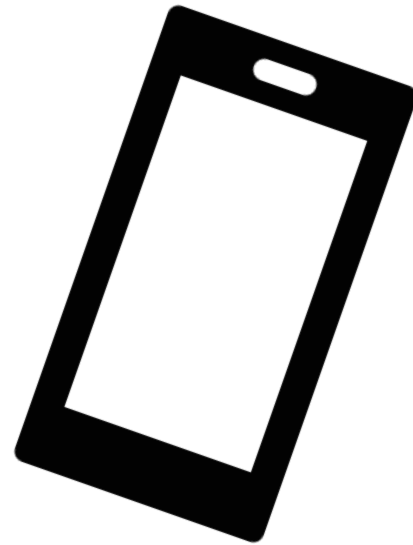
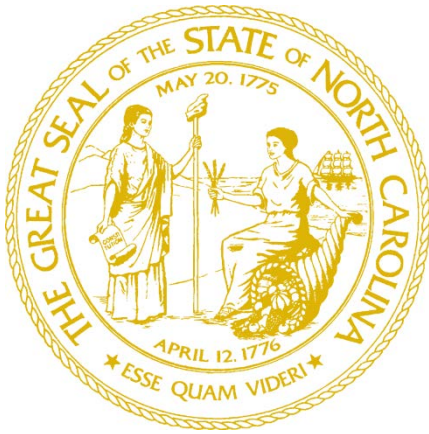


This webinar will be interactive!

- Grab your phone!
- Go to www.menti.com
- Enter the code **114134**





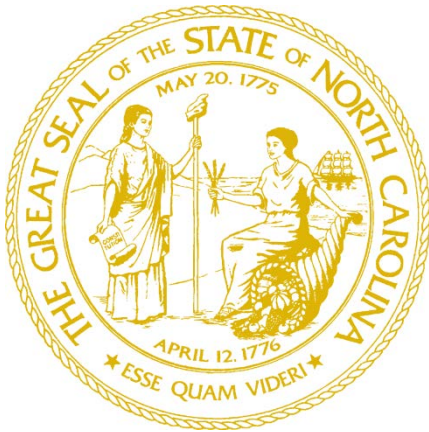
CRE Surveillance, Identification, Containment & Response - PART ONE

SHARPPS Program

Communicable Disease Branch

North Carolina Division of Public Health

October 18, 2018



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Disclosures

- **Our speakers have no relevant financial disclosures or conflicts of interest related to content of this activity.**
- **Completion criteria: the participant must attend 100% of webinar and complete the participant evaluation to receive 1.0 CNE contact hours.**
- **There is no commercial support for this activity.**

Accreditation Statement

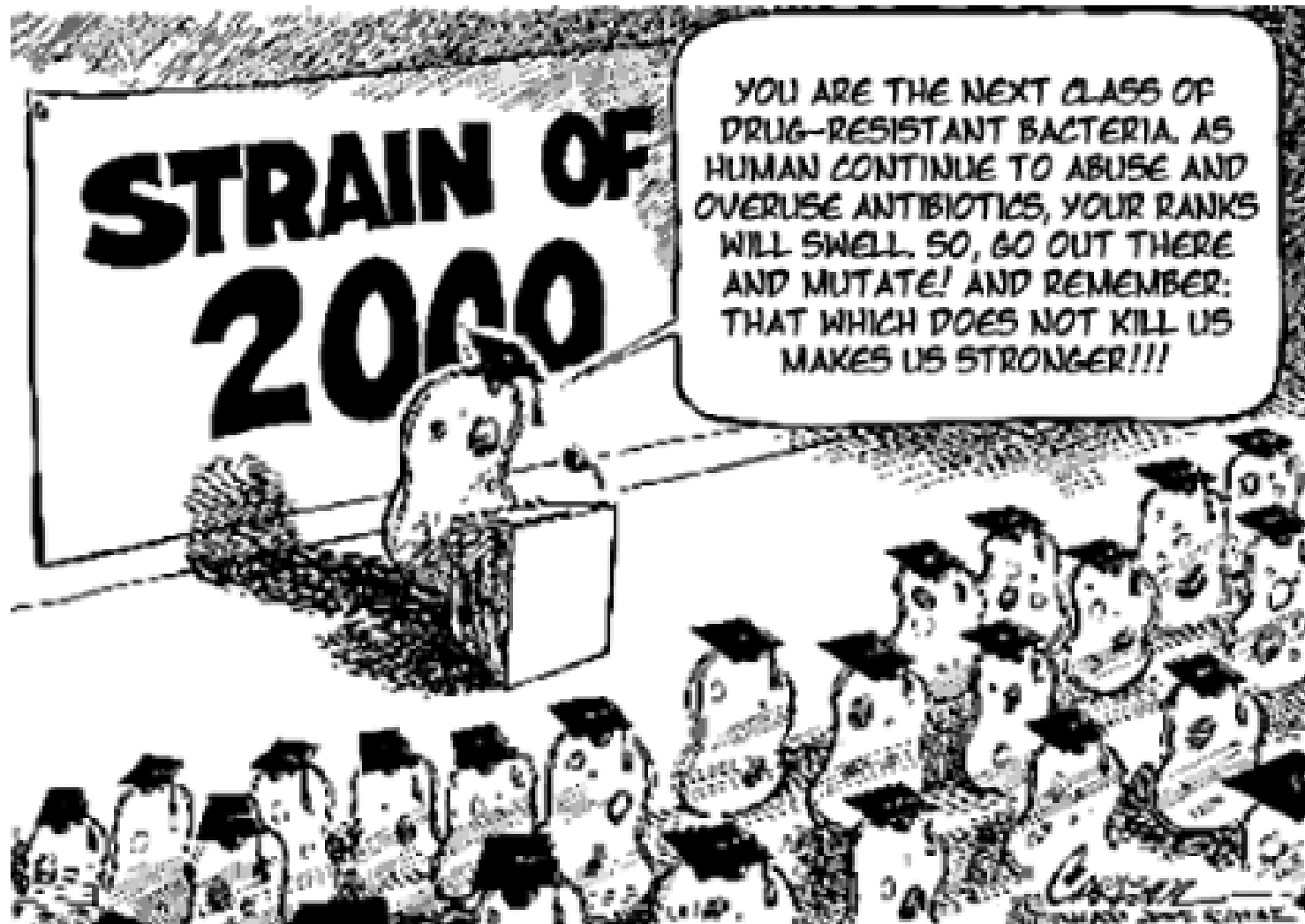
Continuing education credit will be provided through the Public Health Nursing and Professional Development (PHNPD) Unit.

Public Health Nursing and Professional Development, Department of Health and Human Services, is an approved provider of continuing nursing education by the North Carolina Nurses Association, an accredited approver by the American Nurses Credentialing Center's Commission on Accreditation.

Objectives

- **Discuss the public health significance of CRE and describe the process for surveillance and detection**
- **Describe CRE identification**
- **Describe the role of public health in a unified response to CRE**

Multidrug-Resistant Organisms (MDROs)



According to CDC, what is the estimated number of infections caused by antibiotic-resistant infections in the U.S. annually?

- A. 75,000**
- B. 1,000,000**
- C. 2,000,000**
- D. 250,000**

According to CDC, what is the estimated number of infections caused by antibiotic-resistant infections in the U.S. annually?

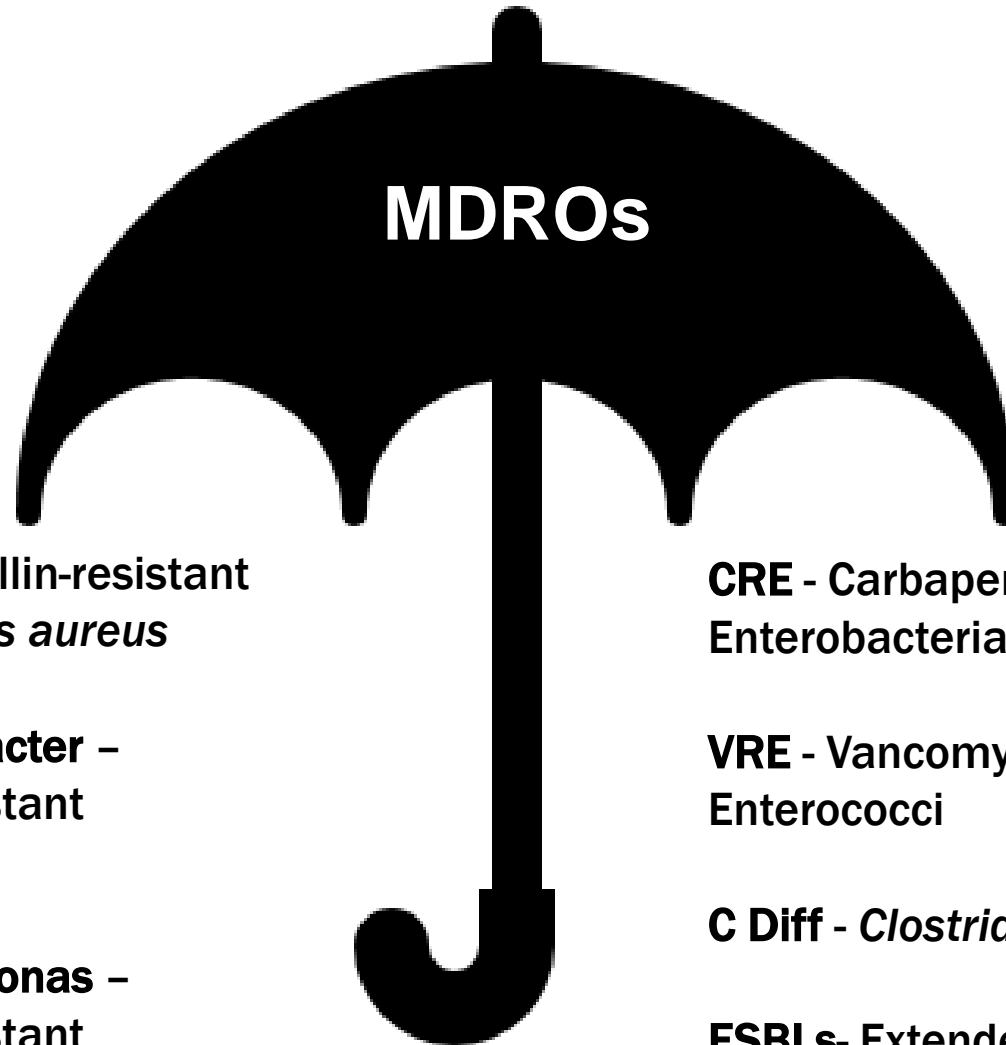
A. 75,000

B. 1,000,000

C. 2,000,000

D. 250,000

Types of MDROs



MRSA - Methicillin-resistant
Staphylococcus aureus

MDR Acinetobacter –
Multi-drug resistant
Acinetobacter

MDR Pseudomonas –
Multi-drug resistant
Pseudomonas

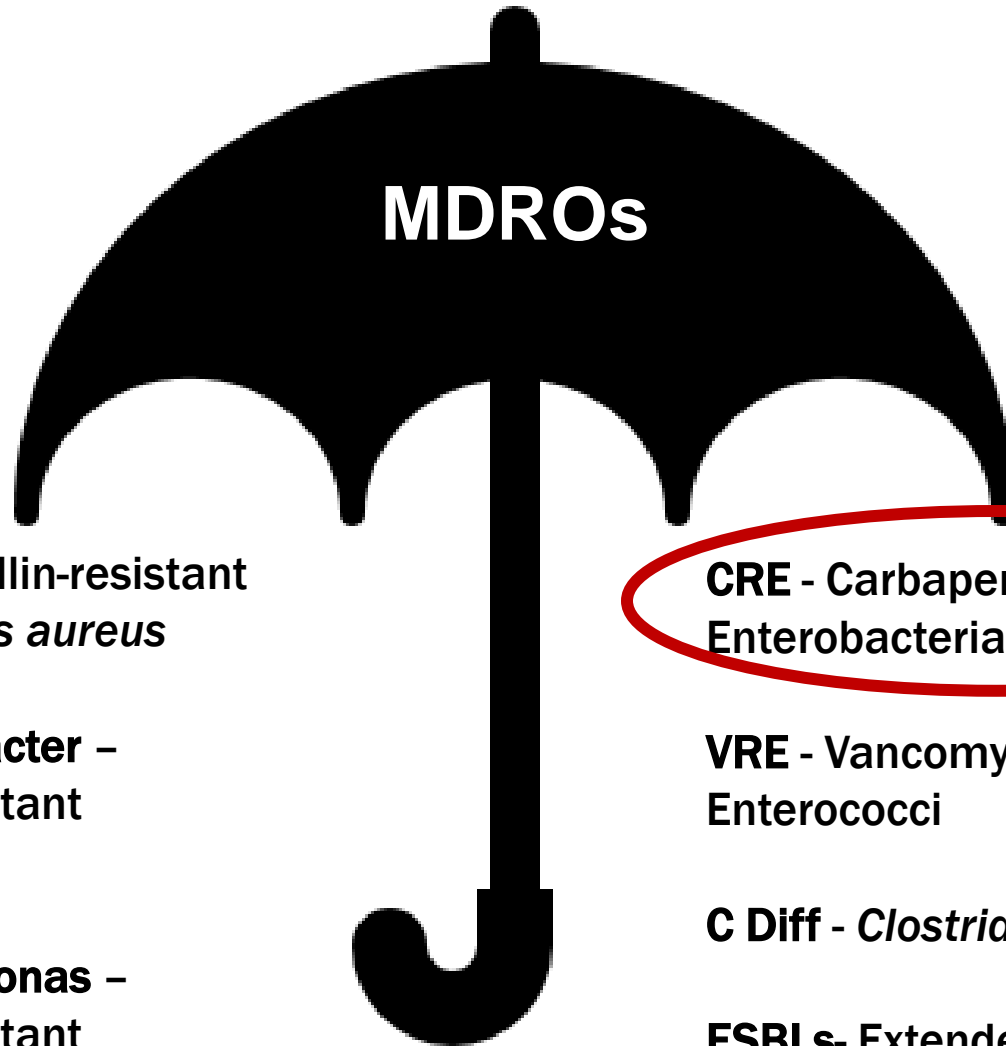
CRE - Carbapenem-Resistant
Enterobacteriaceae

