

2020 Carbapenem Resistance Veterinary Diagnostic Laboratory Survey

The purpose of this survey is to assess current activities and technologies used to detect carbapenem resistance in Enterobacteriaceae, Pseudomonas, and Acinetobacter from dogs and cats and to determine how information regarding carbapenem-resistance is shared with laboratory clients, the veterinary and scientific community, human and animal health officials, public health, and other interested parties.

This survey is being administered through the American Association of Veterinary Laboratory Diagnosticians (AAVLD) in collaboration with the Centers for Disease Control and Prevention (CDC). It contains a series of questions regarding laboratory activities and practices related to detection, carbapenem susceptibility testing, carbapenemase mechanism testing, data sharing capabilities, and emerging technologies for detecting carbapenem resistance. Use of trade names and commercial sources is for identification only and does not imply endorsement. Participation is completely voluntary.

The estimated time to complete this survey is (estimated time from pilot testing to be input here). Your survey answers will be sent to a link at REDCap where data will be stored in a password protected electronic format. The information gathered in this survey may be published; data will be published in aggregate form without identifying any individual laboratory in order to protect the privacy of your laboratory and maintain confidentiality. A summary of the results from this survey will be provided to your laboratory via email through AAVLD.

We appreciate your participation in this survey. Please complete the survey by (date six weeks from initial email to be input here). If you have any questions or concerns regarding the survey, please contact Michelle Waltenburg [nvr6@cdc.gov].

Laboratory Name: _____

State: _____

Title of person completing the survey: _____
(director, administrator, supervisor)

CDC estimates the average public reporting burden for this collection of information as 20 minutes, including the time for reviewing instructions, searching existing data/information sources, gathering and maintaining the data/information needed, and completing and reviewing the collection of information. An agency may not conduct or sponsor, and a person is not required to respond to a collection of information unless it displays a currently valid OMB control number. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing burden to CDC/ATSDR Information Collection Review Office, 1600 Clifton Road NE, MS D-74, Atlanta, Georgia 30333; ATTN: PRA (0920-0879).

Section 1: The first set of questions ask about laboratory testing scope.**Please check the appropriate response or if needed write answers or comments in the spaces provided.**

1. From which of the following sources does your laboratory receive clinical samples (mark all that apply)?

- Academic veterinary practices
- Private veterinary practices
- Other veterinary diagnostic laboratories
- Other (please specify below):

Specify other: _____

2. What proportion of samples received by your laboratory are from dogs and cats?

- Less than 10%
- Between 10% and < 25%
- Between 25% and < 50%
- Between 50% and < 75%
- 75% or more

Section 2: The second set of questions ask about bacterial identification and antimicrobial susceptibility testing (AST).**Please check the appropriate response or if needed write answers or comments in the spaces provided.**

3. Which method(s) does your laboratory currently use for Gram-negative species identification (mark all that apply)?

- Conventional biochemical tube tests
- Commercially available test strips (e.g., API® strips)
- Automated bacterial ID systems (e.g., Vitek®, BD Phoenix (TM), Sensititre (TM), MicroScan)
- MALDI-TOF system
- Sequencing or other molecular based methods
- Other (please specify below):

Specify other:

4. Does your laboratory conduct antimicrobial susceptibility testing (AST) on any Gram-negative isolates?

- Yes No

The following attachment contains information on carbapenem breakpoints by laboratory testing guidelines. Please consult the information as needed to answer Question 5.

[Attachment: "Laboratory testing guidelines.pdf"]

5. What laboratory testing standards does your laboratory use (select all that apply)?

- CLSI M100
- CLSI VET08
- VetCAST/EUCAST
- Other (please specify below):

Specify other:

Any comments you wish to share if you use multiple standards for identification and AST:

Section 3: The following set of questions ask about Enterobacteriaceae from dogs and cats specifically. For the purpose of this survey, Enterobacteriaceae includes, but is not limited to, the following species: E. coli, Salmonella spp., Klebsiella spp., Enterobacter spp., Citrobacter spp., Providencia spp., Proteus spp., and Morganella spp.

Please check the appropriate response or if needed write answers or comments in the spaces provided.

