Matching the Drug to the Bug: Empiric Antibiotic Prescribing in Long-Term Care

Relevant / Recent Duration Guideline Updates!

Antibiotic	Traditional / Prior Duration	Guideline Rec.	Pivotal Evidence
UNCOMPLICATED CYSTITIS			*Lancet NMA 2020 · 61 RCTs · n = 20,780*
TMP-SMX	Single-dose	3 days	**Lancet NMA 2020**: Single-dose inferior to 3-day in clinical cure rate *(Moderate certainty)*
Nitrofurantoin	5 days	5 days (unchanged)	**Lancet NMA 2020**: 3-day may equal 5-day but very low quality evidence; 5-day course remains standard *(Very low — no change)*
Pivmecillinam	5-7 days	3 days	**Lancet NMA 2020**: 3-day equivalent to 5-7 days *(Moderate certainty)*
3rd/4th-gen fluoroquinolones	3 days	Single-dose	**Lancet NMA 2020**: Single-dose equivalent to 3-day; note 2nd-gen FQs (cipro, norfloxacin) inferior at single-dose *(Moderate certainty)*
PYELONEPHRITIS / COMPLICATED UTI			*2025 IDSA Guidelines · Zahavi 2025 LSR · 16 RCTs · n = 4,643*
Fluoroquinolones (cipro, levo)	10-14 days	5-7 days	**Zahavi 2025 LSR**: 5-7 days non-inferior to 10-14 days; 7 of 10 included trials studied fluoroquinolones *(Moderate certainty)*
TMP-SMX	14 days	7-10 days	**Talan 2000 / IDSA 2025**: 7-day cipro vs 14-day TMP-SMX: 96% vs 85% cure; 2025 guidelines extrapolate 7-10 days if susceptible *(Extrapolated)*
Non-FQ agents (ceftriaxone, amikacin)	10-14 days	5-7 days	**Zahavi 2025 LSR**: One small trial (n=54, 78% FQ-resistance setting); 5-7 days may be adequate *(Very low certainty)*
COMMUNITY-ACQUIRED PNEUMONIA			*PTC Trial 2021*
β-Lactams (amox-clav, ceftriaxone)	8 days	3-5 days (3 days if stable)†	**PTC Trial 2021**: 3 days non-inferior to 8 days in patients achieving clinical stability by day 3 *(Non-inferior RCT)*
Azithromycin	5 days	3-5 days	**Meta-analyses**: Evidence supports 3-5 day courses; typically given as 5-day Z-pack in practice *(Moderate certainty)*
Fluoroquinolones (levo, moxi)	10 days	5 days	**Meta-analyses**: 5-day course supported; reserved for patients unable to tolerate β-lactam/macrolide combination *(Moderate certainty)*
COPD EXACERBATION			*El Moussaoui 2008 · 21 RCTs · n = 10,698 · Kuijpers 2025 Umbrella Review*
Amoxicillin-clavulanate	~8 days	~5 days	**El Moussaoui 2008**: Short-course (mean 4.9 days) equivalent to long-course (mean 8.3 days) *(Equivalent)*
Macrolides (azithromycin, clarithromycin)	7-10 days	3-5 days	**El Moussaoui 2008 / Kuijpers 2025**: 3-5 days equivalent to 7-10 days across meta-analysis and umbrella review *(Equivalent)*
Tetracyclines (doxycycline)	>5 days	5 days	**El Moussaoui 2008**: 5-day course equivalent to longer regimens in pooled data *(Equivalent)*
Fluoroquinolones	7 days	≤5 days	**Messous 2025 meta-analysis**: 9 RCTs (n=3,951): ≤5 days equivalent to 7 days with significantly fewer adverse effects *(Equivalent)*
CELLULITIS / SSTI			
Levofloxacin	10 days	5 days	**Hepburn 2004**: n=87: 98% clinical success in both 5-day and 10-day groups *(RCT (small))*
Flucloxacillin	12 days	6 days	**DANCE Trial 2019**: Similar cure rates in 6- vs 12-day groups; confidence intervals inconclusive *(Inconclusive RCT)*
Tedizolid vs. linezolid	10 days (linezolid)	6 days (tedizolid)	**ESTABLISH-1 & ESTABLISH-2**: 6-day tedizolid non-inferior to 10-day linezolid in two Phase III RCTs *(Non-inferior (Phase III))*
Cephalexin, PCN, dicloxacillin, clindamycin	>5 days	5 days	**2014 IDSA Guidelines**: 5-day recommendation extrapolated from levofloxacin data (Hepburn 2004) *(Extrapolated)*

Duration of Therapy

Contents lists available at ScienceDirect

Clinical Microbiology and Infection

journal homepage: www.clinicalmicrobiologyandinfection.com

Narrative review

Short-course antibiotics for common infections: what do we know and where do we go from here?

2023 narrative review synthesizing > 120 RCTs across 7 common infections → conclusion = short course antibiotics are consistently non-inferior to longer courses

Infection	Findings	Notes:
CAP	**5 days is non-inferior to 7-10 days**	Conditions: Patients must show clinical signs of improvement (resolution of vital sign abnormalities, ability to eat, normal mentation); based on multiple meta-analyses and RCTs
Complicated UTI	**5-7 days is non-inferior to 10-14 days for pyelonephritis**	The review notes this applies specifically to women; evidence in men was less robust at the time of publication An RCT in men (2021) with complicated UTI found 7 days of fluoroquinolone or TMP-SMX was non-inferior to 14 days of therapy.
SSTI	**5-6 days is non-inferior to 10-12 days**	Condition: confirmed diagnosis with patient improvement

Lee RA, Stripling JT, Spellberg B, Centor RM. Short-course antibiotics for common infections: what do we know and where do we go from here? Clin Microbiol Infect. 2023 Feb;29(2):150-159. doi: 10.1016/j.cmi.2022.08.024. Epub 2022 Sep 6. PMID: 36075498.

