Development of a Chicagoland Regional Antibiogram

2018 Illinois Summit on Antimicrobial Stewardship

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7/17/18

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Disclosure

- **I have no actual or potential conflicts of interest in relation to this program or presentation**

Objectives

- **Discuss the importance of the antibiogram to antimicrobial stewardship activities**

- **Review data collected from the Chicagoland regional antibiogram project**

- **Consider future directions and applications of regional antibiogram data**

Background

- **Up-to-date, accurate institutional antibiograms are an essential tool for stewardship programs**
  - **Guide empiric antibiotic use**
  - **Track antimicrobial resistance**
  - **Assist in formulary decisions**
- **CDC Core Elements: Tracking and Reporting**
  - **Producing and distributing antibiogram required**

Centers for Disease Control and Prevention. Core elements of hospital antibiotic stewardship programs. Available at: https://www.cdc.gov/antibiotic-use/healthcare/pdfs/core-elements.pdf.

Background

- **Just 9% of community hospitals antibiograms follow all CLSI recommendations**

  - **Primary reason is lack of adequate number of isolates**

  - **M39-A2 recommends ≥30 isolates per species to achieve accuracy level of ~5%**

- **Only 39.2% of 4184 U.S. Acute Care Hospitals reported implementing all 7 core elements in 2014**

Moehring RW, et al. J Clin Microbiol 2015; 53(9): 2977-82.
CLSI. Document M39-A4. Wayne, PA, USA: CLSI, 2014.
Pollack LA, et al. Clin Infect Dis 2016; 63(4): 443-9.

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Background

- **Large surveillance databases don't depict geographical variation**

- **Aggregating data from multiple hospitals into a single regional antibiogram may be a practical solution**

- **Objectives:**

  - **Develop Chicagoland regional antibiogram**

  - **Compare regional susceptibilities to individual hospitals and national data**

Methods

- **MedMined®:**

  - **Antibiograms from 33 Chicagoland hospitals**

  - **Calendar year 1/1/17-12/31/17**

  - **First isolate per patient per 30 days**

  - **Inpatient only**

  - **Excluded catheter tips and surveillance cultures**

Methods

- **Non-MedMined®:**

  - **Antibiograms from 27 additional Chicagoland hospitals**

  - **Most recent antibiogram**

  - **Inpatient only**

  - **Included all isolates even if less than 30 at individual institution**

Methods

- **Results anonymized**

- **Compared regional data to national surveillance data**

  - **JMI SENTRY MVP**

- **Compared individual hospital data to region**

- **Considered >10% difference or discordance around 80% threshold clinically significant**

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Regional Results

Species	Antimicrobial agent, % susceptible (No. isolates)							
	Ampicillin	Cefazolin	Ceftaroline	Ceftriaxone	Clindamycin	Daptomycin	Erythromycin	Levofloxacin
E. faecalis	99 (7557)					99 (674)		
VR*E. faecalis*	96 (113)							
E. faecium	17 (1589)					98 (674)		
VR*E. faecium*	2 (570)							
MRSA			SENTRY: 74 (2682) →		53 (7361)	99 (3540)		
MSSA		99 (4429)	100 (95)	99 (647)	78 (10744)	← SENTRY: 95 (3591)		
S. epidermidis	9 (306)	42 (488)		43 (265)	55 (2872)	100 (176)		
MRSE			SENTRY: 50 (214) →		28 (159)			
S. pneumoniae	96 (27)			97 (792)	83 (176)		58 (619)	98 (668)

Regional Results

Species	Antimicrobial agent, % susceptible (No. isolates)						
	Linezolid	Minocycline	Nitrofurantoin	Penicillin G	Sulfamethoxazole/ trimethoprim	Tigecycline	Vancomycin
E. faecalis	99 (4006)		99 (4775)			99 (2496)	96 (9233)
VR *E. faecalis*	98 (113)		100 (40)			100 (73)	
E. faecium	99 (1193)		39 (907)			98 (235)	34 (1949)
VR *E. faecium*	98 (570)		25 (164)			100 (406)	
MRSA	99 (5387)	90 (2451)			95 (7779)	99 (2611)	99 (7740)
MSSA	99 (5114)	98 (4611)		18 (3416)	98 (11371)	99 (3956)	99 (11186)
S. epidermidis	100 (932)	98 (1823)		7 (496)	61 (3077)	100 (1561)	100 (3304)
MRSE	100 (159)						100 (159)
S. pneumoniae	96 (62)			86 (756)	77 (670)		99 (814)

