UAB MEDICINE *Laboratory Technical Procedure*

Title:	*Susceptibility Testing and Reporting Guidelines*				
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Associated Diagnosis/-Cross-References (CR):		** UAB Hospital Laboratories LabSource*		**Section:** MIC3	

CAP reports to CMS Regulations

1. **PURPOSE:** to provide guidelines proposed by the Microbiology Laboratory in accordance with recommendations of Document M100 27th edition of the CLSI. CLSI criteria are used to determine endpoints (MIC) or zone sizes (Kirby Bauer) for antimicrobial testing.

2. **PRINCIPLE:** Susceptibility test results will be reported as susceptible, susceptible-dose dependent, intermediate, non-susceptible, or resistant.

3. **ASSOCIATED INFORMATION:**
   - 3.1. **Definitions:**
     - 3.1.1. ***Susceptible*** implies that isolates are inhibited by the usually achievable concentrations of antimicrobial agent when the dosage recommended to treat the site of infection is used, resulting in likely clinical efficacy.
     - 3.1.2. ***Susceptible-Dose Dependent (SDD)*** implies that susceptibility of an isolate is dependent on the dosing regimen that is used in the patient.
     - 3.1.3. ***Intermediate*** includes isolates with antimicrobial agent MICs that approach usually attainable blood and tissue levels for which response rates may be less than for susceptible isolates. Treatment with antimicrobial agent may be appropriate for infections in sites where drug is concentrated or if higher than normal dosage is used.
     - 3.1.4. **Non-susceptible *(NS)*** is the category used for organisms that have only a susceptible interpretive category, but not intermediate or resistant interpretive categories (i.e., susceptible-only category). Isolates that test with an MIC above or a zone measurement below the susceptible interpretive breakpoint are designated as non-susceptible. A designation of non-susceptible does not necessarily mean that a resistance mechanism exists in the isolate.
     - 3.1.5. ***Resistant*** implies that isolates are not inhibited by usually achievable concentrations of the antimicrobial agent with normal dosage and/or falls in the range where specific microbial resistance mechanisms are likely and clinical efficacy is unreliable.

4. **BACKGROUND INFORMATION:**
   4.1. CLIA Complexity Level: High
   4.2. Susceptibility results are reported according to cascades established through discussions among the Microbiology Laboratory, Pharmacy, and Division of Infectious Diseases.
   Usually there will be additional drugs to which susceptibilities are performed but not reported. Additional susceptibilities if needed can be obtained by calling the Microbiology Laboratory. If requests for potentially misleading organism/antimicrobial combinations occur, they will be referred to Microbiology Laboratory Section Head or Microbiology Resident before releasing information.
   4.3. The most recent versions of CLSI documents are reviewed and utilized for interpreting susceptibility test results to ensure that appropriate antimicrobials and interpretive breakpoints are utilized when taxonomic changes occur.

5. **REPORTING:**
   I. **GRAM POSITIVE COCCI:**
      A. **Staphylococcus species:**

Microscan for *Staphylococcus* PBP2a and MRSA CHROMagar tests for selected isolates of *S. aureus* E-tests.

Induced beta lactamase (cefinase) test performed at the request of the physician on *Staphylococcus spp*. whose zone size or MIC is shown to be susceptible to penicillin, in the presence of a susceptible oxacillin result. The induced beta lactamase (cefinase) test must be documented in the computer before releasing results showing penicillin to be susceptible.
Penicillin should be used to test the susceptibility of all β-lactamase labile penicillins, such as, ampicillin, amoxicillin, and ticarcillin. Likewise, a positive β-lactamase test will predict resistance to these agents.

Example: If *staphylococcus* is oxacillin-susceptible, penicillin susceptible, and induced β-lactamase positive, then report resistance to: penicillin, ampicillin, and ticarcillin.

Oxacillin resistance in *S. aureus* and STACN (*coagulase negative Staphylococcus*) **predicts resistance to Am/S, Amp, Am/C, all Cephalosporins (I, II, III, and IV generations), Pip/Tazo, Tim, Doripenem, Ertapenem, Imipenem, and Meropenem, regardless of the in vitro activity.** These antibiotics above should not be reported as susceptible if oxacillin resistant.

