October 5, 2018

Dear Laboratory Director,

Carbapenem-resistant *Enterobacteriaceae* (CRE) and carbapenemase-producing CRE (CP-CRE) are a concerning public health threat due to multidrug-resistance, ability to cause serious invasive infection, and potential for rapid spread.

On July 30, 2018, the Georgia Department of Public Health (DPH) updated the Notifiable Disease/Condition Reporting List to require reporting of positive CRE laboratory results to DPH and submission of isolates to the Georgia Public Health Laboratory (GPHL).

CRE Case Definition:

*Enterobacter* species, *Escherichia coli* or *Klebsiella* species, from any clinical specimen (including screening/surveillance cultures) and resistant to at least one carbapenem (minimum inhibitory concentrations of ≥4 mcg/ml for meropenem, imipenem, and doripenem or ≥ 2 mcg/ml for ertapenem) OR production of a carbapenemase (e.g., KPC, NDM, VIM, IMP, OXA-48 carbapenemase) demonstrated by a recognized test (e.g., polymerase chain reaction, metallo-β-lactamase test, modified Hodge test, Carba NP).

Current CLSI (June 2010) carbapenem breakpoints must be used to ensure CRE are properly identified.

Include susceptibility results for all antibiotics tested (quantitative MIC value, and qualitative interpretation [S, I, R]), plus all results regarding carbapenemase production (positive or negative). Include submission of isolates meeting this surveillance definition to GPHL.

Three attached resources provide information needed to report and submit CRE:

1. CRE Reporting Guidelines (pages 2-7)
2. CRE Isolate Submission Guidelines (page 8)
3. CRE-Specific GPHL Isolate Submission Form (page 9; additional copies available here: https://dph.georgia.gov/notifiable-hai-reporting)

We thank you for your cooperation in our initiative to better understand and control CRE in Georgia.

Sincerely,

Cherie L. Drenzek, MS, DVM
State Epidemiologist

# Carbapenem-Resistant *Enterobacteriaceae* (CRE) Reporting Guidelines

## What to Report

### Organism

1. *Enterobacter* species, *Escherichia coli,* or *Klebsiella* species resistant to imipenem, meropenem, doripenem, or ertapenem isolated from any body site or from clinical and surveillance specimens

2. *Enterobacter* species, *Escherichia coli* or *Klebsiella* species that demonstrate production of a carbapenemase (e.g., KPC, NDM, VIM, IMP, OXA-48) by a recognized test (e.g., polymerase chain reaction, metallo-ß- lactamase test, modified Hodge test, Carba NP, carbapenemase inactivation method [CIM] or modified CIM)

3. Any diagnosis of CRE or CP-CRE infection or colonization

### Carbapenem Susceptibility Results

The current CLSI MIC breakpoints for carbapenems are listed below:

| Carbapenem | MIC Breakpoints (µg/mL) | | |
|---|---|---|---|
| | Susceptible | Intermediate | Resistant |
| Ertapenem | ≤0.5 | 1 | ≥2 |
| Doripenem | ≤1 | 2 | ≥4 |
| Imipenem | ≤1 | 2 | ≥4 |
| Meropenem | ≤1 | 2 | ≥4 |

### Patient and Specimen Variables

The following information is to be reported by the laboratory:

- Patient information: name, medical record number, date of birth, gender, race, ethnicity, address, city, state, county, and phone number
- Specimen information: organism name (genus and species), specimen source, **all antimicrobial susceptibility results** (including agent tested, testing method, MIC values, and MIC interpretation as S, I, or R), and carbapenemase testing results (including test method and results)

Unlike other notifiable conditions, **antimicrobial susceptibility results are required** for a report of CRE to be considered complete.

## How to Report

Results are to be reported using Electronic Laboratory Reporting (ELR). If your laboratory is currently reporting to DPH using ELR, you may require modifications to meet the required reporting for CRE. We recommend that you work with the Information Technology staff at DPH to ensure that you can report the fields listed under "What to Report" above.

To test your ability to send CRE messages, send a test message through the existing PHINMS/SFTP connection that you use, ensuring that the name of the file is different than production ELR data. For example, if the name a facility sends for production ELR is "MYHOSPITAL_ELR_"+date, then sending as 'TEST_CRE_'+date will ensure that the file will not get picked up and processed. Once the message has been sent, send an email to Patrick Pitcher (patrick.pitcher@dph.ga.gov) letting him know that a file is ready for him to test (please include the facility name for which you are testing along with the keyword "CRE" in the subject line of email).