Drekonja DM, Trautner B, Amundson C, Kuskowski M, Johnson JR. Effect of 7 vs 14 Days of Antibiotic Therapy on Resolution of Symptoms Among Afebrile Men With Urinary Tract Infection: A Randomized Clinical Trial. *JAMA*. 2021;326(4):324–331. doi:10.1001/jama.2021.9899

MDROs: Prevalence, Transmission, Prevention

MDRO colonization in US nursing home residents is high, with 50-60% of residents colonized with at least one MDRO

- Infection risk and mortality risk increase with colonization
  - CRE carriers: 19% cumulative incidence of infection at 30 days
    - *9% overall mortality from CRE infections, up to 75% in LTCFs*
  - ESBL carriers: 8% cumulative incidence of infection at 30 days
  - VRE carriers: 7–8% cumulative incidence of infection at 30 day
    - 46% higher mortality compared to vancomycin-susceptible infections

Organism	US Nursing Home Prevalence	US Long Term Acute Care Prevalence	Key US Studies
ESBL	16-34%	42%	SHIELD-OC, PROTECT TRIAL
VRE	5-33%	55%	Michigan cohort, SHIELD-OC
CRE	0-8%	8%	SHIELD-OC, CDC Surveillance

Important Note: Ertapenem is the only IM carbapenem; do not use in cases of suspected pseudomonas aeruginosa

Transmission:

Mobile genetic elements (plasmids, transposons) are the key drivers of MDROs in LTC settings

- **Gut-to-gut transmission:** MDROs (VRE, ESBL) colonize the GI tract and spread via healthcare worker hands during care activities
- **Environmental contamination:** High-touch surfaces are frequently contaminated (87%), facilitating ongoing transmission
- **Antibiotic pressure:** Disruption of the microbiome promotes resistance and plasmid-mediated gene transfer
- **Inter-facility spread:** Resident movement between hospitals and LTCFs drives regional MDRO dissemination

Prevention:

- Universal decolonization (chlorhexidine bathing, nasal idophor – PROTECT TRIAL; 16.6% reduction in infection related hospitalizations
- Enhanced barrier precautions (gowns and gloves during high contact care activities for residents with known MDROs
- Hand Hygiene
- Antimicrobial Stewardship

Mody L, Advani SD, Ashraf MS, Bartlett AH, Bradley SF, Burdsall DP, Hanrahan JA, Huang SS, Jump RLP, Nicolle L, Roghmann MC, Stone P, Murthy RK. Multisociety guidance for infection prevention and control in nursing homes. Infect Control Hosp Epidemiol. 2025 Nov;46(11):1069-1096. doi: 10.1017/ice.2025.10252. Epub 2025 Oct 28. PMID: 41146603; PMCID: PMC12620066.

Willems RPJ, van Dijk K, Vehreschild MJGT, Biehl LM, Ket JCF, Remmelzwaal S, Vandenbroucke-Grauls CMJE. Incidence of infection with multidrug-resistant Gram-negative bacteria and vancomycin-resistant enterococci in carriers: a systematic review and meta-regression analysis. Lancet Infect Dis. 2023 Jun;23(6):719-731. doi: 10.1016/S1473-3099(22)00811-8. Epub 2023 Jan 30. PMID: 36731484.

MDROs: Prevalence, Transmission, Prevention - References

SHIELD TRIAL:

- McKinnell JA, Singh RD, Miller LG, Kleinman K, Gussin G, He J, Saavedra R, Dutciuc TD, Estevez M, Chang J, Heim L, Yamaguchi S, Custodio H, Gohil SK, Park S, Tam S, Robinson PA, Tjoa T, Nguyen J, Evans KD, Bittencourt CE, Lee BY, Mueller LE, Bartsch SM, Jernigan JA, Slayton RB, Stone ND, Zahn M, Mor V, McConeghy K, Baier RR, Janssen L, O'Donnell K, Weinstein RA, Hayden MK, Coady MH, Bhattarai M, Peterson EM, Huang SS. The SHIELD Orange County Project: Multidrug-resistant Organism Prevalence in 21 Nursing Homes and Long-term Acute Care Facilities in Southern California. Clin Infect Dis. 2019 Oct 15;69(9):1566-1573. doi: 10.1093/cid/ciz119. PMID: 30753383; PMCID: PMC7320073.

PROTECT TRIAL:

- Miller LG, McKinnell JA, Singh RD, Gussin GM, Kleinman K, Saavedra R, Mendez J, Catuna TD, Felix J, Chang J, Heim L, Franco R, Tjoa T, Stone ND, Steinberg K, Beecham N, Montgomery J, Walters D, Park S, Tam S, Gohil SK, Robinson PA, Estevez M, Lewis B, Shimabukuro JA, Tchakalian G, Miner A, Torres C, Evans KD, Bittencourt CE, He J, Lee E, Nedelcu C, Lu J, Agrawal S, Sturdevant SG, Peterson E, Huang SS. Decolonization in Nursing Homes to Prevent Infection and Hospitalization. N Engl J Med. 2023 Nov 9;389(19):1766-1777. doi: 10.1056/NEJMoa2215254. Epub 2023 Oct 10. PMID: 37815935; PMCID: PMC13016440.

MICHIGAN COHORT:

- Mody L, Foxman B, Bradley S, McNamara S, Lansing B, Gibson K, Cassone M, Armbruster C, Mantey J, Min L. Longitudinal Assessment of Multidrug-Resistant Organisms in Newly Admitted Nursing Facility Patients: Implications for an Evolving Population. Clin Infect Dis. 2018 Aug 31;67(6):837-844. doi: 10.1093/cid/ciy194. PMID: 29635360; PMCID: PMC6117444.

Urinary Tract Infections

Overview

The #1 most commonly reported bacterial infection in LTC settings

> 2 million infections annually in US nursing homes

Accounts for 50–55% of bacteremia cases in LTC residents, yet progression to sepsis is uncommon (<2% of cases); given the high mortality when it does occur (34% at 6 months), early recognition and appropriate antibiotic treatment are critical

New 2025 IDSA Classification!

Classified by anatomic extent of infection – not by patient characteristics or comorbidities

UNCOMPLICATED

INFECTION CONFINED TO THE BLADDER

Afebrile women or men – including those with diabetes, immunocompromise, or structural urologic abnormalities

COMPLICATED

INFECTION BEYOND THE BLADDER

Includes pyelonephritis, febrile UTI, catheter associated UTI (CAUTI), and prostatitis. Defined by symptoms of fever, systemic signs (chills, rigors, hemodynamic instability), flank pain, or tenderness

Kevin P. High, Suzanne F. Bradley, Stefan Gravenstein, David R. Mehr, Vincent J. Quagliarello, Chesley Richards, Thomas T. Yoshikawa, Clinical Practice Guideline for the Evaluation of Fever and Infection in Older Adult Residents of Long-Term Care Facilities: 2008 Update by the Infectious Diseases Society of America, *Clinical Infectious Diseases*, Volume 48, Issue 2, 15 January 2009, Pages 149–171, https://doi.org/10.1086/595683

Artero A, López-Cruz I, Alberola J, Eiros JM, Resa E, Piles L, Madrazo M. Influence of Sepsis on the Middle-Term Outcomes for Urinary Tract Infections in Elderly People. Microorganisms. 2023 Jul 31;11(8):1959. doi: 10.3390/microorganisms11081959. PMID: 37630518; PMCID: PMC10457840.

