

MC 6.031 Staphylococcus Susceptibility Reporting

Purpose This procedure provides instruction and guidance for routine testing and selective and cascade susceptibility reporting on *Staphylococcus* species.

Principal and Clinical Significance The decisions for the most appropriate antimicrobial agents to test and report are made with input from Pharmacy, Infectious Disease and the Clinical Laboratory. The goal is to provide clinically relevant information that will decrease the chance of developing antibiotic resistance, harmful effects of inappropriate antimicrobial use and avoid reporting results that could adversely affect patient care using selective and cascade reporting rules.

Policy Statements This procedure applies to Microbiologists who perform susceptibility testing.

Special Safety Precautions Microbiologists are subject to occupational risks associated with specimen handling.

- [Biohazard Containment](#)
- [Biohazardous Spills](#)
- [Safety in the Microbiology Laboratory](#)

Procedure

1. Examples of *Staphylococcus* species:
 - *Staphylococcus aureus*
 - *Staphylococcus epidermidis*
 - *Staphylococcus lugdunensis*
 - *Staphylococcus saprophyticus*
 - *Staphylococcus pseudointermedius*
 - *Staphylococcus schleiferi*
 - *Staphylococcus auricularis*
 - *Staphylococcus caprae*
 - *Staphylococcus hominis*
 - *Staphylococcus haemolyticus*
 - *Staphylococcus intermedius*
 - *Staphylococcus simulans*
 - *Staphylococcus scurii*
 - *Staphylococcus warneri*
2. Antibiotics appropriate for routine testing and reporting for *Staphylococcus* species include:
 - Erythromycin
 - Clindamycin
 - Oxacillin
 - Doxycycline
 - Tetracycline
 - Trimethoprim Sulfamethoxazole
 - Vancomycin
 - Penicillin
 - Daptomycin
 - Linezolid
 - Ceftaroline
 - Rifampin

- Gentamicin
 - Ciprofloxacin
 - Levofloxacin
 - Nitrofurantoin-Urine only
3. Perform susceptibilities using Vitek cards GP67 or Kirby Bauer Method.
 - Vitek AST-GP67 will be the primary method of testing.
 - Kirby Bauer are back up if testing fails.
 - Do not perform testing on multiple methods to cover all the antibiotics. It is acceptable if cascaded antibiotics are not reported.
 4. Vitek results will be accepted under the Online Results tab. Modifications will be under the **VITMIC** keyboard under the Susceptibility tab.
 5. Kirby Bauer results will be entered manually under the **KB** keyboards under the Susceptibility tab.
 6. ETEST or send out results will be entered manually under the **MMIC** keyboards under the Susceptibility tab.

Selective Reporting

1. Antibiotics will be reported in a specific order indicating the first and subsequent preferences of the Antimicrobial Stewardship Committee and Infectious Disease physicians
2. Antibiotics will be reported depending on the source, if the sample is a urine, non-urine, blood or CSF source.
3. There will be exceptions based on the method used for testing.
4. For **urine sources**, these 5 antibiotics will be reported routinely, in this order.
 1. Oxacillin
 2. Cefazolin
 3. Trimethoprim-Sulfa
 4. Rifampin
 5. Nitrofurantoin

Figure 1 -Only OX, CFZ, TS, RIF and FD are reported. All other antibiotics are in HIDE

Organism #2 - STAPHYLOCOCCUS WARNERI		
- VITMIC -		
SS	OX(<=0.25), CFZ(SS), TS(20), RIF(<=0.5), FD(32)	
HIDE	VA(<=0.5-SS), P(<=0.03-R), CP(<=0.5-SS), OXSF(NEG), LZD(2-SS), LEVO(<=0.12-SS), GM(<=0.5-SS), TE(<=1-SS)	

5. For **non-urine sources**, these 5 antibiotics will be reported routinely, in this order.
 1. Oxacillin
 2. Cefazolin
 3. Clindamycin
 4. Trimethoprim-Sulfa
 5. Rifampin

Figure 2-Only OX, CFZ, CD, TS and RIF are reported. All other antibiotics are in HIDE.

Organism #2 - STAPH AUREUS, METHICILLIN SENSITIVE		
- VITMIC -		
SS	OX(2), CFZ(SS), CD(0.5), TS(40), RIF(1)	
HIDE	VA(2-SS), LZD(4-SS), P(2-R), E(0.5-SS), ICR(NEG), OXSF(NEG), CP(1-SS), LEVO(1-SS), GM(4-SS), TE(4-SS)	

6. For **blood** sources, these 6 antibiotics will be reporting routinely, in this order
 1. Oxacillin
 2. Cefazolin
 3. Vancomycin
 4. Clindamycin
 5. Trimethoprim Sulfa
 6. Rifampin

Figure 3-Only OX, CFZ, VA, CD, TS and RIF are reported. All other antibiotics are in HIDE.