Vancomycin Resistance in *Staphylococcus spp.* has been rarely described in literature. Any **elevated vancomycin MIC of greater than or equal to 4 micrograms/mL or intermediate / resistant by Microscan** should be confirmed by Etest.
Please notify the Microbiology Laboratory Section Head or Supervisor of any suspicious or confirmed results from Etest.

Enter the response: VAN I
States – Intermediate Vancomycin Resistance with a MIC of 4-8 micrograms/mL may be clinically significant. Consult Infectious Disease for treatment recommendations.

Daptomycin Resistance in *Staphylococcus spp.* has been rarely described in literature. Any **elevated daptomycin MIC of greater than or equal to 1 or nonsusceptible by Microscan** should be confirmed by Etest.

Enter the response: DAP NS

States - Daptomycin MIC exceeds the breakpoint for susceptibility; Please contact Infectious Disease for treatment recommendations.

Susceptibilities are not routinely performed on *coagulase-negative staphylococci* isolated from non-sterile sites such as wound drainages and respiratory specimens, single blood culture isolates, or voided urines unless requested by physician. No resident or pathology consult is needed.

CLSI does not recommend routine testing of susceptibilities for ***Staphylococcus saprophyticus*** in women, and it is not advised because infections usually respond to concentrations of antimicrobial agents commonly used to treat acute, uncomplicated urinary tract infections (ex. nitrofurantoin, trimethoprim-sulfamethoxazole or a fluoroquinolone).

CLSI suggest that macrolide resistant isolates of *S. aureus* and *coagulase negative Staphylococcus spp.* may have inducible resistance to clindamycin or may be resistant only to macrolides. Therefore, if clindamycin is susceptible and erythromycin is resistant, a D-test or D-test screen (MicroScan) will be performed to determine true resistance to clindamycin.

- **If D-Test is positive, report clindamycin as resistant and use the following comment:**
- **STAPH SUS: "*This Staphylococcus spp*. is presumed to be resistant to clindamycin based on the detection of inducible clindamycin resistance. Clindamycin may still be effective in some patients."**
- **If D-test is negative, report clindamycin as susceptible.**

***Staphylococcus spp*.** (including *Staphylococcus aureus* and STACN resistant to oxacillin)

If the specimen source is sterile and oxacillin is resistant, then only report the oxacillin and vancomycin result.

All other *Staphylococcus spp*. from non sterile sites will be reported with guidelines below.

Staphylococcus species

Drugs Reported	Comment
Oxacillin (Ox)	Performed by the MicroScan Cefoxitin Screen Well or Kirby-Bauer Cefoxitin disk. Cefoxitin is used as a surrogate for oxacillin resistance; report oxacillin susceptible or resistant based on the cefoxitin result. Note: slow-growing *S. aureus* ("atypical" or "small colony variant") with cefoxitin-sensitive results should be confirmed by Alere™ PBP2a test.
Penicillin (Pen)	Report as resistant if resistant to oxacillin. A penicillin susceptible result is not routinely reported. Only release a susceptible result at the request of a physician after beta lactamase testing is performed. Report as resistant if beta lactamase positive.
Amoxicillin/clavulanate (Am/C)	Report as resistant if non-susceptible to oxacillin. Do not report on CSF.
Ceftriaxone (Cro)	Report as resistant if non-susceptible to oxacillin when drug is tested.
Vancomycin (Va)	Perform E-test only if a Kirby-Bauer is used for susceptibility testing. Confirm all non-susceptible results by Etest. Add VAN I comment if nonsusceptible. Notify the Microbiology Laboratory Section Head and Supervisor if a nonsusceptible result is observed. Send any *S. aureus* that is intermediate or resistant to the Alabama Department of Health.
Erythromycin (E)	Do not report on CSF or Urine.
Clindamycin (CC)	Do not report on CSF or Urine. **Report clindamycin as R if D test is positive and add comment (STAPH SUS).**
Linezolid (Lzd)	If result is nonsusceptible, confirm with Etest before releasing results. Notify the Microbiology Laboratory Section Head and Supervisor if a nonsusceptible result is observed. Results may be unsuppressed by Physician request.
Gentamicin (Gm)	
Trimethoprim/sulfamethoxazole (SXT)	
Tetracycline	Do not report on CSF.
Daptomycin	Do not report on respiratory isolates. If Microscan result is non-susceptible, confirm with Etest. Report Microscan result if non-susceptible and add DAP NS comment.

