LOS ANGELES COUNTY
ACUTE CARE HOSPITAL
2017 MULTI-FACILITY ANTIBIOGRAM

Acute Communicable Disease Control Program
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Introduction

Antimicrobial resistance (AR) is a global public health concern due to high morbidity, mortality, and healthcare costs associated with AR infections. The number of reports of bacteria resistant to antibiotics has grown substantially in the past decade globally, especially isolates resistant to multiple and last-line antibiotics. Facility-level antibiograms provide a summary of the percentage of isolates susceptible to a variety of antimicrobial agents within a healthcare facility. The facility antibiogram is an important tool for the development of antimicrobial stewardship policies and protocols for empiric antibiotic selection. Facility antibiograms are often limited by relatively few organisms tested and restricted geographic sampling.

A multi-facility regional antibiogram skirts many of those limitations by aggregating data from multiple locations for a more precise, accurate, and representative tool. The Los Angeles County Department of Public Health (LAC DPH) produces a multi-facility countywide antibiogram from antibiograms submitted by acute care hospitals in the County. The LAC regional antibiogram allows LAC DPH to track susceptibility data to better understand the problem of AR, and to better target interventions and prevention activities. A LAC DPH Health Officer Order issued by LAC DPH in January 2017 mandated that all acute care hospitals in the county submit their antibiogram to DPH, beginning with data from 2016[1].

In 2017, antibiogram data representing 86 (93%) acute care hospitals were reported and are included in this countywide report. Of the 86 hospitals, 78 are general acute care and 8 are long-term acute care hospitals.

The report contains an overall gram-negative organism antibiogram table, an overall gram-positive organism antibiogram table, and then a separate table for each organism that contains additional data and comments for relevant antibiotics.

This report also contains comments from the Los Angeles County Healthcare-Associated Infections and Antimicrobial Resistance Committee, an advisory committee to LAC DPH comprised of infectious disease, pharmacy, microbiology, infection prevention, and epidemiology subject matter experts.

The intended use of this document is to provide an annual surveillance report of antimicrobial resistance among acute care hospitals in Los Angeles County. Individual facilities may compare their antibiogram to the regional antibiogram for aberrations. The Los Angeles multi-facility antibiogram may also be used to guide empiric therapy selection when: the individual facility antibiogram has too few isolates (less than 30) of a particular organism; small hospitals and skilled nursing facilities do not encounter a wide variety of organisms; and healthcare facilities outside LA County receive patients from within LA County. Although facility or regional antibiograms can assist healthcare professionals in guiding empiric therapies, clinicians should adjust antibiotic treatment to final microbiology results as soon as they are available[2].

[1] http://publichealth.lacounty.gov/acd/docs/CREorder.pdf

[2] Halstead DC, Gomez N, McCarter YS. Reality of Developing a Community-Wide Antibiogram. *Journal of Clinical Microbiology*. 2004;42(1):1-6. doi:10.1128/JCM.42.1.1-6.2004.

Methodology Notes[3]

- Data included in the multi-facility Los Angeles County antibiogram were obtained through Health Officer Order-mandated facility-level antibiograms.
- Facility-level antibiograms were nearly always compiled for the calendar year January 1 to December 31.
- Not all facilities reported results for all organism/drug combinations. Refer to the "# of hospitals reporting" value for each combination.
- Results are reported as presented by local microbiology labs. Inpatient isolates were used whenever possible, but this could not be determined in some facilities. Results from isolates from all sites are combined.
- Susceptibility was defined by local labs in all circumstances.
- The total number of susceptible isolates was calculated by weighting each facility's isolate count by its reported susceptibility rate.
- The interquartile ranges (IQR) are presented for each percent susceptibility (%S) value. The IQR is the difference between the third and first quartiles of data.
- Data for both general acute care and long-term acute care hospitals are presented together.
- Facility-level antibiograms that are used to guide empiric therapy of initial infections are generally prepared following CLSI M39 which recommends including data from the first isolate/patient /analysis period. These reports do not include data from subsequent isolates on a patient which may be more resistant than the first isolate. Therefore, % S values are likely overestimated in some cases.
- Organism/drug combinations reported by only one facility are not included.
- Susceptibility results were rounded down to 99% if less than 100% and greater than 99%.

[3] Clinical and Laboratory Standards Institute (CLSI). 2014. Analysis and Presentation of Cumulative Antimicrobial Susceptibility Test Data; M39-A4. CLSI, Wayne, PA.

Note on Nitrofurantoin

Nitrofurantoin is only indicated for cystitis due to inadequate kidney penetration and insufficient serum levels. Nitrofurantoin should only be used in patients with a glomerular filtration rate > 30 and for limited duration of therapy (<5 days) due to known toxicity risk. Data presented here may include results from non-urine isolates, depending on the laboratory testing practices of our local laboratories.