VRE - Vancomycin-Resistant
Enterococci

C Diff - *Clostridium difficile*

ESBLs- Extended Spectrum
Beta-Lactamase Producers

Types of MDROs



MRSA - Methicillin-resistant
Staphylococcus aureus

MDR Acinetobacter –
Multi-drug resistant
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MDR Pseudomonas –
Multi-drug resistant
Pseudomonas

CRE - Carbapenem-Resistant
Enterobacteriaceae

VRE - Vancomycin-Resistant
Enterococci

C Diff - *Clostridium difficile*

ESBLs- Extended Spectrum
Beta-Lactamase Producers

Carbapenem-resistant Enterobacteriaceae (CRE)

- Enterobacteriaceae = gram negative bacteria found in the digestive tract
 - *E. Coli*
 - *Klebsiella spp.*
- CRE = Enterobacteriaceae resistant to carbapenem antibiotics



Carbapenems

- Class of **Beta-lactam** antibiotics
 - Ertapenem
 - Meropenem
 - Imipenem
 - Doripenem
- Usually reserved to treat drug-resistant infections

BE ANTIBIOTICS AWARE: SMART USE, BEST CARE

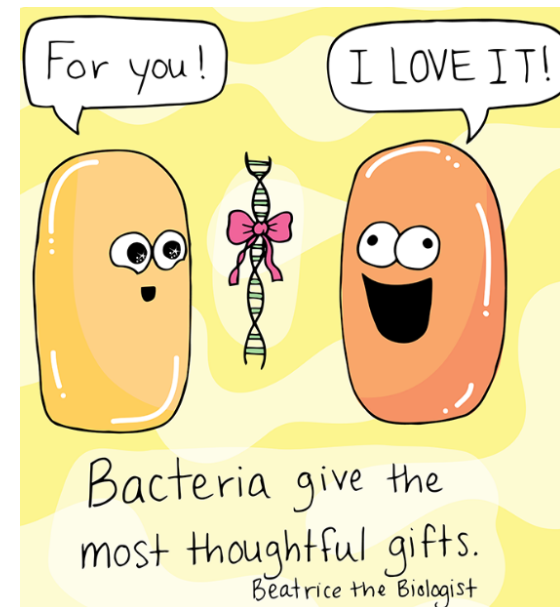


Artwork submitted by 11th grader, Mallori Mull of Mount Holly, NC, Winner of the 2017 NC Get Smart Artwork Competition

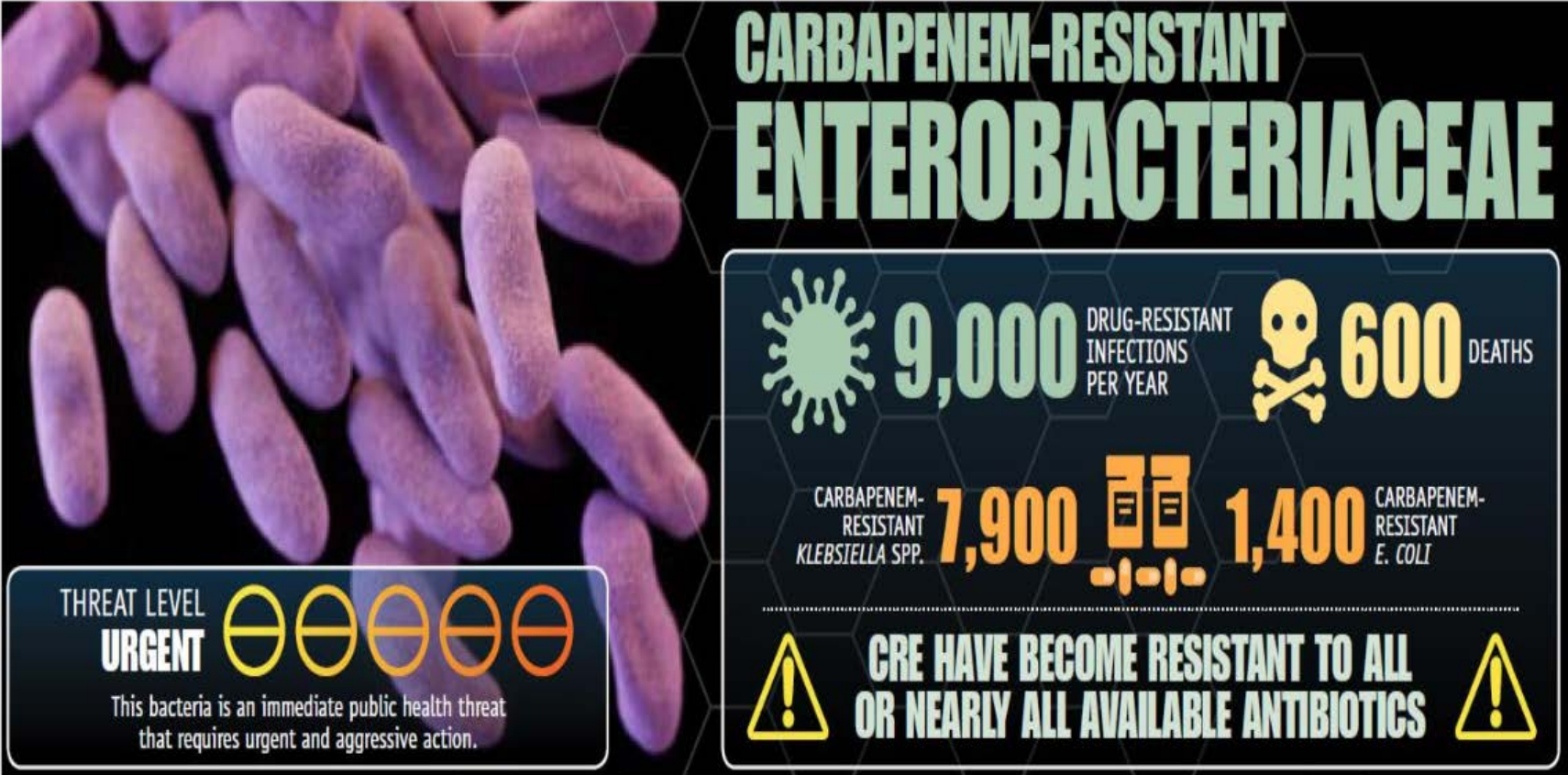
For more information, visit the NC Get Smart Campaign:
<http://epi.publichealth.nc.gov/cd/antibiotics/campaign.html>

Carbapenemase producing CRE (CP CRE)

- Carbapenemase = enzyme that can break down carbapenem antibiotics
 - Klebsiella pneumoniae carbapenemase (KPC),
 - New Delhi metallo- β -lactamase (NDM),
 - Verona integron encoded metallo- β -lactamase (VIM),
 - Imipenemase metallo- β -lactamase (IMP)
 - Oxacillinase-48 (OXA-48)
- Mobile resistance elements



CRE: an urgent public health threat



CDC: Antibiotic Resistance Threats in the United States, 2013

What NC DPH is doing:

Detect MDROs

- Increased awareness
- Surveillance
- Testing at SLPH
- Colonization screening

Ensure rapid response & containment

- Systematic response to even single cases
- Infection prevention assessments
- Inter-facility communication
- Screening for colonization

Stewardship efforts

- Antimicrobial resistance subcommittee
- Be Antibiotics Aware Campaign
- STAR partners

Education

- Webinars
- Toolkits
- Presentations
- Guidance documents

What NC DPH is doing:

Detect MDROs

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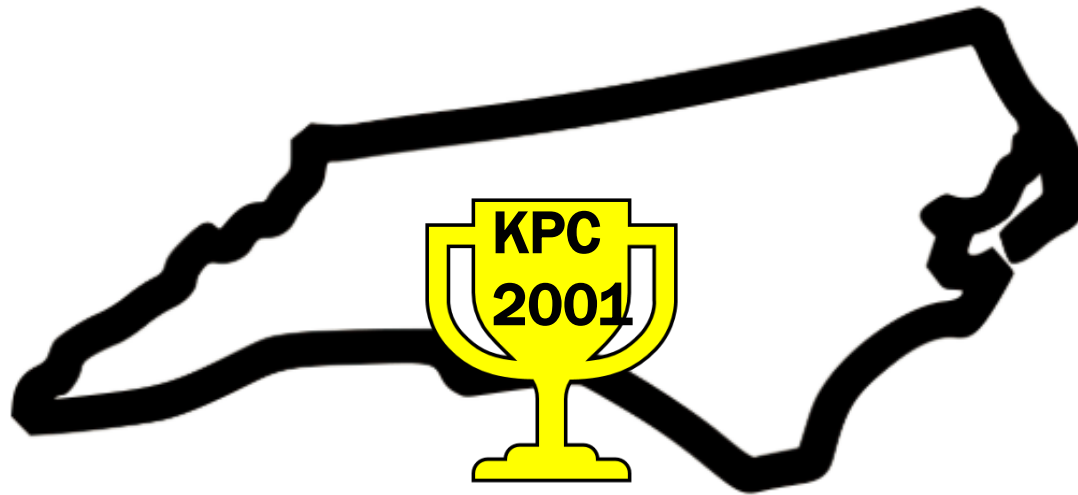
- Antimicrobial resistance subcommittee
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Education

- Webinars
- Toolkits
- Presentations
- Guidance documents

Detection & Surveillance

Coming in First

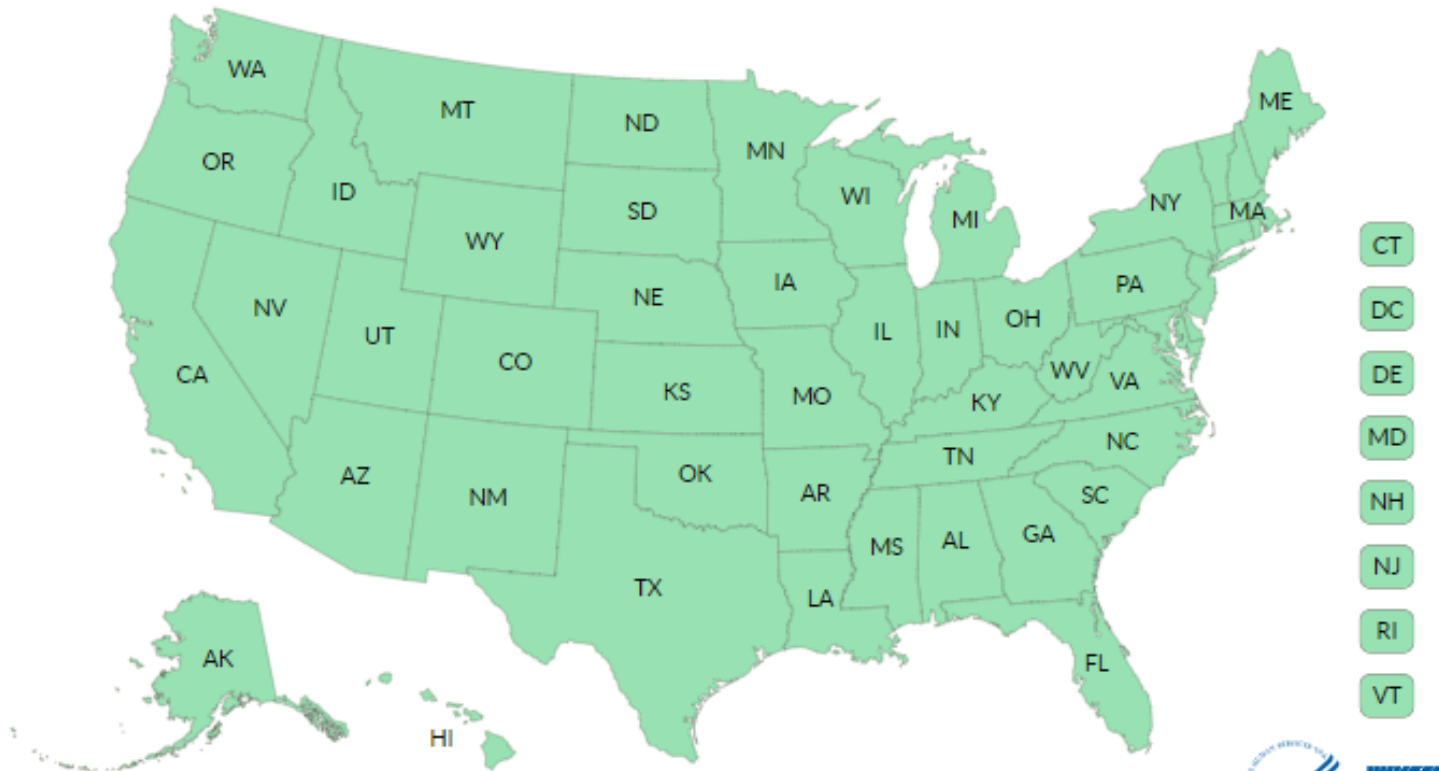


KPC has been reported in all 50 states

Patients with KPC-producing *Carbapenem-resistant Enterobacteriaceae* (CRE) reported to the Centers for Disease Control and Prevention (CDC) as of December 2017, by state