If you are new to ELR reporting, register at this address: https://dph.georgia.gov/meaningful-use

## LOINC and SNOMED Codes

The following list of test/result codes can be used for ELR reporting and creating result queries:

Organism Identification

| LOINC | LOINC Name | SNOMED | SNOMED Name |
|---|---|---|---|
| 11475-1 | Microorganism identified: Prld: PT : xxx: Nom: Culture | 112283007<br>1485002<br>62592009<br>56415008<br>40886007 | *Escherichia coli*<br>*Enterobacter cloacae*<br>*Enterobacter aerogenes*<br>*Klebsiella pneumonia*<br>*Klebsiella oxytoca* |
| 75757-6 | Bacteria identified in Isolate by MS.MALDI-TOF | 112283007<br>1485002<br>62592009<br>56415008<br>40886007 | *Escherichia coli*<br>*Enterobacter cloacae*<br>*Enterobacter aerogenes*<br>*Klebsiella pneumonia*<br>*Klebsiella oxytoca* |

Susceptibility Information

| LOINC | LOINC Name | SNOMED | SNOMED Name |
|---|---|---|---|
| 56031-8 | Doripenem [Susceptibility] by Minimum inhibitory concentration (MIC) | | |
| 35801-0 | Ertapenem [Susceptibility] by Minimum inhibitory concentration (MIC) | | |
| 279-0 | Imipenem [Susceptibility] by Minimum inhibitory concentration (MIC) | | |
| 6652-2 | Meropenem [Susceptibility] by Minimum inhibitory concentration (MIC) | | |

Carbapenemase Detection Methods

| LOINC | LOINC Name | SNOMED | SNOMED Name |
|---|---|---|---|
| 86930-5 | Carbapenemase [Presence] in Isolate | 10828004<br>260385009 | Positive<br>Negative |
| 74676-8 | Carbapenemase [Type] in Isolate by Carba NP | 10828004<br>260385009<br>42425007<br>11896004 | Positive<br>Negative<br>Equivocal<br>Intermediate |
| | Carbapenemase Detected via Carbapenem Inactivation Method (CIM) | 10828004<br>260385009<br>42425007 | Positive<br>Negative<br>Equivocal |
| | Carbapenemase Detected via Modified Carbapenem Inactivation Method (mCIM) | 10828004<br>260385009<br>42425007<br>11896004 | Positive<br>Negative<br>Equivocal<br>Intermediate |
| 85502-3 | Carbapenemase resistance genes panel - Anorectal or isolate by NAA with probe detection | 10828004<br>260385009 | Positive<br>Negative |

Carbapenemase Genes

| LOINC | LOINC Name | SNOMED | SNOMED Name |
|---|---|---|---|
| 75683-3 | Bla(KPC) QI Prb Mag | 10828004<br>260385009 | Positive<br>Negative |
| 75686-6 | Bla(IMP) QI Prb Mag | 10828004<br>260385009 | Positive<br>Negative |
| 756841-1 | Bla(NDM) QI Prb Mag | 10828004<br>260385009 | Positive<br>Negative |
| 75685-8 | Bla(VIM) QI Prb Mag | 10828004<br>260385009 | Positive<br>Negative |
| 75685-5 | Bla(OXA) QI Prb Mag | 10828004<br>260385009 | Positive<br>Negative |
| 85498-4 | Carbapenem resistance blaIMP gene [Presence] in Anorectal or isolate by NAA with probe detection | 10828004<br>260385009 | Positive<br>Negative |
| 85499-2 | Carbapenem resistance blaKPC gene [Presence] in Anorectal or isolate by NAA with probe detection | 10828004<br>260385009 | Positive<br>Negative |
| 85500-7 | Carbapenem resistance blaNDM gene [Presence] in Anorectal or isolate by NAA with probe detection | 10828004<br>260385009 | Positive<br>Negative |
| 85503-1 | Carbapenem resistance blaOXA-48 gene [Presence] in Anorectal or isolate by NAA with probe detection | 10828004<br>260385009 | Positive<br>Negative |
| 85501-5 | Carbapenem resistance blaVIM gene [Presence] in Anorectal or isolate by NAA with probe detection | 10828004<br>260385009 | Positive<br>Negative |