Urinary Tract Infections — Common Bacterial Pathogens

PATHOGENS

E. coli remains the dominant UTI pathogen in LTC, but resistance is substantial. ESBL producers now account for up to 42% of isolates in some facilities — culture before treating

Organism	Uncomplicated UTI	Complicated UTI/CAUTI
Escherichia coli	**75-90%**	**50%**
Staphylococcus saprophyticus	10-15% (mainly in young sexually active women)	Rare
Klebsiella spp.	1-5%	10-15% (ESBL producers increasingly common)
Proteus mirabilis	1-5%	5-10%
Enterococcus spp.	1-5%	10-15%
Pseudomonas aeruginosa	Rare (1%)	5-10%
Enterobacter spp.	1%	3-5%

Sachdeva A, Rai BP, Veeratterapillay R, Harding C, Nambiar A. Non-steroidal anti-inflammatory drugs for treating symptomatic uncomplicated urinary tract infections in non-pregnant adult women. Cochrane Database of Systematic Reviews 2024, Issue 12. Art. No.: CD014762. DOI: 10.1002/14651858.CD014762.pub2. Accessed 21 April 2026

Kurotschka PK, Gágyor I, Ebell MH. Acute Uncomplicated UTIs in Adults: Rapid Evidence Review. Am Fam Physician. 2024 Feb;109(2):167-174. PMID: 38393801.

Urinary Tract Infection — Empiric Antibiotic Therapy

EMPIRIC THERAPY

Outpatient Uncomplicated Cystitis

Agent	Dose	Duration	Key Considerations
Nitrofurantoin (Macrobid)	100 mg BID	5 days	Preferred 1st-line, requires CrCl ≥ 30 ml/min, avoid in pyelonephritis
Sulfamethoxazole/Trimethoprim (Bactrim DS)	160/800 mg BID	3 days	Preferred 1st-line, warning for sulfa allergy, requires CrCl ≥15
Amoxicillin-clavulanate (Augmentin)	875 mg BID	5 days	Renal dosing if CrCl <29 mL/min
Fosfomycin	3 g	Single dose	Reserved for ESBL E. coli, avoid in pyelonephritis

Outpatient Pyelonephritis

Requires agents achieving renal parenchymal concentration. Obtain urine culture before starting. De-escalate once susceptibilities return.

Agent	Dose	Duration	Notes
Ciprofloxacin	500 mg BID	7 days	Preferred for mild-moderate. Local resistance up to 50% — obtain culture first. QT risk
Levofloxacin	750 mg QD	5 days	Same resistance caveat as cipro. QT prolongation risk — check ECG and drug interactions.
TMP-SMX (if susceptible)	160/800 mg BID	7–10 days	Warning for sulfa allergy, requires CrCl ≥15

Note: repeat urinalysis or urine culture after UTI treatment in LTC residents is **NOT recommended if symptoms resolve**, as clinical cure, not microbiologic eradication is the goal. Positive cultures are common due to asymptomatic bacteriuria and do not indicate treatment failure; unnecessary testing can lead to inappropriate antibiotics

Kevin P. High, Suzanne F. Bradley, Stefan Gravenstein, David R. Mehr, Vincent J. Quagliarello, Chesley Richards, Thomas T. Yoshikawa, Clinical Practice Guideline for the Evaluation of Fever and Infection in Older Adult Residents of Long-Term Care Facilities: 2008 Update by the Infectious Diseases Society of America, *Clinical Infectious Diseases*, Volume 48, Issue 2, 15 January 2009, Pages 149–171, https://doi.org/10.1086/595683

UTI — MDRO-Directed Antibiotic Therapy

MDRO TREATMENT

MDRO	US LTC Prevalence	Pathogen of Concern	Preferred Treatment	Alternative Treatment
ESBL-producing Enterobacterales	34% of NH residents (colonization); prevalence in UTI isolates varies by facility	*E. coli*, *K. pneumoniae*	**Uncomplicated cystitis:** Nitrofurantoin, TMP-SMX (if susceptible) **Pyelonephritis/cUTI:** TMP-SMX, ciprofloxacin, or levofloxacin (if susceptible); carbapenems if resistance/toxicity concerns	**Uncomplicated cystitis:** Single-dose aminoglycoside, fosfomycin (*E. coli* only) **Pyelonephritis/cUTI:** Aminoglycosides
Multidrug-resistant Pseudomonas aeruginosa	11% of P. aeruginosa *isolates are MDR*	P. aeruginosa with resistance to multiple classes	**Pyelonephritis/cUTI:** Ceftolozane-tazobactam, ceftazidime-avibactam, imipenem-cilastatin-relebactam, cefiderocol	Once-daily tobramycin or amikacin (if nephrotoxicity risk acceptable)
MRSA	5% of NH UTI pathogens but 67% methicillin-resistant when present	*S. aureus*	Vancomycin, linezolid, daptomycin	TMP-SMX (if susceptible)
Vancomycin Resistant Enterococci (VRE)	5% of NH UTI pathogens but 60% vancomycin-resistant when present	Enterococcus faecium	Linezolid, daptomycin	Nitrofurantoin (uncomplicated cystitis only, if susceptible)
Carbapenem-resistant Enterobacterales (CRE)	1% in NHs; 8% in facilities managing ventilated patients	*K. pneumoniae*, *E. coli*, *Enterobacter* spp.	**Uncomplicated cystitis:** Nitrofurantoin, TMP-SMX, ciprofloxacin, or levofloxacin (if susceptible) **Pyelonephritis/cUTI:** Ceftazidime-avibactam, meropenem-vaborbactam, imipenem-cilastatin-relebactam, cefiderocol	**Uncomplicated cystitis:** Single-dose aminoglycoside, fosfomycin (*E. coli* only), colistin **Pyelonephritis/cUTI:** Aminoglycosides

Consideration: Despite high MRSA colonization rates in nursing homes (up to 36% of residents), MRSA causes only 2–3% of UTIs; empiric MRSA coverage should be risk-based not routine (prior UTI MRSA infection, known colonization with indwelling catheters)