6. Does your laboratory conduct AST on any Enterobacteriaceae isolates?

Yes No

7. Please indicate which method your laboratory uses for primary susceptibility testing of Enterobacteriaceae from dogs and cats:

- Kirby-Bauer disk diffusion
 Automated testing instrument (e.g., Vitek®, BD Phoenix (TM), Sensititre (TM), MicroScan)
 Other broth microdilution method (please specify below):
 Agar dilution method
 Gradient diffusion method (e.g., Etest®)
 Other or use several methods (please specify or describe below):

Specify other broth microdilution method:

Specify other or describe several methods used:

8. Please indicate which method(s) your laboratory uses for secondary, supplemental, or confirmatory testing of Enterobacteriaceae from dogs and cats (if performed):

- Kirby-Bauer disk diffusion
 Automated testing instrument (e.g., Vitek®, BD Phoenix (TM), Sensititre (TM), MicroScan)
 Other broth microdilution method (please specify below):
 Agar dilution method
 Gradient diffusion method (e.g., Etest®)
 Other method (please specify below):
 Not performed

Specify other broth microdilution method:

Specify other:

9. Does your laboratory currently conduct AST on Enterobacteriaceae for clinical management of individual patients?

Yes No

9a. Which isolates undergo AST for clinical decision making?

- Most Enterobacteriaceae isolates received routinely undergo AST.
 Only Enterobacteriaceae isolates from suspected infections undergo AST.
 Only Enterobacteriaceae isolates that are requested by submitter/clinician undergo AST.
 Other Enterobacteriaceae isolates (please specify below)

Specify other: _____

10. Does your laboratory currently conduct AST on Enterobacteriaceae for any monitoring/surveillance programs?

- Yes No

10a. Please select the organism(s) included in surveillance AST:

- E. coli, commensal
 Pathogenic E. coli (e.g., STEC, EHEC, AEEC)
 Salmonella
 Klebsiella
 Enterobacter
 Citrobacter
 Providencia
 Proteus
 Morganella
 Other (please specify below):

Specify other organism(s): _____

11. Does your laboratory currently conduct AST on Enterobacteriaceae for any research projects?

- Yes No

11a. Please select the organism(s) included in research project AST:

- E. coli, commensal
 Pathogenic E. coli (e.g., STEC, EHEC, AEEC)
 Salmonella
 Klebsiella
 Enterobacter
 Citrobacter
 Providencia
 Proteus
 Morganella
 Other (please specify below):

Specify other organism(s): _____

12. For Enterobacteriaceae, if preliminary AST suggests multidrug-resistance (e.g., resistance was detected to 2 or more classes of antibiotics), does your laboratory routinely do any additional AST or mechanism of resistance testing (e.g., ESBL, carbapenemase-production) to investigate further?

- Yes No At request of client

13. For Enterobacteriaceae, does your laboratory's primary AST panel for dogs and cats include one or more third-generation cephalosporins (e.g., cefpodoxime, ceftiofur, ceftiofur, cefovecin, ceftriaxone)?

Yes No

14. Are any third-generation cephalosporins (e.g., cefpodoxime, ceftiofur, cefovecin, ceftriaxone) included in any secondary, supplemental, or confirmatory AST for Enterobacteriaceae?

Yes No

15. For Enterobacteriaceae, does your laboratory's primary AST panel for dogs and cats include one or more carbapenems?

Yes No

15a. Please select the carbapenem(s) included:

- Imipenem
- Meropenem
- Doripenem
- Ertapenem
- Other carbapenem (please specify below):

Specify other carbapenem:

16. Are any carbapenems included in any secondary, supplemental, or confirmatory AST for Enterobacteriaceae?

Yes No

16a. Please select the carbapenem(s) included:

- Imipenem
- Meropenem
- Doripenem
- Ertapenem
- Other carbapenem (please specify below):

Specify other carbapenem:

17. Does your laboratory provide MIC interpretations for carbapenems in Enterobacteriaceae?

Yes No Sometimes (please specify below):

Specify:

18. Does your laboratory provide zone diameter interpretations for carbapenems in Enterobacteriaceae?

Yes No Sometimes (please specify below):

Specify:

Section 4: The following set of questions ask about Pseudomonas aeruginosa from dogs and cats specifically.**Please check the appropriate response or if needed write answers or comments in the spaces provided.**

19. Does your laboratory conduct AST on any Pseudomonas aeruginosa isolates?

Yes No

20. Please indicate which method your laboratory uses for primary susceptibility testing of Pseudomonas aeruginosa from dogs and cats:

- Kirby-Bauer disk diffusion
 Automated testing instrument (e.g., Vitek®, BD Phoenix (TM), Sensititre (TM), MicroScan)
 Other broth microdilution method (please specify below):
 Agar dilution method
 Gradient diffusion method (e.g., Etest®)
 Other or use several methods (please specify or describe below):

Specify other broth microdilution method:

Specify other or describe several methods used:

21. Please indicate which method(s) are used for secondary, supplemental, or confirmatory testing of Pseudomonas aeruginosa from dogs and cats (if performed):

- Kirby-Bauer disk diffusion
 Automated testing instrument (e.g., Vitek®, BD Phoenix (TM), Sensititre (TM), MicroScan)
 Other broth microdilution method (please specify below):
 Agar dilution method
 Gradient diffusion method (e.g., Etest®)
 Other method (please specify below):
 Not performed

Specify other broth microdilution method:

Specify other method:

22. Does your laboratory currently conduct AST on Pseudomonas aeruginosa for clinical management of individual patients?

Yes No

22a. Which isolates undergo AST for clinical decision making?

