



The 2015 statewide antibiogram is the fourth annual antibiogram report released by the Hawaii State Department of Health (HDOH). Similar to [prior statewide antibiograms](#), data were compiled based on recommendations from the Clinical and Laboratory Standards Institute (CLSI) M39 Guidelines (See Appendix A).

- Tripler Army Medical Center, Kaiser Permanente, Diagnostic Laboratory Services, Clinical Laboratories of Hawaii (CLH), Kuakini Hospital, and Wahiawa General Hospital each submitted their data in aggregate form. The data represent isolates cultured from January 2015 through December 2015.
- Changes for the 2015 antibiogram
 - All facilities submitted data for methicillin-resistant *Staphylococcus aureus* (MRSA) and methicillin-susceptible *S. aureus* (MSSA) separately. This eliminated the need for presenting aggregated *S. aureus* susceptibilities.
 - Doxycycline and tetracycline, of the tetracycline family of antibiotics, were added to the antibiogram and analyzed against the gram positive set of organisms.
 - Doripenem was removed from the antibiogram
- **Note: Data are presented for surveillance purposes only and are not intended for use in clinical decision making. This antibiogram should not take the place of individual clinical assessment and isolate susceptibility testing.**
- Limitations:
 - A distinction was not made between inpatient and outpatient isolates in all laboratories; additionally, not all laboratories distinguished between urine and systemic isolates (See Appendix B). Data presented on the statewide antibiogram are thus presented in aggregate form considering those parameters.
 - Not all laboratories have implemented the revised carbapenem or cephalosporin and monobactam breakpoints for *Enterobacteriaceae* recommended by CLSI in 2010 (M100-S20)¹.

Stopping the Spread of Antibiotic Resistance

Increased antibiotic resistance, due in part to overuse and misuse of antimicrobials, is one of today's most urgent public health issues. Each year, two million people in the United States are infected with an antibiotic resistant infection, resulting in at least 23,000 deaths². To combat this growing threat, a coordinated approach across the continuum of care is necessary. Recent studies have found 30-50% of all antibiotics prescribed in the outpatient setting in the United States are either unnecessary or inappropriate. Antibiotic stewardship is aimed at reducing these numbers by ensuring antibiotics are only used when needed, as well as making certain the right drug, dose, and duration are selected. In Hawaii, the [Hawaii Antimicrobial Stewardship Collaborative \(HASC\)](#) has been working to implement and sustain antimicrobial stewardship programs within the state's healthcare facilities. More recently, these endeavors have begun to move into long term care facilities, as well as the outpatient setting. The statewide antibiogram is a useful tool to understand antimicrobial susceptibility in Hawaii and monitor antibiotic resistance trends over time. The annual statewide antibiogram reports and the efforts of HASC continue to raise awareness of antibiotic resistance threats and promote the judicious use of antibiotics among prescribers and healthcare facilities in Hawaii.



¹ As entered in NHSN, 88% of facilities reported implementing carbapenem breakpoints for *Enterobacteriaceae*; 82% of facilities reported implementing cephalosporin and monobactam breakpoints for *Enterobacteriaceae*

