

## The Antimicrobial Resistance Laboratory Network (ARLN) – Providing CRE Colonization Testing to a State Lab in a Neighboring Region

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## Northeast Region ARLN Combating AR through the ARLN in 3 ways

<u>State/Local PHL</u> Carbapenem-Resistant *Enterobacteriaceae* (CRE)/
Carbapenem- Resistant *Pseudomonas aeruginosa* (CRPA) testing (CT, MA, ME, NH, NJ, NY, NYC, RI, VT)
Find CP-CRE and CP-CRPA



**CRE Colonization screening-** rectal swab direct testing contacts



- Targeted surveillance for emerging AR threats
  - Carbapenem-Resistant Acinetobacter (CRAB)
  - *mcr* gene in Extended-Spectrum β-lactamases (ESBLS)
  - Resistance to colistin/Polymyxin B

What is emerging?

#### Can the NE ARLN Lab Provide CRE Colonization testing?



12/01/16- CDC- Would your lab be able to provide some CRE colonization testing for an outbreak in PA?

12/05/16- PADOH lab-Swabs, collection numbers, requisition forms, shipping

12/06/16- PADOH HAI Coordinator- Provided CDC guidance, batched collection/testing, Fedex Acct.

12/08/16- PADOH HAI Coordinator- Requisition form submitter, results dissemination (secure fax, HPN), shipping address, collection date

12/19/16- PADOH HAI Coordinator- Swabs collected for the point prevalence survey today. They are shipping them all out tonight in two boxes via FedEx for arrival to you tomorrow. There were some refusals. Shipping was challenging.

12/20/16- Shipment received! 77 swabs, patient requisition forms.



# **ARLN Testing Approach**

#### **Tiered Testing**



Wadsworth Center Northeast







2 Days of testing: 11 Positive bla<sub>KPC</sub> gene 4 inconclusive 62 Negative

Additional testing: 2 Positive bla<sub>KPC</sub> gene



CRE C	CRE Colonization Testing -														
Regiona	Laboratory				NYS										
Reportin	ng Date				12/21/16										
Detectio	on Method Used (Cepheid an	d/or Direct Mac)			Inhouse PCR										
	7	77 Rectal Swabs received 12	2/20/16												
		PT		Specimen	Date Specimen	PC	PCR testing (resistance mechanism) (Detected/Not Detected/Not Tested								
	NYS Specimen ID	initials/DOB/Identifier	State	Collection	Received at	KPC	NDM	OXA-48-like	VIM	mcr-1	IMP				
								Not							
	IDR1600057402-01-00	LS_12/9/1922_25/B	PA	12/19/16	12/20/16	Detected	Not Detected	Detected	Not Detected	Not Detected	Not tested				
								Not							
	IDR1600057421-01-00	MW_12/4/1920_09/B	PA	12/19/16	12/20/16	Detected	Not Detected	Detected	Not Detected	Not Detected	Not tested				
								Not							
	IDR1600057423-01-00	AF_11/23/1947_27/B	PA	12/19/16	12/20/16	Detected	Not Detected	Detected	Not Detected	Not Detected	Not tested				
								Not							
	IDR1600057424-01-00	HC_8/17/1925_11/A	РА	12/19/16	12/20/16	Detected	Not Detected	Detected	Not Detected	Not Detected	Not tested				
				10/10/10	10/00/10			Not							
	IDR1600057427-01-00	AC_5/4/1921_4//A	РА	12/19/16	12/20/16	Detected	Not Detected	Detected	Not Detected	Not Detected	Not tested				
				12/12/16	12/20/10			Not							
	IDR1600057438-01-00	EO_8/14/1916_06/B	PA	12/19/16	12/20/16	Detected	Not Detected	Detected	Not Detected	Not Detected	Not tested				
		10 10/10/1027 27/4	D.A.	12/10/10	12/20/16	Detected	Net Detected	Not	Net Detected	Net Detected	Netterted				
	IDK1600057475-01-00	IC_10/16/1927_27/A	PA	12/19/16	12/20/16	Detected	Not Detected	Detected	Not Detected	Not Detected	Not tested				
	IDP1600057491 01 00	IE E /22 /1040 27 /P	DA	12/10/16	12/20/16	Detected	Not Detected	Detected	Not Detected	Not Detected	Nottostad				
	IDK1600037481-01-00	JF_5/25/1940_57/B	PA	12/19/10	12/20/16	Detected	Not Detected	Not	Not Detected	Not Detected	Not tested				
	IDP1600057488-01-00	PH 12/10/1027 80/A	DA	12/10/16	12/20/16	Detected	Not Detected	Detected	Not Detected	Not Detected	Not tosted				
	1011000037488-01-00	MI_12/10/1927_80/A	FA	12/13/10	12/20/10	Detected	Not Detected	Not	Not Detected	Not Detected	Not tested				
	IDR1600057494-01-00	GK 2/17/1927 20/A	DA	12/19/16	12/20/16	Detected	Not Detected	Detected	Not Detected	Not Detected	Not tested				
	12111000037434-01-00	GK_2/1//132/_20/A		12/13/10	12/20/10	Detected	Not Detected	Not	Not Detected	Not Detected	Not tested				
	IDR1600057501-01-00	AM 5/15/1942 34/B	РА	12/19/16	12/20/16	Detected	Not Detected	Detected	Not Detected	Not Detected	Not tested				
Totals	11			12,13,10	12,23,10	11		2000000							

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# Along came an ARLN fellow...