KPC enzyme

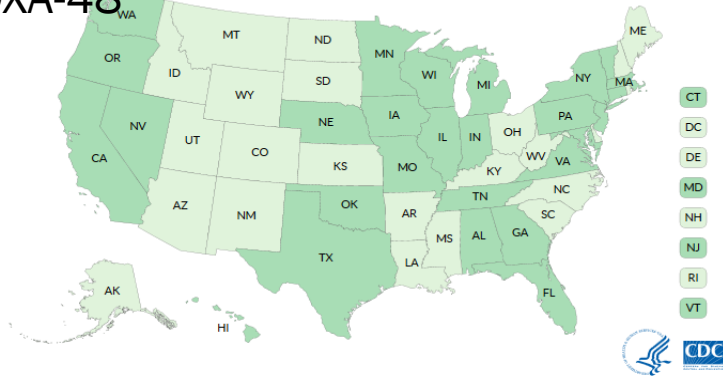
- None
- Reported



Detection of other CP-CRE varies by state

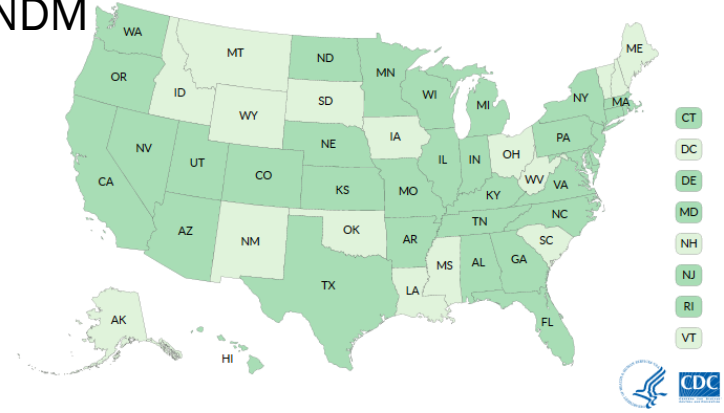
Patients with OXA-48-Type-producing *Carbapenem-resistant Enterobacteriaceae* (CRE) reported to the Centers for Disease Control and Prevention (CDC) as of December 2017, by state

OXA-48



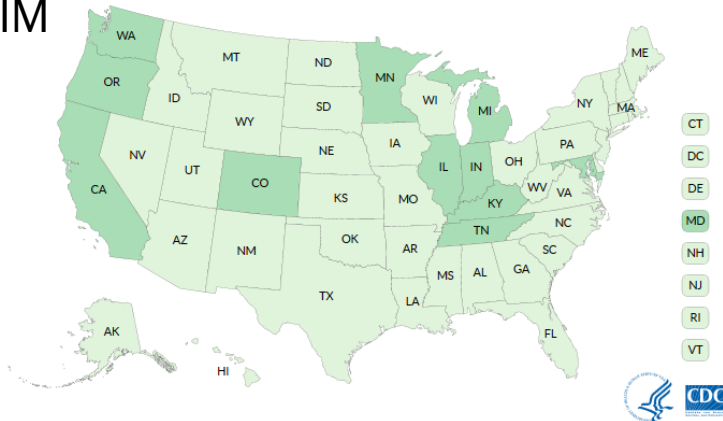
Patients with NDM-producing *Carbapenem-resistant Enterobacteriaceae* (CRE) reported to the Centers for Disease Control and Prevention (CDC) as of December 2017, by state

NDM



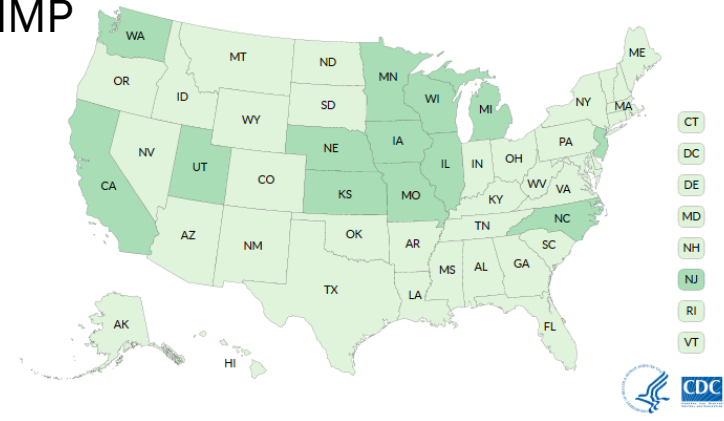
Patients with VIM-producing *Carbapenem-resistant Enterobacteriaceae* (CRE) reported to the Centers for Disease Control and Prevention (CDC) as of December 2017, by state

VIM



Patients with IMP-producing *Carbapenem-resistant Enterobacteriaceae* (CRE) reported to the Centers for Disease Control and Prevention (CDC) as of December 2017, by state

IMP



Maps are routinely updated and available from : <https://www.cdc.gov/hai/organisms/cre/trackingcre.html>

Surveillance in NC



Sentinel site surveillance

Targeted recruitment for sentinel surveillance, special projects and outbreak response.

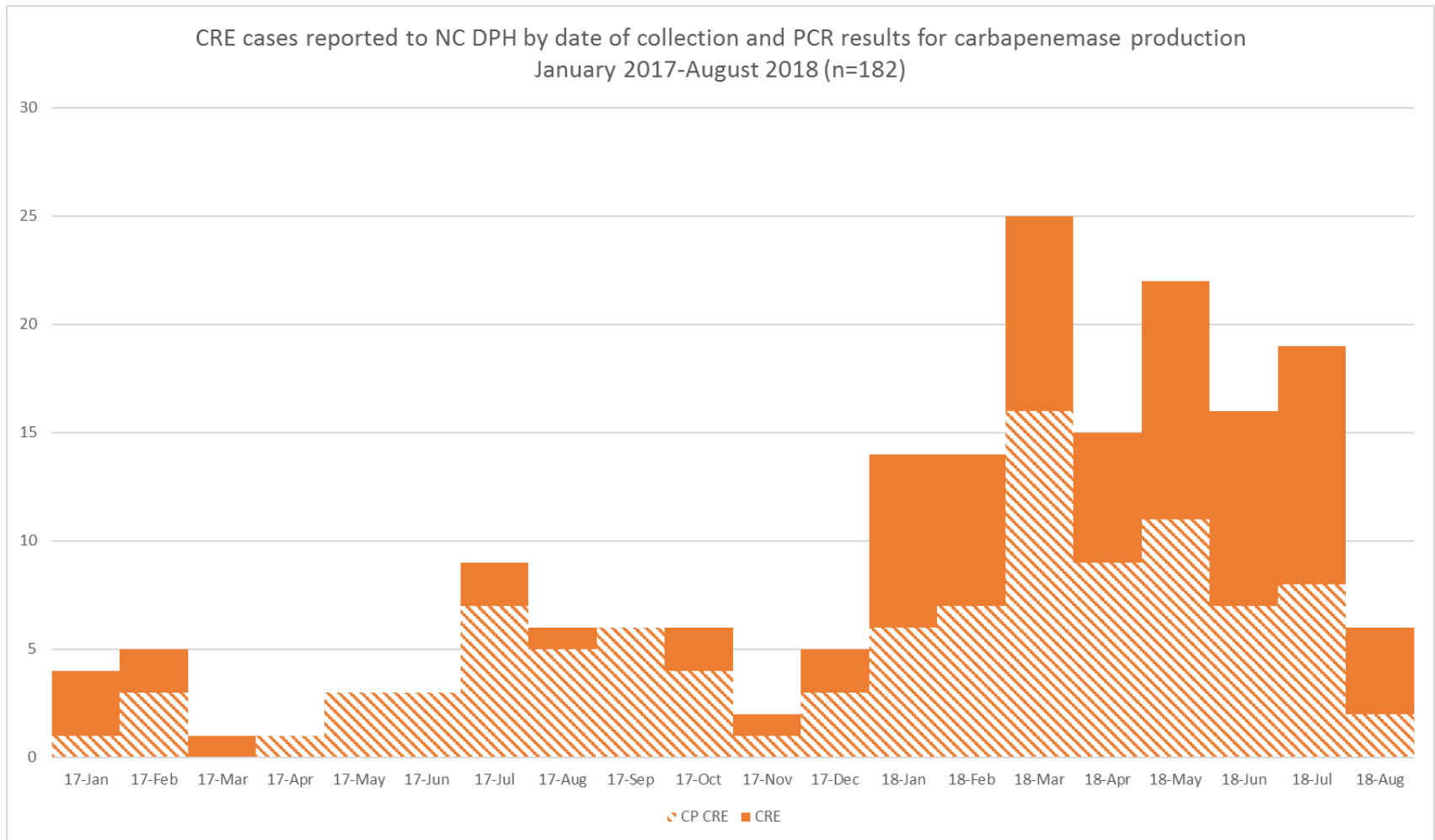
Mar. 2015 – Sep. 2016

Nov. 2016 – June 2017

July 2017-present

Accepted Isolates but did not actively recruit sites

Sentinel surveillance efforts



*Excludes duplicate CRE (Same Carbapenemase/organism; repeat clinical isolates in a 12 month period; screening results subsequent to a clinical result)

Sentinel surveillance efforts

57%

of CRE reported to NC DPH
are carbapenemase producing

Sentinel surveillance efforts

~10 CRE per
month statewide

Sentinel surveillance efforts

The Prevalence of types of carbapenemases among reported CP-CRE, North Carolina January 2017-August 2018 (n=103)



Changes to 10A NCAC 41A .0101

- **Effective October 1, 2018**

Changes to 10A NCAC 41A .0101

Changes to include:

- Carbapenem-resistant Enterobacteriaceae (CRE) – 24 hours
- *Candida Auris* – 24 hours

Reporting will:

- Facilitate early detection, rapid response and containment
- Prevent transmission
- Provide data to develop and implement prevention and control measures

What to report?

- Identification of CRE from a clinical specimen associated with either infection or colonization –AND –

What to report?

- Identification of CRE from a clinical specimen associated with either infection or colonization –AND –
- All susceptibility results (if available) – AND –

What to report?

- Identification of CRE from a clinical specimen associated with either infection or colonization –AND –
- All susceptibility results (if available) – AND –
- All phenotypic or molecular test results (if conducted and available)

For the purposes of reporting, Carbapenem-Resistant *Enterobacteriaceae* (CRE) are defined as:

(1) *Enterobacter* spp., *E.coli* or *Klebsiella* spp. positive for a known carbapenemase resistance mechanism or positive on a phenotypic test for carbapenemase production

or

(2) *Enterobacter* spp., *E.coli* or *Klebsiella* spp. resistant to any carbapenem in the absence of carbapenemase resistance mechanism testing or phenotypic testing for carbapenemase production.

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Lab reports: look for organism identity

- Organism identification
 - May use a culture or “NAAT” (“nucleic acid amplification test”) or “PCR”

Order		CULTURE, URINE [URC] (Order 308868132)	
Ordering Provider			
Authorizing [REDACTED]			
Acknowledgement Info			
For Placing Order	At 05/17/17 1927	Acknowledged By [REDACTED]	Acknowledged On 05/17/17 1957
Task Unit Sec Ack		Completed by [REDACTED]	Date/Time Wed May 17, 2017 7:29 PM
Order Info			
Priority: STAT	Start: 05/17/17 1927	Process Instructions: ** Minimum Specimen Requirements: 25 ML Urine ** **Submit urine in a container with NO preservative** **Use Orange Screw-capped urine cup, White Screw-capped urine tube or Red top tubes**	
Order Frequency			
Antibiotic		Organism >100,000 cfu/ml enterobacter cloacae	Organism
AMP/SULBACTAM	MIC	RESISTANT	Final
AMPICILLIN	MIC	RESISTANT	Final
AUGMENTIN	MIC	RESISTANT	Final
CIPROFLOXACIN	MIC	RESISTANT	Final
ERTAPENEM	MIC	RESISTANT	Final
GENTAMICIN	MIC	SUSCEPTIBLE	Final
NITROFURANTOIN	MIC	SUSCEPTIBLE	Final
PIPERACILLIN/TAZOBACTAM	MIC	RESISTANT	Final
TRIMETH-SULFAMETHOXAZOLE	MIC	SUSCEPTIBLE	Final
Lab and Collection			
CULTURE, URINE on 6/3/2017			
Result History			
CULTURE, URINE on 6/6/2017			
Reviewed by List			
[REDACTED]			
View SmartLink Info			
Culture, Urine (Order #308868172) on 6/3/17			
Ordering Provider NPI ID			

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or

(2) *Enterobacter* spp., *E.coli* or *Klebsiella* spp. **resistant to any carbapenem in the absence of carbapenemase resistance mechanism testing or phenotypic testing for carbapenemase production.**

Lab reports: look for susceptibility results

- Antimicrobial susceptibility results
 - Also called “MICs” (“minimum inhibitory concentration”) with “interps” (“interpretation”)

Order CULTURE, URINE [URC] (Order 308868132)

Ordering Provider
 Authorizing [REDACTED]

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----------------	----------------------	---

Order Frequency

Antibiotic	Organism	Organism
	>100,000 cfu/ml	enterobacter cloacae
AMP/SULBACTAM	MIC RESISTANT	Final
AMPICILLIN	MIC RESISTANT	Final
AUGMENTIN	MIC RESISTANT	Final
CIPROFLOXACIN	MIC RESISTANT	Final
ERTAPENEM	MIC RESISTANT	Final
GENTAMICIN	MIC SUSCEPTIBLE	Final
NITROFURANTOIN	MIC SUSCEPTIBLE	Final
PIPERACILLIN/TAZOBACTAM	MIC RESISTANT	Final
TRIMETH-SULFAMETHOXAZOLE	MIC SUSCEPTIBLE	Final

Lab and Collection
 CULTURE, URINE on 6/3/2017

Result History
 CULTURE, URINE on 6/6/2017

Reviewed by List
 [REDACTED]