² <http://www.cdc.gov/drugresistance/threat-report-2013/>

2015 Hawaii Statewide Antibioqram

Gram-Positive Organisms

Percent Susceptible (Number of isolates tested)	# of all isolates from all sources	Penicillins			Cephalosporins		Quinolones		Tetracyclines		Other Antibiotics							
		Ampicillin	Oxacillin	Penicillin	Cefazolin	Ceftriaxone	Levofloxacin	Moxifloxacin	Doxycycline	Tetracycline	Tigecycline	Clindamycin	Erythromycin	Linezolid	Nitrofurantoin	Rifampin	Trimethoprim/Sulfamethoxazole	Vancomycin
<i>Enterococcus sp.</i> (unspciated)	3,112	92 (3,112)					81 (816)		75 (100)	29 (2,912)	89 (918)			99 (2,865)	97 (2,513)			89 (3,105)
<i>Enterococcus faecalis</i>	2,046	99 (2,046)					82 (1,699)		32 (461)	25 (1,699)	100 (1,396)			100 (1,365)	100 (910)	†		100 (2,041)
<i>Enterococcus faecium</i>	167	25 (161)					14 (163)		68 (139)	21 (163)				100 (166)				41 (167)
Methicillin-resistant <i>Staphylococcus aureus</i> (MRSA)*	7,447		0 (4,658)		0 (1,227)	†	44 (4,669)	50 (4,938)	100 (1,739)	95 (7,446)	100 (4,555)	67 (7,382)	17 (7,276)	100 (7,342)		99 (7,426)	86 (7,447)	100 (7,437)
Methicillin-susceptible <i>Staphylococcus aureus</i> (MSSA)*	12,029		100 (11,841)		100 (8,459)	†	95 (6,748)	96 (8,094)	99 (1,626)	96 (12,028)	100 (6,141)	83 (11,935)	74 (11,917)	100 (11,825)		100 (11,818)	98 (12,029)	100 (12,024)
<i>Streptococcus pneumoniae</i>	362			86 (329)		96 (362)	99 (210)	†		78 (359)	100 (14)	83 (227)	69 (289)				85 (341)	100 (349)

Comparison to 2014 susceptibility: 10% or greater increase 5-9% increase 5-9% decrease 10% or greater decrease

Note: Data are presented for surveillance purposes only and are not intended for use in clinical decision making. This antibiogram should not take the place of individual clinical assessment and isolate susceptibility testing.



* The vancomycin susceptibilities presented reflect *Staphylococcus aureus* isolates with an MIC ≤ 4 µg/mL; treatment failures have been observed in isolates with an MIC to vancomycin of 2 µg/mL.

† Insufficient sample size

‡ Statistically significant results using χ^2 -heterogeneity test (p<.05)

2015 Hawaii Statewide Antibioqram

Gram-Negative Organisms

Percent Susceptible (Number of isolates tested)	# of all isolates from all sources	Penicillins			Cephalosporins				Carbapenems			Quinolones			Other Antibiotics	
		Amoxicillin/ Clavulanic Acid	Ampicillin/ Sulbactam	Piperacillin/ Tazobactam	Cefuroxime	Ceftriaxone	Ceftazidime	Cefepime	Ertapenem	Imipenem	Meropenem	Ciprofloxacin	Levofloxacin	Amikacin	Nitrofurantoin	Trimethoprim/ Sulfamethoxazole
<i>Acinetobacter sp.</i>	299						74 (138)	93 (215)		100 (74)	99 (79)	91 (264)	96 (138)	97 (69)		89 (299)
<i>Citrobacter freundii</i> [†]	232	*	*	*	*	*	*	100 (190)			100 (42)	94 (228)	98 (42)	100 (232)	95 (226)	87 (232)
<i>Citrobacter koseri</i> [†]	526			100 (525)		98 (526)	99 (128)	100 (398)			100 (128)	99 (522)	100 (128)	100 (526)	91 (445)	98 (526)
<i>Enterobacter sp.</i>	1,447	*	*	*	*	*	*	99 (1,093)	100 (284)	100 (293)	99 (494)	96 (1,401)	96 (499)	100 (1,357)	51 (810)	90 (1,411)
<i>Escherichia coli</i>	54,101	87 (27,616)	65 (35,736)	98 (53,542)	78 (22,867)	95 (52,709)	93 (33,920)	95 (46,996)	100 (31,408)	100 (30,881)	100 (29,170)	80 (54,080)	84 (33,327)	100 (49,368)	97 (41,625)	76 (54,101)
<i>Klebsiella pneumoniae</i>	10,194	95 (5,122)	85 (6,641)	96 (9,671)	89 (4,371)	98 (10,091)	97 (6,321)	98 (9,007)	100 (5,679)	100 (5,638)	100 (5,570)	96 (10,169)	96 (6,207)	100 (9,468)	56 (6,207)	89 (10,193)
<i>Proteus mirabilis</i>	4,181	100 (2,355)	95 (2,909)	100 (4,018)	96 (1,830)	98 (4,113)	99 (2,894)	99 (3,666)	100 (2,424)	92 (2,135)	100 (2,356)	93 (4,102)	93 (2,811)	100 (3,595)	0 (1,786)	90 (4,096)
<i>Pseudomonas aeruginosa</i>	6,306			98 (4,161)			93 (3,994)	94 (6,272)		86 (3,344)	95 (3,893)	88 (6,098)	80 (3,868)	99 (6,200)		
<i>Serratia marcescens</i>	445	*	*	*	*	*	*	100 (353)	100 (131)	‡	100 (127)	98 (444)	96 (224)	99 (347)	0 (121)	99 (445)