- Most Pseudomonas aeruginosa isolates received routinely undergo AST.
 Only Pseudomonas aeruginosa isolates from suspected infections undergo AST.
 Only Pseudomonas aeruginosa isolates that are requested by submitter/clinician undergo AST.
 Other Pseudomonas aeruginosa isolates (please specify below):

Specify other:

30. Does your laboratory provide MIC interpretations for carbapenems in *Pseudomonas aeruginosa*?

Yes No Sometimes (please specify below):

Specify:

31. Does your laboratory provide zone diameter interpretations for carbapenems in *Pseudomonas aeruginosa*?

Yes No Sometimes (please specify below):

Specify:

Section 5: The following set of questions ask about Acinetobacter baumannii complex from dogs and cats specifically.

Please check the appropriate response or if needed write answers or comments in the spaces provided.

32. Does your laboratory conduct AST on any Acinetobacter baumannii complex isolates?

Yes No

33. Please indicate which method your laboratory uses for primary susceptibility testing of Acinetobacter baumannii complex from dogs and cats:

- Kirby-Bauer disk diffusion
 Automated testing instrument (e.g., Vitek®, BD Phoenix (TM), Sensititre (TM), MicroScan)
 Other broth microdilution method (please specify below):
 Agar dilution method
 Gradient diffusion method (e.g., Etest®)
 Other or use several methods (please specify or describe below):

Specify other broth microdilution method:

Specify other or describe several methods used:

34. Please indicate which method(s) are used for secondary, supplemental, or confirmatory testing of Acinetobacter baumannii complex from dogs and cats (if performed):

- Kirby-Bauer disk diffusion
 Automated testing instrument (e.g., Vitek®, BD Phoenix (TM), Sensititre (TM), MicroScan)
 Other broth microdilution method (please specify below):
 Agar dilution method
 Gradient diffusion method (e.g., Etest®)
 Other (please specify below):
 Not performed

Specify other broth microdilution method:

Specify other:

35. Does your laboratory currently conduct AST on Acinetobacter baumannii complex for clinical management of individual patients?

Yes No

35a. Which isolates undergo AST for clinical decision making?

- Most Acinetobacter baumannii complex isolates received routinely undergo AST.
 Only Acinetobacter baumannii complex isolates from suspected infections undergo AST.
 Only Acinetobacter baumannii complex isolates that are requested by submitter/clinician undergo AST.
 Other Acinetobacter baumannii complex isolates (please specify below):

Specify other:

43. Does your laboratory provide MIC interpretations for carbapenems in *Acinetobacter baumannii* complex?

- Yes
 No
 Sometimes (please specify below):

Specify: _____

44. Does your laboratory provide zone diameter interpretations for carbapenems in *Acinetobacter baumannii* complex?

- Yes
 No
 Sometimes (please specify below):

Specify: _____

You answered that your laboratory does not perform AST on any Enterobacteriaceae, *Pseudomonas aeruginosa*, or *Acinetobacter baumannii* complex isolates. Is this true?

- Yes No

Please revisit question(s) 6, 19, and/or 32 to identify which Enterobacteriaceae, *Pseudomonas*, or *Acinetobacter baumannii* complex isolates your laboratory performs AST on.

Section 6: The following questions ask about what is done when carbapenem resistance from dogs and cats is detected in any Gram-negative organism.**Please check the appropriate response or if needed write answers or comments in the spaces provided.**

45. If carbapenem resistance was detected in any isolate from a dog or cat, which of the following action(s) would your laboratory initiate (mark all that apply)?

- Notify clinician at submitting facility
- Notify biosecurity officer or infection prevention staff at submitting facility
- Notify the state agriculture department
- Notify the state veterinarian
- Notify other public health official/department
- Perform additional laboratory testing (e.g., mCIM, CarbaNP, Modified Hodge Test [MHT], whole genome sequencing)
- Other action (please specify below):
- None of the above

Specify other action: _____

46. If your laboratory identified a carbapenem-resistant isolate from a dog or cat, would your laboratory perform any tests to identify carbapenemase production or carbapenemase genes?

- Yes No

46a. For which organism(s) (mark all that apply)?

- Carbapenem-resistant Enterobacteriaceae
- Carbapenem-resistant *Pseudomonas aeruginosa*
- Carbapenem-resistant *Acinetobacter baumannii* complex
- Other (please specify below):

Specify other: _____

46b. What mechanism testing would your laboratory perform (mark all that apply)?

