



Massachusetts Department of Public Health
Bureau of Infectious Disease and Laboratory Sciences

Antibiotic Resistance Surveillance at the MA SPHL

Tracy Stiles
Microbiology Division Director
Massachusetts State Public Health Laboratory
April 24, 2018
Tracy.stiles@state.ma.us
617-983-6619

ARLN Background

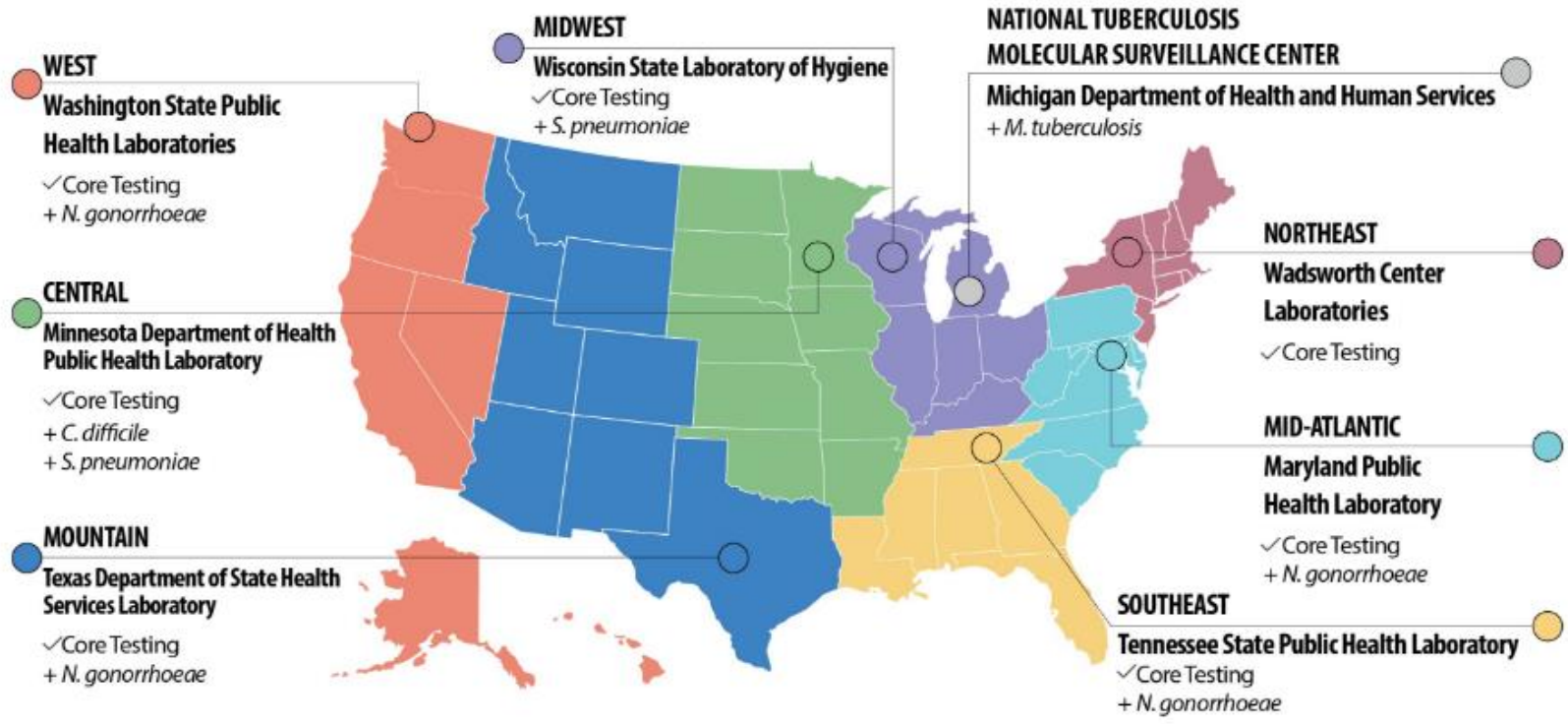
- Antibiotic Resistance Laboratory Network
- Started in 2016
- Funded through CDC to collect, confirm, and characterize
 - carbapenem-resistant Enterobacteriaceae (CRE) and *Pseudomonas aeruginosa* (CRPA),
 - CRE and CRPA which are carbapenemase-producing strains