## Parent/Child ELR Relationship for Culture and Susceptibility Testing

Modified from the Tennessee Department of Health ELR On-Boarding Handbook

To fully assess antimicrobial resistance, DPH needs to receive enough information about resistance testing for specific organisms. This includes:

1. The antimicrobial/bactericidal agent being tested
2. The method of testing (Kirby-Bauer, MIC, etc.)
3. The actual quantitative and qualitative results and interpretations

Specific fields in the HL7 message allow for the antimicrobial susceptibilities to be reported to public health. The messages should contain the organism, antibiotic susceptibilities, and the specimen source. The parent observation is the identified observation and the child observation is the antibiotic susceptibility result. The child observations should list all antibiotics tested against the organism, the measured MIC values, and the phenotypic interpretation.

How to link parent-child observations using HL7 2.5.1:

MSH
PID
ORC
OBR|1|Placer|Filler
OBX|1||Observation^Identifier|ObservationSubID|ObservationValue
SPM
OBR|2|||||||||||||||Observation&Identifier^ObservationSubID^ObservationValue|||Placer^Filler
OBX|1 OBX|2
OBX|3
SPM

Example [OBR-26] Parent Result:

|600-7&Microorganism identified&LN&CULT&Culture&L^1^Streptococcus pneumoniae|

- The first component *<600-7&Microorganism identified&LN&CULT&Culture&L>* consists of the test codes and descriptions for a microbial culture that appeared in the parent observation [OBX-3].
- The second component *<1>* is the sub-ID in the parent organism [OBX-4].
- The third component *<Streptococcus pneumoniae>* is the result description of the parent observation. The result description should come from [OBX-5.2] of the parent observation, but may come from [OBX-5.5] if [OBX-5.2] is empty.

Additional information and message examples can be found in Appendix A of the HL7 Version 2.5.1 Implementation Guide: Electronic Laboratory Reporting to Public Health Release 1 (US Realm), with errata.

## Sample Message for Parent/Child ELR Relationship for Culture and Susceptibility Testing

Modified from the CSTE AR/ELR Working Group Recommended Best Practices for Surveillance of Antimicrobial Resistance via Electronic Laboratory Reporting

In the observation request (OBR) segment, the parent filler order number (highlighted in green) located in OBR 3 is linked to the child parent sequence located in OBR 29.2 to link parent culture results to child susceptibility results.

MSH|^~\&|NIST^2.16.840.1.113883.3.72.5.20^ISO|NIST^2.16.840.1.113883.3.72.5.21^ISO|NIST^2.16.840.1.113883.3.72.5.22^ISO|NIST^2.16.840.1.113883.3.72.5.23^ISO|20120821140551-0500||ORU^R01^ORU_R01|NIST-ELR-004.01|T|2.5.1|||NE|NE|||||PHLabReport-NoAck^HL7^2.16.840.1.113883.9.11^ISO
SFT|NIST Lab, Inc.^L^^^^NIST&2.16.840.1.113883.3.987.1&ISO^XX^^^123544|3.6.23|A-1 Lab System|6742873-12||20100617

PID|1||PATID1234^^^&2.16.840.1.113883.3.72.5.24&ISO^MR^Seminole Cnty Hlth C&2.16.840.1.113883.3.0&ISO||Jones^William^A^^^^L||19610615|M||2106-3^White^CDCREC|1955 Seminole Lane^^Oveido^FL^32765^USA^H^^12059||^PRN^PH^^1^407^2351234|||||||||N^Not Hispanic or Latino^HL70189^NL^not latino^L^2.5.1

ORC|RE|ORD723222-4^^2.16.840.1.113883.3.72.5.24^ISO|R-783274-4^LIS^2.16.840.1.113883.3.72.5.25^ISO|||||||||57422^RADON^NICHOLAS^^^Dr.^^^NPI&2.16.840.1.113883.4.6&ISO^L^^^NPI||^PRN^PH^^^407^2341212|||||||Seminole County Health Clinic|555 Orange Ave^^Oviedo^FL^32765^^B|^WPN^PH^^^813^8847284|555 Orange Ave^^Oviedo^FL^32765^^B

OBR|1|ORD723222-4^^2.16.840.1.113883.3.72.5.24^ISO|R-783274-4^LIS^2.16.840.1.113883.3.72.5.25^ISO|625-4^Bacteria identified in Stool by Culture^LN^3456543^CULTURE STOOL^99USI^2.40|||20110528|||||||||57422^RADON^NICHOLAS^^^Dr.^^^NPI&2.16.840.1.113883.4.6&ISO^L^^^NPI|^PRN^PH^^^407^2341212|||||201106010900-0500|||F