Non-MedMined® Results

Species	Antimicrobial agent, % susceptible (No. isolates)/ No. hospitals contributing						
	Ampicillin	Cefazolin	Ceftriaxone	Clindamycin	Daptomycin	Erythromycin	Levofloxacin
E. faecalis	99 (5495)/ 24				100 (404)/ 6		
VR*E. faecalis*	96 (113)/ 9						
E. faecium	19 (1068)/ 21				97 (269)/ 6		
VR*E. faecium*	2 (570)/ 9						
MRSA				53 (4348)/ 19	99 (2957)/ 13		
MSSA		100 (3196)/ 4	99 (477)/ 2	78 (6940)/ 17	100 (1860)/ 4		
S. epidermidis	9 (287)/ 2	44 (324)/ 1	47 (228)/ 1	56 (2369)/ 13	100 (87)/ 2		
MRSE				28 (159)/ 1			
S. pneumoniae	96 (27)/ 1		98 (505)/ 8	78 (71)/ 3		59 (418)/ 10	99 (383)/ 12

Non-MedMined® Results

Species	Antimicrobial agent, % susceptible (No. isolates)/ No. hospitals contributing						
	Linezolid	Minocycline	Nitrofurantoin	Penicillin G	Sulfamethoxazole/ trimethoprim	Tigecycline	Vancomycin
E. faecalis	99 (2951)/ 11		99 (2572)/ 1			100 (1883)/ 8	97 (5926)/ 25
VR*E. faecalis*	100 (82)/ 2		100 (40)/ 1			100 (73)/ 2	
E. faecium	99 (689)/ 10		24 (377)/ 3			100 (101)/ 2	38 (1068)/ 15
VR*E. faecium*	98 (570)/ 8		25 (164)/ 1			100 (406)/ 7	
MRSA	100 (4069)/ 16	90 (2451)/ 9			95 (4364)/ 19	100 (2003)/ 8	99 (4328)/ 18
MSSA	100 (3462)/ 6	98 (4611)/ 9		26 (1961)/ 3	98 (6953)/ 17	100 (3135)/ 8	100 (6915)/ 16
S. epidermidis	100 (701)/ 5	98 (1823)/ 9		9 (286)/ 2	62 (2196)/ 13	100 (1499)/ 8	100 (2428)/ 14
MRSE	100 (159)/ 1						100 (159)/ 1
S. pneumoniae				94 (445)/ 7	75 (410)/ 7		100 (505)/ 15

Region: 39 (907)

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Individual Hospital Results

Species	Antimicrobial agent, N (%) hospitals w/ >10% difference in susceptibility							
	Ampicillin	Clindamycin	Daptomycin	Erythromycin	Nitrofurantoin	Penicillin G	Sulfamethoxazole/ trimethoprim	Vancomycin
E. faecalis								2 (7)
E. faecium	5 (19)		1 (4)		1 (4)			12 (44)
MRSA		1 (4)						
MSSA						3 (11)		
S. epidermidis							3 (11)	
MRSE								
S. pneumoniae				1 (4)		2 (7)		

Regional Results

Antimicrobial agent, % susceptible (No. isolates)

Species	Amikacin	Ampicillin/ sulbactam	Aztreonam	Cefazolin	Cefepime	Ceftazidime	Ceftazidime/ avibactam	Ceftolozane/ tazobactam	Ceftriaxone
A. baumannii complex	61 (874)	52 (1114)	0 (43)		34 (1009)	35 (940)	SENTRY: 20 (191)		60 (470)
E. cloacae	99 (1847)		82 (1678)	0.7 (1659)	96 (2449)	79 (1803)	SENTRY: 98 (360)		78 (2505)
ESBL *E. cloacae*					25 (28)				
E. coli		60 (62849)		82 (63636)	96 (5225)	93 (37225)			
ESBL *E. coli*	99 (281)	18 (314)				16 (281)			
K. pneumoniae	97 (8353)	80 (14352)	90 (9371)	88 (14184)		91 (9714)			90 (13571)
ESBL *K. pneumoniae*	87 (38)	16 (97)			10 (75)	17 (75)			
CR *K. pneumoniae*	10 (41)								
P. aeruginosa	94 (9404)		74 (10809)		85 (12617)	86 (10485)	100 (1)	80 (10)	
S. maltophilia	100 (10)					38 (387)			