View SmartLink Info
 Culture, Urine (Order #308868172) on 6/3/17

Ordering Provider NPI ID

Lab reports: look for susceptibility results

- Antimicrobial susceptibility results
 - Also called “MICs” (“minimum inhibitory concentration”) with “interps” (“interpretation”)
 - Look for interpretations:
 - S = “susceptible”; listed drug can be used to treat
 - I = “intermediate”; listed drug may not be effective treatment
 - R = “resistant”; listed drug can not be used to treat

Order CULTURE, URINE [URC] (Order 308868132)

Ordering Provider
 Authorizing [REDACTED]

Acknowledgement Info

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Order Frequency

Antibiotic	MIC	Organism	Organism
		>100,000 cfu/ml	enterobacter
		cloacae	
AMP/SULBACTAM	MIC	RESISTANT	Final
AMPICILLIN	MIC	RESISTANT	Final
AUGMENTIN	MIC	RESISTANT	Final
CIPROFLOXACIN	MIC	RESISTANT	Final
ERTAPENEM	MIC	RESISTANT	Final
GENTAMICIN	MIC	SUSCEPTIBLE	Final
NITROFURANTOIN	MIC	SUSCEPTIBLE	Final
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TRIMETH-SULFAMETHOXAZOLE	MIC	SUSCEPTIBLE	Final

Lab and Collection
 CULTURE, URINE on 6/3/2017

Result History
 CULTURE, URINE on 6/6/2017

Reviewed by List
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Laboratory evidence for carbapenemase production or resistance mechanism

- Phenotypic methods for carbapenemase production:
 - Carba NP
 - Metallo- β -lactamase testing (e.g., E-test)
 - Modified Carbapenem Inactivation Method (mCIM)
 - Carbapenem Inactivation Method (CIM)
 - Modified Hodge Test (MHT)

Laboratory evidence for carbapenemase production or resistance mechanism

- Phenotypic methods for carbapenemase production:
 - Carba NP
 - Metallo- β -lactamase testing (e.g., E-test)
 - Modified Carbapenem Inactivation Method (mCIM)
 - Carbapenem Inactivation Method (CIM)
 - Modified Hodge Test (MHT)
- Molecular methods for resistance mechanism:
 - PCR (for KPC, NDM, OXA-48, IMP, or VIM)
 - Gene Xpert Carba-R (for KPC, NDM, OXA-48, IMP, or VIM)

Example molecular method result

<u>Test Name</u>	<u>Results</u>	<u>Date Reported</u>
Cepheid GeneXpert Carba-R assay		09/06/2018
KPC	KPC gene DETECTED by real time rtPCR.	09/06/2018
IMP	IMP gene NOT DETECTED by real time rtPCR.	09/06/2018
NDM	NDM gene NOT DETECTED by real time rtPCR.	09/06/2018
OXA	OXA-48 gene NOT DETECTED by real time rtPCR.	09/06/2018
VIM	VIM gene NOT DETECTED by real time rtPCR.	09/06/2018

Example molecular method result

<u>Test Name</u>	<u>Results</u>	<u>Date Reported</u>
Cepheid GeneXpert Carba-R assay		09/06/2018
KPC	KPC gene DETECTED by real time rtPCR.	
IMP	IMP gene NOT DETECTED by real time rtPCR.	09/06/2018
NDM	NDM gene NOT DETECTED by real time rtPCR.	09/06/2018
OXA	OXA-48 gene NOT DETECTED by real time rtPCR.	09/06/2018
VIM	VIM gene NOT DETECTED by real time rtPCR.	09/06/2018

Exercise 1

What do you think?

Order CULTURE, URINE [URC] (Order 308868132)

Ordering Provider

Authorizing
[REDACTED]

Acknowledgement Info

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Placing Order	05/17/17 1927	[REDACTED]	05/17/17 1957
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AMPICILLIN	MIC	RESISTANT	Final
AUGMENTIN	MIC	RESISTANT	Final
CIPROFLOXACIN	MIC	RESISTANT	Final
ERTAPENEM	MIC	RESISTANT	Final
GENTAMICIN	MIC	SUSCEPTIBLE	Final
NITROFURANTOIN	MIC	SUSCEPTIBLE	Final
PIPERACILLIN/AZOBACTAM	MIC	RESISTANT	Final
TRIMETH-SULFAMETHOXAZOLE	MIC	SUSCEPTIBLE	Final

Lab and Collection

CULTURE, URINE on 6/3/2017

Result History

CULTURE, URINE on 6/6/2017

Reviewed by List

[REDACTED]

View SmartLink Info

Culture,Urine (Order #308868172) on 6/3/17

Exercise 1

What do you think?

• Organism

Antibiotic

Organism

>100,000 cfu/ml enterobacter
cloacae

• Susceptibility

AMP/SULBACTAM	MIC	RESISTANT	Final
AMPICILLIN	MIC	RESISTANT	Final
AUGMENTIN	MIC	RESISTANT	Final
CIPROFLOXACIN	MIC	RESISTANT	Final
ERTAPENEM	MIC	RESISTANT	Final
GENTAMICIN	MIC	SUSCEPTIBLE	Final
NITROFURANTOIN	MIC	SUSCEPTIBLE	Final
PIPERACILLIN/TAZOBACTAM	MIC	RESISTANT	Final
TRIMETH- SULFAMETHOXAZOLE	MIC	SUSCEPTIBLE	Final

Exercise 1

What do you think?

- Organism

Antibiotic

Organism

>100,000 cfu/ml enterobacter cloacae

- Susceptibility

AMP/SULBACTAM	MIC	RESISTANT	Final
AMPICILLIN	MIC	RESISTANT	Final
AUGMENTIN	MIC	RESISTANT	Final
CIPROFLOXACIN	MIC	RESISTANT	Final
ERTAPENEM	MIC	RESISTANT	Final
GENTAMICIN	MIC	SUSCEPTIBLE	Final
NITROFURANTOIN	MIC	SUSCEPTIBLE	Final
PIPERACILLIN/TAZOBACTAM	MIC	RESISTANT	Final
TRIMETH-SULFAMETHOXAZOLE	MIC	SUSCEPTIBLE	Final

HINT: Carbapenem antibiotics include:

- Doripenem
- Ertapenem
- Imipenem
- Meropenem

Exercise 1

What do you think?

• Organism

Antibiotic

Organism

>100,000 cfu/ml enterobacter cloacae

• Susceptibility

AMP/SULBACTAM	MIC	RESISTANT	Final
AMPICILLIN	MIC	RESISTANT	Final
AUGMENTIN	MIC	RESISTANT	Final
CIPROFLOXACIN	MIC	RESISTANT	Final
ERTAPENEM	MIC	RESISTANT	Final
GENTAMICIN	MIC	SUSCEPTIBLE	Final
NITROFURANTOIN	MIC	SUSCEPTIBLE	Final
PIPERACILLIN/TAZOBACTAM	MIC	RESISTANT	Final
TRIMETH-SULFAMETHOXAZOLE	MIC	SUSCEPTIBLE	Final

Exercise 1

What do you think?

- Organism:

Enterobacter cloacae

- Susceptibility:

Resistant to ertapenem

Antibiotic		Organism	
		>100,000 cfu/ml enterobacter cloacae	
AMP/SULBACTAM	MIC	RESISTANT	Final
AMPICILLIN	MIC	RESISTANT	Final
AUGMENTIN	MIC	RESISTANT	Final
CIPROFLOXACIN	MIC	RESISTANT	Final
ERTAPENEM	MIC	RESISTANT	Final
GENTAMICIN	MIC	SUSCEPTIBLE	Final
NITROFURANTOIN	MIC	SUSCEPTIBLE	Final
PIPERACILLIN/TAZOBACTAM	MIC	RESISTANT	Final
TRIMETH-SULFAMETHOXAZOLE	MIC	SUSCEPTIBLE	Final

Exercise 1

What do you think?

- Organism:

Enterobacter cloacae

- Susceptibility:

Resistant to ertapenem



CRE alert

Antibiotic

Organism

>100,000 cfu/ml enterobacter cloacae

AMP/SULBACTAM	MIC	RESISTANT	Final
AMPICILLIN	MIC	RESISTANT	Final
AUGMENTIN	MIC	RESISTANT	Final
CIPROFLOXACIN	MIC	RESISTANT	Final
ERTAPENEM	MIC	RESISTANT	Final
GENTAMICIN	MIC	SUSCEPTIBLE	Final
NITROFURANTOIN	MIC	SUSCEPTIBLE	Final
PIPERACILLIN/TAZOBACTAM	MIC	RESISTANT	Final
TRIMETH-SULFAMETHOXAZOLE	MIC	SUSCEPTIBLE	Final

Exercise 2

What do you think?

Result				
Urine Culture, Routine				
Result 1		Klebsiella pneumoniae Abnormal		
	25,000-50,000 colony forming units per mL			
Antimicrobial Susceptibility				
** S = Susceptible; I = Intermediate; R = Resistant **				
P = Positive; N = Negative				
MICS are expressed in micrograms per mL				
Antibiotic	RSLT#1	RSLT#2	RSLT#3	RSLT#4
Amoxicillin/Clavulanic Acid	R			
Ampicillin	R			
Cefazolin	R			
Cefepime	R			
→ Ceftriaxone	R			
Cefuroxime	R			
Cephalothin	R			
Ciprofloxacin	R			
Ertapenem	S			
Gentamicin	S			
Imipenem	S			
Levofloxacin	R			
Nitrofurantoin	I			
Piperacillin	R			
Tetracycline	R			
Tobramycin	R			
Trimethoprim/Sulfa	R			

Exercise 2

What do you think?

- Organism
- Susceptibility

Result

Urine Culture, Routine
Result 1

Klebsiella pneumoniae Abnormal

25,000-50,000 colony forming units per mL

Antimicrobial Susceptibility

** S = Susceptible; I = Intermediate; R = Resistant **
P = Positive; N = Negative
MICS are expressed in micrograms per mL

Antibiotic	RSLT#1	RSLT#2	RSLT#3	RSLT#4
Amoxicillin/Clavulanic Acid	R			
Ampicillin	R			
Cefazolin	R			
Cefepime	R			
→ Ceftriaxone	R			
Cefuroxime	R			
Cephalothin	R			
Ciprofloxacin	R			
Ertapenem	S			
Gentamicin	S			
Imipenem	S			
Levofloxacin	R			
Nitrofurantoin	I			
Piperacillin	R			
Tetracycline	R			
Tobramycin	R			
Trimethoprim/Sulfa	R			

Exercise 2

What do you think?

- Organism

K. pneumoniae

- Susceptibility

S to Ertapenem

S to Imipenem

Result

Urine Culture, Routine
Result 1

Klebsiella pneumoniae Abnormal

25,000-50,000 colony forming units per mL

Antimicrobial Susceptibility

** S = Susceptible; I = Intermediate; R = Resistant **
P = Positive; N = Negative
MICS are expressed in micrograms per mL

Antibiotic	RSLT#1	RSLT#2	RSLT#3	RSLT#4
Amoxicillin/Clavulanic Acid	R			
Ampicillin	R			
Cefazolin	R			
Cefepime	R			
→ Ceftriaxone	R			
Cefuroxime	R			
Cephalothin	R			
Ciprofloxacin	R			
Ertapenem	S			
Gentamicin	S			
Imipenem	S			
Levofloxacin	R			
Nitrofurantoin	I			
Piperacillin	R			
Tetracycline	R			
Tobramycin	R			
Trimethoprim/Sulfa	R			

Exercise 2

What do you think?


- Organism

K. pneumoniae

- Susceptibility

S to Ertapenem

S to Imipenem


NOT CRE

Result

Urine Culture, Routine
Result 1

Klebsiella pneumoniae Abnormal

25,000-50,000 colony forming units per mL

Antimicrobial Susceptibility

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Ertapenem	S			
Gentamicin	S			
Imipenem	S			
Levofloxacin	R			
Nitrofurantoin	I			
Piperacillin	R			
Tetracycline	R			
Tobramycin	R			
Trimethoprim/Sulfa	R			

