findings	Stage
No systemic or local signs of infection	1/Uninfected
At least two of: local swelling/induration, erythema, local tenderness/pain, local increased warmth, purulent drainage	2/Mild
Erythema extending $\geq 2$ cm from wound margin AND/OR involvement deeper than skin/subcutaneous tissue	3/Moderate
Findings of SIRS – at least 2 of: fever or hypothermia, HR $>90$ , RR $>20$ , WBC $>12$ or $>10\%$ bands	4/Severe

# MANAGEMENT

- ▶ Risk factors for osteomyelitis:
  - ▶ Grossly visible bone or ability to probe to bone
  - ▶ Ulcer >2 cm<sup>2</sup>
  - ▶ Ulcer duration >1-2 weeks
- ▶ Only Stage 2 (mild) and some Stage 3 (moderate) remain outpatient
- ▶ Sharp debridement of necrotic tissue
- ▶ Do not culture if Stage 2 or 3 infection without osteomyelitis and no recent antibiotic exposure (colonization is common)
  - ▶ Choices: cephalexin, TMP-SMX, doxycycline, clindamycin
  - ▶ Duration: 1-2 weeks, can go up to 4 weeks if responding slowly

A previously healthy 13-year-old girl presents with pain and swelling of her right forearm. She is afebrile and well-appearing. On exam, there is an irregularly shaped region of erythema and edema that's about 8 cm x 5 cm in size. This is moderately tender to palpation. You notice a small puncture wound within this erythematous region. You ask about it, and she says her new cat bit her there three days ago. It bled a little bit and she put a Band-Aid over it, then it was fine. The next best step is:

- ▶ Start clindamycin
- ▶ Obtain an X-ray
- ▶ Start doxycycline
- ▶ Start amoxicillin-clavulanic acid

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- ▶ Obtain an X-ray
- ▶ Start doxycycline
- ▶ **Start amoxicillin-clavulanic acid**




# SSTI: SPECIAL SITUATIONS

Scenario	Organisms	Coverage
Human bite	Oral flora ( <i>Eikenella</i> , other anaerobes)	Amox-clav
Cat or dog bite	<i>Pasteurella</i> , <i>Capnocytophaga</i>	Amox-clav; allergy: TMP-SMX plus metronidazole
Hot tub exposure	<i>Pseudomonas</i>	Fluoroquinolone
Fresh water exposure	<i>Aeromonas</i> , <i>Pseudomonas</i>	Fluoroquinolone plus cephalexin
Salt water exposure	<i>Vibrio vulnificus</i>	Fluoroquinolone plus doxycycline
Nail through shoe through foot	<i>Pseudomonas</i> , <i>Staph aureus</i>	Fluoroquinolone plus cephalexin or TMP-SMX

# CLASSIFICATION OF SSTIS

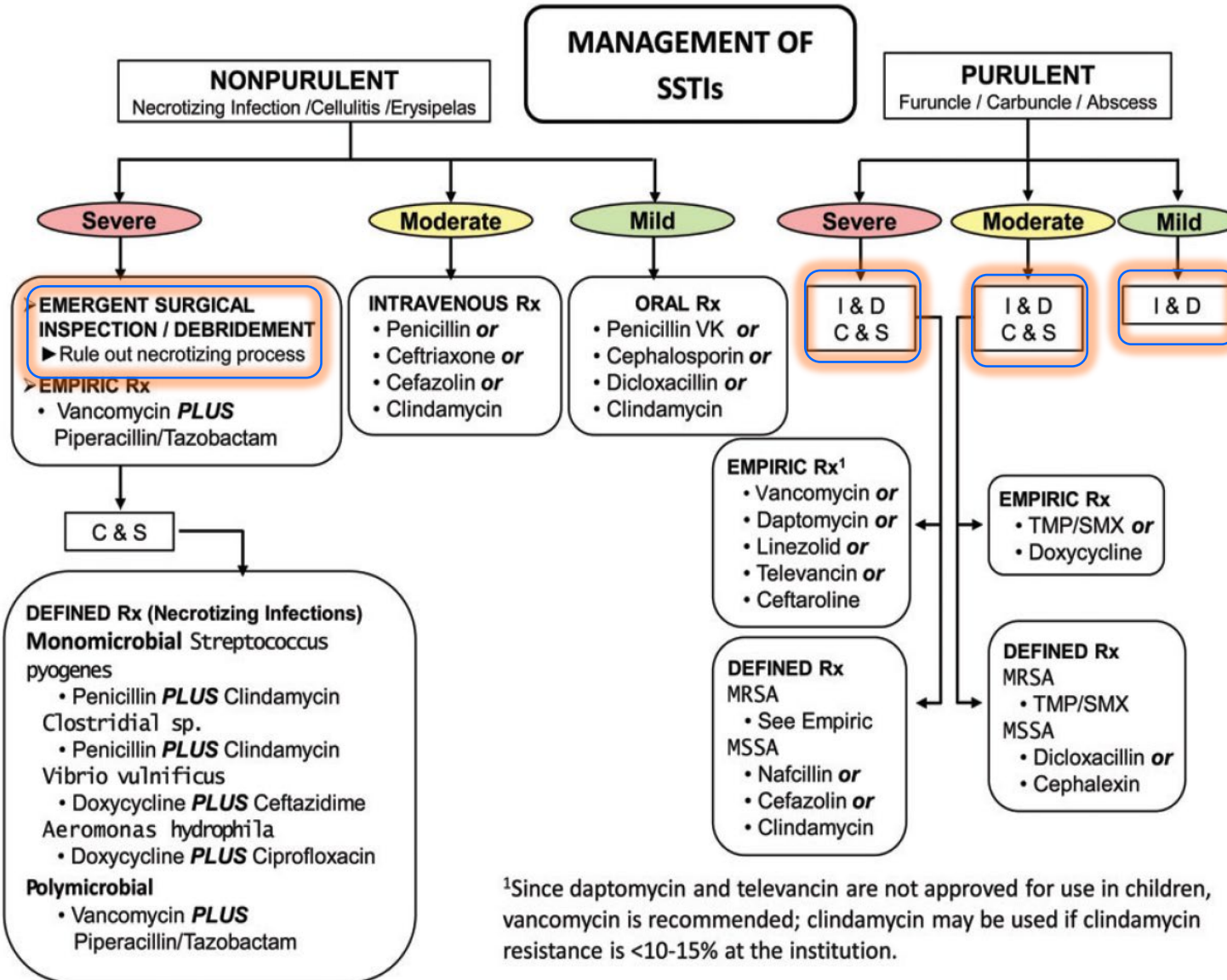
Usually Monomicrobial	Often Polymicrobial
Cellulitis Carbuncle, furuncle Mild-moderate diabetic foot infection Surgical incision infection	Severe diabetic foot infection Infected pressure ulcers Fournier's gangrene Some bite wounds