Gram-Negative Organism Antibiogram

		Penicillins			Cephalosporins				Carbapenems			Aminoglycosides			Quinolones		Other			
Data presented as: **Percent Susceptible** (# of Isolates Tested)	# of all isolates tested (# of hospitals reporting)	Ampicillin	Ampicillin/ Sulbactam	Piperacillin/ Tazobactam	Ceftriaxone	Ceftazidime	Cefepime	Cefazolin	Ertapenem	Imipenem	Meropenem	Amikacin	Gentamicin	Tobramycin	Ciprofloxacin	Levofloxacin	Trimethoprim/ Sulfamethoxazole	Nitrofurantoin	Minocycline	Tigecycline
Acinetobacter baumannii	**2,723**	**R**	**43**	**27**	**10**	**27**	**40**	**R**	**R**	**27**	**39**	**36**	**37**	**40**	**27**	**26**	**48**	-	**79**	**79**
	75		2,084	1,776	1,320	1,894	1,139			1,120	1,436	1,925	2,661	2,084	2,030	1,985	2,287		154	424
Citrobacter freundii	**1,720**	**R**	**R**	**83**	**79**	**80**	**98**	**R**	**100**	**98**	**98**	**99**	**92**	**92**	**91**	**90**	**82**	**95**	-	**100**
	45			1,604	1,629	1,370	1,579		1,100	361	1,329	1,517	1,720	916	1,490	801	1,683	1,443		254
Citrobacter koseri	**561**	**R**	**90**	**99**	**96**	**97**	**99**	**93**	**100**	**99**	**100**	**99**	**99**	**97**	**99**	**98**	**96**	**86**	-	**100**
	19		85	549	527	383	483	498	248	161	364	450	561	427	372	450	550	542		61
Enterobacter sp.	**8,911**	**R**	**R**	**81**	**79**	**81**	**96**	**R**	**95**	**94**	**99**	**99.5**	**97**	**97**	**96**	**95**	**92**	**35**	-	**99**
	71			8508	7918	6816	8044		5333	2138	6770	7207	8818	5022	7331	4605	8510	5735		1650
Escherichia coli	**143,153**	**38**	**50**	**94**	**87**	**89**	**89**	**83**	**100**	**100**	**100**	**99**	**88**	**83**	**73**	**67**	**67**	**96**	-	**100**
	82	15,318	59,750	135,592	136,184	118,505	128,176	123,386	89,252	27,115	11,374	123,826	142,208	67,642	122,656	69,750	141,267	129,730		8,523
Klebsiella oxytoca	**3,248**	**R**	**66**	**93**	**93**	**96**	**97**	**53**	**100**	**100**	**100**	**100**	**96**	**94**	**95**	**95**	**91**	**85**	-	**100**
	49		1,693	2,844	2,842	2,448	2,772	2,604	1,890	717	2,408	2,679	2,948	1,692	2,588	1,358	2,780	2,046		479
Klebsiella pneumoniae	**30,629**	**R**	**71**	87	**85**	**86**	**87**	**81**	**96**	**90**	**97**	**95**	**90**	**84**	**86**	**84**	**83**	**35**	-	**93**
	80		13,763	24,936	25,145	20,712	23,744	21,631	15,606	6,529	19,382	24,501	25,802	15,356	21,942	13,646	24,970	20,500		1,948
Morganella morganii	**2,300**	**R**	**10**	**96**	**85**	**78**	**96**	**R**	**100**	**55***	**99**	**99**	**73**	**85**	**63**	**54**	**56**	**R**	-	**R**
	53		1,362	2,223	2,037	1,747	2,077		1,300	439	1,599	2,119	2,240	1,325	1,876	1,401	2,178			
Proteus mirabilis	**19,503**	**70**	**77**	**97**	**87**	**91**	**92**	**74**	**99**	**69***	**97**	**99**	**83**	**82**	**67**	**62**	**68**	**R**	-	**R**
	80	17,791	9,969	17,599	17,582	14,857	16,487	16,657	10,454	2,583	13,057	15,833	18,733	11,239	15,154	11,572	18,603			
Pseudomonas aeruginosa	**23,921**	**R**	**R**	**85**	**R**	**81**	**85**	**R**	**R**	**80**	**84**	**96**	**85**	**93**	**73**	**65**	**R**	**R**	-	**R**
	83			23,524		20,258	21,045			12,142	17,770	22,185	23,575	21,464	19,554	16,206				
Serratia marcescens	**2,668**	**R**	**R**	**94**	**90**	**92**	**95**	**R**	**99**	**96**	**97**	**96**	**97**	**79**	**87**	**86**	**98**	**R**	-	**99.6**
	58			1,876	2,376	2,047	2,401		1,462	555	1,987	2,417	2,663	1,707	2,330	1,581	2,256			550
Stenotrophomonas maltophilia	**1,970**	**R**	**R**	**R**	**R**	**46**	-	**R**	**R**	**R**	**R**	**R**	**R**	**R**	-	**81**	**92**	-	**98**	**R**
	51					1,082										1,511	1,996		42	

R: Intrinsically resistant

-: Not routinely tested or not applicable

*Note: Some isolates are not susceptible to imipenem due to non-carbapenemase mechanisms.