	Report result at the request of physician regardless of susceptibility result.
Special cases	
Ceftaroline	Perform Kirby-Bauer Disk and report only if requested by ID physician and/or approved by ID physician.
Tigecycline	Perform E Test and report only if requested by ID physician and/or approved by ID physician.

Comments for C Nasophar

If MRSA is observed on the MRSA CHROMagar enter the following computer response:
MRSA – Methicillin Resistant Staphylococcus aureus.

If MRSA is not observed on the MRSA CHROMagar enter the following computer response: **NO MRSAF** – No Methicillin resistant Staphylococcus aureus detected.

Comments for MRSA/MSSA Screen:

If MRSA is observed on the MRSA CHROMagar enter the following computer response:
MRSA – Methicillin Resistant Staphylococcus aureus.

If MSSA is observed on the MRSA CHROMagar enter the following computer response:
MSSA – Methicillin susceptible Staphylococcus aureus.

If MRSA is not observed on the MRSA CHROMagar enter the following computer response: **Neg MRSA/MSSA** – No Methicillin resistant or susceptible Staphylococcus aureus detected.

B. Streptococcus pneumonia:

Kirby-Bauer Disks
E-tests
Do not use Microscan

All alpha streptococci identified as *Streptococci pneumoniae*, should have a susceptibility performed by Kirby Bauer disc diffusion. Penicillin, Ceftriaxone, and Moxifloxacin E test MICs should also be performed.

Identification will be performed by MALDI-TOF or P-disc (Optochin disk).

Comment for susceptibility report:
"SP SUS" - Interpretation of this susceptibility report for ceftriaxone is based on the presumption that infection does not involve the CNS. If this patient is believed to have meningitis, contact the Microbiology Laboratory at 934-4830 for further information regarding proper interpretation of this report. This comment is to be used on all non CSF sites only because the breakpoints are different than those for CSF.

New **CLSI guidelines mandate breakpoints for ceftriaxone are source dependant**. Interpretation of susceptibility is based on whether or not CNS involvement is suspected. All *Streptococcus pneumoniae* isolates will be assumed to be from other sites, unless the source is CSF.
If Physician suspects patient has CNS involvement, and contacts the Laboratory, the Laboratory will change the interpretation of the results in the computer. Comment to be added to computer report: **"SUSUP"** - Susceptibility has been updated for this culture.

CLSI suggest that macrolide resistant isolates of *S. pneumoniae* may have inducible resistance to clindamycin or may be resistant only to macrolides. Therefore, if clindamycin is susceptible and erythromycin is resistant, a D-test will be performed to determine true resistance to clindamycin:

- **If D-Test is positive, report clindamycin as resistant and use the following comment:**
- **STR Dtest: "*This Streptococcus spp*. is presumed to be resistant to clindamycin based on the detection of inducible clindamycin resistance. Clindamycin may still be effective in some patients."**
- **If D-test is negative, report clindamycin as susceptible.**

Any other antibiotic needed, must have resident approval before releasing susceptibilities.

Send isolates from sterile sites from patients under the age of 5 to the ADPH (state lab) for serotyping.

Streptococcus pneumoniae

Drugs reported	**Comments**
Penicillin	Etest only
Ceftriaxone CSF: **Susceptible** — Less than or equal to 0.5 **Intermediate** — 1 **Resistant** — Greater than or equal to 2 **All other sites:** **Susceptible** — Less than or equal to 1 **Intermediate** — 2 **Resistant** — Greater than or equal to 4	Etest only Use Comment: **SP SUS** on all non CSF isolates.
Clindamycin	Do not report on CSF or BLOOD. **Report clindamycin as R if D test is positive and add comment (STR Dtest).**
Erythromycin	Do not report on CSF or BLOOD.
Vancomycin	If nonsusceptible, confirm with Etest. If result is confirmed as non-susceptible, reconfirm isolate identification. Notify Microbiology Laboratory Section Head and Supervisor if a non-susceptible result is observed.
Moxifloxacin	Etest only.

	Do not report on CSF.
Tetracycline	Do not report on CSF or BLOOD.