ARLN: Organisms being collected

- *E. coli*, *Klebsiella oxytoca*, *Klebsiella pneumoniae*, *Enterobacter species*
- *Pseudomonas aeruginosa*
- *Acinetobacter baumannii* (targeted surveillance)
 - resistant to imipenem, meropenem, doripenem, ertapenem

ARLN: the Network

7 regional labs, the National Tuberculosis Molecular Surveillance Center, labs in 50 states, Six cities, and Puerto Rico



ARLN in Massachusetts

What is Reportable?

- Any CRE (isolated from any source), including CP-CRE (reportable since December 2013)
 - *Klebsiella pneumoniae*
 - *Klebsiella oxytoca*
 - *Enterobacter cloacae*
 - *Enterobacter aerogenes*
 - *E. coli*
- Any identified novel resistance (isolated from any source) or organism of concern
 - – This includes **mcr-1** and ***Candida auris***

105 CMR 300.000 Reportable Diseases, Surveillance, and Isolation and Quarantine Requirements.

(Latest version from January 2017):

<http://www.mass.gov/eohhs/docs/dph/cdc/reporting/rprtbl diseases-labs.pdf>

AR Lab in Massachusetts

What must be submitted?

- Any of the following *Enterobacteriaceae* (isolated from any source):

Klebsiella pneumoniae

Klebsiella oxytoca

Enterobacter cloacae

Enterobacter aerogenes

E. coli

- With resistance to one or more of the following **THREE** carbapenems:
 - Imipenem (MIC ≥ 4 $\mu\text{g/ml}$)
 - Meropenem (MIC ≥ 4 $\mu\text{g/ml}$)
 - Doripenem (MIC ≥ 4 $\mu\text{g/ml}$)
- OR, demonstrate carbapenemase production (CP-CRE)

One isolate per patient per admission, regardless of source

AR Lab in Massachusetts

What must be submitted?

- CRPA: Carbapenem Resistant
Pseudomonas aeruginosa: **Submit only the first isolate per month**
- CRAB: Carbapenem Resistant
Acinetobacter baumannii: **Do NOT submit at this time**

How to submit your CRE and CRPA

- CRE: One isolate per patient per admission, regardless of source
- CRPA: Submit only the first isolate per month
- Please use general state lab requisition found:
 - <http://www.mass.gov/eohhs/docs/dph/laboratory-sciences/general-submission-form.pdf>
- Please send to the clinical microbiology lab
- Please include all susceptibility data generated at your facility
 - Your results may help inform our testing

What testing will be done?

- Isolate identification will be confirmed via Maldi-TOF or API 20E
- mCIM to determine carbapenemase production
- AST testing via sensititre**, Kirby Bauer disk diffusion, or both
- PCR to detect resistance genes: **bla_{kpc}** **bla_{ndm}**
bla_{imp}** **bla_{vim}**, **bla_{oxa-48like}**, *bla_{mcr}** (1 AND 2)

* Will be live in May2018

** Still undergoing validation

Discordant results

- Testing done at the MA-SPHL & ARLN/CDC is for surveillance purposes
- MA SPHL may generate different results than the submitting lab—these will be submitted to NYS Wadsworth for additional testing
- Treatment decisions should be based on your facility susceptibility results

Notes:

The test results included in this report will be used to support infection prevention measures. This report should not be used as a substitute for diagnostic procedures or used to guide clinical decisions.

Reporting Results

Page: 1 of 2

Massachusetts Department of Public Health
MA State Public Health Laboratory
305 South Street, Jamaica Plain, MA 02130 (617) 983-6607

Report Date
Accession



Patient Name
Provider Patient ID
DOB
Sex
Collection Date
Received Date
Contact
Source
Specimen Type



FINAL REPORT

Organism
identification
10/25/2017

Pseudomonas aeruginosa was identified.
* Identification determined by MALDI-TOF.

mCIM
10/25/2017

Positive for carbapenemase production.