Methodology Notes for Gram-Negatives:

- In 2015, LACDPH identified that more than 25% of laboratories submitting data were using outdated breakpoints (higher than currently recommended) for carbapenems when testing many gram-negative bacteria. In response, LACDPH has worked with hospitals to update carbapenem breakpoint for Enterobacteriaceae; as a result, more than 20 additional hospitals now have updated breakpoints. However, outreach to update breakpoints for *Pseudomonas* spp. or other pathogens has not been pursued. Consequently, %S data for ertapenem, imipenem and meropenem should be interpreted with caution and may be erroneously high for some pathogens.
- %S for carbapenems varies considerably among facilities
- Meropenem results should not be used to predict imipenem results for any species, nor imipenem used to predict meropenem results.
- Cephalosporin breakpoints for Enterobacteriaceae and piperacillin-tazobactam breakpoints for *P. aeruginosa* have also been updated by standards organizations in the past few years. Not all laboratories have adopted the updated breakpoints and it is not known which breakpoints were used to generate the 2017 antibiograms at the local facilities.

Acinetobacter baumannii (n=2,723 from 75 Hospitals)			
	% Susceptible (IQR)	**Number of Isolates**	**Number of Hospitals**
Ampicillin-Sulbactam	43% (28-64)	2,084	60
Piperacillin-Tazobactam	27% (19-54)	1,776	48
Ceftriaxone	10% (0-18)	1,320	45
Ceftazidime	27% (16-50)	1,894	61
Cefepime	40% (25-67)	1,139	34
Imipenem	27% (11-51)	1,120	25
Meropenem	39% (25-75)	1,436	48
Amikacin	36% (25-62)	1,925	45
Gentamicin	37% (28-65)	2,661	72
Tobramycin	40% (25-61)	2,084	56
Ciprofloxacin	27% (14-54)	2,030	58
Levofloxacin	26% (14.5-42.5)	1,985	52
Trimethoprim/ Sulfamethoxazole	48% (38-71)	2,287	66
Minocycline	79% (50-80)	154	5
Tigecycline	79% (70-100)	424	14

Comments from LA County Healthcare-Associated Infection and Antibiotic Resistance Committee: The observed patterns of antibiotic resistance are worrisome. Caution should be used with tigecycline due to FDA black-box warnings of reduced clinical efficacy. Susceptibility of minocycline was tested in relatively few hospitals (n=5) and clinical experience with minocycline in treatment of *A. baumannii* is limited.

Citrobacter freundii (n=1,720 from 45 Hospitals)			
	% Susceptible (IQR)	**Number of Isolates**	**Number of Hospitals**
Piperacillin-Tazobactam	83% (81-95)	1,604	40
Ceftriaxone	79% (73.5-89)	1,629	42
Ceftazidime	80% (77-91)	1,370	36
Cefepime	98% (97.5-100)	1,579	37
Ertapenem	100% (100-100)	1,100	22
Imipenem	98% (97.5-100)	361	13
Meropenem	98% (100-100)	1,329	28
Amikacin	99% (100-100)	1,517	38
Gentamicin	92% (89-100)	1,720	44
Tobramycin	92% (89-100)	916	30
Ciprofloxacin	91% (88-97.5)	1,490	37
Levofloxacin	90% (86-95)	901	29
Trimethoprim/ Sulfamethoxazole	82% (76-90)	1,683	44
Nitrofurantoin	95% (94-100)	1,443	42
Tigecycline	100% (100-100)	254	11

Citrobacter koseri (n=561 from 19 Hospitals)			
	% Susceptible (IQR)	**Number of Isolates**	**Number of Hospitals**
Ampicillin-Sulbactam	90% (69.5-93.5)	85	4
Piperacillin-Tazobactam	99% (98-100)	549	17
Ceftriaxone	96% (91-100)	527	17
Ceftazidime	97% (93-100)	383	14
Cefepime	99% (100-100)	483	16
Cefazolin	93% (85-96)	498	18
Ertapenem	100% (100-100)	248	9
Imipenem	99% (100-100)	161	5
Meropenem	100% (100-100)	364	11
Amikacin	99% (100-100)	450	16
Gentamicin	99% (100-100)	561	19
Tobramycin	97% (92-100)	427	14
Ciprofloxacin	99% (100-100)	372	14
Levofloxacin	98% (96-100)	450	14
Trimethoprim/ Sulfamethoxazole	96% (90-100)	550	18
Nitrofurantoin	86% (86-95)	542	18
Tigecycline	100% (100-100)	61	3