C. Beta hemolytic Streptococcus Groups:

Kirby-Bauer Disks E-tests Do not use Microscan

Susceptibilities routinely performed only on sterile sites, blood, and CSF isolates unless by special request.

Susceptibilities for Group B streptococci will be performed upon request from OB physicians who have patients allergic or unable to take Penicillin. Hold all Group B streps for one week. Use the following comment below when reporting out Group B streptococci isolates for which susceptibilities are not routinely performed:

All Sources other than Urine and Vaginal/Rectal (for Group B Strept only):

STREP SUS: "Group B streptococci (S. agalactiae) are susceptible to ampicillin, penicillin and cefazolin. Contact the laboratory if erythromycin and or clindamycin testing is needed, within 24 hours."

Urine:

STREP BUR: "Group B Streptococci are susceptible to ampicillin, penicillin, and cefazolin."

Vaginal/Rectal

STREP VAG (for Group B Strept only) : "Group B streptococci (S. agalactiae) are susceptible to ampicillin, penicillin, and cefazolin. For patients unable to take beta-lactams, contact the lab within five days for clindamycin and vancomycin testing."

CLSI suggests that macrolide resistant isolates of beta hemolytic Streptoccocci may have inducible resistance to clindamycin or may be resistant only to macrolides. Therefore, if clindamycin is susceptible and erythromycin is resistant, a D-test will be performed to determine true resistance to clindamycin. If D-test is positive report clindamycin as resistant and use the following comment:

STR Dtest: "This Streptococcus is presumed to be resistant to Clindamycin based on the detection of inducible clindamycin resistance. Clindamycin may still be effective in some patients."

- **If D-test is negative, report clindamycin as susceptible.**

Any other requests for additional antibiotics must have resident approval prior to testing.

Beta hemolytic Streptococcus Groups A, B, C, F, G

Drugs Reported	Comments
Penicillin	Etest only If non-susceptible confirm with Etest.
Clindamycin	Do not report on CSF or urine . Report clindamycin as R if D-test is positive and add STREP SUS comment.
Erythromycin	Do not report on CSF or urine. Do not report on Group B Strept if source is vag or vag/rectal. A Dtest still needs to be performed.
Vancomycin	If non-susceptible, confirm with Etest. If result is confirmed as non-susceptible, reconfirm isolate identification. Notify Microbiology Laboratory Section Head and Supervisor if a non-susceptible result is observed.
Tetracycline	Do not report on CSF. Do not report on Group B Strept if source is vag or vag/rectal. A Dtest still needs to be performed.

D. *Streptococcus spp*., Viridans Group :

Kirby-Bauer Disks
E-tests
Do not use Microscan for susceptibilities

Susceptibilities routinely performed only on blood, CSF & other sterile body fluids or tissues.

Any other antibiotic request must have resident approval prior to testing.

***Streptococcus spp*., Viridans Group**

Drugs Reported	Comments
Penicillin	E test only
Ceftriaxone	E test only
Clindamycin	Do not report on CSF.
Erythromycin	Do not report on CSF.
Tetracycline	Organisms that are susceptible to tetracycline are also considered susceptible to doxycycline and minocycline.
Vancomycin	If non-susceptible, confirm with Etest. If result is confirmed as nonsusceptible, reconfirm isolate identification. Notify Microbiology Laboratory Section Head and Supervisor if a non-susceptible result is observed.

E. *Enterococcus species:*

Microscan MIC panels E-tests Spectra VRE

Susceptibilities will be performed using the Microscan system in conjunction with organism species identification for sterile and nonsterile sites.

Species identification and susceptibility tests should be performed on all *Enterococcus* isolates except when a VRE screen is ordered or the organism is detected in a routine feces culture.

CLSI warns that cephalosporins, aminoglycosides (except for high-level resistance screening), clindamycin and trimethoprim-sulfamethoxazole may appear active in vitro but are not effective clinically. The susceptibility results for these drugs must be suppressed on all *Enterococcus* reports and never reported to physicians.