Susceptibility
Testing
10/25/2017

| | | |
|----------------|-------|-------------------|
| AZTREONAM KB | 23 mm | Susceptible |
| CEFAZOLIN KB | 6 mm | No interpretation |
| CEFEPIME KB | 15 mm | Indeterminate |
| CEFTAZIDIME KB | 15 mm | Indeterminate |
| CEFTRIAXONE KB | 6 mm | No interpretation |
| COLISTIN KB | 15 mm | No interpretation |
| DORIPENEM KB | 6 mm | Resistant |
| ERTAPENEM KB | 6 mm | No interpretation |
| IMIPENEM KB | 6 mm | Resistant |
| MEROPENEM KB | 6 mm | Resistant |

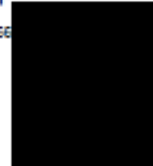
Page: 2 of 2

Massachusetts Department of Public Health
MA State Public Health Laboratory
305 South Street, Jamaica Plain, MA 02130 (617) 983-6607

Report Date
Accession



Patient Name
Provider Patient ID
DOB
Sex
Collection Date
Received Date
Contact
Source
Specimen Type



MATTHEW COTE
A/11 CARB
SUBCUTAN

FINAL REPORT

PIPERACILLIN-TAZOBACTAM KB 19 mm Indeterminate

Gene Targets
10/25/2017

| | |
|----------------------------|--------------|
| bla _{YIM} | Detected |
| bla _{KPC} | Not detected |
| bla _{NDM} | Not detected |
| bla _{OXA-48-like} | Not detected |

NOTE:

The test results included in this report will be used to support infection prevention measures. This report should not be used as a substitute for diagnostic procedures or used to guide clinical decisions.

* The performance characteristics of this test were determined by the MA SPHL. It has not been cleared or approved by the FDA.

End of Report

Isolates tested

September 2017-March 2018

| Tested at MA SPHL | CRE (n=94) | CRPA (n=58) |
|-------------------|------------|-------------|
| North | 6 | 2 |
| Greater Boston | 48 | 17 |
| Southeast | 8 | 12 |
| Inside 495 | 22 | 10 |
| Western MA | 6 | 13 |
| Cape | 1 | 4 |
| Reference Labs | 22 | 0 |

Source of Isolates

| | CRE | CRPA |
|-------------|-----|------|
| Urine | 56 | 27 |
| Body Fluid | 5 | 0 |
| Bronchial | 1 | 2 |
| Sputum | 6 | 14 |
| Blood | 8 | 2 |
| Wound | 6 | 6 |
| Tissue | 2 | 1 |
| Rectal Swab | 0 | 1 |
| Other | 10 | 6 |

Enterobacter aerogenes

- 8 from urine
- 1 from sputum
- All mCIM negative
- No gene targets detected
 - KPC, NDM, VIM, Oxa 48-like

Enterobacter cloacae complex

- **31 total**
 - 3 blood
 - 2 body fluid
 - 4 other
 - 1 sputum
 - 1 tissue
 - 18 urine
 - 2 wound
- **mCIM**
 - 13 positive, 16 negative, 1 indeterminate
- **PCR**
 - 12 KPC positive, 1 NDM positive
 - 1 mCIM positive but all gene targets tested were negative

E. coli

- 11 total
 - 6 urine
 - 1 sputum
 - 1 bronchial
 - 1 blood
 - 2 “other”
- mCIM
 - 4 positive, 7 negative
- PCR
 - 2 KPC pos
 - 2 NDM pos
 - 1 KPC/NDM
 - 1 Oxa 48-like/NDM pos

Klebsiella oxytoca

- **6 total**
 - 2 urine
 - 2 body fluid
 - 1 wound
 - 1 blood
- **mCIM**
 - 5 positive, 1 negative
- **PCR**
 - 5 KPC pos

Klebsiella pneumoniae

- **37 total**
 - 3 blood
 - 1 body fluid
 - 4 “other”
 - 3 sputum
 - 1 tissue
 - 23 urine
 - 3 wound
- **mCIM**
 - 23 positive, 14 negative
- **PCR**
 - 17 KPC, 1 NDM, 1NDM/KPC, 5 Oxa 48-like