Organism #2 - STAPH AUREUS, METHICILLIN SENSITIVE		
- VITMIC -		
SS	OX(0.5), CFZ(SS), VA(1), CD(<=0.25), TS(<=10), RIF(<=0.5)	
HIDE	ICR(NEG), E(<=0.25-SS), P(>=0.5-R), OXSF(NEG), CP(<=0.5-SS), LZD(2-SS), LEVO(<=0.12-SS), TE(<=1-SS)	

7. For **CSF** sources, these 3 antibiotics will be reported routinely, in this order.
 1. Oxacillin
 2. Trimethoprim Sulfa
 3. Rifampin

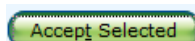
Figure 4-Only OX, TS and RIF are reported. All other antibiotics are in HIDE.

Organism #1 - STAPH AUREUS, METHICILLIN SENSITIVE		
- VITMIC - (ZZ00)		
SS	OX(0.5), TS(40), RIF(1)	
HIDE	VA(4-SS), P(0.12-R), OXSF(NEG), LZD(4-SS), GM(4-SS)	

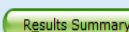
Cascade Reporting-Vitek Method

If resistance is encountered, additional antibiotics will automatically be released.

1. For Vitek method, hidden antibiotics will be released when Accept Selected is clicked.



The released results will be visible in Results Summary.



2. Results can be edited under the **VITMIC** keyboard but is not needed to report the cascaded antibiotics.

Method: Vitek -all sources

- If Oxacillin is R → report Vancomycin *
- If Vancomycin is R → report Linezolid
- If Ciprofloxacin R → report Levofloxacin **

Figure 5- Example with resistance from a urine source

Organism #1 - STAPHYLOCOCCUS EPIDERMIDIS		
- VITMIC -		
SS	TS(<=10), RIF(<=0.5), FD(<=16), VA(1), LEVO(<=0.12)	
R	OX(>=4), CFZ(R)	
HIDE	P(>=0.5-R), CP(4-R), OXSF(POS), LZD(1-SS), GM(>=16-R), TE(<=1-SS)	

3. * Exception: Vancomycin will always report on blood sources
4. ** Exception: Ciprofloxacin and Levofloxacin are not reported on CSF.
5. When the ICR is positive and the Clindamycin is reported as Resistant, remove the MIC result.

Table 6-Example with positive ICR on non-urine source

Organism #1 - STAPH AUREUS, METHICILLIN SENSITIVE		
- VITMIC -		
SS	OX(0.5), CFZ(SS), TS(<=10), RIF(<=0.5)	
R	CD(R)	
HIDE	VA(<=0.5-SS), LZD(2-SS), P(0.12-R), E(>=8-R), ICR(POS), OXSF(NEG), CP(<=0.5-SS), LEVO(0.25-SS), TE(>=16-R)	

- All other antibiotics on the panel that are not part of the cascade are hidden. Do not release and report. Hidden antibiotics include:
 - Erythromycin
 - Penicillin
 - Ciprofloxacin
 - Tetracycline
 - Gentamicin
 - Inducible Clindamycin Resistance
 - Cefoxitin Screen
- Requested antibiotics may be released with a provider request

Cascade Reporting-MicroScan Method

If additional antibiotics are requested or ETEST performed, use the MMIC keyboard and release from HIDE.

- Enter results manually under the **MMIC** keyboard.
- Click the check mark under SUP to remove from HIDE.

- Click on File.  Result will be un-hidden.

Figure 7 Vancomycin, Daptomycin, Ceftaroline or Doxycycline requested

Organism #1 - STAPH AUREUS, METHICILLIN SENSITIVE		
- MMIC -		
SS	VA(2), DAP(1), CPT(1), DOXY(4)	

- Requested antibiotics may be released with a provider request.

**Cascade
Reporting-
Kirby Bauer
Method**

If resistance is encountered, additional antibiotics will automatically be released.

1. Enter **all** listed results manually under the **KB** keyboard. Antibiotics will be released following the cascade rules.