NC SLPH funded to characterize CRE

1. Antimicrobial susceptibility testing (AST) to confirm phenotypic detection of CRE

2. Phenotypic methods to detect carbapenemase production

Carbapenem Inactivation Method (CIM) -- preferred method

3. Molecular methods for carbapenemase gene detection

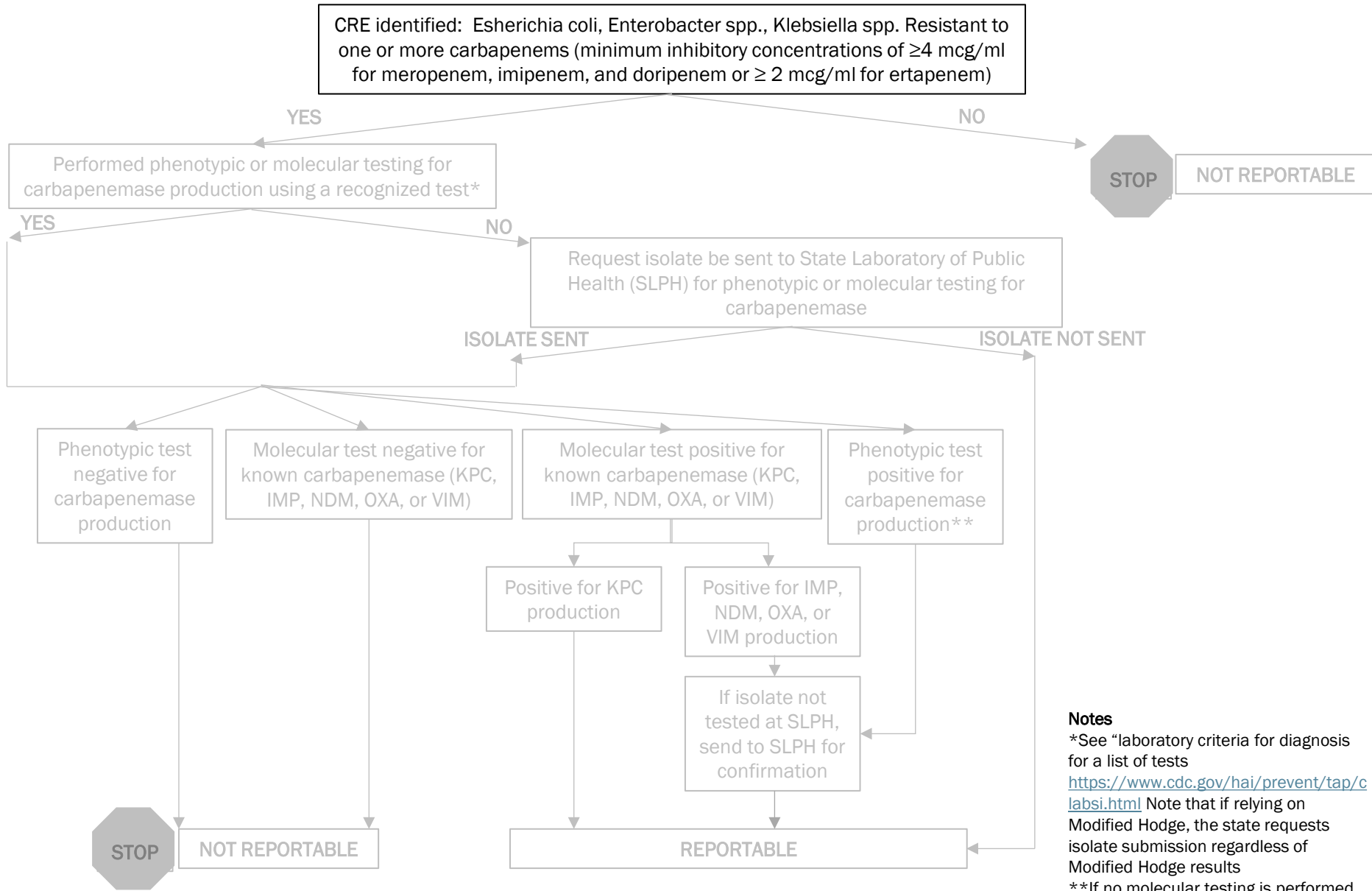
KPC, NDM, and OXA 48-like

VIM, IMP, *mcr-1* -optional

When should isolates be sent to the State Laboratory of Public Health?

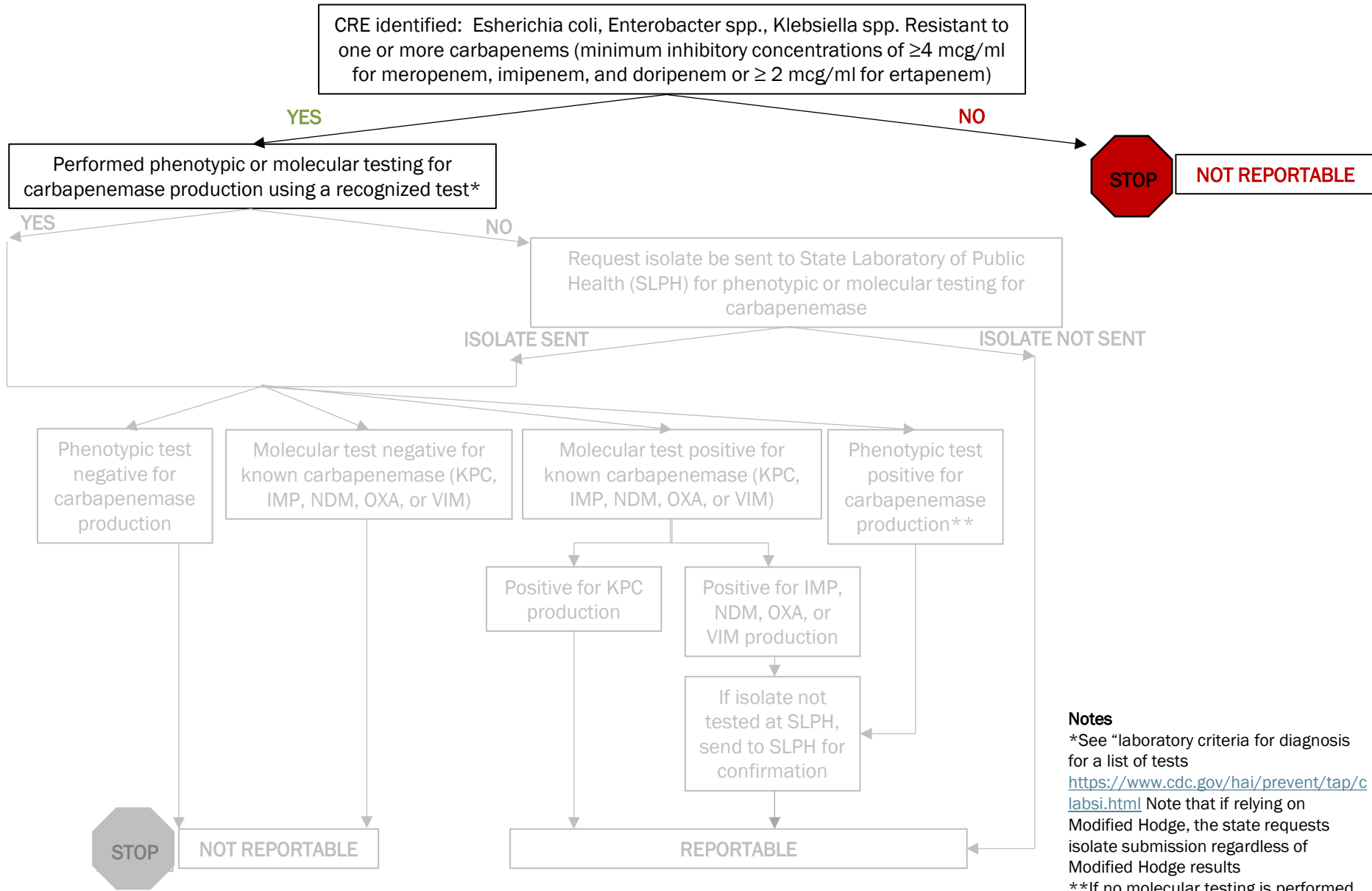
- *Enterobacter* spp., *E. coli* or *Klebsiella* spp. resistant to any carbapenem in the absence of carbapenemase resistance mechanism testing
- Identification of CRE producing a carbapenemase other than KPC may be requested for additional testing.

What should be reported to the North Carolina Division of Public Health (NC DPH) Carbapenemase-Producing Carbapenem-Resistant Enterobacteriaceae (CP-CRE)



