## 2021 VAPAHCS GRAM-NEGATIVE ORGANISM

<table>
<thead>
<tr>
<th>(%) Susceptibility</th>
<th># isolates tested</th>
<th>Penicillins</th>
<th>Beta lactams</th>
<th>Cephalosporins</th>
<th>Carbapenems</th>
<th>Aminoglycosides</th>
<th>Fluoroquinolones / Miscellaneous</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Ampicillin</td>
<td>Ampicillin/</td>
<td>Ampicillin/</td>
<td>Piperacillin/</td>
<td>Cefazolin*</td>
<td>Cefotaxime</td>
</tr>
<tr>
<td>Acinetobacter baumannii</td>
<td>11*</td>
<td>-</td>
<td>-</td>
<td>100*</td>
<td>82*</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Citrobacter freundii#</td>
<td>32</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>72</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Citrobacter koseri</td>
<td>50</td>
<td>-</td>
<td>100*</td>
<td>100</td>
<td>100</td>
<td>95^</td>
<td>96</td>
</tr>
<tr>
<td>Enterobacter cloacae#</td>
<td>89</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>90</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Escherichia coli^</td>
<td>636</td>
<td>56</td>
<td>87</td>
<td>64</td>
<td>96</td>
<td>81^</td>
<td>92</td>
</tr>
<tr>
<td>Klebsiella aerogenes#</td>
<td>44</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>89</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Klebsiella oxytoca</td>
<td>80</td>
<td>-</td>
<td>67*</td>
<td>62</td>
<td>91</td>
<td>52^</td>
<td>99</td>
</tr>
<tr>
<td>Klebsiella pneumoniae^</td>
<td>252</td>
<td>-</td>
<td>100*</td>
<td>83</td>
<td>94</td>
<td>88^</td>
<td>95</td>
</tr>
<tr>
<td>Morganella morganii</td>
<td>48</td>
<td>-</td>
<td>-</td>
<td>17</td>
<td>100</td>
<td>-</td>
<td>67</td>
</tr>
<tr>
<td>Proteus mirabilis</td>
<td>183</td>
<td>85</td>
<td>96*</td>
<td>100</td>
<td>75^</td>
<td>95</td>
<td>96</td>
</tr>
<tr>
<td>Providencia rettgeri</td>
<td>24*</td>
<td>-</td>
<td>58*</td>
<td>100*</td>
<td>-</td>
<td>100*</td>
<td>96*</td>
</tr>
<tr>
<td>Providencia stuartii</td>
<td>6*</td>
<td>-</td>
<td>-</td>
<td>100*</td>
<td>-</td>
<td>100*</td>
<td>100*</td>
</tr>
<tr>
<td>Pseudomonas aeruginosa</td>
<td>208</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>94</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Serratia marcescens#</td>
<td>36</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>97</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Stenotrophomonas maltophilia</td>
<td>22*</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

### Cost per day ($)
- $25
- $25-100
- $$$ 100-200

### Footnotes

- Fewer than 30 isolates were tested. Due to the small number of isolates tested, results may be statistically unreliable (i.e., interpret with caution).
- Criteria restricted: ampicillin/sulbactam for animal bite wounds; ceftazidime for neutropenic fever; amikacin for gram-negative organisms resistant to gentamicin/tobramycin; streptomycin for gentamicin-resistant Enterococcal endocarditis; ciprofloxacin for Pseudomonas infection, gram-negative bacteria, intra-abdominal infection if severe anaphylactic beta lactam allergy, severe sepsepsis (as part of empiric combination therapy), urological surgical prophylaxis, epididymitis if non-STD enteric organs, prostatitis/ pyelonephritis if TMP/SMX resistant organism/susceptibility unknown, traveler’s diarrhea (not SE Asia) if azithromycin contraindicated; levofloxacin for community-acquired pneumonia if severe beta lactam allergy, epididymitis. Use for other indications requires Infectious Diseases approval.
- Restricted. Use of these agents requires Infectious Diseases approval.
- Actual cefazolin urine susceptibilities are likely better than what is listed in this column (due to MIC interpretation differences).
- Enterobacter, Klebsiella aerogenes (formerly Enterobacter), Citrobacter, and Serratia may develop resistance during prolonged therapy (approx 4 days) with 3rd generation cephalosporins as a result of derepression of AmpC beta-lactamase. Therefore, isolates that are initially susceptible may become resistant after initiation of therapy. Repeat testing may be warranted. For blood culture/sterile sites, ID consult is recommended.
- %ESBL: E.coli 10% (94% of E.coli isolates tested susceptible to fosfomycin); Klebsiella oxytoca 6%, Klebsiella pneumoniae 10%