SENTRY: 52 (191)

SENTRY: 57 (191)

SENTRY: 76 (191)

SENTRY: 99 (360)

SENTRY: 100 (26)

SENTRY: 4 (242)

SENTRY: 5 (242)

SENTRY: 55 (49)

SENTRY: 90 (360)

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Regional Results

Antimicrobial agent, % susceptible (No. isolates)

Species	Ciprofloxacin	Colistin	Fosfomycin	Meropenem	Minocycline	Nitrofurantoin	Piperacillin/ tazobactam	Sulfamethoxazole /trimethoprim	Tigecycline
A. baumannii complex	31 (1025)			39 (925)			31 (857)		85 (34)
E. cloacae	95 (2196)			98 (2438)			82 (3636)	89 (76)	99 (1019)
ESBL *E. cloacae*	65 (28)			100 (28)			40 (28)	52 (28)	
E. coli	76 (52982)		98 (101)	99 (53757)		97 (59441)	96 (60715)	73 (61306)	99 (17712)
ESBL *E. coli*	10 (281)			99 (281)				32 (281)	
K. pneumoniae	91 (11998)	99 (504)	100 (11)	97 (11861)		43 (12627)	91 (13514)	85 (15024)	99 (3335)
ESBL *K. pneumoniae*	29 (75)			98 (59)			82 (75)		
CR *K. pneumoniae*	27 (11)								
P. aeruginosa	79 (11885)	88 (4847)				20 (136)	87 (13572)		
S. maltophilia	100 (2)				98 (122)			97 (665)	

SENTRY annotations:
- SENTRY: 52 (191) → Piperacillin/tazobactam
- *A. baumannii* complex — SENTRY: 58 (191) → Ciprofloxacin; SENTRY: 62 (191) → Meropenem; SENTRY: 81 (26) → Sulfamethoxazole/trimethoprim
- *E. cloacae* — SENTRY: 99 (360) → Piperacillin/tazobactam
- ESBL *E. cloacae* — SENTRY: 89 (26) → Ciprofloxacin; SENTRY: 96 (26) → Piperacillin/tazobactam
- ESBL *E. coli* — SENTRY: 21 (566) → Ciprofloxacin; SENTRY: 67 (566) → Sulfamethoxazole/trimethoprim
- ESBL *K. pneumoniae* — SENTRY: 50 (242) → Ciprofloxacin; SENTRY: 80 (242) → Meropenem; SENTRY: 61 (242) → Piperacillin/tazobactam
- CR *K. pneumoniae* — SENTRY: 14 (49) → Ciprofloxacin
- *P. aeruginosa* — SENTRY: 99 (2105) → Colistin

Non-MedMined® Results

Species	Antimicrobial agent, % susceptible (No. isolates)/ No. hospitals contributing							
	Amikacin	Ampicillin/ sulbactam	Aztreonam	Cefazolin	Cefepime	Ceftazidime	Ceftriaxone	Ciprofloxacin
A. baumannii complex	66 (628)/ 10	56 (787)/ 14			**Region: 60 (470)**		29 (216)/ 5	36 (682)/ 11
E. cloacae	99 (1747)/ 16		82 (1678)/ 13	0.2 (545)/ 4	96 (2449)/ 21	79 (1803)/ 13	78 (2505)/ 18	95 (2196)/ 15
ESBL *E. cloacae*					25 (28)/ 1			65 (28)/ 1
E. coli	99 (25797)/ 17	62 (43016)/ 24	94 (25372)/ 16	81 (43707)/ 27	96 (35223)/ 16	94 (27873)/ 14	93 (43150)/ 26	78 (35216)/ 16
ESBL *E. coli*	82 (33)/ 1	18 (314)/ 2				16 (281)/ 1		10 (281)/ 1
K. pneumoniae	98 (5918)/ 16	81 (9403)/ 24	91 (5750)/ 15	89 (9443)/ 25	91 (5750)/ 15	92 (6326)/ 15	93 (9661)/ 25	93 (7761)/ 16
ESBL *K. pneumoniae*	87 (38)/ 2	16 (97)/ 3	11 (75)/ 2		11 (75)/ 2	16 (75)/ 2		29 (75)/ 2
CR *K. pneumoniae*	10 (41)/ 2							27 (11)/ 1
P. aeruginosa	95 (7625)/ 18		76 (7871)/ 19		76 (7871)/ 18	87 (7956)/ 17		81 (8013)/ 16
S. maltophilia	100 (10)/ 1					39 (291)/ 6		