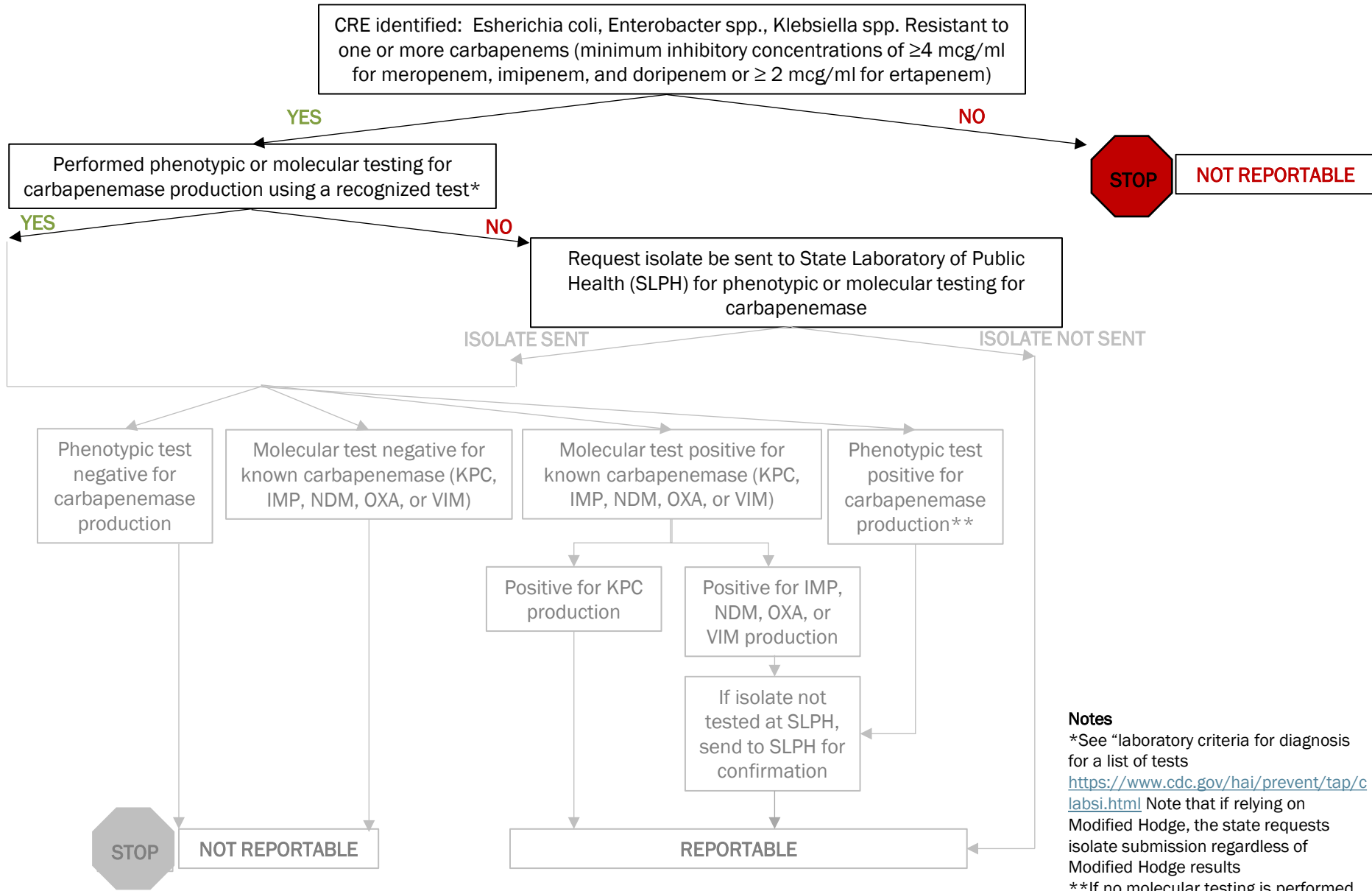
Notes
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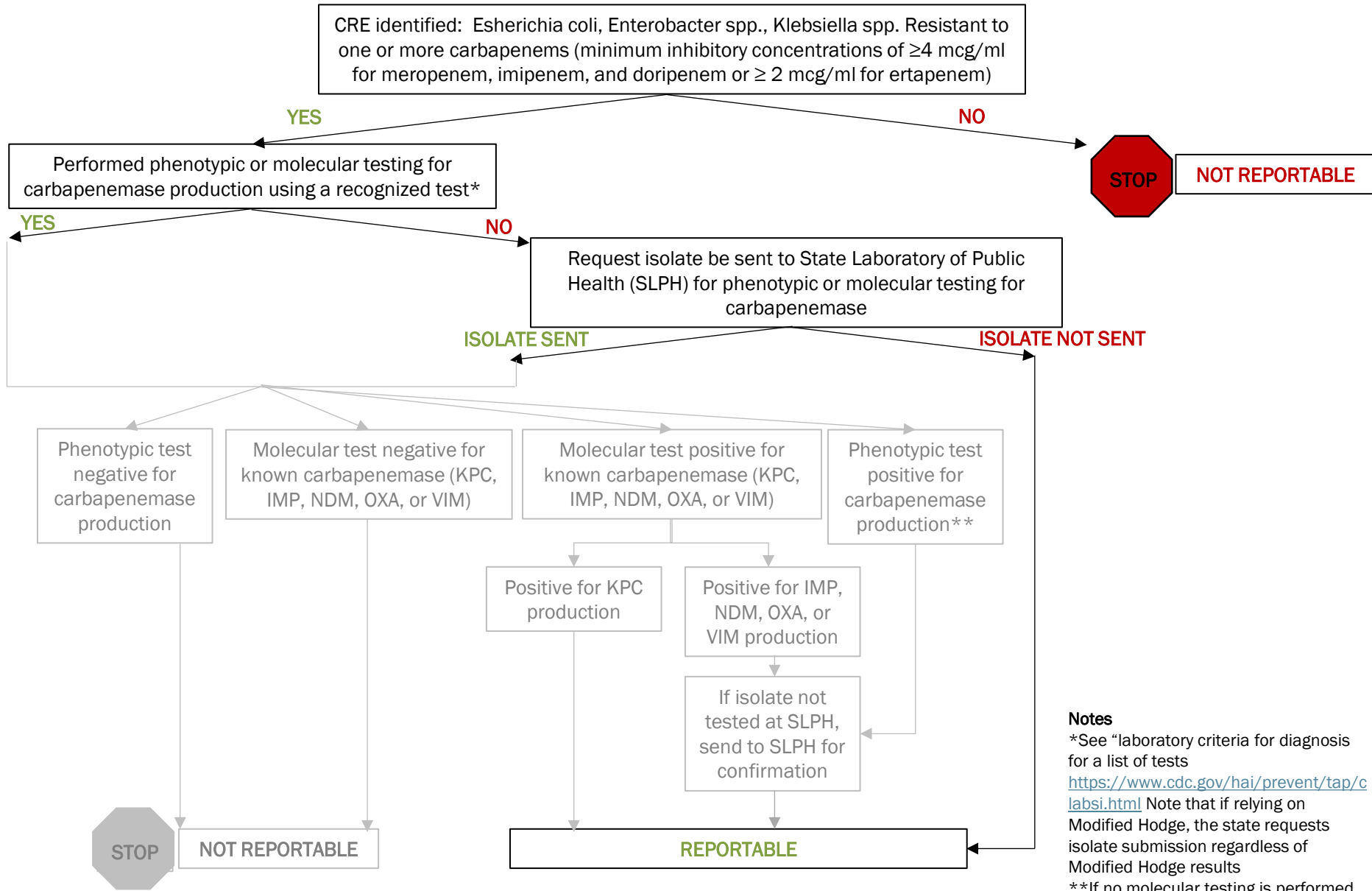
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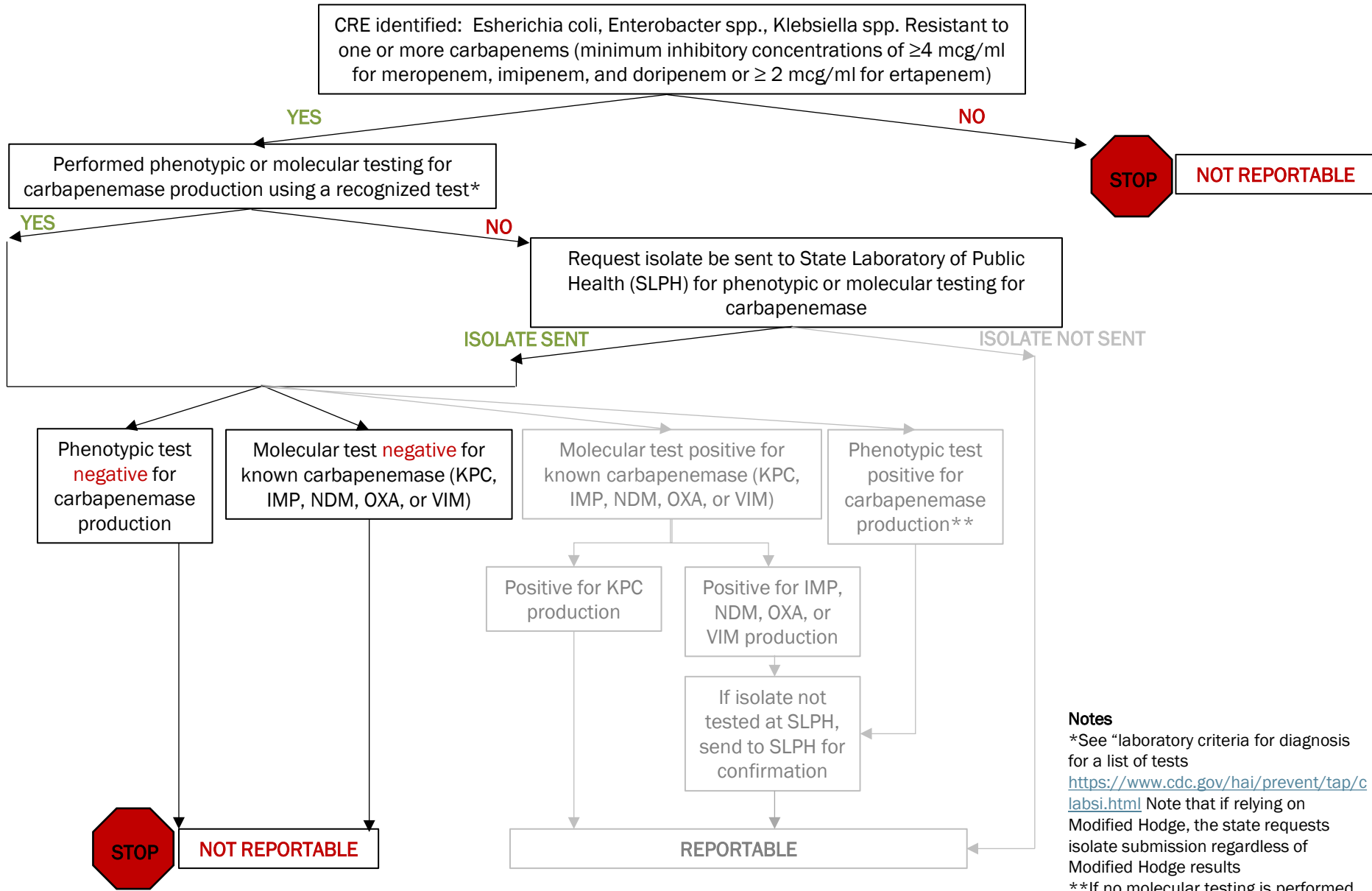
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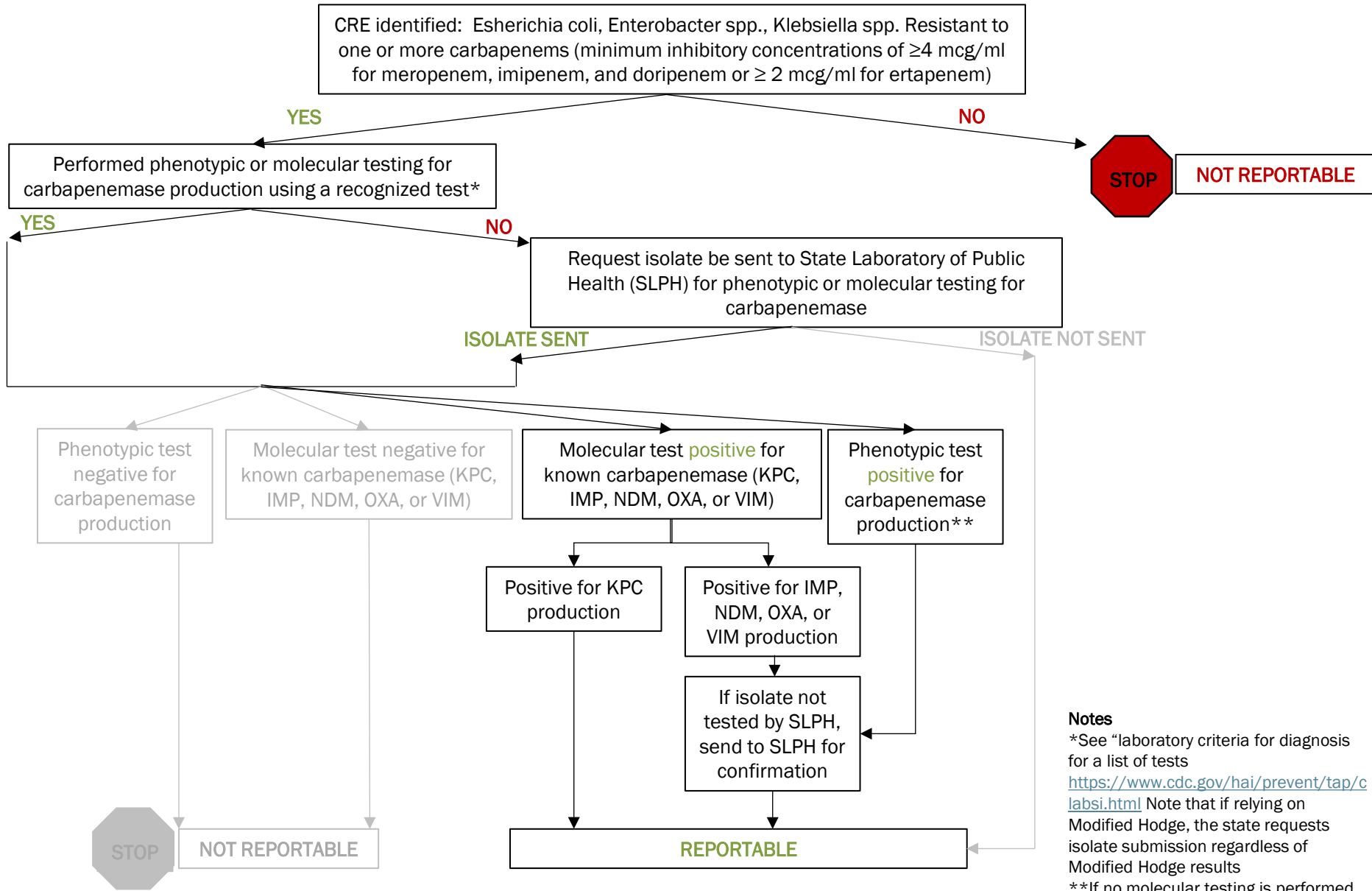
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How am I going to prioritize?

Priority	Mechanism	Setting	Number of Cases
1	Non KPC CP-CRE	LTCF	1 or more
2	Non KPC CP-CRE	ACH	1 or more
3	KPC CP-CRE	LTCF	2 or more
4	KPC CP-CRE	ACH	2 or more
5	KPC CP-CRE	LTCF	1
6	KPC CP-CRE	ACH	1
7	Non CP-CRE	LTCF	2 or more
8	Non CP-CRE	ACH	2 or more

LTCF = long-term care facility

ACH = acute care hospital

How am I going to prioritize?

Priority	Mechanism	Setting	Number of Cases
1	Non KPC CP-CRE	LTCF	1 or more

LTCF = long-term care facility

ACH = acute care hospital

How am I going to prioritize?

Priority	Mechanism	Setting	Number of Cases
1	Non KPC CP-CRE	LTCF	1 or more
2	Non KPC CP-CRE	ACH	1 or more

LTCF = long-term care facility
 ACH = acute care hospital

How am I going to prioritize?

Priority	Mechanism	Setting	Number of Cases
3	KPC CP-CRE	LTCF	2 or more
4	KPC CP-CRE	ACH	2 or more

LTCF = long-term care facility

ACH = acute care hospital

How am I going to prioritize?

Priority	Mechanism	Setting	Number of Cases
5	KPC CP-CRE	LTCF	1
6	KPC CP-CRE	ACH	1

LTCF = long-term care facility

ACH = acute care hospital

How am I going to prioritize?

Priority	Mechanism	Setting	Number of Cases
7	Non CP-CRE	LTCF	2 or more
8	Non CP-CRE	ACH	2 or more

LTCF = long-term care facility

ACH = acute care hospital

Resources:

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Carbapenem-Resistant Enterobacteriaceae (CRE) Investigation Overview

Carbapenemase-producing CRE (CP-CRE) are of primary public health concern and as such, an investigation should be opened within 24 hours of confirming identification of CP-CRE. Notify facilities, providers, and infected/colonized patients as appropriate. Conduct an investigation to assess the risk factors for transmission in the affected setting. Implement control measures such as contact precautions as soon as possible. Discuss the need for screenings of potentially exposed individuals. The appropriate screenings can be performed through the State Laboratory of Public Health (SLPH) and by the Antibiotic Resistance Laboratory Network (ARLN) free of charge and the Communicable Disease Branch (CDB) is available to help coordinate these screenings. Screening recommendations may differ between healthcare settings. CDB is available for consultation regarding investigations, please call the Epidemiologist on call at 919-733-3419. Refer to <https://www.cdc.gov/hai/outbreaks/docs/Health-Response-Contain-MDRO.pdf> for additional information.

Basic Steps of a CRE Investigation

1. Confirm case meets definition	<ul style="list-style-type: none"> If the organism is <i>Escherichia coli</i>, <i>Enterobacter</i> spp., or <i>Klebsiella</i> spp. and is resistant to one or more carbapenems (minimum inhibitory concentrations of ≥ 4 mcg/ml for meropenem, imipenem, and doripenem or ≥ 2 mcg/ml for ertapenem) it meets case definition for CRE If no phenotypic or molecular testing has been performed on the isolate, arrange to have it sent to the State Laboratory of Public Health for characterization Facilities capable of performing phenotypic or molecular testing should save isolates testing positive for carbapenemase production or for a specific mechanism of resistance if possible, as they may be asked to forward these to SLPH for additional characterization within one month Implement contact precautions for patient as soon as CRE is identified
2. Notifying the Facility, Providers, and Patients as appropriate	<ul style="list-style-type: none"> Notify the facility, providers, and patients (infected or colonized) and conduct a healthcare investigation <ul style="list-style-type: none"> Review healthcare exposure (typically for the past 30 days) Notify identified healthcare facilities Ensure appropriate control measures are in use (i.e. contact precautions and appropriate environmental cleaning)
3. Perform Risk Assessment of Patient	<ul style="list-style-type: none"> Review patient's exposures and risk factors including: <ul style="list-style-type: none"> Recent international hospitalizations Antibiotic use within the past 30 days Hemodialysis treatment Recent domestic hospitalizations (notify facility if appropriate) Recent procedures (endoscopies, surgeries etc.) Indwelling Medical Device Use (Intravenous catheters, urinary catheters, tracheostomy tubes etc.) Open wounds (If yes, which wound clinic is attended and notify if appropriate) Recent Long Term Care Facility admission (Document name of facility and notify if appropriate) Refer to Case Report Form for more information
4. Conduct IP Assessment (in consultation with the North Carolina Division of Public Health)	<ul style="list-style-type: none"> Assess infection prevention (IP) practices and opportunities for transmission <ul style="list-style-type: none"> Risk of Transmission Hand hygiene compliance of healthcare workers Does the patient share a room? Was the patient on contact precautions during healthcare stay? Did the patient share any devices for procedures (endoscopes etc.)? Are there any environmental reservoirs (Do cleaning services use FDA approved cleaners)? Interfacility communication regarding MultiDrug-Resistant Organisms if the patient was transferred A site visit to one or more facilities may be warranted (consult DPH for more information)
5. Conduct a Contact Investigation	<ul style="list-style-type: none"> CDC recommends screening roommates and others that are epidemiologically linked due to recent healthcare exposure The following are considerations to make when assessing who to screen <ul style="list-style-type: none"> Recent healthcare exposure Mechanism of Resistance Contact Precautions Infection Prevention assessment The North Carolina Division of Public Health is available to facilitate surveillance screening and coordination with the Antibiotic Resistance Laboratory Network
6. Prospective Surveillance	<ul style="list-style-type: none"> Monitor infection prevention practices to reduce transmission within the facility Monitor facility for new CRE or carbapenemase producing CRE cases

For more information: <https://epi.publichealth.nc.gov/cd/lhds/manuals/cd/toc.html>

Resources:

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Carbapenem-Resistant Enterobacteriaceae (CRE) Disease Reporting and Surveillance Case Definition

What to report:

Identification of CRE from a clinical specimen associated with either infection or colonization, including all susceptibility results and all phenotypic or molecular test results.