Cost per day ($) | $25 | $25-100 | $$$ 100-200
## 2021 VAPAHCS GRAM-POSITIVE ORGANISM

### (% Susceptibility)

<table>
<thead>
<tr>
<th>ORGANISM</th>
<th># isolates tested</th>
<th>Beta lactams (Penicillins / Cephalosporins)</th>
<th>Fluoroquinolones / AGs (for synergy only)</th>
<th>Miscellaneous</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Penicillin</td>
<td>Oxacillin</td>
<td>Ampicillin</td>
</tr>
<tr>
<td><strong>Enterococcus faecalis</strong></td>
<td>362</td>
<td>-</td>
<td>-</td>
<td>100</td>
</tr>
<tr>
<td><strong>Enterococcus faecium</strong></td>
<td>24*</td>
<td>-</td>
<td>-</td>
<td>21*</td>
</tr>
<tr>
<td><strong>Staphylococcus aureus (MRSA)</strong></td>
<td>95</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td><strong>Staphylococcus aureus (MSSA)</strong></td>
<td>271</td>
<td>31</td>
<td>100</td>
<td>-</td>
</tr>
<tr>
<td><strong>Staphylococcus, coag-negative</strong></td>
<td>187</td>
<td>16</td>
<td>62</td>
<td>-</td>
</tr>
<tr>
<td><strong>Staphylococcus lugdunensis</strong></td>
<td>24*</td>
<td>42*</td>
<td>96*</td>
<td>-</td>
</tr>
<tr>
<td><strong>Streptococcus agalactiae (gp B)</strong></td>
<td>19*</td>
<td>100*</td>
<td>-</td>
<td>100*</td>
</tr>
<tr>
<td><strong>Streptococcus pneumoniae (c)</strong></td>
<td>6*</td>
<td>100*</td>
<td>100*</td>
<td>-</td>
</tr>
</tbody>
</table>

### Cost per day ($)

<table>
<thead>
<tr>
<th></th>
<th>C. albicans</th>
<th>C. glabrata</th>
<th>C. krusei</th>
<th>C. parapsilosis</th>
<th>C. tropicalis</th>
</tr>
</thead>
<tbody>
<tr>
<td># isolates tested</td>
<td>24*</td>
<td>35</td>
<td>2*</td>
<td>8*</td>
<td>4*</td>
</tr>
<tr>
<td>Cost per day ($)</td>
<td>$</td>
<td>$-$$</td>
<td>$</td>
<td>$$$</td>
<td>$$$$</td>
</tr>
</tbody>
</table>

### FOOTNOTES

- Fewer than 30 isolates were tested. Due to the small number of isolates tested, results may be statistically unreliable (i.e. interpret with caution).
- (a) Test for Enterococcal high-level resistance to aminoglycosides (AGs), gentamicin (MIC 500 mcg/mL) and streptomycin (MIC 2000 mcg/mL); S: synergy with beta-lactams likely, R: synergy with beta-lactams unlikely.
- (b) Rifampin should NOT be used as monotherapy for treatment of Staphylococcal infections.
- (c) % susceptibility for S.pneumoniae: non-meningitis: penicillin 100% (5/5), ceftriaxone 100% (5/5); meningitis: penicillin 80% (4/5), ceftriaxone 100% (5/5).
- (d) Daptomycin was only tested against 10 E. faecium isolates; 6 were vancomycin-resistant Enterococcus isolates.