Enterobacter species (n=8,911 from 71 Hospitals)			
	% Susceptible (IQR)	**Number of Isolates**	**Number of Hospitals**
Piperacillin-Tazobactam	81% (74-88)	8,508	66
Ceftriaxone	79% (73-85)	7,918	61
Ceftazidime	81% (74-88)	6,816	55
Cefepime	96% (94-100)	8,044	58
Ertapenem	95% (93-100)	5,333	36
Imipenem	94% (92-100)	2,138	30
Meropenem	99% (99-100)	6,770	47
Amikacin	100% (100-100)	7,207	59
Gentamicin	97% (96-100)	8,818	69
Tobramycin	97% (93-100)	5,022	56
Ciprofloxacin	96% (94-100)	7,331	57
Levofloxacin	95% (93-100)	4,605	54
Trimethoprim/ Sulfamethoxazole	92% (87-100)	8,510	68
Nitrofurantoin	35% (18-47)	5,735	56
Tigecycline	99% (100-100)	1,650	12

Escherichia coli (n=143,153 from 82 Hospitals)			
	% Susceptible (IQR)	**Number of Isolates**	**Number of Hospitals**
Ampicillin	38% (34-49)	15,318	73
Ampicillin-Sulbactam	50% (33-54)	59,750	62
Piperacillin-Tazobactam	94% (88-96)	135,592	79
Ceftriaxone	87% (71-91)	136,184	77
Ceftazidime	89% (75-94)	118,505	64
Cefepime	89% (59-94)	128,176	70
Cefazolin	83% (57-86)	123,386	67
Ertapenem	100% (99-100)	89,252	42
Imipenem	100% (99-100)	27,115	36
Meropenem	100% (99-100)	11,374	50
Amikacin	99% (97-100)	123,826	73
Gentamicin	88% (72-89)	142,208	80
Tobramycin	83% (51-88)	67,642	62
Ciprofloxacin	73% (30-76)	122,656	66
Levofloxacin	67% (21-71.5)	69,750	64
Trimethoprim/ Sulfamethoxazole	67% (50-69)	141,267	81
Nitrofurantoin	96% (94-97)	129,730	72
Tigecycline	100% (100-100)	8,523	14

Comments from LA County Healthcare-Associated Infection and Antibiotic Resistance Committee:
Percent susceptible for oral agents for management of urinary tract infection, particularly trimethoprim-sulfamethoxazole and fluoroquinolones, is relatively low. Nitrofurantoin remains highly active, but is only indicated for cystitis (see note on page 6).

Klebsiella oxytoca (n=3,248 from 49 Hospitals)			
	% Susceptible (IQR)	**Number of Isolates**	**Number of Hospitals**
Ampicillin-Sulbactam	66% (58-73)	1,693	39
Piperacillin-Tazobactam	93% (90-99)	2,844	47
Ceftriaxone	93% (89-98)	2,842	44
Ceftazidime	96% (90-100)	2,448	39
Cefepime	97% (94-100)	2,772	41
Cefazolin	53% (41.5-74)	2,604	41
Ertapenem	100% (100-100)	1,890	26
Imipenem	100% (100-100)	717	16
Meropenem	100% (100-100)	2,408	34
Amikacin	100% (100-100)	2,679	43
Gentamicin	96% (94-100)	2,948	
Tobramycin	94% (90-97)	1,692	35
Ciprofloxacin	95% (93-100)	2,588	38
Levofloxacin	95% (91-98)	1,358	33
Trimethoprim/ Sulfamethoxazole	91% (86-96)	2,780	46
Nitrofurantoin	85% (81.5-92)	2,046	42
Tigecycline	100% (100-100)	479	11

Klebsiella pneumoniae (n=30,629 from 80 Hospitals)			
	% Susceptible (IQR)	**Number of Isolates**	**Number of Hospitals**
Ampicillin-Sulbactam	71% (25.5-82)	13,763	59
Piperacillin-Tazobactam	87% (61-92)	24,936	72
Ceftriaxone	85% (45-93)	25,145	73
Ceftazidime	86% (18-93)	20,712	66
Cefepime	87% (39-94)	23,744	64
Cefazolin	81% (33-91)	21,631	63
Ertapenem	96% (83-100)	15,606	40
Imipenem	90% (69.5-97)	6,529	33
Meropenem	97% (94-100)	19,382	50
Amikacin	95% (81-99)	24,501	68
Gentamicin	90% (61-95)	25,802	75
Tobramycin	84% (42-90)	15,356	62
Ciprofloxacin	86% (42-93)	21,942	63
Levofloxacin	84% (44-90)	13,646	60
Trimethoprim/ Sulfamethoxazole	83% (50-87.5)	24,970	75
Nitrofurantoin	35% (23-41)	20,500	65
Tigecycline	93% (80-100)	1,948	11

Comments from LA County Healthcare-Associated Infection and Antibiotic Resistance Committee:
Susceptibility of *K. pneumoniae* to meropenem remains relatively stable compared to data from 2015.