For the purpose of reporting, CRE are defined as:

- (1) *Enterobacter* spp, *E.coli* or *Klebsiella* spp positive for a known carbapenemase resistance mechanism or positive on a phenotypic test for carbapenemase production; or
- (2) *Enterobacter* spp, *E.coli* or *Klebsiella* spp resistant to any carbapenem in the absence of carbapenemase resistance mechanism testing or phenotypic testing for carbapenemase production.

Isolate Submission:

Further characterization of CRE isolates is available at no cost to the submitter through the state laboratory of public health. Isolate submission is requested for the following:

- *Enterobacter* spp., *E. coli* or *Klebsiella* spp. resistant to any carbapenem in the absence of carbapenemase resistance mechanism testing
- *Enterobacter* spp., *E. coli* or *Klebsiella* spp. resistant to any carbapenem and positive for carbapenemase production via phenotypic test
- *Enterobacter* spp., *E. coli* or *Klebsiella* spp. with discordant phenotypic and molecular results for carbapenemase production

Identification of CRE producing a carbapenemase other than *Klebsiella pneumoniae* carbapenemase (KPC) may also be requested for isolate submission. If your facility identifies Carbapenemase Producing Carbapenem-Resistant Enterobacteriaceae (CP-CRE) among Enterobacteriaceae spp. other than *Enterobacter* spp., *E. coli* or *Klebsiella* spp., consider sending these isolates for testing as well.

CP-CRE 2018 CDC Case Definition:

E. coli, *Klebsiella* spp., or *Enterobacter* spp. where the isolate is:

- Positive for carbapenemase production by a phenotypic method
- OR-
- Positive for a known carbapenemase resistance mechanism by a CDC recognized test (see methods below)

Methods for detecting Carbapenemase production:

Phenotypic methods for carbapenemase production:


- Carba NP positive
- Metallo- β -lactamase testing (e.g., E-test) positive
- Modified Carbapenem Inactivation Method (mCIM) positive or indeterminate
- Carbapenem Inactivation Method (CIM) positive
- Modified Hodge Test (MHT) positive

Molecular methods for resistance mechanism:

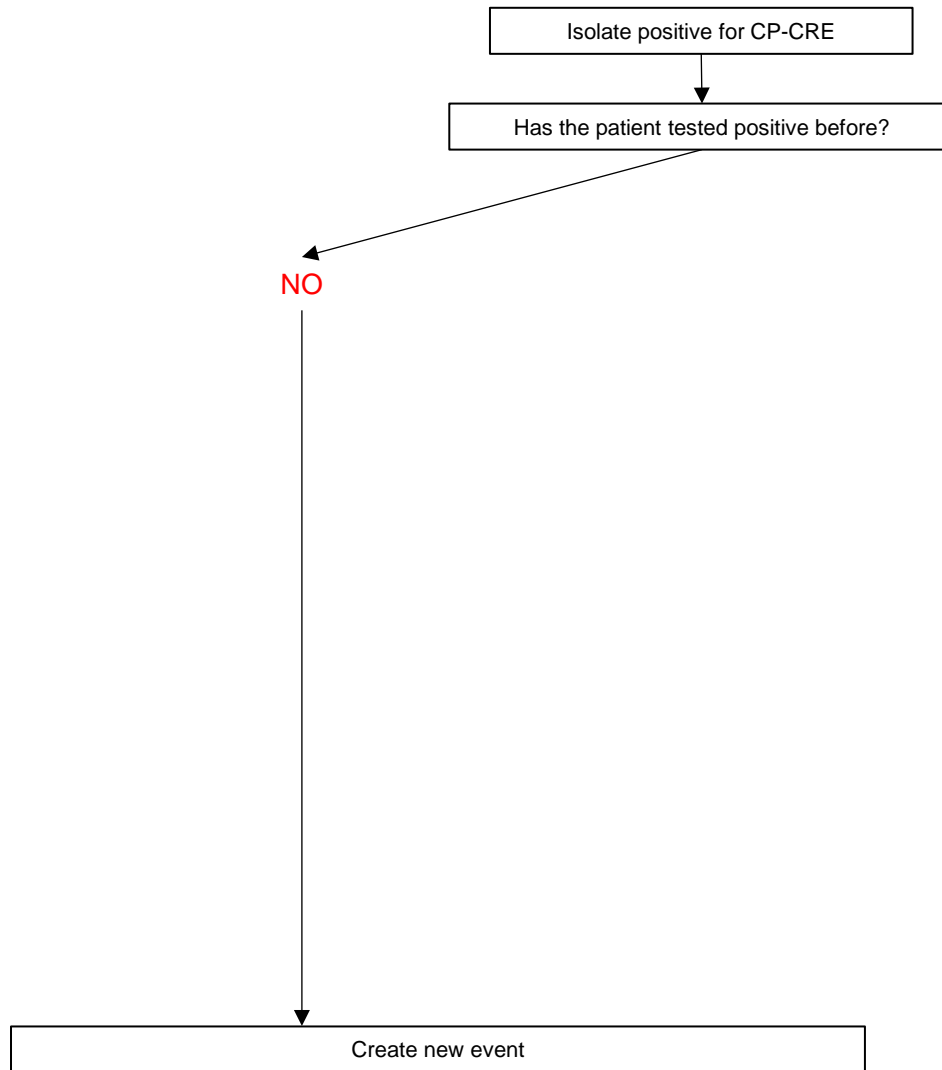
- PCR positive (for *Klebsiella pneumoniae* Carbapenemase [KPC], New Delhi metallo- β -lactamase [NDM], oxacillinase-48 [OXA-48], Verona integron-encoded metallo- β -lactamase [VIM], or imipenemase [IMP])
- Xpert Carba-R positive (for KPC, NDM, OXA-48, VIM, IMP)
- PCR or Xpert Carba-R positive for novel carbapenemase

Criteria to Distinguish a New CP-CRE Case from an Existing CP-CRE Case:

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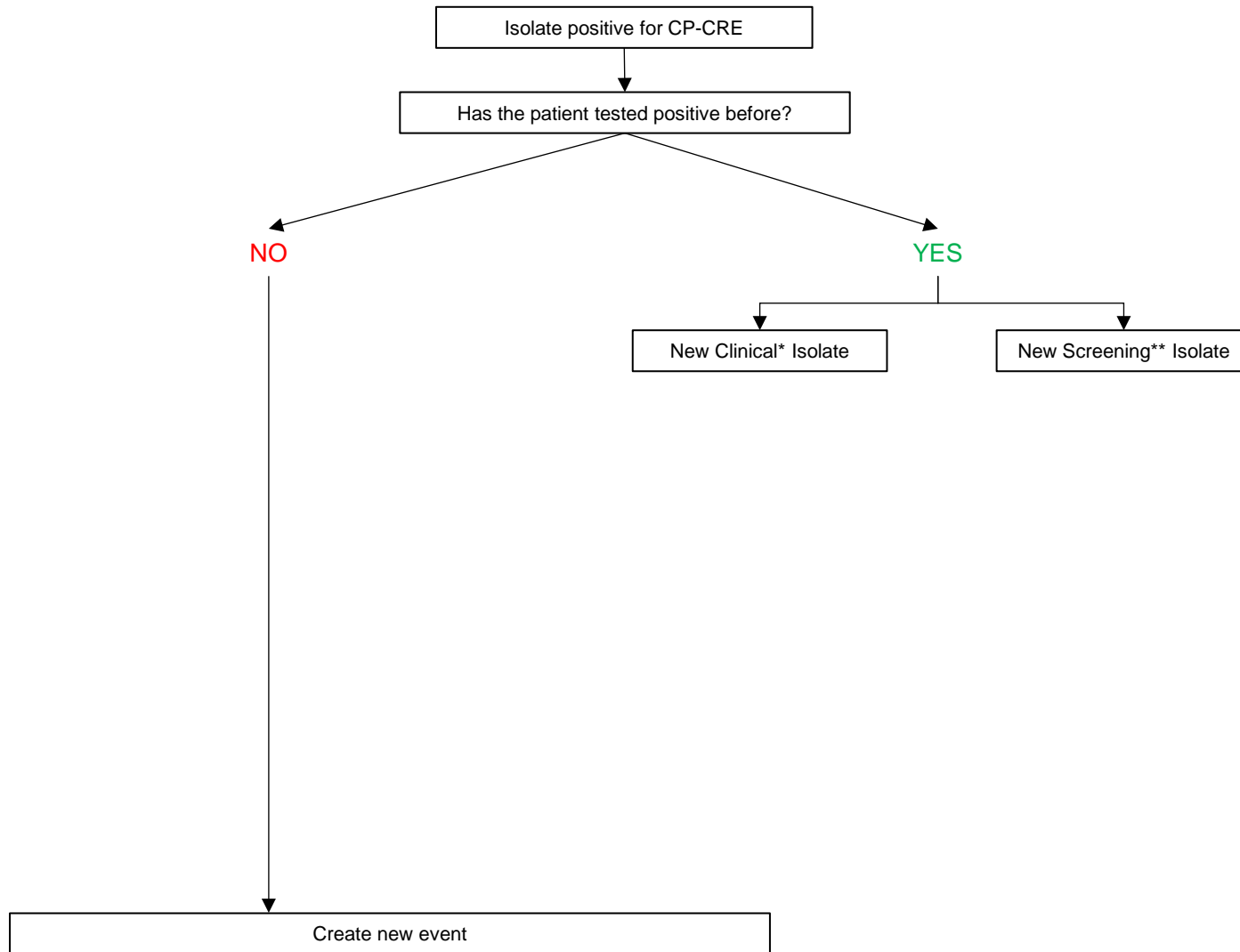
What to do with a confirmed Carbapenemase Producing CRE (CP-CRE) result



* A clinical isolate is obtained through a clinical diagnostic test for the purposes of diagnosis and/or treatment