### CANDIDA SP.

#### Jan 2010-Dec 2021 - isolated from blood cultures (% Susceptibility)

<table>
<thead>
<tr>
<th>ORGANISM</th>
<th># blood isolates tested</th>
<th>Fluconazole</th>
<th>Voriconazole (CR)</th>
<th>Echinocandinsa</th>
<th>Micafungin preferred echinocandin (CR)</th>
<th>Amphotericin B</th>
<th>Anfotericin B dependent (R)</th>
<th>LEX</th>
<th>ERT</th>
<th>NITRO</th>
<th>RIF</th>
<th>TET</th>
<th>TRI / sulfa</th>
</tr>
</thead>
<tbody>
<tr>
<td>C. albicans</td>
<td>24*</td>
<td>96 (SDD 4)*</td>
<td>96*</td>
<td>100*</td>
<td>100*</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C. glabrata</td>
<td>35</td>
<td>11 (SDD 89)*</td>
<td>88</td>
<td>97</td>
<td>100*</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C. krusei</td>
<td>2*</td>
<td>-</td>
<td>100*</td>
<td>50*</td>
<td>100*</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C. parapsilosis</td>
<td>8*</td>
<td>75 (SDD12)*</td>
<td>88 (SDD12)*</td>
<td>100*</td>
<td>100*</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C. tropicalis</td>
<td>4*</td>
<td>75*</td>
<td>67*</td>
<td>100*</td>
<td>100*</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Cost per day ($) (CR) Criteria restricted.

- CR: cephalosporin-resistant Staphylococcus tuberculosis.
- SDD: Susceptible dose-dependent (higher dose necessary)
- a: Micafungin is the preferred echinocandin at VAPAHCS. While caspofungin / anidulafungin primarily tested, susceptibilities to all echinocandins may be extrapolated.
- b: Specific cut-offs not provided; in general, MIC ≥ 1 mcg/mL is usually considered resistant.

**FOOTNOTES**

- % inducible clindamycin resistance: MRSA 12%; MSSA 16%. Strepococcus agalactiae 6%
- SDD: Susceptible dose-dependent (higher dose necessary)
- Specific cut-offs not provided; in general, MIC ≥ 1 mcg/mL is usually considered resistant.

**Cost per day ($) (SDD): $ < 25; $25-100; $100-200; $200-300; $300-$$ > 200**
VAPAHCS Fluoroquinolone Alternatives

Note: Use of fluoroquinolones is associated with increased risk of C.difficile infection/gram negative resistance/MRSA, with multiple potential adverse effects (e.g. QTc prolongation, peripheral neuropathy, tendon inflammation/ rupture, mental health side effects, hypoglycemia, aortic aneurysm/ dissection), which may be disabling and potentially permanent.

**FDA alerts 5/2016, 7/2016, 7/2018, and 12/2018 advise again**:

- Consider susceptibility data and need for renal dose adjustments
- Not all isolates tested for susceptibility (0 gram positive cocci were tested for susceptibilities. e.g., Anaerococcus, Peptostreptococcus, Peptostreptococcus)
- Includes 2 B. caceae, 4 B. ovatus, 18 B.thetaiaotamicorn, 5 B. uniformis, 1 B. vulgatus
- Includes 8 Fusobacterium (7 nucleatum, 1 spp), 22 Prevotella (3 P. bivia, 1 P. buccae, 2 P. denticola, 5 P. diensi, 3 P. intermedia, 2 P. melaninogenica, 2 P. oralis, 4 spp)
- Includes 1 C. ramosum, 1 C. septicum, 3 C. sporogenes
- Includes 5 Cutibacterium acnes (0 Actinomyces, Bilidobacterium, Lactobacillus, etc.)
- Restricted. Use of these agents requires Infectious Diseases (ID) approval.