OBX|1|CWE|625-4^Bacteria identified in Stool by Culture^LN^Bacteria identified^Bacteria identified^99USI^2.40|1|85729005^Shigella flexneri^SCT^^^^^^Shigella flexneri||||||F|||20110528|||||20110531130655-0500||||Seminole County Health Department Laboratory^^^^^&2.16.840.1.113883.3.72.5.30.1&ISO^XX^^^987|6756 Florida Avenue^^Oveido^FL^32765^^B|10092^Pafford^Hamlin^^^^^^&2.16.840.1.113883.3.72.5.30.1&ISO^L^^^NPI

SPM|1|^ORD723222-4&&2.16.840.1.113883.3.72.5.24&ISO||119339001^Stool specimen^SCT^^^^07/31/2012||||||||||||20110528|20110529

OBR|2||R-783274-5^LIS^2.16.840.1.113883.3.72.5.25^ISO|50545-3^Bacterial susceptibility panel in Isolate by Minimum inhibitory concentration (MIC)^LN^Bact suscept^Bacteria susceptibility^99USI^2.40|||20110528|||||||||57422^RADON^NICHOLAS^^^Dr.^^^NPI&2.16.840.1.113883.4.6&ISO^L^^^NPI|^PRN^PH^^^407^2341212|||||201106010900-0500|||F|625-4&Bacteria identified in Stool by Culture&LN&Bacteria identified&Bacteria identified&99USI^^Shigella flexneri|||^R-783274-4&LIS&2.16.840.1.113883.3.72.5.25&ISO

OBX|1|SN|20-8^Amoxicillin+Clavulanate [Susceptibility] by Minimum inhibitory concentration (MIC)^LN^AmoxClav^Amoxicillin-clavulanic acid^99USI^2.40||=^16|ug/mL^microgram per milliliter^UCUM^^^^1.8.2||I^Intermediate^HL70078^^^^2.5.1|||F|||20110528|||||201106010900-0500|||Seminole County Health Department Laboratory^^^^^&2.16.840.1.113883.3.72.5.30.1&ISO^XX^^^987|6756 Florida Avenue^^Oveido^FL^32765^^B|10092^Pafford^Hamlin^^^^^^&2.16.840.1.113883.3.72.5.30.1&ISO^L^^^NPI

OBX|2|SN|516-5^Trimethoprim+Sulfamethoxazole [Susceptibility] by Minimum inhibitory concentration (MIC)^LN^TMP-SMX^Trimethoprim-sulfamethoxazole^99USI^2.40||=^8^/^152|ug/mL^microgram per milliliter^UCUM^^^^1.8.2||R^Resistant^HL70078^^^^2.5.1|||F|||20110528|||||201106010900-0500|||Seminole County Health Department Laboratory^^^^^&2.16.840.1.113883.3.72.5.30.1&ISO^XX^^^987|6756 Florida Avenue^^Oveido^FL^32765^^B|10092^Pafford^Hamlin^^^^^^&2.16.840.1.113883.3.72.5.30.1&ISO^L^^^NPI

OBX|3|SN|185-9^Ciprofloxacin [Susceptibility] by Minimum inhibitory concentration (MIC)^LN^CIPROFLOXACIN^CIPROFLOXACIN^99USI^2.40||<=^0.06|ug/mL^microgram per milliliter^UCUM^^^^1.8.2||S^Susceptible^HL70078^^^^2.5.1|||F|||20110528|||||201106010900-0500|||Seminole County Health Department Laboratory^^^^^&2.16.840.1.113883.3.72.5.30.1&ISO^XX^^^987|6756 Florida Avenue^^Oveido^FL^32765^^B|10092^Pafford^Hamlin^^^^^^&2.16.840.1.113883.3.72.5.30.1&ISO^L^^^NPI

## Additional Guidance

The HL7 Version 2.5.1 Implementation Guide can be found at http://www.hl7.org/implement/standards/product_brief.cfm?product_id=98

THE CSTE ELR Best Practices for reporting CRE can be found at https://www.cste2.org/Publications/CRE_ELR_Best_Practices_FINALv1.0_20170515.pdf

For laboratories that are currently unable to report using ELR, please contact Liz Smith, Acute Disease Epidemiology Section, for interim guidance on reporting (Elizabeth.Smith@dph.ga.gov).