** A screening isolate is obtained through a rectal swab performed for the purpose of surveillance

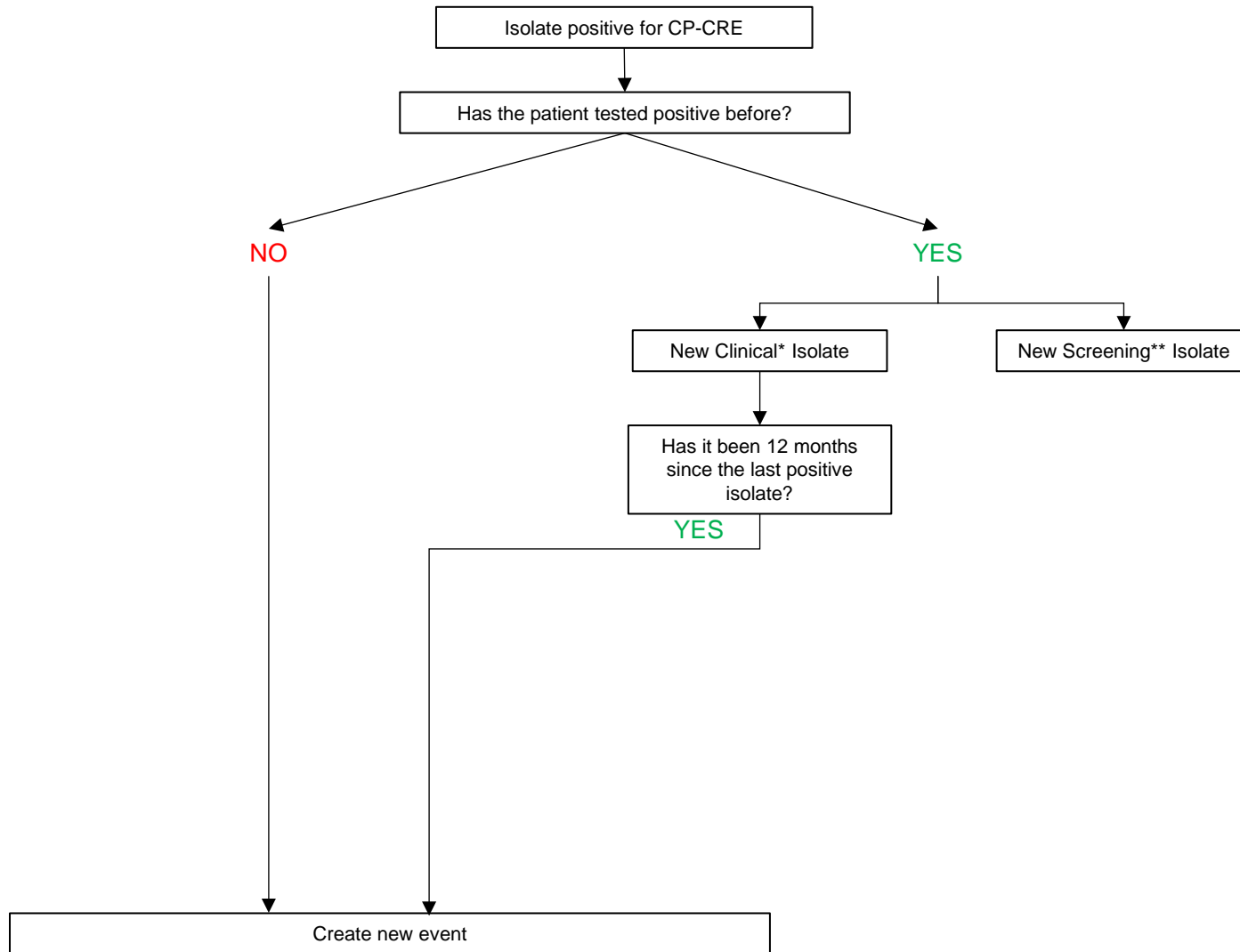
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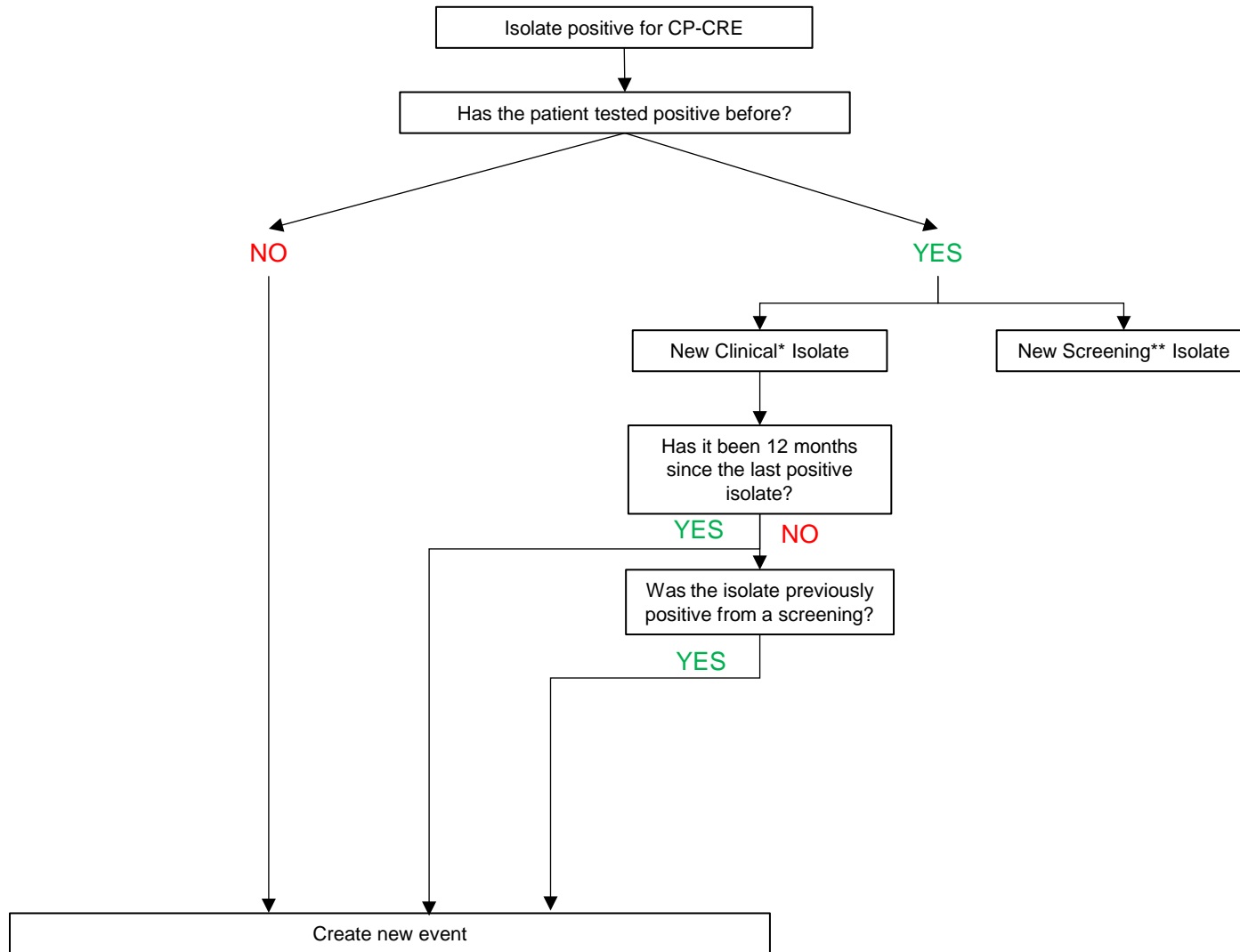
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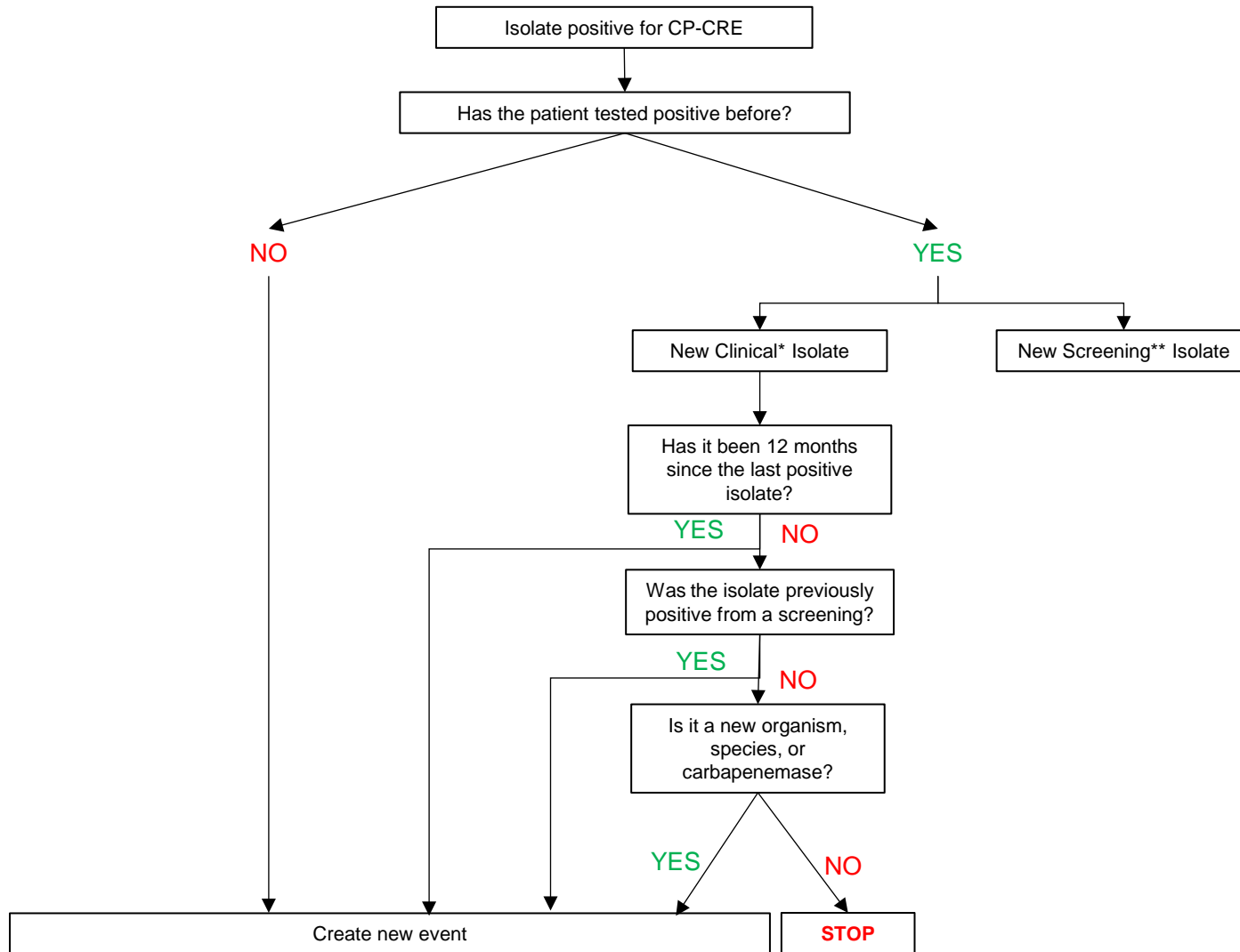
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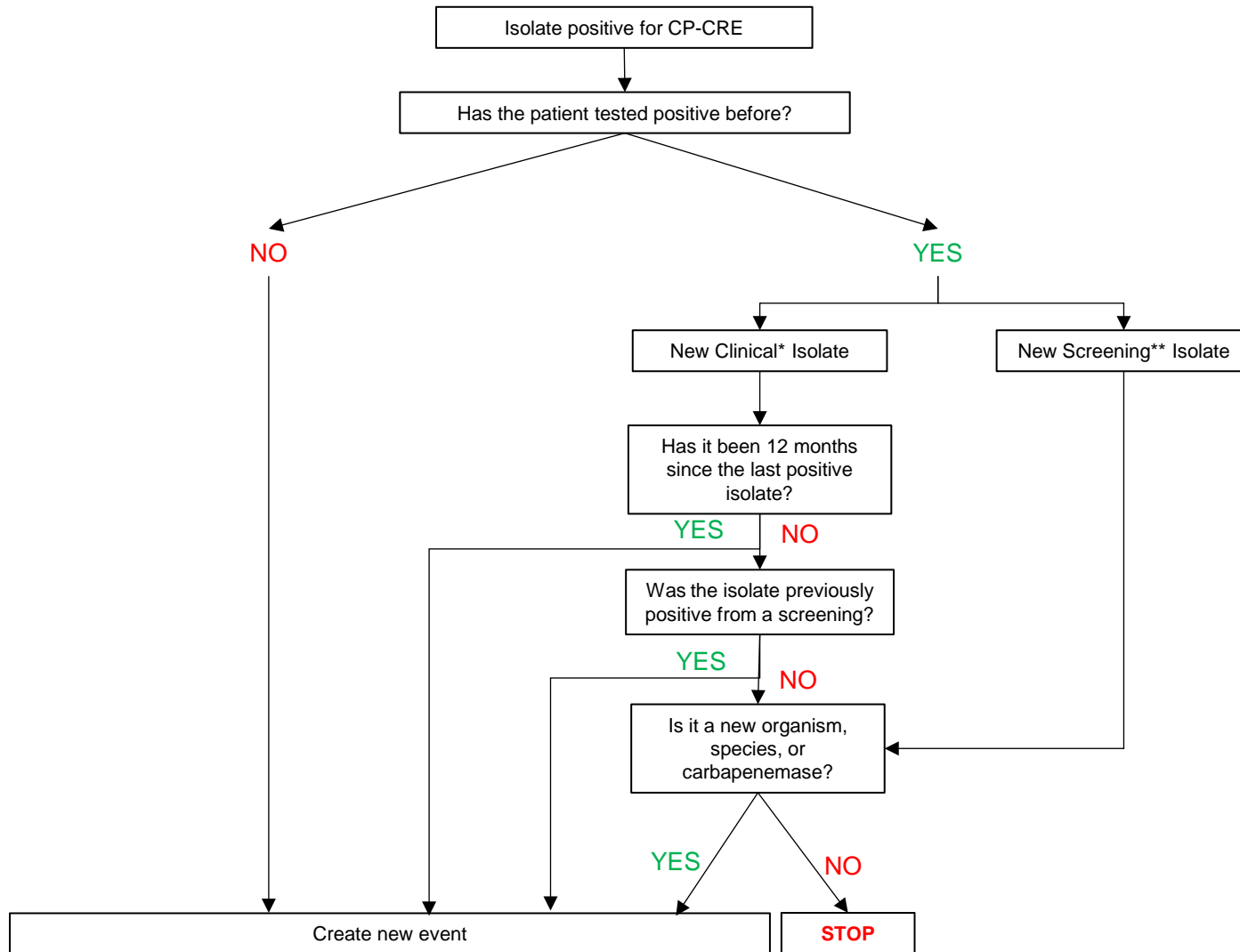
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Administrative Package

1. Reporter Information

Reporting physician/practice	<input type="text"/>
Contact person/title	<input type="text"/>
Phone number	<input type="text"/>
Fax (area code):	<input type="text"/>
Health care provider for this disease (if not reporting physician)	<input type="text"/>
Name of provider's practice or facility	<input type="text"/>
Telephone number for health care provider (area code):	<input type="text"/>
Fax number (area code):	<input type="text"/>


2. NC County of Residence for the Event

3. Date of Report

MM/DD/YYYY

MM/DD/YYYY	
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North Carolina CRE Laboratory Task Force

Carbapenem-Resistant Enterobacteriaceae (CRE) Screening and Confirmatory Testing Recommendations in North Carolina 2018

Consensus guidelines developed by the
North Carolina Carbapenem-Resistant Enterobacteriaceae Laboratory Task Force
in association with the North Carolina Surveillance for Healthcare
Associated and Resistant Pathogens Patient Safety
Program and the North Carolina Laboratory Response Forum

North Carolina Carbapenem-Resistant Enterobacteriaceae Laboratory Task Force Members:

Elizabeth Palavecino, **Wake Forest University Baptist Medical Center**; Gerald Capraro, **Carolinas Pathology Group, Atrium Health**; Heather Dubendris, **CDB/NCDPH**; James Lewis, **CDB/NCDPH**; Kevin Hazen, **Duke University**; Robert Sautter, **RL Sautter Consulting LLC**; Shermalyn Greene, **SLPH/NCDPH**

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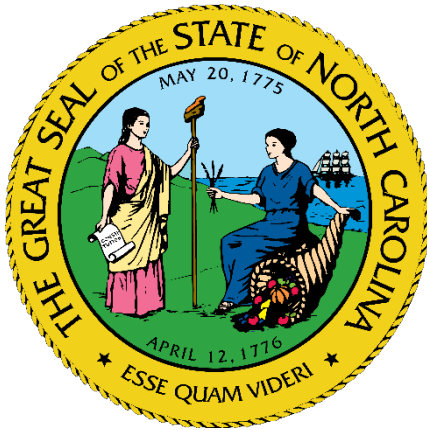
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NEXT TIME...



CRE Surveillance, Identification, Containment & Response - PART TWO

SHARPPS Program



Questions?

SHARPPS inbox: NCHAI@DHHS.NC.GOV

Epi-On-Call: 919-733-3419

Heather Dubendris, MSPH

heather.dubendris@dhhs.nc.gov

919-546-1654