McKinnell JA, Miller LG, Singh RD, Gussin G, Kleinman K, Mendez J, Laurner B, Catuna TD, Heim L, Saavedra R, Felix J, Torres C, Chang J, Estevez M, Mendez J, Tchakalian G, Bloomfield L, Ceja S, Franco R, Miner A, Hurtado A, Hean R, Varasteh A, Robinson PA, Park S, Tam S, Tjoa T, He J, Agrawal S, Yamaguchi S, Custodio H, Nguyen J, Bittencourt CE, Evans KD, Mor V, McConeghy K, Weinstein RA, Hayden MK, Stone ND, Steinberg K, Beecham N, Montgomery J, DeAnn W, Peterson EM, Huang SS. High Prevalence of Multidrug-Resistant Organism Colonization in 28 Nursing Homes: An "Iceberg Effect". J Am Med Dir Assoc. 2020 Dec;21(12):1937-1943.e2. doi: 10.1016/j.jamda.2020.04.007. Epub 2020 Jun 16. PMID: 32553489; PMCID: PMC7708431.

Eure TR, Stone ND, Mungai EA, Bell JM, Thompson ND. Antibiotic-resistant pathogens associated with urinary tract infections in nursing homes: Summary of data reported to the National Healthcare Safety Network Long-Term Care Facility Component, 2013-2017. Infect Control Hosp Epidemiol. 2021 Jan;42(1):31-36. doi: 10.1017/ice.2020.348. Epub 2020 Aug 12. PMID: 32782037; PMCID: PMC10627066.

Urinary Tract Infection — Special Situations: CAUTI

CAUTI

ORAL THERAPY

OUTPATIENT

Patients with CAUTI may often be managed as outpatients with oral therapy or step down to oral therapy

1 Fluoroquinolones

Ciprofloxacin
500 mg PO BID × 7 days

Levofloxacin
750 mg PO QD × 5 days

Effective first-line — check local resistance rates before prescribing. Monitor for adverse effects (tendinopathy, C. diff)

Monitor local resistance before use

2 TMP-SMX

Trimethoprim-SMX
160/800 mg PO BID × 7 d

Effective but resistance limits use. Confirm susceptibility with prior culture results before initiating.

Review prior culture sensitivities

3 Oral Cephalosporins

Cefpodoxime
200 mg PO BID × 7 d

Ceftibuten
400 mg PO QD × 7 d

Comparable efficacy to FQ/TMP-SMX as step-down therapy. Use when ESBL-producing organisms are not a concern.

Not for ESBL-producing organisms

INTRAVENOUS (IV) THERAPY

WITH SEPSIS / SEPTIC SHOCK

≥90% susceptibility required

Extended-spectrum beta-lactam
Piperacillin-tazobactam

Carbapenems
Meropenem, Imipenem-cilastatin, Ertapenem (IM/IV)

Novel BL/BLI Combinations
Ceftolozane-tazobactam, Ceftazidime-avibactam, Meropenem-vaborbactam, Imipenem-cilastatin-relebactam

Select agent with ≥90% susceptibility per local antibiogram (≥80% if no septic shock)

WITHOUT SEPSIS

Prefer over carbapenems — stewardship

3rd/4th-Gen Cephalosporins: Ceftriaxone, ceftazidime, cefotaxime, cefepime

Piperacillin-tazobactam: IV standard dosing

Fluoroquinolones (IV): Ciprofloxacin, levofloxacin

Stewardship: reserve carbapenems and novel agents for sepsis management only

AVOID FOR CAUTI

Nitrofurantoin · **Oral fosfomycin**

Insufficient renal parenchymal and blood-level penetration

Consideration: In catheterized patients, nearly 100% will have bacteriuria, but this alone does not indicate a UTI; only treat when bacteriuria ≥10^3 CFU/mL + GU symptoms + no other source is identified

Lindsay E Nicolle, Kalpana Gupta, Suzanne F Bradley, Richard Colgan, Gregory P DeMuri, Dimitri Drekonja, Linda O Eckert, Suzanne E Geerlings, Béla Köves, Thomas M Hooton, Manisha Juthani-Mehta, Shandra L Knight, Sanjay Saint, Anthony J Schaeffer, Barbara Trautner, Bjorn Wullt, Reed Siemieniuk, Clinical Practice Guideline for the Management of Asymptomatic Bacteriuria: 2019 Update by the Infectious Diseases Society of America, *Clinical Infectious Diseases*, Volume 68, Issue 10, 15 May 2019, Pages e83–e110, https://doi.org/10.1093/cid/ciy1121

EMPIRIC THERAPY

Asymptomatic Bacteriuria

IV. Should ASB Be Screened for and Treated in Functionally Impaired Older Women or Men Residing in the Community, or in Older Residents of Long-term Care Facilities?

Recommendations

1. In older, community-dwelling persons who are functionally impaired, we recommend against screening for or treating ASB (*strong recommendation, low-quality evidence*).

2. In older persons resident in long-term care facilities, we recommend against screening for or treating ASB (*strong recommendation, moderate-quality evidence*).

Why We Don't Treat

No improvement in clinical outcomes (mortality, sepsis)

No sustained benefit despite short-term microbiologic clearance

Increased harm:

- *Clostridioides difficile* infection
- Antimicrobial resistance

Up to 50% of LTC residents have bacteriuria at any given time with only 16% of these cases meeting criteria for UTI, yet 75% still receive antibiotics!