***Not*** “when to use double coverage”



Antibiotics alone may suffice	Surgery +/- antibiotics	Surgery + antibiotics
Cellulitis Mild-moderate diabetic foot infection	Any purulent infection Furuncle, Carbuncle Surgical incision infection	Any necrotizing infection

# IT'S NOT JUST ABOUT ANTIBIOTICS...



Surgical attention:  
“source control”

- Surgical site infection: suture removal/ I&D
- Infected burn wounds
- Traumatic wounds (e.g. road rash)

Stevens, et al. CID 2014;59:10ff

# ADDRESS UNDERLYING CAUSES OF SSTI

- ▶ Address/prevent edema: venous or lymphatic insufficiency
- ▶ *S aureus* (and *Streptococcus*) loves wounds
  - ▶ Foot exams for patients with diabetes and other sensory defects
- ▶ Immunosuppression
- ▶ Dry, cracked skin; tinea pedis
- ▶ Glycemic control
- ▶ Peripheral vascular disease
- ▶ Recurrent *S. aureus*: consider decolonization measures
  - ▶ Nasal mupirocin/retapamulin + chlorhexidine bathing

# BREAKOUT SESSION

- ▶ What populations of patients do you see with frequent skin infections?
- ▶ Is management standardized? What are the barriers to appropriate care?
- ▶ How could antimicrobial stewardship be implemented for SSTI?

# ANTIMICROBIAL STEWARDSHIP OPPORTUNITIES

- ▶ Best studies: guideline implementation for cellulitis and abscess
- ▶ Guideline components:
  - ▶ Differentiate cellulitis from noninfectious conditions
  - ▶ Rule out severe infection and risk factors for unusual pathogen
  - ▶ Early source control of pus
  - ▶ Targeted antibiotics based on antibiogram (e.g., cephalexin for cellulitis, doxycycline for abscess)
  - ▶ 5-day durations
  - ▶ Consider not using antibiotics if adequate I&D done

# THE NORTH CAROLINA CLINICAL ANTIBIOTIC STEWARDSHIP PARTNERS (NC CLASP)

- ▶ All the information from today's session will be on our website <https://spice.unc.edu/ncclasp/>



# RESOURCES

- ▶ Stevens DL, Bisno AL, Chambers HF, Dellinger EP, Goldstein EJC, Gorbach SL, Hirschmann JV, Kaplan SL, Montoya JG, Wade JC. Practice Guidelines for the Diagnosis and Management of Skin and Soft Tissue Infections: 2014 Update by the Infectious Diseases Society of America. *Clinical Infectious Diseases*. 2014 Jul 15;59(2):e10–e52.
- ▶ Senneville É, Albalawi Z, van Asten SA, Abbas ZG, Allison G, Aragón-Sánchez J, Embil JM, Lavery LA, Alhasan M, Oz O, Uçkay I, Urbančič-Rovan V, Xu ZR, Peters EJG. IWGDF/IDSA Guidelines on the Diagnosis and Treatment of Diabetes-related Foot Infections (IWGDF/IDSA 2023). *Clinical Infectious Diseases*. 2023 Oct 2;ciad527.