12 K pneumoniae bla<sub>KPC</sub> positive isolates (CRE Colonization Screening) A-L

3 Klebsiella pneumoniae bla<sub>KPC</sub> positive isolates (Clinical Isolates) M, N, O



#### mCIM and PCR Results of CRE Isolates

Isolate	mCIM	Real-time PCR						
Α	+	bla <sub>KPC</sub>						
В	+	bla <sub>KPC</sub>						
С	+	<i>bla</i> крс						
D	+	<i>bla</i> крс						
E	+	<i>bla</i> крс						
F	-	<i>bla</i> крс						
M*	+	<i>bla</i> крс						
<b>O</b> *	+	<i>bla</i> крс						
G	+	<i>bla</i> крс						
Н	+	<i>bla</i> крс						
	÷	<i>bla</i> крс						
J	+	<i>bla</i> крс						
N*	+	<i>bla</i> крс						
K	+	<i>bla</i> крс						
L	+	<i>bla</i> <sub>KPC</sub>						

### Discordance...



ĞAACAĞATTTTĞĞCAAAAATATCCCACA ACAGATTTTGGCAAAAATATCCCACA ACAGATTTTGGCAAAAATATCCCACA AGATTTTGGCAAAAATATCCCACA AGATTTTGGCAAAAATATCCCACA AGATTTTGGCAAAAATATCCCACA AGATTTTGGCAAAAATATCCCACA TTTTGGCAAAAATATCCCACA GGCAAAAATATCCCACA GCCAAAAATATCCCACA

STO

Test	Result
mCIM	Negative
AST	Carbapenem-susceptible
Real-time PCR	bla <sub>kPC</sub> positive



### **Antimicrobial Susceptibility Testing Profiles**

 $\equiv$ 

Isolate	ŀ	Aminoglycos	sides	Cephalosporins				Carba	apenems	Trimethoprim/ Sulfonamide	Quinolones		
	Amikacin	Gentamicin	Tobramycin	Cefepime	Cefotaxime	Ceftazidime	Ertapenem	Imipenem	Meropenem	Doripenem	Trimeth/Sulfa	Ciprofloxacin	Levofloxacin
Α	S		R	SDD	R	R	R	R	R	R	R	R	R
В	S		R	R	R	R	R	R	R	R	R	R	R
С	S	S	R	R	R	R	R	R	R	R	R	R	R
D	S	S	R	R	R	R	R	R	R		R	R	R
Е	S	S	R	R	R	R	R	R	R		R	R	R
F	S	S	R	S	S	S	S	S	S	S	R	R	R
M	S		R	R	R	R	R	R	R	R	R	R	R
0*	S	S		R	R	R	R	R	R	R	R	R	R
G	S	S	R	R	R	R	R	R	R	R	R	R	R
Н	S		R	R	R	R	R	R	R	R	R	R	
I	S		R	R	R	R	R	R	R		R	R	R
J	S		R	R	R	R	R	R	R	R	R	R	R
N*	S	S		R	R	R	R	R	R	R	R	R	R
Κ	S	S	S	R	R	R	R	R	R		S	R	
L	S	S	S	SDD	R	R	R	R	R		S	R	

#### Plasmid Present in K. pneumoniae Isolates Harbors Multiple Antimicrobial Resistance Genes



### **Acquired Resistance Gene WGS Analysis**

		solate	olate			Beta-lactam					Trimethoprim		Sulfonamide		Quinolone				
	_ [		aac(6')-lb	aadA1	aadA2	strA	strB	bla <sub>OXA-9</sub>	bla <sub>SHV-11</sub>	bla <sub>тем</sub>	<i>bla</i> <sub>AmpH</sub>	bla <sub>KPC-3</sub>	dfrA12	dfrA14	sul1	sul2	oqxA	oqxB	qnrS1
ſ		Α	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	no
		В	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
		С	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	no
		D	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	no
		Е	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	no
		F	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	no
		M*	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	no
L	_ L	0'	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	no
ſ		G	yes	yes	no	yes	yes	yes	yes	yes	yes	yes	no	yes	no	yes	yes	yes	no
		Н	yes	yes	no	yes	yes	yes	yes	yes	yes	yes	no	yes	no	yes	yes	yes	no
4		Ι	yes	yes	no	yes	yes	yes	yes	yes	yes	yes	no	yes	no	yes	yes	yes	no
		J	yes	yes	no	yes	yes	yes	yes	yes	yes	yes	no	yes	no	yes	yes	yes	no
	╸┝	N*	yes	yes	no	yes	yes	yes	yes	yes	yes	yes	no	yes	no	yes	yes	yes	no
		Κ	no⁺	no	no	no	no	no	yes	no⁺	yes	yes	no	yes	no	no	yes	yes	no
		L	no+	no	no	no	no	no	yes	no+	yes	yes	no	yes	no	no	yes	yes	no

#### **PFGE Analysis**



- One clinical isolate (O) clusters with an isolate (G) recovered from the colonization screening (cluster 1-red).
- Two additional clusters (purple and green) were formed by 10 isolates

Clusters were determined using the New York State Wadsworth Center cluster definition of 3 bands for relatedness.

#### WGS SNP Analysis

В



#### 2 clusters <20 SNPs

Somewhat different determinations of relatedness, additional work in progress...



Many missing pieces of data



- CRE colonization testing can contribute to reducing transmission in facilities
- Isolation from PCR-positive CRE Rectal Swab colonization specimens may shed additional light on investigations
- Discordant results can be resolved!
- AST and WGS gene analysis are correlate well
- Plasmids may loose or gain genes in healthcare settings
- PFGE and WGS SNP analysis may contribute to the understanding of CRE transmission/relatedness

# Lots more to learn...



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