Bottom line: Treating ASB in most patients, *especially the elderly* causes harm without benefit

Lindsay E Nicolle, Kalpana Gupta, Suzanne F Bradley, Richard Colgan, Gregory P DeMuri, Dimitri Drekonja, Linda O Eckert, Suzanne E Geerlings, Béla Köves, Thomas M Hooton, Manisha Juthani-Mehta, Shandra L Knight, Sanjay Saint, Anthony J Schaeffer, Barbara Trautner, Bjorn Wullt, Reed Siemieniuk, Clinical Practice Guideline for the Management of Asymptomatic Bacteriuria: 2019 Update by the Infectious Diseases Society of America, *Clinical Infectious Diseases*, Volume 68, Issue 10, 15 May 2019, Pages e83–e110, https://doi.org/10.1093/cid/ciy1121

EMPIRIC THERAPY

Urine PCR Testing

PALTmed 2025 consensus statement:
We recommend <u>against</u> the routine use of urine polymerase chain reaction (PCR) testing for the diagnosis of urinary tract infection

Key Concerns:

- **Overly sensitive → overdiagnosis:** Urine PCR can detect organisms of unclear significance, often identifying asymptomatic bacteriuria rather than true infection
- **Resistance interpretation is unclear:** Genetic resistance markers may not match actual susceptibilities, and its often unknown which organism carries which gene
- **No validated thresholds:** Unlike cultures (≥10^5 CFU/mL), PCR lacks established cutoffs to guide treatment decisions
- **Substantially higher cost:** $585 per test vs $8 for standard culture (70× higher)
- **Potential bias in evidence:** Much of the supporting data is industry-funded
- **No proven clinical benefit:** There is no clear evidence that PCR improves patient outcomes

Bottom Line: PCR Use in LTC is not recommended; the high sensitivity in a population with a high prevalence of asymptomatic bacteriuria likely drives antibiotic overuse without improving clinical outcomes

Zering J, Dumyati G, Osevala N,. A Need for a Time-Out: A Consensus Statement From the Post-Acute and Long-Term Care Medical Association (PALTmed) on the Use of Urine Polymerase Chain Reaction Testing for Urinary Tract Infection Journal of the American Medical Directors Association, 2025; 26

Pneumonia

Overview

10x higher incidence in LTC facilities than among other elderly community dwellers

2nd most common infection among nursing home residents after UTI

Leading cause of infectious death in LTC facilities

50% Pneumonia cases in the LTC setting are expected to rise by 2030 (>2 million cases annually) due to shifting demographics

Kevin P. High, Suzanne F. Bradley, Stefan Gravenstein, David R. Mehr, Vincent J. Quagliarello, Chesley Richards, Thomas T. Yoshikawa, Clinical Practice Guideline for the Evaluation of Fever and Infection in Older Adult Residents of Long-Term Care Facilities: 2008 Update by the Infectious Diseases Society of America, *Clinical Infectious Diseases*, Volume 48, Issue 2, 15 January 2009, Pages 149–171, https://doi.org/10.1086/595683

Cao Y, Liu C, Lin J, Ng L, Needleman I, Walsh T, Li C. Oral care measures for preventing nursing home-acquired pneumonia. Cochrane Database of Systematic Reviews 2022, Issue 11. Art. No.: CD012416. DOI: 10.1002/14651858.CD012416.pub3. Accessed 21 April 2026.

Pneumonia — Common Bacterial Pathogens

PATHOGENS

S. pneumoniae remains the dominant pathogen. Atypical organisms (Legionella, Mycoplasma) must be considered. In severe cases, S. aureus and gram-negatives become more prominent. Never add MRSA or Pseudomonas coverage without specific risk factors.

Organism	CAP	HAP/VAP	Aspiration Pneumonia
Streptococcus pneumoniae	5-15%	1%	Predominant in community acquired aspiration
Staphylococcus aureus MSSA	1%	10-18%	12% (overall for MSSA and MRSA)
Staphylococcus aureus MRSA	0.7%	5-10%	12% (overall for MSSA and MRSA)
Haemophilus influenzae	6%	1%	Predominant in community acquired aspiration
Pseudomonas aeruginosa	1-4%	21-22%	Predominant hospital acquired aspiration
Klebsiella species	2%	10-20%	49% (overall for gram negative enterics)
Enterobacter species	1%	6%	49% (overall for gram negative enterics)
Atypical Pathogens (mycoplasma pneumoniae, legionella)	3-11%	1%	1%
Respiratory viruses (human rhinovirus, influenza A/B)	23%	5%	N/A
Anaerobic bacteria	1%	1%	16-20%

Note: For nursing home acquired pneumonia, MRSA accounts for 1-4% of all cases, making it a relatively uncommon pathogen; routine empiric MRSA coverage is not recommended; MRSA coverage should be reserved for patients with validated risk factors (recent IV antibiotic exposure (within 90 days), prior MRSA infection or colonization, or local epidemiologic data indicating high MRSA prevalence)

Metlay JP, Waterer GW, Long AC, Anzueto A, Brozek J, Crothers K, Cooley LA, Dean NC, Fine MJ, Flanders SA, Griffin MR, Metersky ML, Musher DM, Restrepo MI, Whitney CG. Diagnosis and Treatment of Adults with Community-acquired Pneumonia. An Official Clinical Practice Guideline of the American Thoracic Society and Infectious Diseases Society of America. Am J Respir Crit Care Med. 2019 Oct 1;200(7):e45-e67. doi: 10.1164/rccm.201908-1581ST. PMID: 31573350; PMCID: PMC6812437.

EMPIRIC THERAPY

Outpatient Empiric Antibiotic Selection for Community Acquired Pneumonia with no MRSA/Pseudomonas Risk

Patient Characteristic	Preferred Regimen	Duration	Considerations
CAP with no comorbidities	Amoxicillin 3 g QD or Doxycycline 100 mg	5 days	Monotherapy with a macrolide may be considered if local resistance is < 25%
CAP with comorbidities (DM, CKD, CHF, immunosuppression, asplenia)	Combination Therapy: Beta-lactam (Amox/clav, cefpodoxime) PLUS azithromycin OR doxycycline Monotherapy: Levofloxacin 750 mg QD or Moxifloxacin 400 mg QD	5 days	Combination therapy is preferred over monotherapy with a respiratory fluoroquinolone. Given risk of resistance and adverse effects associated with fluroquinolones, empiric use should be reserved for patients with high risk PCN and cephalosporin allergies

Metlay JP, Waterer GW, Long AC, Anzueto A, Brozek J, Crothers K, Cooley LA, Dean NC, Fine MJ, Flanders SA, Griffin MR, Metersky ML, Musher DM, Restrepo MI, Whitney CG. Diagnosis and Treatment of Adults with Community-acquired Pneumonia. An Official Clinical Practice Guideline of the American Thoracic Society and Infectious Diseases Society of America. Am J Respir Crit Care Med. 2019 Oct 1;200(7):e45-e67. doi: 10.1164/rccm.201908-1581ST. PMID: 31573350; PMCID: PMC6812437.