Morganella morganii (n=2,300 from 53 Hospitals)			
	% Susceptible (IQR)	**Number of Isolates**	**Number of Hospitals**
Ampicillin-Sulbactam	10% (2-14)	1,362	38
Piperacillin-Tazobactam	96% (95-100)	2,223	52
Ceftriaxone	85% (78-93)	2,037	48
Ceftazidime	78% (70-86)	1,747	41
Cefepime	96% (94-100)	2,077	45
Ertapenem	100% (100-100)	1,300	28
Imipenem	55% (35-78)	439	16
Meropenem	99% (100-100)	1,599	33
Amikacin	99% (100-100)	2,119	47
Gentamicin	73% (65-83)	2,240	51
Tobramycin	85% (76-93)	1,325	38
Ciprofloxacin	63% (44-79)	1,876	43
Levofloxacin	54% (36-67)	1,401	40
Trimethoprim/ Sulfamethoxazole	56% (42-68)	2,178	52

Comments from LA County Healthcare-Associated Infection and Antibiotic Resistance Committee:
Proteus, *Providencia*, and *Morganella* are intrinsically less susceptible to imipenem than to meropenem. Imipenem should not be used to classify *Proteus / Providencia / Morganella* isolates as CRE.

Proteus mirabilis (n=19,503 from 80 Hospitals)			
	% Susceptible (IQR)	**Number of Isolates**	**Number of Hospitals**
Ampicillin	70% (54-76)	17,791	72
Ampicillin-Sulbactam	77% (69-83)	9,969	57
Piperacillin-Tazobactam	97% (95-100)	17,599	76
Ceftriaxone	87% (76-96)	17,582	74
Ceftazidime	91% (81-98)	14,857	65
Cefepime	92% (75-99)	16,487	66
Cefazolin	74% (59-83)	16,657	67
Ertapenem	99% (99-100)	10,454	41
Imipenem	69% (12-91)	2,583	21
Meropenem	97% (98-100)	13,057	49
Amikacin	99% (98-100)	15,833	67
Gentamicin	83% (74-90)	18,733	78
Tobramycin	82% (75-90)	11,239	61
Ciprofloxacin	67% (39-79)	15,154	63
Levofloxacin	62% (41-70)	11,572	65
Trimethoprim/ Sulfamethoxazole	68% (54-75)	18,603	79

Comments from LA County Healthcare-Associated Infection and Antibiotic Resistance Committee:
Proteus, *Providencia*, and *Morganella* are intrinsically less susceptible to imipenem than to meropenem. Imipenem should not be used to classify *Proteus / Providencia / Morganella* isolates as CRE.

Pseudomonas aeruginosa (n=23,921 from 83 Hospitals)			
	% Susceptible (IQR)	**Number of Isolates**	**Number of Hospitals**
Piperacillin-Tazobactam	85% (79-93)	23,524	82
Ceftazidime	81% (71-90)	20,258	72
Cefepime	85% (75.5-90)	21,045	71
Imipenem	80% (62-88)	12,142	44
Meropenem	84% (74-93)	17,770	52
Amikacin	96% (94-98)	22,185	78
Gentamicin	85% (76-91)	23,575	81
Tobramycin	93% (90-97)	21,464	72
Ciprofloxacin	73% (57-83)	19,554	68
Levofloxacin	65% (50-71)	16,206	67

Comments from LA County Healthcare-Associated Infection and Antibiotic Resistance Committee: Carbapenem resistance among *Pseudomonas* spp. is relatively common in Los Angeles County. These data are particularly relevant to the empiric management of sepsis, where microbiologically active therapy is crucial (Kolleff et al. Chest. 1999; Kumar et al. Critical care Medicine. 2006). One potential approach to improve the probability of microbiologically active therapy is the inclusion of adjunctive therapy with a non-beta-lactam antibiotic. (IDSA HAP/VAP guidelines – Kalil et al. Clinical Infectious Disease, 2016; Gutierrez-Gutierrez et al. Lancet Infectious Disease. 2017) Fluoroquinolone susceptibility is relatively low, compared to aminoglycosides. This may be relevant to management of pneumonia and other hospital-acquired infections where *Pseudomonas* spp. infection is likely.