Pseudomonas aeruginosa

- 58 Total
 - 27 Urine
 - 14 Sputum
 - 2 Bronchial
 - 1 Tissue
 - 6 Other
 - 1 Blood
 - 1 rectal swab
- mCIM
 - 4 positive, 54 negative
- PCR
 - 1 KPC+, 1 NDM/Vim+, 3 VIM +

ARLN Alerts

- Pan Resistance
 - Resistant to all drugs tested by both SPHL and submitting lab
- mcr-resistance by PCR or WGS
- Novel carbapenemase in CRE or CRPA
- Non-KPC carbapenemase in an Enterobacteriaceae
- Any Carbapenemase producing *Pseudomonas aeruginosa*
- Any Carbapenemase producing *Acinetobacter baumannii*
- Any Carbapenemase detected during colonization screening

What happens following an alert?

- MA Lab notifies MA Epi
- Epi sends secure email to CDC ARLN alert mailbox
- ARLN notifies MA Epi and Lab that an alert has been received on the isolate
 - list of instructions

What happens following an alert?

- To prevent spread of this resistance mechanism, we recommend the following:
- Place patient in a single room on contact precautions if currently inpatient in an acute care hospital or high-acuity post-acute care setting. If the patient is in a lower-acuity post-acute care setting, such as a non-ventilator unit of a skilled nursing facility, we recommend following infection control recommendations as outlined in the CDC CRE toolkit (available at: <https://www.cdc.gov/hai/pdfs/cre/CRE-guidance-508.pdf>).
- Conduct a public health response as outlined in the CDC Interim guidance for a Public Health Response to Contain Novel or Targeted MDROs (available at: <https://www.cdc.gov/hai/outbreaks/docs/health-response-contain-mdro.pdf>).
- The following epi is often helpful when performing a containment response:
 - • A brief medical history
 - • Healthcare exposures in the past month and in the month prior to the specimen collection date
 - • Any travel or healthcare exposures outside the US in the last 12 months
 - • Roommates or overlap with other patients during recent overnight stays in healthcare facilities
 - • If/when any infection control interventions were implemented such as isolation and contact precautions
- If you have any questions or need any further assistance, please don't hesitate to contact us.

Recommendations

- Patient on contact precautions
- Targeted screening of roommates
- Consideration of wider screening in facility depending on organism/gene identified and facility characteristics
- Testing is coordinated with the regional lab
 - Send supplies and mailing labels in a “kit”
 - Swabs sent to Wadsworth directly
 - Results within 24 hours
- CDC CRE toolkit
 - <https://www.cdc.gov/hai/pdfs/cre/CRE-guidance-508.pdf>).
- CDC Interim guidance for a Public Health Response to Contain Novel or Targeted MDROs
 - <https://www.cdc.gov/hai/outbreaks/docs/health-response-contain-mdro.pdf>).