Pneumonia — Special Situations: MRSA & Pseudomonas Directed Therapy

ORGANISM-DIRECTED THERAPY

MRSA Pneumonia

Risk Factors for MRSA Pneumonia — Add Coverage If Present

- Prior MRSA isolation (respiratory, skin, or nares)
- Hospitalization + IV antibiotics within prior 90 days
- Cavitary lung lesion or necrotizing pneumonia
- Post-influenza bacterial superinfection
- Hemodialysis-dependent or severely immunocompromised

Additional Agent	Dose	Advantages	Limitations
Vancomycin (IV)	15–20 mg/kg IV q8–12h (AUC-guided; target AUC/MIC 400–600)	Gold standard; bactericidal; extensive clinical data; well-established	Nephrotoxicity; requires AUC-based TDM; poor lung penetration vs linezolid; slow activity
Linezolid (PO)	600 mg BID	Excellent lung penetration; 100% PO bioavailability; inhibits toxin production (PVL, TSST-1); possible superior clinical cure rates in modified ITT analyses	Myelosuppression, serotonin syndrome** with SSRIs/SNRIs/tramadol; weekly CBC >2 weeks; expensive **occurs in less than 0.5% of patients with no significant difference between those taking antidepressants and those who are not
Daptomycin	**N/A — CONTRAINDICATED**		**ABSOLUTELY CONTRAINDICATED for pneumonia; inactivated by pulmonary surfactant. Never use for any respiratory infection regardless of susceptibility**

Pseudomonas aeruginosa Pneumonia

Risk Factors for Pseudomonas Pneumonia — Add Coverage If Present

- Prior Pseudomonas isolation (respiratory or other site)
- Structural lung disease (bronchiectasis, cystic fibrosis)
- Hospitalization + IV antibiotics within prior 90 days
- Severe immunocompromise (neutropenia, high-dose steroids)
- Prior hospitalization requiring ICU or ventilator support

Susceptibility	Preferred Regimen	Alternative
Susceptible Pseudomonas	Antipseudomonal beta-lactam (pip-tazo 4.5g q6h, cefepime 2g q8h, or meropenem 1g q8h) PLUS ciprofloxacin 400 mg q8h or levofloxacin 750 mg daily	Antipseudomonal beta-lactam + aminoglycoside (amikacin or tobramycin). De-escalate to monotherapy once susceptibility confirmed.
MDR Pseudomonas (resistant ≥3 classes)	Ceftolozane-tazobactam 3g IV q8h —OR— Ceftazidime-avibactam 2.5g IV q8h	Imipenem-relebactam 1.25g IV q6h · Colistin + carbapenem (last resort) · ID consultation strongly recommended
DTR Pseudomonas (resistant to all standard agents)	Cefiderocol 2g IV q8h (extended infusion) ± combination therapy guided by ID specialist	Aztreonam-avibactam (if available); · ID consultation mandatory

Dual-agent empiric coverage recommended initially; de-escalate to monotherapy once susceptibility is confirmed.

Metlay JP, Waterer GW, Long AC, Anzueto A, Brozek J, Crothers K, Cooley LA, Dean NC, Fine MJ, Flanders SA, Griffin MR, Metersky ML, Musher DM, Restrepo MI, Whitney CG. Diagnosis and Treatment of Adults with Community-acquired Pneumonia. An Official Clinical Practice Guideline of the American Thoracic Society and Infectious Diseases Society of America. Am J Respir Crit Care Med. 2019 Oct 1;200(7):e45-e67. doi: 10.1164/rccm.201908-1581ST. PMID: 31573350; PMCID: PMC6812437.

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EMPIRIC THERAPY

HAP (Hospital Acquired Pneumonia)

All patients with hospital-acquired pneumonia (HAP) receive empiric antibiotics with activity against Staphylococcus aureus and gram-negative bacilli including Pseudomonas aeruginosa

Those with factors increasing likelihood of Pseudomonas infection (prior IV antibiotics within 90 days) or high mortality risk, two different classes of antipseudomonal antibiotics are suggested. Single-agent antipseudomonal therapy is acceptable for other HAP patients.

Antipseudomonal options

- Piperacillin-tazobactam (4.5 g IV every 6 hours)
- Cefepime (2 g IV every 8 hours)
- Ceftazidime (2 g IV every 8 hours)
- Imipenem (500 mg IV every 6 hours)
- Meropenem (1 g IV every 8 hours)
- Aztreonam (2 g IV every 8 hours)

Metlay JP, Waterer GW, Long AC, Anzueto A, Brozek J, Crothers K, Cooley LA, Dean NC, Fine MJ, Flanders SA, Griffin MR, Metersky ML, Musher DM, Restrepo MI, Whitney CG. Diagnosis and Treatment of Adults with Community-acquired Pneumonia. An Official Clinical Practice Guideline of the American Thoracic Society and Infectious Diseases Society of America. Am J Respir Crit Care Med. 2019 Oct 1;200(7):e45-e67. doi: 10.1164/rccm.201908-1581ST. PMID: 31573350; PMCID: PMC6812437.

Pneumonia — Special Situations: Aspiration Pneumonia

Treatment is dependent on setting in which the aspiration event occurred

Community-Acquired (CAP)

Amoxicillin-clavulanate
875 mg BID x 7 days
First-line; covers anaerobes & gram-negatives

Moxifloxacin or Levofloxacin
400 mg QD x 7 days or 750 mg QD x 7 days
Respiratory fluoroquinolones; good anaerobic activity
**cipro NOT appropriate

Clindamycin
450 mg TID x 7 days
Anaerobic coverage; less preferred (C. diff risk); reserved for PCN and cephalosporin allergy
** may be added on when risk of anerobic infection is high (severe periodontal disease, necrotizing pneumonia, lung abscess)

Metronidazole
500 mg TID x 7 days
Enhanced anaerobic cover; never used alone; not routinely recommended
** used in combination with ceftriaxone 2 g QD

Hospital-Acquired (HAP)

Piperacillin-tazobactam (Zosyn)
Broad-spectrum; covers Pseudomonas & anaerobes

Cefepime / Ceftazidime
Anti-pseudomonal cephalosporins

Meropenem / Imipenem
Reserved for severe or resistant organisms

Aztreonam
PCN allergy; add metronidazole for anaerobes

High-Risk (MRSA coverage)