Serratia marcescens (n=2,668 from 58 Hospitals)			
	% Susceptible (IQR)	**Number of Isolates**	**Number of Hospitals**
Piperacillin-Tazobactam	94% (92-100)	1,876	39
Ceftriaxone	90% (86-96)	2,376	54
Ceftazidime	92% (86-100)	2,047	46
Cefepime	95% (92-100)	2,401	48
Ertapenem	99% (100-100)	1,462	33
Imipenem	96% (94-100)	555	17
Meropenem	97% (99-100)	1,987	39
Amikacin	96% (95-100)	2,417	49
Gentamicin	97% (93-100)	2,663	59
Tobramycin	79% (70-86)	1,707	43
Ciprofloxacin	87% (71-98)	2,330	49
Levofloxacin	86% (72-98)	1,581	43
Trimethoprim/ Sulfamethoxazole	98% (95-100)	2,256	53
Tigecycline	100% (100-100)	550	14

Stenotrophomonas maltophilia (n=1,970 from 51 Hospitals)			
	% Susceptible (IQR)	**Number of Isolates**	**Number of Hospitals**
Ceftazidime	46% (29-59)	1,082	23
Levofloxacin	81% (75-88)	1,511	43
Trimethoprim/ Sulfamethoxazole	92% (92-100)	1,996	51
Minocycline	98% (91-97)	42	2

Comments from LA County Healthcare-Associated Infection and Antibiotic Resistance Committee:
Clinicians should be aware that several local laboratories reported susceptibility results for beta-lactam antibiotics to which *Stenotrophomonas maltophilia* are intrinsically resistant: piperacillin-tazobactam, ceftriaxone, cefepime, ertapenem, and meropenem.[4][5][6] We also note that the local antibiogram reports for *Stenotrophomonas maltophilia* from some laboratories included aminoglycoside antibiotics: amikacin, gentamicin , and tobramycin to which *S. maltophilia* are also intrinsically resistant. Clinicians should be aware that a result of "susceptible" is not reliable for drugs to which *S. maltophilia* are intrinsically resistant.

[4] Sanchez et al. (2009). *Stenotrophomonas maltophilia* drug resistance. *Future Microbiology*, Vol 4(6).
[5] Sanford Guide Antimicrobial Therapy (2017).
[6] Brooke, JS. (2012). Stenotrophomonas maltophilia: An Emerging Global Opportunistic Pathogen. *Clinical Microbiology Reviews*, Vol 25 (1):2-41.

Gram-Positive Organism Antibiogram

		Penicillin			Cephalosporins		Quinolones	Tetracyclines		Aminoglycosides			Other						
Percent Susceptible (# of Isolates Tested)	# of all isolates tested (# of hospitals reporting)	Ampicillin	Oxacillin	Penicillin	Ceftriaxone	Ceftaroline	Levofloxacin	Doxycycline	Tetracycline	Gentamicin	Gentamicin Synergy	Streptomycin Synergy	Clindamycin	Daptomycin	Erythromycin	Linezolid	Nitrofurantoin	Trimethoprim/ Sulfamethoxazole	Vancomycin
Enterococcus species	**16,551**	**88**	**R**	**87**	**R**	**-**	**68**	**44**	**23**	**-**	**76**	**67**	**R**	**99**	**-**	**99**	**90**	**R**	**89**
	37	15,860		6,016			2,926	1,209	3,705		3,096	2,450		2,705		13,119	11,520		16,131
Enterococcus faecalis	**14,071**	**98**	**R**	**98**	**R**	**-**	**69**	**21**	**20**	**-**	**66**	**72**	**R**	**100**	**-**	**99**	**97**	**R**	**94**
	69	11,920		4,763			6,633	767	6,422		4,832	2,530		1,129		7,658	10,620		12,824
Enterococcus faecium	**3,572**	**13**	**R**	**11**	**R**	**-**	**12**	**54**	**38**	**-**	**89**	**48**	**R**	**97**	**-**	**97**	**18**	**R**	**23**
	57	2,793		1,625			1,471	180	1,710		1,212	594		461		2,419	2,088		3,362
Staphylococcus aureus	**35,074**	**0.4**	**64**	**6**	**-**	**-**	**52**	**96**	**93**	**88**	**-**	**-**	**73**	**99**	**46**	**99**	**-**	**97**	**100**
	58	1,481	32,481	17,372			2,275	5,658	25577	10,028			32,581	3,288	16,211	12,135		33,222	35,079
Methicillin-resistant Staphylococcus aureus (MRSA)	**15,317**	**R**	**0**	**R**	**R**	**-**	**7**	**95**	**89**	**80**	**-**	**-**	**61**	**99**	**14**	**99**	**-**	**95**	**100**
	53		10,302				399	1,843	12,410	4,429			15,166	904	8,154	10,604		14,912	15,436
Methicillin-susceptible Staphylococcus aureus (MSSA)	**19,898**	**-**	**98**	**13**	**-**	**-**	**85**	**99**	**95**	**94**	**-**	**-**	**81**	**99**	**67**	**100**	**-**	**98**	**100**
	41		17,513	13,804			5,551	1,326	16,799	3,178			18,004	1,844	8,135	7,290		18,697	18,772
Streptococcus agalactiae (Group B Streptococcus)	**1,092**	**100**	**-**	**100**	**100**	**-**	**96**	**-**	**17**	**-**	**-**	**-**	**43**	**-**	**33**	**100**	**-**	**-**	**-**
	18	905		910	148		318		411				647		416	453			
Streptococcus pneumoniae (non-meningitis)	**1,708**	**95**	**-**	**90**	**97**	**-**	**97**	**79**	**81**	**-**	**-**	**-**	**81**	**-**	**66**	**100**	**-**	**74**	**-**
	47	19		919	793		679	100	375				486		826	176		827	
Streptococcus pneumoniae (meningitis)	**520**	-	-	**73**	**90**	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	24			520	501														