Alerts

September 2017-March 2018

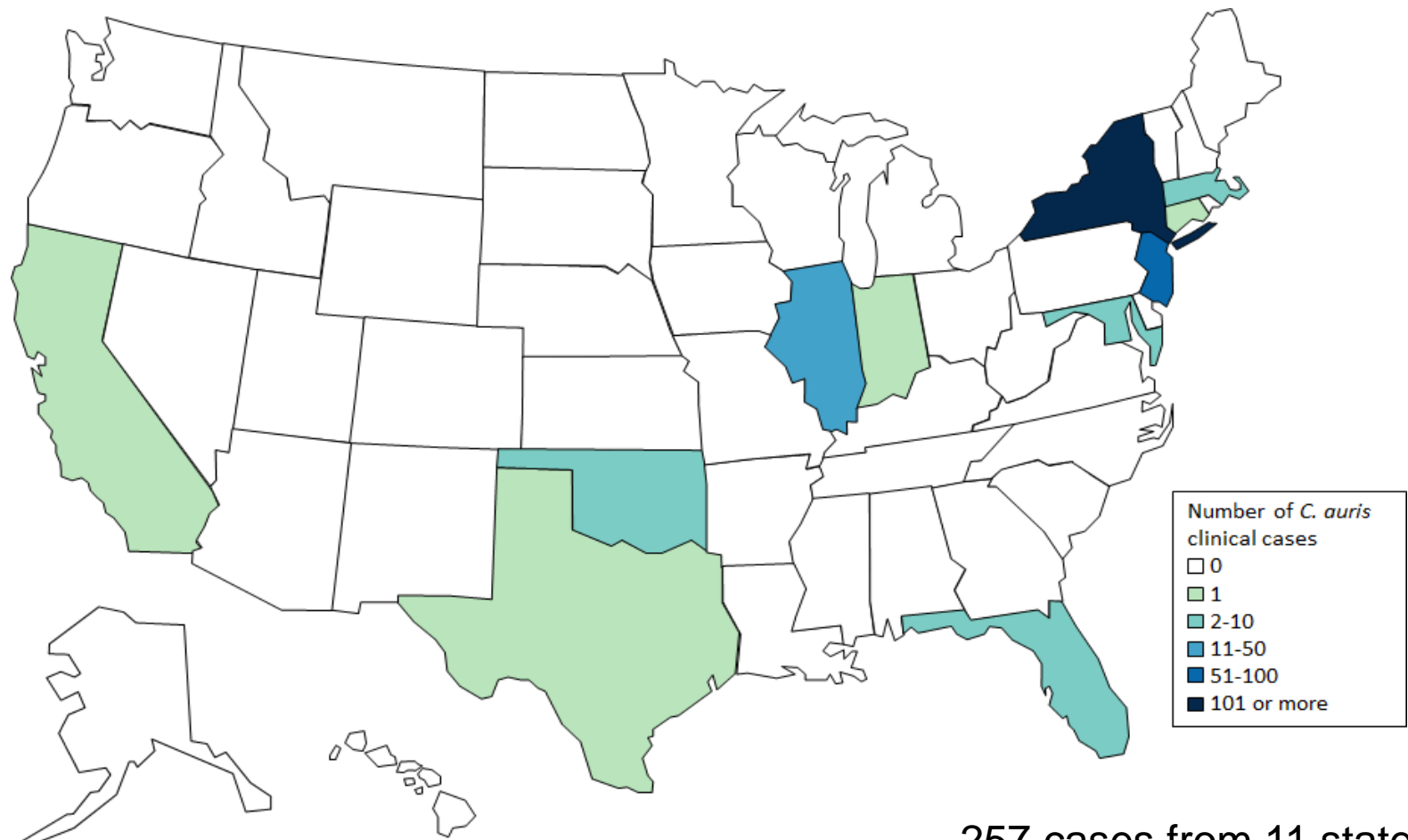
| Tested at MA SPHL | CRE | CRPA |
|--|-----|------|
| Pan-Resistance | 6 | 0 |
| Novel carbapenemase in CRE or CRPA | 2 | 0 |
| Non-KPC in CRE | 10 | NA |
| Any carbapenemase producing <i>Pseudomonas aeruginosa</i> | NA | 4 |
| Any carbapenemase producing <i>Acinetobacter baumannii</i> | NA | NA |
| Any Carbapenemase detected during colonization screening | NA | NA |

What about *Candida auris*

- Emerging Pathogen: first identified in 2009 in Japan
 - Retrospective review suggests earliest strain dates to 1996
- Often multidrug resistant
- Causes outbreaks in healthcare settings

Candida auris

U.S. Map: Clinical cases of *Candida auris* reported by state, United States, as of March 31, 2018



Laboratory Diagnosis of *Candida auris*

- Candida isolates from normally sterile sites should be fully speciated
 - Especially if the patient is already known to be colonized, or the facility is known to have had other cases
- Commercial systems do not routinely have *C. auris* in their library
 - Bruker Maldi-ToF MS (RUO) and Vitek MS (RUO) do
 - Other systems do not (misidentify with *Candida haemulonii*, *Candida sake*, *C. duobushaemulonii*, *Rhodotorula glutinis*)
 - <https://www.cdc.gov/fungal/diseases/candidiasis/pdf/Testing-algorithm-by-Method-temp.pdf>

What should clinical labs do?