Enterococcus species

Drugs reported	**Comments**
Ampicillin	
Vancomycin	
Tetracycline	Do not report on CSF or Blood.
Linezolid	If non-susceptible, confirm with Etest. Report if non-susceptible to vancomycin.
Quinupristin/dalfopristin	Report if non-susceptible to vancomycin and linezolid on *E.faecium* isolates only.
Gentamicin high level	Report only on blood and CSF and only if resistant.
Nitrofurantoin	Report only on urine isolates.
Streptomycin high level	Report only on blood and CSF and only if resistant. Incubate 24-48 hours (if susceptible at 24hrs, reincubate).
Daptomycin	Do not report on respiratory isolates. Report if non-susceptible to vancomycin. If Microscan result is non-susceptible, confirm with Etest before releasing results. Report Microscan result if non-susceptible and add DAP NS comment. Report Daptomycin result at the request of the physician regardless of susceptibility result.

Interpretation of Gentamicin High Level Synergy Testing and Streptomycin High Level Testing

Resistant: Will not be synergistic with cell-wall- active agent (ex. ampicillin, penicillin, vancomycin)

Sensitive: Will be synergistic with cell-wall-active agent to which the isolate is susceptible (ex.ampicillin, penicillin, vancomycin).

Comments for C VRE CHRG:
If enterococcus is observed on the VRE CHROMagar enter the following computer response: **VRE** – Vancomycin Resistant Enterococcus

If enterococcus is not observed on the VRE CHROMagar enter the following computer response: **VRE NEG** – No Vancomycin resistant enterococci detected.

DO NOT HOLD VRE CHROMagar MORE THAN 24 HOURS.

II. Gram Positive Bacilli

F. Listeria monocytogenes

Microscan MIC panels

Listeria

Drugs Reported	**Comments**
Ampicillin	Confirm all non-susceptible results by Etest. If result is confirmed as non-susceptible, reconfirm isolate identification. Notify the Microbiology Laboratory Section Head and Supervisor if a non-susceptible result is observed.
Penicillin	Confirm all non-susceptible results by Etest. If result is confirmed as non-susceptible, reconfirm isolate identification. Notify the Microbiology Laboratory Section Head and Supervisor if a nonsusceptible result is observed.
Trimethoprim/sulfamethoxazole	Do not report on CSF.

Send isolates to the Alabama Department of Public Health (State Lab) for testing.

III. Gram Negative Bacteria

A. *Enterobacteriaceae* (except *Salmonella/Shigella and Enterobacter*):

Enterobacteriaceae.

Extended Spectrum Beta Lactamases.

These plasmid-mediated enzymes are being encountered in hospitalized patients with greater frequency. Extended spectrum beta-lactamase testing is performed on *E. coli*, *K. pneumoniae*, and *K. oxytoca*, and *Proteus spp*. automatically using the MicroScan. Once confirmed organism is an ESBL, the following drugs should be reported as resistant: ampicillin, aztreonam, ceftriaxone, ceftazidime, cephalothin, cefepime, and cefuroxime and the **ESBL comment** should be entered on the report.

Plesiomonas species follow the same interpretative guidelines as Enterobacteriaceae.

Enterobacteriaceae (except Salmonella/Shigella and Enterobacter species)

Drugs Reported	Comments
Ampicillin (Am)	Always report as resistant for *Klebsiella*, *Citrobacter*, and *Morganella.*
Cephalothin (Ceph)	Report on urine isolates. Always report as resistant for *Citrobacter freundii*, *Hafnia alvei*, *Morganella*, *Proteus penneri, Proteus vulgaris, Providencia rettgeri, Providencia stuartii, Serratia marcenscens*, or *Yersinia enterocolitica*.
Ceftazidime (Caz)	Report if non-susceptible to ceftriaxone.
Ceftriaxone (Cro)	Report on all ESBLs. Report if non-susceptible to cephalothin. Not routinely reported on urines.
Cefepime (Cpe)	Report if non-susceptible to ceftriaxone.
Ciprofloxacin (Cip)	Do not report on CSF.
Piperacillin/tazobactam (Pip/Taz)	

Imipenem (Imp)	Report if non-susceptible. Report if meropenem is non-susceptible.
Meropenem (Mero)	Report all resistance. Report if non-susceptible to Amp/Sul, Ceftaz, Cefep, Cefotax, and Pip/Taz. Report on all ESBLs. Report on all CREs and notify Infection Prevention at 934-5324 if non-susceptible to imipenem, cefotaxime, ceftazidime, and ceftriaxone.
Amikacin (AK)	Report only if non-susceptible to Gm or To.
Gentamicin (Gm)	Always report as resistant *for Providencia stuartii*.
Tobramycin (To)	Always report as resistant *for Providencia stuartii*.