Vancomycin
Add to HAP regimen; monitor renal function & levels

Linezolid
Superior lung penetration; preferred if renal impairment

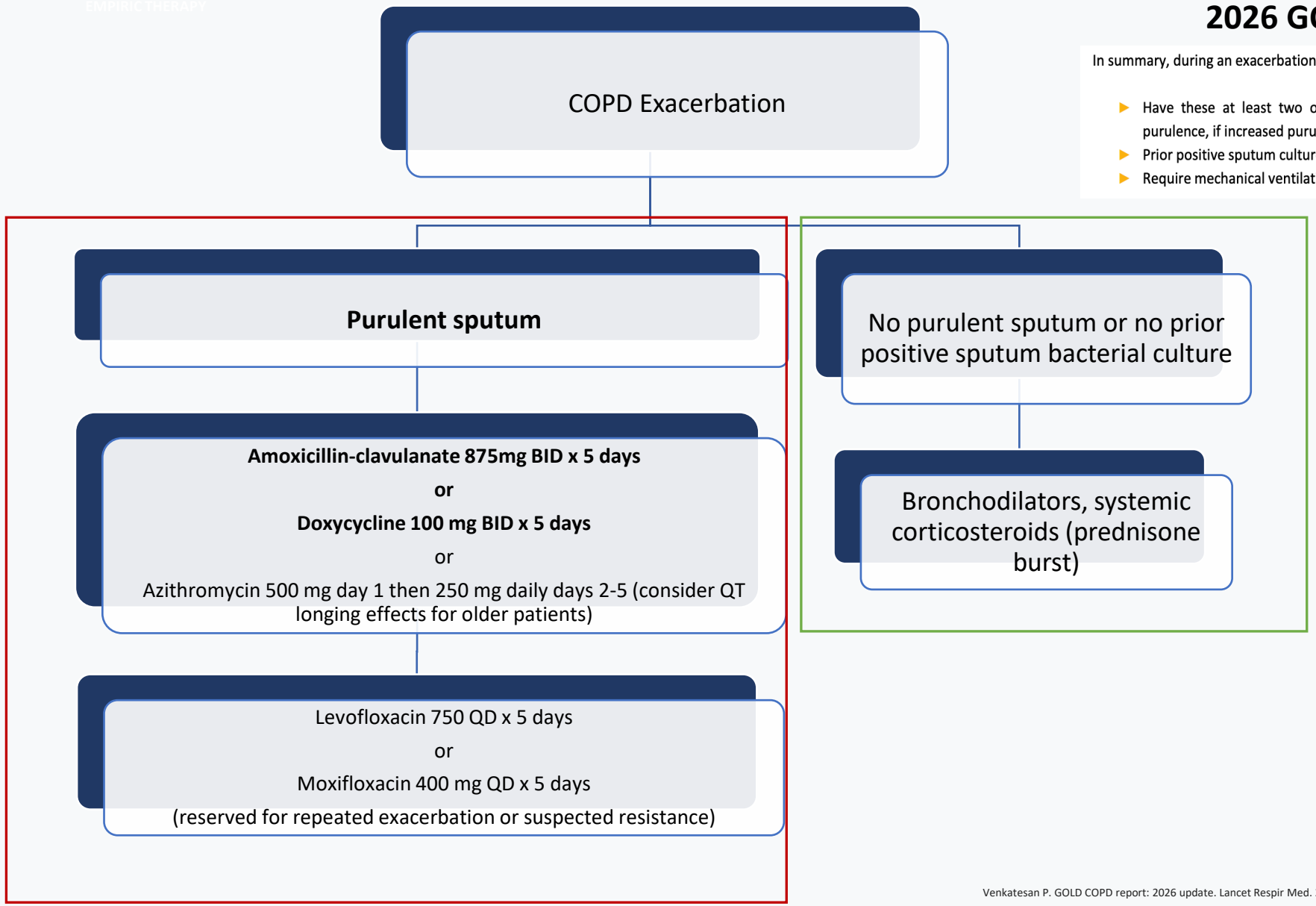
Risk factors:
Prior MRSA, recent hospitalization, IV drug use, severe illness

De-escalate to narrower antibiotics once culture results are available

Metlay JP, Waterer GW, Long AC, Anzueto A, Brozek J, Crothers K, Cooley LA, Dean NC, Fine MJ, Flanders SA, Griffin MR, Metersky ML, Musher DM, Restrepo MI, Whitney CG. Diagnosis and Treatment of Adults with Community-acquired Pneumonia. An Official Clinical Practice Guideline of the American Thoracic Society and Infectious Diseases Society of America. Am J Respir Crit Care Med. 2019 Oct 1;200(7):e45-e67. doi: 10.1164/rccm.201908-1581ST. PMID: 31573350; PMCID: PMC6812437.

Pneumonia — Special Situations: COPD Exacerbation

EMPIRIC THERAPY



2026 GOLD Report Recommendations:

In summary, during an exacerbation antibiotics should be given to patients with COPD who:

- Have these at least two of these symptoms: increase in dyspnea, fever, sputum volume, and sputum purulence, if increased purulence of sputum is one of these symptoms
- Prior positive sputum culture during prior exacerbation
- Require mechanical ventilation (invasive or noninvasive).[926,964]

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Skin & Soft Tissue Infections (SSTI)

SSTI — Overview & Empiric Therapy

OVERVIEW + EMPIRIC THERAPY

SSTIs are the 3rd most common LTC infectious diagnosis. MRSA colonization rates of 16–23% in LTC residents mandate lower threshold for MRSA coverage.
The key clinical distinction is purulence: non-purulent → streptococcal coverage; purulent → MRSA coverage.

Empiric Antibiotic Selection by SSTI Type & Severity

Type & Severity	Preferred Agents	PCN-Allergic Alternative	Duration
Non-purulent cellulitis / Mild — outpatient	Cephalexin 500 mg TID Dicloxacillin 500 mg QID Amoxicillin-clavulanate 875/125 mg BID	Clindamycin 300 mg TID	5 days
Non-purulent cellulitis / Moderate — IV needed	Cefazolin 2g IV q8h Ampicillin-sulbactam 3g IV q6h	Clindamycin 600 mg IV q8h Vancomycin (severe PCN allergy)	Until improved, then step-down PO (total 5–6 days)
Purulent cellulitis / MRSA suspected / Mild	TMP-SMX 1–2 DS tabs PO BID Doxycycline 100 mg PO BID +/– Cephalexin for streptococcal coverage	Clindamycin 300 mg PO TID (D-zone test required) Linezolid 600 mg PO BID	5–7 days
Purulent cellulitis / MRSA suspected / Moderate-Severe	Vancomycin 15–20 mg/kg IV q8–12h Linezolid 600 mg BID Daptomycin 4–6 mg/kg IV daily Ceftaroline 600 mg IV q8h For oral step down options see above (Purulent cellulitis / MRSA suspected / Mild)	Same agents	7–14 days (until clinical resolution)
Necrotizing fasciitis (SURGICAL EMERGENCY)	Meropenem or pip-tazo + Vancomycin + Clindamycin (toxin inhibition) SURGERY IS MANDATORY	Broad coverage regardless of allergy — life-threatening emergency	Until source controlled + clinical resolution (ID consult)