R: Intrinsically resistant

-: Not routinely tested or not applicable

***Enterococcus* spp.** (n=16,551 from 37 Hospitals)			
	% Susceptible (IQR)	**Number of Isolates**	**Number of Hospitals**
Ampicillin	88% (47-97)	15,860	34
Penicillin	87% (41-96)	6,016	13
Levofloxacin	68% (37-77.5)	2,926	14
Doxycycline	44% (10-95)	1,209	4
Tetracycline	23% (21-32)	3,705	14
Gentamicin Synergy	76% (69-100)	3,096	9
Streptomycin Synergy	67% (55-79)	2,450	9
Daptomycin	99% (99-99)	2,705	4
Linezolid	99% (100-100)	13,119	29
Nitrofurantoin	90% (50-95)	11,520	30
Vancomycin	89% (0-100)	16,131	37

Comments from LA County Healthcare-Associated Infection and Antibiotic Resistance Committee: This table includes data from Enterococcus isolates not identified to species level by the submitting laboratory and does not include data from isolates listed in a submitting facility's antibiogram as *E. faecalis* or *E. faecium*.

Enterococcus faecalis (n=14,071 from 69 Hospitals)			
	% Susceptible (IQR)	**Number of Isolates**	**Number of Hospitals**
Ampicillin	98% (98-100)	11,920	66
Penicillin	98% (98-100)	4,763	17
Levofloxacin	69% (51-73)	6,633	35
Doxycycline	21% (17.5-22)	767	5
Tetracycline	20% (16-23)	6,422	35
Gentamicin Synergy	66% (50-70)	4,832	24
Streptomycin Synergy	72% (65-78)	2,530	13
Daptomycin	100% (100-100)	1,129	12
Linezolid	99% (99-100)	7,658	52
Nitrofurantoin	97% (95-100)	10,620	52
Vancomycin	94% (72-100)	12,824	69

Enterococcus faecium (n=3,572 from 57 Hospitals)			
	% Susceptible (IQR)	**Number of Isolates**	**Number of Hospitals**
Ampicillin	13% (0-19)	2,793	48
Penicillin	11% (0-7)	1,625	9
Levofloxacin	12% (0-14.5)	1,471	27
Doxycycline	54% (33-54)	180	5
Tetracycline	38% (33.5-48.5)	1,710	32
Gentamicin Synergy	89% (80.5-94.5)	1,212	22
Streptomycin Synergy	48% (36-57)	594	12
Daptomycin	97% (96-100)	461	9
Linezolid	97% (100-100)	2,419	46
Nitrofurantoin	18% (10.5-28)	2,088	42
Vancomycin	23% (2.5-31.0)	3,362	57

Staphylococcus aureus (n=35,074 from 57 Hospitals)			
	% Susceptible (IQR)	**Number of Isolates**	**Number of Hospitals**
Oxacillin	64% (50-70)	32,481	54
Penicillin	6% (4.5-14)	17,372	20
Levofloxacin	52% (38-68.5)	2,275	7
Doxycycline	96% (91-98)	5.658	8
Tetracycline	93% (89-94)	25,577	41
Gentamicin	88% (78-93)	10,028	31
Clindamycin	73% (63-78)	32,581	52
Daptomycin	99% (99-100)	3,288	9
Erythromycin	46% (35-59)	16,211	36
Linezolid	99% (99-100)	12,135	28
Trimethoprim/Sulfamethoxazole	97% (96-98)	33,222	52
Vancomycin	100% (100-100)	35,079	57

Comments from LA County Healthcare-Associated Infection and Antibiotic Resistance Committee:
Daptomycin and linezolid resistance was reported for several isolates of *Staphylococcus aureus* in LA in 2017. When very uncommon types of resistance such as these are encountered, isolates should be sent to a referral laboratory for confirmation.