# Carbapenem-Resistant *Enterobacteriaceae* (CRE)
## Isolate Submission Guidelines

### What are the specimen requirements?
Submit all isolates of carbapenem-resistant *Enterobacter spp*, *Klebsiella spp*, and *Escherichia coli* from any body site as pure, low passage culture on a non-inhibitory, non-selective agar slant within seven days of identification to the Georgia Public Health Laboratory. Each tube must be labeled with the patient's name, date of birth, and date of isolation.

### What forms are needed?
Complete a CRE-specific GPHL form for each isolate (see next page). The form can also be found on the Georgia DPH Healthcare-Associated Infections website here: https://dph.georgia.gov/notifiable-hai-reporting.

### How do I ship specimens to GPHL?
Triple contain isolates according to Category B UN3373 shipping regulations for infectious substances/diagnostic specimens by (1) wrapping each specimen tube in absorbent material, then (2) placing into the inner mailing container with cap securely tightened, and (3) placing into outer mailing container with completed forms. Clearly label the outer mailing container with your name/address and GPHL's address:

Georgia Public Health Laboratory
1749 Clairmont Road
Decatur, Georgia, 30033

For more information see:
https://dph.georgia.gov/sites/dph.georgia.gov/files/related_files/site_page/GPHL%20PS%20Plan-8%2010%202018-Updated.pdf

### What will GPHL do with the specimens I submit?
GPHL will perform additional testing to identify carbapenemase-producing CRE, to understand the epidemiology of CRE across Georgia, to aid in outbreak investigation, and to support CRE prevention initiatives.

The results of additional testing will be sent to you via mail or will be available electronically via the GPHL Web Portal. If you are not signed up for the GPHL Web Portal and would like to be, contact the DPH IT Help Desk at dphall.it@dph.ga.gov.

### What if I participate in the Emerging Infections Program (EIP)?
If you suspect you have a cluster or outbreak of CRE or other multi-drug resistant organism, contact the DPH HAI program via email (dph.hai@dph.ga.gov) or ask for an HAI team member at 404-657-2588. Otherwise, continue your regular submission to EIP, which will forward isolates to GPHL.

# GEORGIA PUBLIC HEALTH
# CRE/ARLN SENTINEL
# LABORATORY SUBMISSION FORM

Georgia Department of Public Health

Laboratory use only

***HEALTH CARE PROVIDER INFORMATION*** ***PATIENT INFORMATION***

**Submitter Code**

**Submitter Name***

**Street Address**

**City** **State** **Zip**

**Responsible Official**

**Responsible Official (Copy To)**

**Contact Information (Alert Values)**

☐ **APPROVAL CODE:**
**EPI-14-14-4242730**

**Patient ID Number*** **PATIENT NAME Last*** **First*** **MI** **Suffix**

**County of Residence*** **DOB***
___/___/_____

**Home Phone:** **Cell Phone:** **Work Phone:**

**Address** **City,** **State** **Zip**

**EIP Number/Specimen ID**

**Race**
- ☐ American Indian/Alaska Native
- ☐ Asian
- ☐ Black/African-American
- ☐ Native Hawaiian/Pacific Islander
- ☐ White/ Caucasian
- ☐ Multi-Racial

**Ethnicity**
- ☐ Hispanic or Latino
- ☐ Non-Hispanic or Latino

**Gender***
- ☐ Male
- ☐ Female

**Pregnant?**
☐ Yes ☐ No ☐ N/A

**Travel in the past month?** ☐ Yes ☐ No **Travel Dates?** _____
**Where?** _____

Other lab tests performed and results: _____

Suspected organism: _____

***SPECIMEN INFORMATION***

**Specimen Type:**

☐ Isolate (Microbial)
Source*
_____

Date of Collection*
____/____/_____

Time of Collection
_____:_____ ☐ AM ☐ PM

**Shipped:**
- ☐ Frozen
- ☐ Refrigerated
- ☐ Room Temperature

Symptoms
_____
_____
_____

Date of onset
____/____/_____

***TEST REQUESTED***

***CRE Surveillance and Response***

- ☒ 12100 **Microbial Identification for CRE | CRPA**
- ☐ 3999 **Forward to TN ARLN**
  - ☐ **Candida auris rule out**
  - ☐ **Sentinel Reporting (ESBL, *Candida glabrata*, CR-Acinetobacter)**
  - ☐ **Other** _____