Note: With cellulitis being a common SSTI in long-term care settings, true bilateral lower extremity cellulitis is rare. Bilateral presentations are frequently misdiagnosed, with studies showing that 30–39% of presumed cellulitis cases are actually pseudocellulitis, most commonly stasis dermatitis, which is inherently bilateral. **True cellulitis typically presents unilaterally** due to the need for a localized breach in the skin barrier, making bilateral involvement a key clinical red flag for alternative diagnoses rather than true infection

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SSTI — Primary Pathogens & Coverage

PATHOGENS

Common Primary SSTI Pathogens

Organism	Infection Types	Outpatient (Mild) Antibiotic Coverage for Specific Organisms	Key Clinical Features
S. aureus (MSSA)	Abscesses, furuncles, carbuncles, cellulitis, wound infections	**Cephalexin** **Dicloxacillin** **Amoxicillin-clavulanate** **Clindamycin** (penicillin allergy)	**I&D is primary treatment for abscesses** — antibiotics are adjunctive. Cannot distinguish MRSA from MSSA clinically. Culture abscess drainage.
MRSA (CA & HA strains)	Same spectrum as MSSA	**Trimethoprim-sulfamethoxazole** (Unreliable activity against Group A and Group B streptococci; consider adding a β-lactam if streptococcal infection is suspected) **Doxycycline** (same limitation) **Clindamycin** (provides both MRSA and streptococcal coverage, but use cautiously due to inducible resistance in CA-MRSA; check local resistance patterns) **Linezolid** (option for penicillin-allergic patients)	USA300 (CA-MRSA) is more antibiotic-susceptible than HA-MRSA. PVL+ strains cause recurrent furunculosis and necrotizing pneumonia. Colonization rate 16–23% in LTC.
Group A Strep (S. pyogenes)	Erysipelas, non-purulent cellulitis, necrotizing fasciitis, myositis	**Cephalexin** **Dicloxacillin** **Penicillin VK** **Amoxicillin-clavulanate** **Clindamycin** (penicillin allergy)	Erysipelas: sharply demarcated, raised, bright red. Streptococcal TSS can cause systemic toxicity disproportionate to local findings. Penicillin fully active.
Group B Strep (S. agalactiae)	Cellulitis, wound infections (diabetics, elderly)	**Penicillin G** (preferred) **Ampicillin** (acceptable alternative) **Cephalosporin**s (cephalexin, cefazolin) **GBS remains almost universally susceptible to beta-lactams	Common in LTC — skin tears, stasis ulcers, diabetic foot. Penicillin/amoxicillin fully active. Not an MRSA concern

J Michael Miller, Matthew J Binnicker, Sheldon Campbell, Karen C Carroll, Kimberle C Chapin, Mark D Gonzalez, Amanda Harrington, Robert C Jerris, Sue C Kehl, Sixto M Leal, Robin Patel, Bobbi S Pritt, Sandra S Richter, Barbara Robinson-Dunn, James W Snyder, Sam Telford, Elitza S Theel, Richard B Thomson, Melvin P Weinstein, Joseph D Yao, Guide to Utilization of the Microbiology Laboratory for Diagnosis of Infectious Diseases: 2024 Update by the Infectious Diseases Society of America (IDSA) and the American Society for Microbiology (ASM) , *Clinical Infectious Diseases*, 2024;, ciae104, https://doi.org/10.1093/cid/ciae104

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SSTI — MDRO Considerations

MDROs

MDRO	Primary SSTI Types	Secondary SSTI Types	Oral Options	IV Options
MRSA **colonization ranges from 36-42% in nursing homes	Cellulitis, purulent infections, abscesses, folliculitis, impetigo	Infected pressure ulcers, surgical wound infections	• TMP-SMX • Doxycycline • Minocycline • Linezolid • Clindamycin*	• Vancomycin • Linezolid • Daptomycin • Ceftaroline
ESBL-producing Enterobacterales (E. coli, Proteus, Klebsiella) **colonization ranges from 16-34% in nursing homes	Rare in primary SSTI	Infected pressure ulcers (polymicrobial), chronic wound infections, diabetic foot infections	• TMP-SMX (if susceptible) • Fluoroquinolones (if susceptible)	• Meropenem • Imipenem-cilastatin • Ertapenem (IV/IM)
Pseudomonas aeruginosa (MDR strains)	Rare in primary SSTI	Infected pressure ulcers, (polymicrobial), chronic wound infections	Limited oral options	• Ceftazidime • Cefepime • Piperacillin-tazobactam • Meropenem • Ceftolozane-tazobactam**
VRE	Rare in primary SSTI	Infected pressure ulcers (polymicrobial), chronic wound infections	Linezolid	• Daptomycin

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SSTI — Special Situations: Pressure Ulcer Infections

Pressure Ulcer Infections — Polymicrobial Pathogens & Treatment

Surface swabs are unreliable (always colonized). Deep tissue biopsy or needle aspiration of wound base required for actionable culture data. Treat ONLY when systemic signs of infection or advancing local infection are present.

Severity	Clinical Criteria	Pathogen Coverage Needed	Recommended Regimen
Mild (local only)	Increased erythema/warmth/tenderness, NO systemic signs	Surface colonization — topical only	Topical: silver sulfadiazine, cadexomer iodine, or medical-grade honey. Systemic antibiotics NOT indicated.
Moderate (spreading cellulitis)	Erythema >2 cm from wound edge, low-grade fever, mild leukocytosis	MRSA + gram-negative bacilli + anaerobes	PO: TMP-SMX + amox-clav IV: Vancomycin + pip-tazo OR: Vancomycin + ceftriaxone + metronidazole
Severe (bacteremia/osteomyelitis)	High fever, hemodynamic instability, bacteremia, osteomyelitis signs	Broad polymicrobial including MDR organisms	IV: Vancomycin + pip-tazo or meropenem. Blood cultures mandatory. Surgical debridement essential. Consider antifungals if immunocompromised.

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Thank you!