Methicillin-Resistant *Staphylococcus aureus (*MRSA*)* (n=15,317 from 53 Hospitals)			
	% Susceptible (IQR)	**Number of Isolates**	**Number of Hospitals**
Oxacillin	0%	10,302	32
Levofloxacin	7% (6-8)	399	3
Doxycycline	95% (95-99)	1,843	6
Tetracycline	89% (83-92)	12,410	41
Gentamicin	80% (74-84)	4,429	22
Clindamycin	61% (50-64)	15,166	53
Daptomycin	99% (99-100)	904	5
Erythromycin	14% (10-16)	8,154	35
Linezolid	99% (99-100)	10,604	33
Trimethoprim/ Sulfamethoxazole	95% (94-97)	14,912	52
Vancomycin	100% (100-100)	15,436	53

Comments from LA County Healthcare-Associated Infection and Antibiotic Resistance Committee:
MRSA are predictably resistant to antistaphylococcal β-lactams except ceftaroline. In terms of oral MRSA therapy, linezolid, trimethoprim/sulfamethoxazole, and doxycycline retain good microbiologic activity. Clindamycin %S is relatively low.

Methicillin-Susceptible *Staphylococcus aureus (*MSSA*)* (n=19,898 from 41 Hospitals)			
	% Susceptible (IQR)	**Number of Isolates**	**Number of Hospitals**
Oxacillin	98% (100-100)	17,513	32
Penicillin	13% (8-27)	13,804	19
Levofloxacin	85% (75-87)	5,551	18
Doxycycline	99% (98-99)	1,326	4
Tetracycline	95% (93-96)	16,799	31
Gentamicin	94% (92-97)	3,178	15
Clindamycin	81% (77-84)	18,004	40
Daptomycin	99% (99-100)	1,844	6
Erythromycin	67% (64-72)	8,135	28
Linezolid	100% (100-100)	7,290	24
Trimethoprim/ Sulfamethoxazole	98% (97-99)	18,697	40
Vancomycin	100% (100-100)	18,772	40

Comments from LA County Healthcare-Associated Infection and Antibiotic Resistance Committee:
MSSA are predictably susceptible to antistaphylococcal β-lactams. In terms of oral MSSA therapy, linezolid, trimethoprim/sulfamethoxazole, and doxycycline retain good microbiologic activity. Clindamycin percent susceptible is relatively low. This may have relevance for skin and skin structure infections (SSTI).

*Streptococcus agalactiae (*Group B *Streptococcus)* (n=1,092 from 18 Hospitals)			
	% Susceptible (IQR)	**Number of Isolates**	**Number of Hospitals**
Ampicillin	100% (100-100)	905	12
Penicillin	100% (100-100)	910	12
Ceftriaxone	100% (100-100)	148	6
Levofloxacin	96% (96-100)	318	8
Tetracycline	17% (9.5-20)	411	10
Clindamycin	43% (12.5-59)	647	13
Erythromycin	33% (17-53)	416	7
Linezolid	100% (100-100)	453	11

Comments from LA County Healthcare-Associated Infection and Antibiotic Resistance Committee:
Clindamycin %S of 43% for Group B *Streptococcus* is noteworthy.

Published literature has reported a clindamycin susceptibility rate of 59% for Group B *Streptococcus* largely due to the presence of a 23S rRNA methylase gene (ermB, ermTR or ermT) (Metcalf et al. Clin Microbion Infect 2017). Clindamycin resistance may be more prevalent in Los Angeles than other parts of the country.

The CDC has issued specific guidance on the Prevention of Perinatal Group B Streptococcal Disease that includes susceptibility testing for clindamycin for patients with known allergy and particularly anaphylaxis to penicillin (MMWR November 19, 2010, Vol. 59). The clindamycin %S data listed here should be discussed with local infectious disease specialists and microbiology experts to determine strategies for prophylaxis of highly penicillin-allergic pregnant women who are colonized with *S. agalactiae*. *S. agalactiae* reported to date worldwide have been susceptible to vancomycin, but few data exist on use of vancomycin for prevention of perinatal GBS.

Streptococcus pneumoniae (n=1,708 from 47 Hospitals)			
	% Susceptible (IQR)	**Number of Isolates**	**Number of Hospitals**
Ampicillin	95% (92-97)	19	2
Penicillin			
Non-meningitis	90% (89-100)	919	34
Meningitis	73% (58-83)	520	19
Ceftriaxone			
Non-meningitis	97% (95-100)	793	30
Meningitis	90% (87.5-98.5)	501	21
Levofloxacin	97% (97.5-100)	679	26
Doxycycline	79% (76-88.5)	100	2
Tetracycline	81% (75-90)	375	13
Clindamycin	81% (69-87)	486	20
Erythromycin	66% (54-75.5)	826	35
Linezolid	100% (100-100)	176	5
Trimethoprim/ Sulfamethoxazole	74% (63-80)	827	34

Comments from LA County Healthcare-Associated Infection and Antibiotic Resistance Committee:
Streptoccoccus pneumoniae reported to date worldwide have been susceptible to vancomycin.

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