Comparison to 2014 Susceptibility[§]: 10% or greater increase 5-9% increase 5-9% decrease 10% or greater

Note: Data are presented for surveillance purposes only and are not intended for use in clinical decision making. This antibiogram should not take the place of individual clinical assessment and isolate susceptibility testing.



* Because of the presence of inducible beta-lactamase, these organisms should be considered resistant to the antimicrobial indicated.

† Data excludes one facility that did not differentiate between *Citrobacter freundii* and *Citrobacter koseri* isolates

‡ Insufficient sample size

§ Statistically significant results using χ^2 -heterogeneity test ($p < .05$)

Appendix A: Summary of the recommendations contained in CLSI M39-A4 Guidelines

The Routine Cumulative Antibigram

- Analyze/present cumulative antibiogram report at least annually
- Include only final, verified test results
- Include only species with testing data for ≥ 30 isolates
- Include only diagnostic isolates
- Eliminate duplicate isolates
- Include only antimicrobial agents routinely tested
- Report percent susceptible and do not include percent intermediate
- Suggested supplemental analyses:
 - For *Streptococcus pneumoniae* and cefotaxime/ceftriaxone/penicillin: report percent susceptible for both meningitis and non-meningitis breakpoints.
 - For viridans group streptococci and penicillin: list both percent intermediate and percent susceptible.
 - For antimicrobial agents that have susceptible dose-dependent (SDD)^{*} interpretive criteria, calculate and list separately the % Susceptible and %SDD.
 - Perform separate analyses for oxacillin-resistant *S. aureus* (MRSA) and oxacillin-susceptible *S. aureus*
 - Differentiate *Enterococcus faecalis* and *E. faecium*, and present their susceptibility patterns separately

The Enhanced Antibigram

- Stratifying cumulative antibiogram data by various parameters
 - Differentiate by nursing unit or site of care (e.g. ICU, outpatient clinic)[†]
 - Differentiate by an organism's resistance characteristics, especially for multidrug resistant organisms (MDROs) (e.g. VRE)
 - Differentiate by specimen type or infection site (e.g. urine and blood isolates)[†]
 - Differentiate by clinical service or patient population (e.g. surgical, pediatric)
- Supplemental analyses of MDROs
 - List the percentage of a species that is MDR next to the organism name
 - Stratify isolates of species where multidrug resistance is known to occur (e.g. *K. pneumoniae*)
- Examine the percentage of isolates susceptible to drugs in relevant combinations for individual species or for groups of organisms

Appendix B: Additional factors that can impact aggregate antibiogram data

- Interpretation and clinical utility of particular pathogen-antibiotic combinations may differ depending on site of infection, in particular for urinary or central nervous system infections; additionally, susceptibility testing performed at different laboratories may vary depending on source of specimen, and different minimum inhibitory concentration (MIC)[‡] "breakpoints" may be given for antibiotics most frequently used to treat urinary tract infections—for instance, nitrofurantoin and trimethoprim-sulfamethoxazole
- Patient population served: for example, substantial differences may be seen in susceptibility patterns in the outpatient and inpatient setting
- Culturing practices: for example, susceptibility patterns may be biased if local practice involves culturing for uncomplicated infections only in the context of treatment failure
- Laboratory antimicrobial susceptibility testing and reporting policies
- Temporal outbreaks



* The SDD category implies susceptibility of an isolate is dependent on the dosing regimen used in the patient.

[†] These recommendations moved from Suggested Supplemental Analyses (M39-A3) to the Enhanced Antibigram.

[‡] The MIC is defined as the lowest concentration of a drug that will inhibit the visible growth of an organism after overnight incubation.