Method: Kirby Bauer – urine source

- If Oxacillin is R → report Vancomycin Etest result*

Figure 8 Example with resistance to oxacillin, Vancomycin Etest reported

Organism #2 - METHICILLIN RESISTANT STAPH AUREUS ***MDRO***		
- KB -		
(ZZ07)		
SS	TS(18),RIF(21),FD(24)	
R	OX(R),CFZ(R)	
HIDE	P(20-R),CP(22-SS),CFX(16-R),GM(23-SS)	
- MMIC -		
SS	VA(2)	

2. Enter interpretation for OX and CFZ based on the CFX interpretation.
 - If CFX is R, report OX and CFZ as R
 - If CFX is SS, report OX and CFZ as SS
3. * Perform Vancomycin Etest for result if needed. Perform Etest day of use QC for Vancomycin. Result Vancomycin on the MMIC keyboard.
4. Perform Vancomycin Etest for *S. pseudointermedius* and *schleiferi* as Oxacillin is not reported. Perform Etest day of use QC for Vancomycin. Result Vancomycin on the MMIC keyboard.
5. Perform KB day of use QC for Nitrofurantoin.

Method: Kirby Bauer – non-urine source

- If Oxacillin is R → report Vancomycin Etest result*
- If ICR is positive → report Clindamycin as R

Figure 9 Example with resistance to Oxacillin, Vancomycin Etest reported. ICR positive, CD reported as R

Org #2. METHICILLIN RESISTANT STAPH AUREUS ***MDRO***		
- KB -		
SS	TS(23),RIF(23)	
R	OX(R),CFZ(R),CD(R)	
HIDE	ICR(POS),E(23-SS),P(23-R),CP(22-SS),CFX(20-R),GM(16-SS)	
- MMIC -		
SS	VA(2)	

6. Enter interpretation for OX and CFZ based on the CFX interpretation.
 - If CFX is R, report OX and CFZ as R
 - If CFX is SS, report OX and CFZ as SS
7. * Perform Vancomycin Etest for result if needed. Perform Etest day of use QC for Vancomycin. Result Vancomycin on the MMIC keyboard.
8. Perform Vancomycin Etest for *S. pseudointermedius* and *schleiferi* as Oxacillin is not reported. Result Vancomycin on the MMIC keyboard.

Method: Kirby Bauer – BC source

- Perform Vancomycin Etest and report under MMIC keyboard. Perform Etest day of use QC for Vancomycin.
- If ICR is positive → report Clindamycin as R

Figure 10 Example with susceptibility to Oxacillin, Vancomycin Etest reported. ICR positive, CD reported as R.

Org #4.		STAPH AUREUS, METHICILLIN SENSITIVE (STRAIN 1)
- KB -		
	SS	OX(SS), CFZ(SS), TS(23), RIF(23)
	R	CD(R)
	HIDE	ICR(POS), E(23-SS), P(23-R), CP(22-SS), CFX(24-SS), GM(16-SS)
- MMIC -		
	SS	VA(2)

- Enter interpretation for OX and CFZ based on the CFX interpretation.
 - If CFX is R, report OX and CFZ as R
 - If CFX is SS, report OX and CFZ as SS
- Perform Vancomycin Etest for *S. pseudointermedius* and *schleiferi* as Oxacillin is not reported. Result Vancomycin on the MMIC keyboard.

Method: Kirby Bauer – CSC source

- If Oxacillin is R → report Vancomycin Etest result*

Figure 11 Example with resistance to Oxacillin, Vancomycin Etest reported

- KB -		
	SS	TS(18), RIF(20)
	R	OX(R)
	HIDE	CFX(20-R), P(20-R), GM(16-SS)
- MMIC -		
	SS	VA(2)

- Enter interpretation for OX based on the CFX interpretation.
 - If CFX is R, report OX as R
 - If CFX is SS, report OX as SS
- *Perform Vancomycin Etest for result if needed. Perform Etest day of use QC for Vancomycin. Result Vancomycin on the MMIC keyboard
- Perform Vancomycin Etest for *S. pseudointermedius* and *schleiferi* as Oxacillin is not reported. Result Vancomycin on the MMIC keyboard
- All other antibiotics on the panel that are not part of the cascade are hidden. Do not release and report. Hidden antibiotics include:
 - Erythromycin
 - Penicillin
 - Ciprofloxacin
 - Gentamicin
 - ICR
 - Cefoxitin

15. Requested antibiotics may be released with a provider request.

**Method
Performance
Specifications**

1. Usually, only the Vitek card AST-GP67 will be required for testing *Staphylococcus* species.
2. Set up Vancomycin Etest including day of use QC when testing with Kirby Bauer Method.
3. Set up Nitrofurantoin day of QC with urine sources with the Kirby Bauer Method.