Trimethoprim/sulfamethoxazole (SXT)	
Nitrofurantoin (F/M)	Report on urines isolates only.
Special Cases	
Ceftaroline	Perform Kirby-Bauer Disk and report only if requested by ID physician and/or approved by ID physician.
Doripenem	E-test only Report at the request of the physician regardless of susceptibility result.
Tigecycline	Reported from the Gram Negative MicroScan panel for *Enterobacteriaceae* except for *Proteus mirabilis*. *Proteus mirabilis* must be tested using an E-test. Report only at the request of a physician. Report FDA interpretations of S, I, and R.

B. ***Enterobacter species:***

Drugs Reported	Comments
Ampicillin (Am)	Always report as resistant.
Cephalothin (Ceph)	Report on urine isolates. Report as resistant if *Enterobacter aerogenes* and/or *Enterobacter cloacae*.
Cefepime (Cpe)	
Ciprofloxacin (Cip)	Do not report on CSF.

Imipenem (Imp)	Report if non-susceptible. Report if meropenem is non-susceptible.
Meropenem (Mero)	Report all resistance. Report if non-susceptible to cefepime Report if non-susceptible to Amp/Sul, Ceftaz, Cefep, Cefotax, and Pip/Taz. Report on all CREs and notify Infection Prevention at 934-5324 if non-susceptible to imipenem, cefotaxime, ceftazidime, and ceftriaxone.
Amikacin (AK)	Report only if non-susceptible to Gm or To.
Gentamicin (Gm)	
Tobramycin (To)	
Trimethoprim/sulfamethoxazole (SXT)	
Nitrofurantoin (F/M)	Report on urines isolates only.
Special Cases	
Ceftaroline	Perform Kirby-Bauer Disk and report only if requested by ID physician and/or approved by ID physician.
Doripenem	E-test only

	Report at the request of the physician regardless of susceptibility result.
Tigecycline	Reported from the Gram Negative MicroScan panel except for *Proteus mirabilis*. Report only at the request of a physician.

C. ***Salmonella/Shigella:***

MicroScan MIC Panels Kirby-Bauer Disks

CLSI warns: 1st and 2nd generation cephalosporins and cephamycins may appear active in vitro, but are not effective clinically and should not be reported as susceptible.

The preferred test for assessing fluoroquinolone susceptibility or resistance in *Salmonella* spp. is a ciprofloxacin MIC test. No single test detects resistance resulting from all possible fluoroquinolone resistance mechanisms that have been identified in *Salmonella* spp.

Salmonella/Shigella

Drugs Reported	**Comments**
Ampicillin	Etest or Kirby Bauer Disk Only. Do not use Microscan result.
Ceftriaxone (Cro)	Report if source is not gastro-intestinal.
Ciprofloxacin (Cip)	Perform Etest. Do not use Microscan Result.
Trimethoprim/sulfamethoxazole (SXT)	

Send isolates of Salmonella/Shigella to the ADPH (State Lab) for confirmation testing.

D. ***Pseudomonas*, *Stenotrophomonas*, *Burkholderia*, *Acinetobacter* and other *Non-Enterobacteriaceae:***

Microscan MIC panels Kirby-Bauer Disk

Pseudomonas aeruginosa

Drugs Reported	**Comments**
Ceftazidime (Caz)	
Cefepime (Cpe)	Do not use Microscan result. Perform Kirby Bauer Disk
Piperacillin/tazobactam (Pip/Taz)	Do not use Microscan result. Perform Kirby Bauer Disk
Imipenem (Imp)	Report if meropenem is non-susceptible.
Meropenem (Mero)	Report all resistance. Report if non-susceptible to Amp/Sul, Ceftaz, Cefep, and Pip/Taz.

