2012 Hawaii Statewide Antibiogram for Selected Bacteria of Public Health Significance

- The antibiogram reflects data submitted by the 4 major clinical laboratories throughout the state
  - TAMC, Kaiser, DLS each submitted their data in aggregate form
  - CLH submitted facility-specific antibiograms for Hilo Medical Center, Kapiolani Medical Center for Women and Children, Kona Community Hospital, Maui Memorial Medical Center, Pali Momi Medical Center, Straub Clinic & Hospital, and Wilcox General Hospital.
  - The data represent isolates cultured from January 2012 to December 2012
- **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:
  - Not all laboratories adhered to all recommendations from the Clinical and Laboratory Standards Institute (CLSI) guideline M39-A3 (See Appendix A).
  - A distinction was not made between inpatient and outpatient isolates in all laboratories; additionally, not all laboratories distinguished between urine and systemic isolates. Data presented on the statewide antibiogram are thus presented in aggregate form. (See Appendix B)

Antibiotic Resistance: A Need for Continued Vigilance.

- Every year, more than two million people in the United States are infected with bacteria that are resistant to antibiotics, and at least 23,000 people die as a result according to a report issued by the Centers for Disease Control and Prevention (CDC).
- Carbapenem-resistant *Enterobacteriaceae* (CRE) have been detected in Hawaii and are categorized as "urgent threats" by CDC. Carbapenem susceptibility testing should be considered for *Enterobacteriaceae*, particularly for those demonstrating extensive ß-lactam resistance.
- Chromosomal, inducible AmpC ß -lactamases are present in some *Enterobacteriaceae*, in particular *Serratia marcescens*, *Citrobacter freundii*, *Providencia* spp., and *Morganella morganii*. Therapy with third-generation cephalosporins as well as other beta-lactams can result in clinical failure despite initial *in vitro* susceptibility. These bacteria merit close monitoring as this issue contributes to the increasing challenge of our narrowing antimicrobial armamentarium.
- Extended-spectrum β-lactamase (ESBL)-producing *Enterobacteriaceae* are categorized as "serious threats" in the CDC report. Detection of ESBL production in clinical isolates can have significant implications for clinical care; screening for ESBLs should be routinely performed, and results reported.
- Because methicillin-resistant *Staphylococcus aureus* (MRSA) epidemiology and susceptibility patterns have evolved over time and MRSA is categorized as a "serious threat" in the CDC report, it may become important to monitor MRSA susceptibilities as a separate subgroup from methicillin-susceptible *Staphylococcus aureus* (MSSA). Future reports may separate the two subgroups.

2012 Hawaii Statewide Antibiogram

Gram-Positive Organisms

Percent Susceptible (Number of isolates tested)		Penicillins			Cephalosporins		Quinolones			Other Antibiotics						
	# of all isolates from all sources	Ampicillin	Oxacillin	Penicillin	Cefazolin	Ceftriaxone	Levofloxacin	Moxifloxacin	Clindamycin	Erythromycin	Linezolid	Nitrofurantoin	Rifampin	Tigecycline	Trimethoprim/ Sulfamethoxazole	Vancomycin
Enterococcus sp.(unspeciated)	3,572	**91** (3,523)		**91** (1,508)			**83** (1,498)			**16** (62)	**99** (3,523)	**96** (2,494)		**100** (265)		**96** (3,542)
Enterococcus faecalis	1,123	**99** (1,123)		**99** (1,123)			**83** (527)			**18** (212)	**100** (410)	**100** (680)	**50** (215)	**100** (390)		**100** (1,121)
Enterococcus faecium	104	**23** (104)		**23** (104)			**21** (95)			**36** (34)	**99** (104)					**35** (104)
Staphylococcus aureus	17,645	**9** (1,498)	**62** (17,645)	**19** (17,645)	**81** (9,068)	**53** (1,498)	**76** (9,188)	**81** (11,212)	**83** (17,475)	**55** (17,367)	**100** (16,390)	**100** (11,752)	**100** (15,584)	**100** (6,042)	**97** (17,645)	**100** (17,644)
Streptococcus pneumoniae	473			**83** (473)		**93** (431)	**99** (250)	**99** (141)	**64** (35)	**47** (195)					**77** (404)	**100** (378)

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2012 Hawaii Statewide Antibiogram

Gram-Negative Organisms

Percent Susceptible (Number of isolates tested)		Penicillins		Cephalosporins				Carbapenems				Quinolones		Other Antibiotics		
	# of all isolates from all sources	Amoxicillin/Clavulanic Acid	Piperacillin/Tazobactam	Cefuroxime	Ceftriaxone	Ceftazidime	Cefepime	Doripenem	Ertapenem	Imipenem	Meropenem	Ciprofloxacin	Levofloxacin	Amikacin	Nitrofurantoin	Trimethoprim/Sulfamethoxazole
Acinetobacter sp.	227	**0** (43)			**21** (206)	**77** (175)	**86** (184)			**84** (202)	**100** (159)	**94** (218)	**95** (211)	**100** (175)	**0** (43)	**89** (218)
Enterobacter sp.	1,844	*	*	*	*	*	**98** (1,664)	**99** (271)	**100** (787)	**81** (794)	**98** (716)	**93** (1,844)	**93** (764)	**100** (1,812)	**46** (1,343)	**87** (1,818)
Escherichia coli	37,050	**92** (29,965)	**97** (10,063)	**91** (12,340)	**96** (34,611)	**95** (12,340)	**89** (34,511)	**100** (6,814)	**100** (18,082)	**100** (16,331)	**100** (16,171)	**83** (36,166)	**78** (16,757)	**100** (36,122)	**98** (30,078)	**78** (36,598)
Klebsiella pneumoniae	6,417	**98** (5,306)	**98** (2,049)	**91** (2,506)	**98** (6,065)	**97** (2,506)	**98** (5,666)	**100** (1,547)	**100** (3,297)	**100** (3,011)	**100** (3,086)	**97** (6,279)	**96** (3,222)	**100** (6,250)	**62** (4,650)	**90** (6,315)
Proteus mirabillis	3,064	**100** (2,693)	**100** (903)	**99** (1,099)	**100** (2,885)	**100** (1,099)	**100** (2,725)		**98** (1,416)	**92** (396)	**100** (1,359)	**95** (3,000)	**95** (1,418)	**100** (2,998)	**0** (2,262)	**86** (3,011)
Pseudomonas aeruginosa	4,838		**95** (1,942)		**27** (328)	**90** (1,849)	**92** (4,838)	**83** (1,246)	**40** (63)	**88** (1,851)	**92** (2,354)	**83** (4,756)	**81** (4,604)	**97** (4,838)		
Serratia marcescens	388	*	*	*	*	*	**89** (365)		**100** (96)	**100** (56)	**100** (104)	**93** (388)	**95** (130)	**99** (374)	**0** (330)	**80** (368)

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

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Appendix A: Summary of the recommendations contained in M39-A3

- 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.
    - Analyze by clinically important organism resistance characteristics: for example, present separate analyses for oxacillin-resistant *S. aureus* (MRSA) and oxacillin-susceptible *S. aureus,* or for ESBL-producing Gram-negative bacilli
    - Differentiate *Enterococcus faecalis* and *E. faecium,* and present their susceptibility patterns separately
    - Differentiate by specimen type or infection site (e.g. urine and blood isolates), or site of care (e.g. ICU, outpatient clinic)

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 site of culture, and different minimum inhibitory concentration (MIC)[1] "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

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