**Vitek
Product
Limitations**

Results for an antibiotic/organism combination may have limitations and may be suppressed from reporting. Refer to table below for specific limitations.

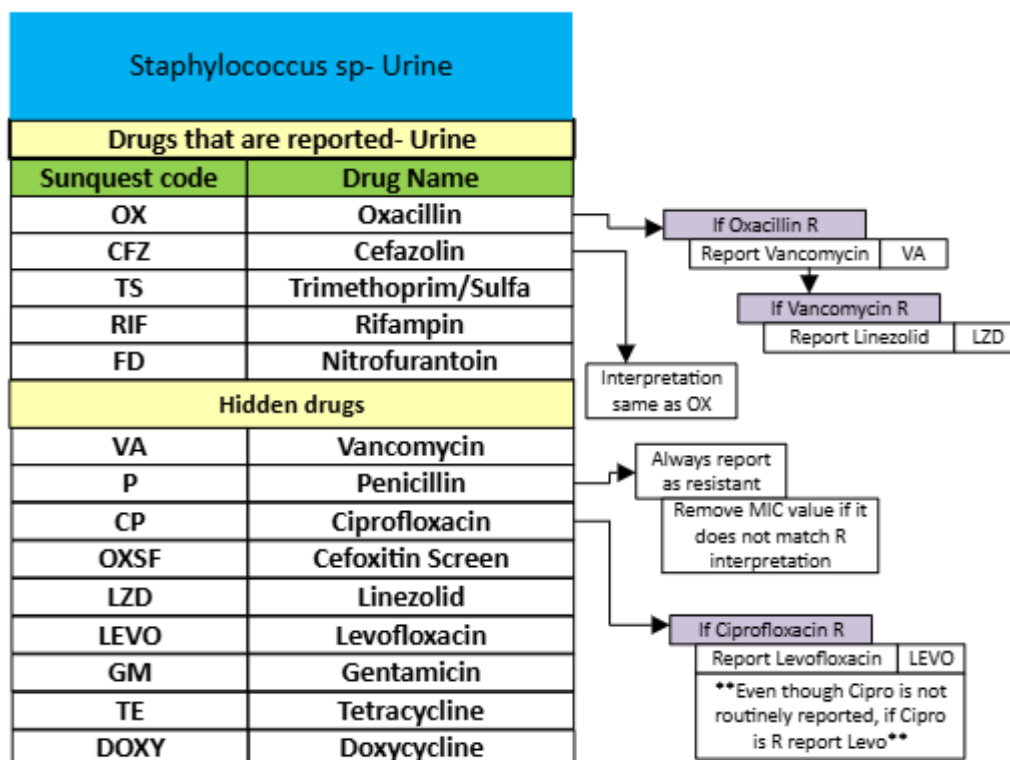
AST-GP67 card for Staphylococcus species