Cost per day ($): $ < 25; $$ 25-100; $$$ 100-200; $$$> 200

### Fluoroquinolones

#### Ciprofloxacin
- **ID Criteria**
  - Restricted
- **Common Indications**
  - UTI
  - Intra-abdominal infection (with metronidazole)
  - Nosocomial pneumonia (double *Pseudomonas* coverage)
  - Spontaneous bacterial peritonitis (SBP) prophylaxis
- **Potential Oral Alternatives**
  - **UTI**: nitrofurantoin; TMP/SMX; cephalexin; cefpodoxime
  - **SBP prophylaxis**: cefpodoxime; TMP/SMX
- **Comments**
  - Not reliable against gram positive organisms (*Streptococcus pneumoniae, Staphylococcus spp*); No anaerobic activity

#### Levofoxacin
- **ID Criteria**
  - Restricted
- **Common Indications**
  - CAP / Nosocomial pneumonia (double *Pseudomonas* coverage)
  - Rhinosinusitis
  - COPD exacerbation
  - UTI
- **Potential Oral Alternatives**
  - **CAP, sinusitis**: oral beta-lactam† + azithromycin or doxycycline
  - **COPD**: amoxicillin/clavulanate; azithromycin; doxycycline
  - **UTI**: nitrofurantoin; TMP/SMX; cephalexin; cefpodoxime
- **Comments**
  - No anaerobic activity

#### Moxifloxacin
- **ID**
  - Restricted
- **Common Indications**
  - CAP
  - Rhinosinusitis
  - COPD exacerbation
  - Intra-abdominal infection (caution: incr anaerobe resistance)
- **Potential Oral Alternatives**
  - **CAP, sinusitis**: oral beta-lactam† + azithromycin or doxycycline
  - **COPD**: amoxicillin/clavulanate; azithromycin; doxycycline
  - **Intra-abdom**: cefpodoxime + metronidazole; amoxicillin/clav
- **Comments**
  - Not recommended in UTI treatment
  - No *Pseudomonas* activity
  - Limited anaerobic activity

### KEY:  
- *Consider susceptibility data and need for renal dose adjustments; UTI - Urinary tract infection; TMP/SMX - trimethoprim/sulfamethoxazole; CAP - Community-acquired pneumonia; COPD - Chronic obstructive pulmonary disease; †According to IDSA guidelines for CAP and rhinosinusitis, preferred oral beta-lactam agents are high dose amoxicillin (1g PO TID) or Augmentin XR (nonformulary 2g/125mg PO BID). Cefpodoxime (200mg PO BID) is also an alternative option.

**NOTES**

- Fewer than 30 isolates were tested. Due to the small number of isolates tested, results may be statistically unreliable (i.e. interpret with caution).

(a) Not all isolates tested for susceptibility (0 gram positive cocci were tested for susceptibilities. e.g., Anaerococcus, Peptostreptococcus, Peptostreptococcus)
(b) Includes 2 B. caceae, 4 B. ovatus, 18 B.thetaiaotamicorn, 5 B. uniformis, 1 B. vulgatus
(c) Includes 8 Fusobacterium (7 nucleatum, 1 spp), 22 Prevotella (3 P. bivia, 1 P. buccae, 2 P. denticola, 5 P. diensi, 3 P. intermedia, 2 P. melaninogenica, 2 P. oralis, 4 spp)
(d) Includes 1 C. ramosum, 1 C. septicum, 3 C. sporogenes
(e) Includes 5 Cutibacterium acnes (0 Actinomyces, Bilidobacterium, Lactobacillus, etc.)

(R) Restricted. Use of these agents requires Infectious Diseases (ID) approval.

4/2014, Updated 2022