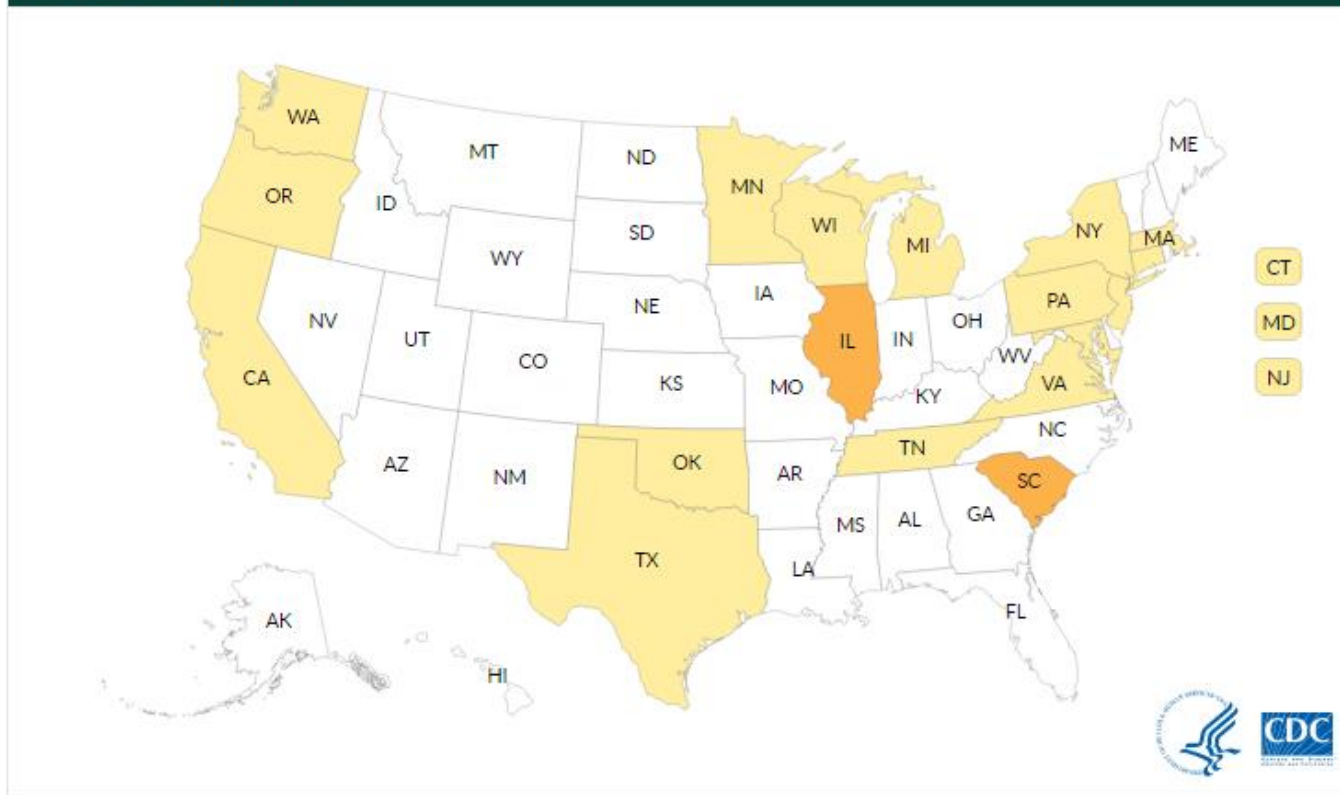
- MA SPHL does not have approved procedures for *Candida* identification
- If *C. auris* is confirmed or suspected, call 617-983-6800
 - Isolate will be sent to Wadsworth or CDC directly, SPHL will assist
- No isolates are to be sent to CDC or Wadsworth without SPHL approval

Global Emergence of mcr-1, 2 and 3

- Plasmid mediated colistin resistance
 - First identified in 2015
 - Gene found on plasmids
 - Infers colistin resistance
- 35 isolates from 18 states
- If you suspect colistin resistance, contact 617-983-6800
- These isolates are being referred to Wadsworth currently, MA SPHL assay live later this spring

Global Emergence of mcr-1, 2 and 3

Tracking the *mcr* genes



About This Map

- No isolates reported
- Human isolate
- Animal isolate

Questions?