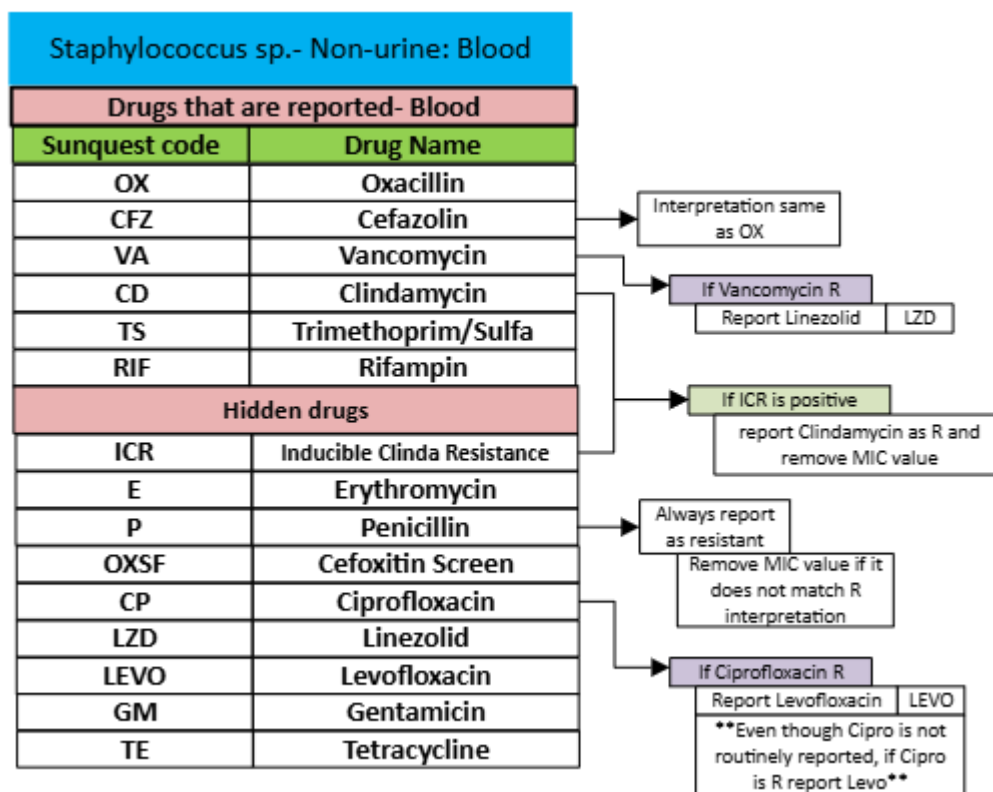
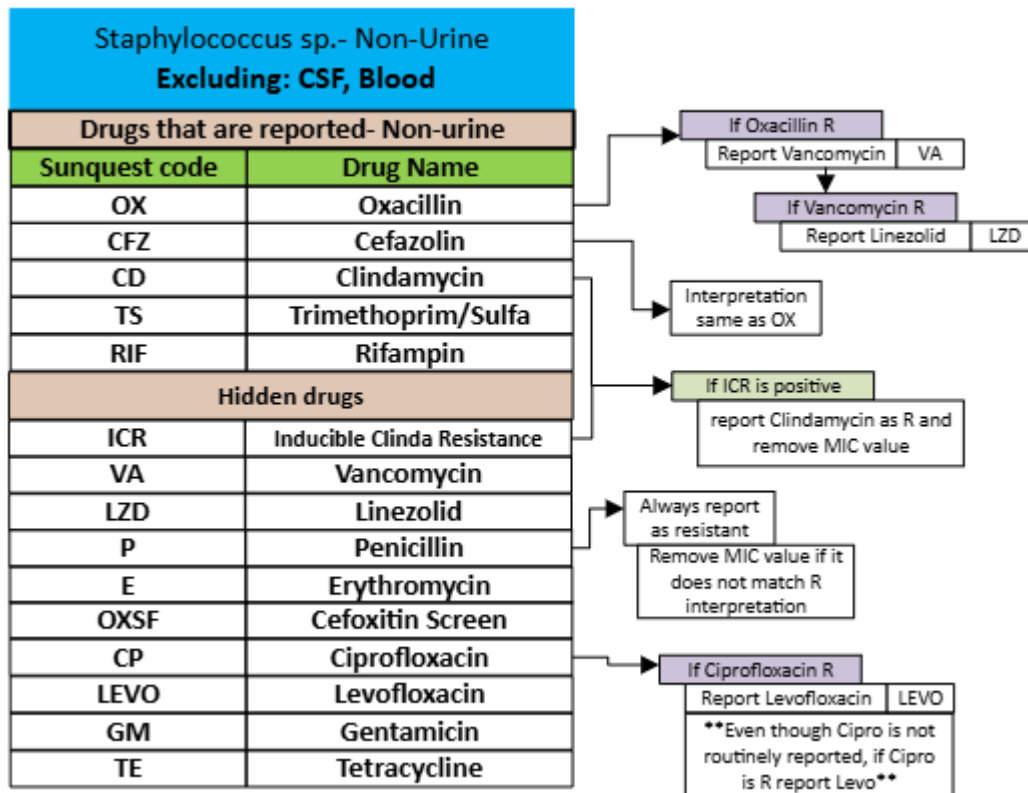
Antibiotic	Product Limitations
Cefoxitin screen	Do not report on <i>S. saprophyticus</i> and <i>S. pseudointermedius</i>

Appendix

Additional Tables and Flowcharts

Vitek





Staphylococcus sp.- CSF	
Drugs that are reported- CSF	
Sunquest code	Drug Name
OX	Oxacillin
TS	Trimethoprim/Sulfa
RIF	Rifampin
Hidden drugs	
VA	Vancomycin
P	Penicillin
OXSF	Cefoxitin Screen
LZD	Linezolid
GM	Gentamicin

If Oxacillin R
 Report Vancomycin VA
 If Vancomycin R
 Report Linezolid LZD

Always report as resistant
 Remove MIC value if it does not match R interpretation