Amikacin (AK)	Report only if non-susceptible to Gentamicin and Tobramycin.
Gentamicin (Gm)	
Tobramycin (To)	
Ciprofloxacin (Cip)	Do not report on CSF.
Special cases	
Aztreonam	Report only after consultation with Microbiology Resident, unless ID Physician (result can be used that is generated by MicroScan).
Colistin	Use CF panel. Report only after consultation with Microbiology Resident, unless ID physician.
Doripenem	Report at the request of the physician regardless of susceptibility result. Perform QC before releasing patient results.
Tigecycline	E-test only Report MIC only **Do not** use the Microscan result. Report only after approval by ID or if requested by ID. Note that less than 5% of *P. aeruginosa* are susceptible, but if the isolate is resistant to everything else and ID wants the MIC it can be determined and reported.

Acinetobacter spp.

Drugs Reported	**Comments**
Ampicillin/sulbactam (Am/S)	
Ceftazidime (Caz)	
Cefepime (Cpe)	
Piperacillin/tazobactam (Pip/Taz)	Do not report MicroScan MICs. Rarely of value, but E-test can be used if necessary with approval of resident or request of ID Physician.
Imipenem (Imp)	Etest only Report only by E-test if non-susceptible to meropenem.
Meropenem (Mero)	Report if non-susceptible. Report if non-susceptible to Amp/Sul, Ceftri, Ceftaz, and Cefep.
Amikacin (Ak)	Report only if non-susceptible to gentamicin and tobramycin.
Gentamicin (Gm)	
Tobramycin (To)	
Ciprofloxacin (Cip)	Do not report on CSF.
Trimethoprim/sulfamethoxazole (SXT)	
Special cases	
Aztreonam	Report only after consultation with Microbiology Resident, unless ID Physician (result can be used that is generated by MicroScan).

Doripenem	Report at the request of the physician regardless of susceptibility result. Perform QC before releasing patient results.
Tigecycline	Etest only **Do not** use the Microscan result. Report MIC only Report only after approval by ID or if requested by ID.

Stenotrophomonas maltophilia

Drugs Reported	**Comments**
Ceftazidime (Caz)	Cannot test by disk.
Trimethoprim/sulfamethoxazole (SXT)	Confirm all non-susceptible results by Etest.
Special cases	
Levofloxacin (Levo)	Report at the request of the physician. Result can be used that is generated by MicroScan.
Minocycline	Etest only Report only after consultation with Microbiology Resident, unless ID Physician. Perform QC before releasing patient results.
Tigecycline	Etest only **Do not** use the Microscan result. Report MIC only Report only after approval by ID or if requested by ID.
Ticarcillin/clavulanic acid	Report only after consultation with Microbiology Resident, approval by ID, or if requested by ID. (Result can be used that is generated by MicroScan.)

Burkholderia cepacia

Drugs Reported	**Comments**
Ceftazidime (Caz)	
Meropenem	Report if non-susceptible to Ceftaz and SXT.
Trimethoprim/sulfamethoxazole (SXT)	
Special cases	
Minocycline	Etest only Report only after consultation with Microbiology Resident, unless ID Physician. Perform QC before releasing patient results.
Levofloxacin (Levo)	Report at the request of the physician. Result can be used that is generated by MicroScan.
Ticarcillin/clavulanic acid	Report only after consultation with Microbiology Resident, unless ID Physician. (Result can be used that is generated by MicroScan.)

D. **Cystic Fibrosis Gram Negative Bacilli**

MicroScan MIC Panels and frozen CF MIC panels.

Mucoid *Pseudomonas species* – MicroScan MIC Panel (dilution method)
All gram negative bacilli – MicroScan MIC Panel (routine method)

Frozen CF MIC Panel – performed if Amik, Gent, and Tobra are resistant or if physician requests Colistin.

Cystic Fibrosis Gram Negative Bacilli

Drugs Reported	**Comments**
Amikacin (AK)	
Gentamicin (GM)	
Tobramycin (TO)	
Aztreonam (AZT)	
Cefepime (PM)	
Ceftazidime (TZ)	
Ciprofloxacin (CI)	
Colistin (CO)	Only performed if requested by Physician
Imipenem (IP)	
Meropenem (MP)	
Piperacillin (PP)	
Piperacillin/tazobactam (PTc)	
Ticarcillin/clavulanate (TLc)	

E. **Candida species:**

F-Test performed by UAB Fungal Reference Laboratory.