Non-MedMined® Results

Species	Antimicrobial agent, % susceptible (No. isolates)/ No. hospitals contributing							
	Colistin	Fosfomycin	Meropenem	Minocycline	Nitrofurantoin	Piperacillin/ tazobactam	Sulfamethoxazole/ trimethoprim	Tigecycline
A. baumannii complex	100 (476)/ 7		40 (736)/ 12	79 (127)/ 2		34(618)/ 9	60 (235)/ 5	
E. cloacae			98 (2438)/ 17		39 (2121)/ 15	84 (2553)/ 16	88 (2766)/ 22	100 (905)/ 8
ESBL *E. cloacae*		55 (28)/ 1	100 (28)/ 1		17 (28)/ 1	39 (28)/ 1	52 (28)/ 1	
E. coli			99 (39418)/ 21		97 (39970)/ 23	96 (42075)/ 25	74 (43777)/ 27	100 (13418)/ 8
ESBL *E. coli*		95 (281)/ 1	99 (281)/ 1		91 (281)/ 1	90 (281)/ 1	32 (281)/ 1	
K. pneumoniae	100 (486)/ 1		97 (8656)/ 20		44 (8575)/ 21	92 (9272)/ 24	87 (9602)/ 25	99 (2523)/ 7
ESBL *K. pneumoniae*		82 (59)/ 1	98 (59)/ 1		18 (59)/ 1	82 (75)/ 2	20 (75)/ 2	
CR *K. pneumoniae*							0 (11)/ 1	
P. aeruginosa	88 (4787)/ 9		84 (8997)/ 22			86 (9669)/ 26		
S. maltophilia				98 (122)/ 2			97 (387)/ 11	

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Individual Hospital Results

Species	Antimicrobial agent, N (%) hospitals w/ >10% difference in susceptibility									
	Amikacin	Ampicillin/ sulbactam	Aztreonam	Cefazolin	Cefepime	Ceftazidime	Ciprofloxacin	Colistin	Nitrofurantoin	Sulfamethoxazole/ trimethoprim
A. baumannii complex	5 (19)	3 (11)			4 (15)		6 (22)			2 (7)
E. cloacae			2 (7)						3 (11)	
ESBL *E. cloacae*										
E. coli		2 (7)		4 (15)		4 (15)	2 (7)			1 (4)
ESBL *E. coli*										
K. pneumoniae				1 (4)	1 (4)	1 (4)			4 (15)	
ESBL *K. pneumoniae*										
CR *K. pneumoniae*										
P. aeruginosa			4 (15)		2 (7)			1 (4)		
S. maltophilia										

Conclusions

- **Gram positive organisms:**

  - **National surveillance data is similar to Chicagoland regional antibiogram data**

    - **Clindamycin**

  - **Individual hospitals showed similar susceptibility patterns compared to the Chicagoland region**

    - *E. faecium*

Conclusions

- **Gram negative organisms:**

  - **National surveillance data is not predictive of Chicagoland regional antibiogram data**

  - **Individual hospitals showed similar susceptibility patterns compared to the Chicagoland region**

    - *A. baumannii*

    - *E. coli*

Conclusions

- **SENTRY data should not be used to predict regional susceptibilities**

- **Chicagoland regional antibiogram could be used to predict local susceptibilities for the majority of pathogens**

- **Regional data should not supplant local data if available and applicable**

- **Regional data may be helpful for infrequently encountered pathogens or for institutions without an antibiogram**

Limitations

- **Lack of raw MIC data**

- **Heterogeneous testing methods between sites**

- **Utilized weighted pooled mean rates**

  - **Disproportionate influence from some sites**

Future Directions

- **Analyze by hospital demographics, patient location, source, etc**

- **Refine comparator groups**

- **Additional hospital data**

- **Convert to central repository/interactive website like JMI MVP**

Development of a Chicagoland Regional Antibiogram