Kirby-Bauer

Staphylococcus sp.- Urine		
Drugs that are reported- Urine		
Disk (Abbrev.)	Sunquest code	Drug Name
	OX	Oxacillin
	CFZ	Cefazolin
SXT	TS	Trimethoprim/Sulfa
RA	RIF	Rifampin
F/M- Needs QC	FD	Nitrofurantoin
Hidden drugs		
P	P	Penicillin
CIP	CP	Ciprofloxacin
FOX	CFX	Cefoxitin
Gm	GM	Gentamicin
VA-Etest, Needs QC	VA	Vancomycin

Report R or SS based on interpretation of cefoxitin
 If Oxacillin R
 Report Vancomycin VA

Always report as resistant

Do not report
 Only used for OX and CFZ interpretation

Only done if Oxacillin R
 Enter results in MMIC Keyboard

Staphylococcus sp.- Non-Urine Excluding: CSF, Blood		
Drugs that are reported- Non-urine		
Disk (Abbrev.)	Sunquest code	Drug Name
	OX	Oxacillin
	CFZ	Cefazolin
CC	CD	Clindamycin
SXT	TS	Trimethoprim/Sulfa
RA	RIF	Rifampin
Hidden drugs		
	ICR	Inducible Clinda Resistance
E	E	Erythromycin
P	P	Penicillin
Cp	CP	Ciprofloxacin
FOX	CFX	Cefoxitin
Gm	GM	Gentamicin
VA-Etest, Needs QC	VA	Vancomycin

Report R or SS based on interpretation of cefoxitin

If Oxacillin R

Report Vancomycin VA

If ICR is positive

report Clindamycin as R

Always report as resistant

Do not report

Only used for OX interpretation

Only done if Oxacillin R

Enter results in MMIC Keyboard

Staphylococcus sp.- Non-Urine: Blood		
Drugs that are reported- Blood		
Disk (Abbrev.)	Sunquest code	Drug Name
	OX	Oxacillin
	CFZ	Cefazolin
VA-Etest, Needs QC	VA	Vancomycin
CC	CD	Clindamycin
SXT	TS	Trimethoprim/Sulfa
RA	RIF	Rifampin
Hidden drugs		
	ICR	Inducible Clinda Resistance
E	E	Erythromycin
P	P	Penicillin
Cp	CP	Ciprofloxacin
FOX	FOX	Cefoxitin
Gm	GM	Gentamicin

Report R or SS based on interpretation of cefoxitin

Enter results in MMIC Keyboard

If ICR is positive

report Clindamycin as R

Always report as resistant

Do not report

Only used for OX interpretation

Staphylococcus sp.- CSF		
Drugs that are reported- CSF		
Disk (Abbrev.)	Sunquest code	Drug Name
	OX	Oxacillin
SXT	TS	Trimethoprim/Sulfa
RA	RIF	Rifampin
Hidden drugs		
FOX	FOX	Cefoxitin
P	P	Penicillin
Gm	GM	Gentamicin
VA-Etest Needs QC	VA	Vancomycin

Report R or SS based on interpretation of cefoxitin

If Oxacillin R

Report Vancomycin VA

Do not report

Only used for OX interpretation

Always report as resistant

Only done if Oxacillin R

Enter results in MMIC Keyboard

MicroScan

Staphylococcus sp.	
Hidden drugs	
Sunquest code	Drug Name
VA	Vancomycin
DAP	Daptomycin
DOXY	Doxycycline
CPT	Ceftaroline

References

1. bioMerieux Vitek 2 AST-N806 Gram Negative Susceptibility Card 424709 2023-07
2. bioMerieux Vitek 2 AST-XN30 Gram Negative Susceptibility Card 424639 20235-04
3. Beckman Coulter Diagnostics. 250 South Kraemer Boulevard. Brea, CA 92821-6232 USA, MicroScan® Dried Gram Negative (8/2022).
4. CLSI M100 edition 34 Performance Standards for Antimicrobial Susceptibility Testing 2024

Training Plan/ Competency Assessment

Training Plan	Initial Competency Assessment
<ol style="list-style-type: none"> 1. Employee must read the procedure. 2. Employee will observe trainer performing the procedure. 3. Employee will demonstrate the ability to perform procedure, record results and document corrective action after instruction by the trainer. 	<ol style="list-style-type: none"> 1. Direct observation.

Historical Record

Version	Written/Revised by:	Effective Date:	Summary of Revisions
1	Susan DeMeyere	3/4/2025	Initial version