Candida species:

Fluconazole	
Micafungin	
Voriconazole	Report if organism is *Candida albicans*, *Candida glabrata*, *Candida parapsilosis*, or *Candida tropicalis* and is non-susceptible. Report for *Candida krusei*, *Candida inconspicua*, *Candida krusei/inconspicua*,

Special Circumstances:

A. **Corynebacterium species:**

No susceptibilities are performed.
If susceptibilities are requested, organism must be sent to a reference lab for testing.
Consult with Microbiology Resident to contact physician to determine antimicrobials to be tested.

B. **Haemophilus species:**

Beta lactamase (cefinase) test is performed on all isolates.
No susceptibilities are performed.
Refer *Haemophilus influenzae* isolates from sterile sites to the Alabama Department of Health.

C. **Moraxella catarrhalis:**

No Beta lactamase (cefinase) test is performed.
No susceptibilities are performed.

D. **Neisseria gonorrhoeae:**

No Beta lactamase (cefinase) test is performed.
No susceptibilities are performed.

E. **Neisseria meningitides:**

Beta lactamase (cefinase) test is performed on all isolates.
No susceptibilities are performed.
Refer isolates from sterile sites to the Alabama Department of Health.

F. **Pasteurella:**

Identification only, performed by MALDI-TOF and/or MicroScan
No susceptibilities are released from the MicroScan.
If susceptibilities are requested, organism must be sent to a reference lab for testing. Consult with Microbiology Resident to contact physician to determine antimicrobials to be tested.

G. **Mycobacteria:**

The State Department of Health in Montgomery performs susceptibilities on M. tuberculosis. It is sometimes desirable to get susceptibilities for other non-tuberculosis mycobacteria from the University of Texas Health Center at Tyler. This must be arranged through the Microbiology Laboratory on a case by case basis after consultation with the Microbiology Resident.

H. **Nocardia:**

Sent to the University of Texas Health Center at Tyler for identification and susceptibilities.

I. **Fungi:**

Susceptibilities on bloodstream or other normally sterile body sites are performed through the UAB Fungal Reference laboratory. Fungal susceptibilities on isolates from non-sterile sites must be approved by Microbiology resident or Pathologist. Physicians from the Infectious Disease department may request susceptibilities from any site without resident approval.

J. **Anaerobes:**

Susceptibilities are available through a reference laboratory if requested after consultation with Microbiology Resident.

K. **Bacillus and other Gram -positive bacteria:**

Physicians should specify which of the following drugs they would like to have tested. Such testing, when deemed appropriate, may be performed for selected antimicrobial agents using the E test technique and interpreted according to CLSI guidelines.

Bacillus species (Etest only)	**Micrococcus (Etest only)**
	Clindamycin
Clindamycin	Erythromycin
Penicillin	Penicillin
Tetracycline	Vancomycin
Vancomycin	

K. **Editing Susceptibilities:**

When making changes, please contact RN or MD and use the comment "SUSUP" – Susceptibility has been updated for this culture.

6. **REFERENCES:**

6.1. Performance Standards for Antimicrobial Susceptibility Testing; M100S 27th ed. January 2017. Clinical And Laboratory Standards Institute.

6.2. Methods for Antimicrobial Dilution and Disk Susceptibility Testing of Infrequently Isolated or Fastidious Bacteria, M45, 3rd ed. October 2015.

7. **SCOPE:** This technical procedure applies to UAB Hospital Microbiology Laboratory.

8. **ATTACHMENTS:** None

Tracking Record

Action				Reasons for Development/Change of Technical Procedure							Change in Practice		
Devel-oped	Refor-matted	Re-viewed	Revised	Re-quired Review	Rele-vance	Ethics	Legal	New Knowl-edge	QA/I	Risk	No	Yes	Comment/ Explanation of Impact
		X	X	X							X		
Supersedes:	5/20/09,02/19/10,11/01/10, 07/02/12, 08/12/14; 11/06/14; 12/21/15; 10/21/15; 07/08/16												
File Name:	Susceptibility Testing and Reporting Guidelines LAMI #195r8												
REVISIONS: Consistent with CAP requirements, this technical procedure is to be reviewed at least every two years and/or as practice changes.													