- Phenotypic testing
- Commercial molecular test (e.g., Cepheid Xpert® Carba-R, BioFire® FilmArray®, VERIGENE®)
- PCR for carbapenemase genes
- Whole genome sequencing

46c. What phenotypic testing would your laboratory perform for carbapenem-resistant Enterobacteriaceae?

- Modified carbapenem-inactivation method (mCIM) or carbapenem-inactivation method (CIM)
- Rapid commercial test (e.g., RAPIDEX® CarbaNP)
- Modified Hodge Test (MHT)
- Other (please specify below):

What other phenotypic testing is performed for carbapenem-resistant Enterobacteriaceae? _____

46d. What phenotypic testing would your laboratory perform for carbapenem-resistant *Pseudomonas aeruginosa*?

- Modified carbapenem-inactivation method (mCIM) or carbapenem-inactivation method (CIM)
 - Rapid commercial test (e.g., RAPIDEX® CarbaNP)
 - Modified Hodge Test (MHT)
 - Other (please specify below):
-

What other phenotypic testing is performed for carbapenem-resistant *Pseudomonas aeruginosa*?

46e. What phenotypic testing would your laboratory perform for carbapenem-resistant *Acinetobacter baumannii* complex?

- Modified carbapenem-inactivation method (mCIM) or carbapenem-inactivation method (CIM)
 - Rapid commercial test (e.g., RAPIDEX® CarbaNP)
 - Modified Hodge Test (MHT)
 - Other (please specify below):
-

What other phenotypic testing is performed for carbapenem-resistant *Acinetobacter baumannii* complex?

46f. Please indicate PCRs performed to detect which carbapenemase gene(s):

- blaKPC
 - blaNDM
 - blaOXA-48-like
 - blaVIM
 - blaIMP
 - Other (please specify below):
-

Specify other carbapenemase gene(s):

Section 7: The following set of questions ask about laboratory test results from dogs and cats. Please reference the standards your laboratory uses (e.g., CLSI M100, CLSI VET08, VetCAST/EUCAST) to define carbapenem resistance when answering the following questions.

Please check the appropriate response or if needed write answers or comments in the spaces provided.

The following attachment contains information on carbapenem breakpoints for various laboratory testing guidelines. Please consult this information as needed to answer questions in Section 7.

[Attachment: "Laboratory testing guidelines.pdf"]

47. Did your laboratory identify any carbapenem-resistant isolate(s) from a dog or cat in 2019 (Jan-Dec)?

Yes No Unknown

48a. Approximately how many Enterobacteriaceae isolates from dogs and cats were tested for antibiotic susceptibility in 2019 (Jan-Dec)?

0-10 11-50 51-100 101-200 >201 Prefer not to answer

48b. Among the Enterobacteriaceae isolates from dogs and cats that your laboratory performed antibiotic susceptibility, how many were resistant to a carbapenem?

Zero 1-5 6-10 11-15 >16 Prefer not to answer

48c. Among the Enterobacteriaceae isolates from dogs and cats that your laboratory performed antibiotic susceptibility, how many were resistant to a third-generation cephalosporin?

0-5 6-25 26-50 51-100 >100 Prefer not to answer

49a. Approximately how many Pseudomonas aeruginosa isolates from dogs and cats were tested for antibiotic susceptibility in 2019 (Jan-Dec)?

0-10 11-50 51-100 101-200 >201 Prefer not to answer

49b. Among the Pseudomonas aeruginosa isolates from dogs and cats that your laboratory performed antibiotic susceptibility, how many were resistant to a carbapenem?

Zero 1-5 6-10 11-15 >16 Prefer not to answer

49c. Among the Pseudomonas aeruginosa isolates from dogs and cats that your laboratory performed antibiotic susceptibility, how many were resistant to a third-generation cephalosporin?

Zero 1-5 6-10 11-15 >16 Prefer not to answer

50a. Approximately how many Acinetobacter baumannii complex isolates from dogs and cats were tested for antibiotic susceptibility in 2019 (Jan-Dec)?

Zero 1-5 6-10 11-15 >16 Prefer not to answer

50b. Among the *Acinetobacter baumannii* complex isolates from dogs and cats that your laboratory performed antibiotic susceptibility, how many were resistant to a carbapenem?

Zero 1-5 6-10 11-15 >16 Prefer not to answer

50c. Among the *Acinetobacter baumannii* complex isolates from dogs and cats that your laboratory performed antibiotic susceptibility, how many were resistant to a third-generation cephalosporin?

Zero 1-5 6-10 11-15 >16 Prefer not to answer

51. Does your laboratory save a viable culture of carbapenem-resistant isolates?

Yes No

51a. Which isolates are routinely saved (select all that apply)?

- Clinical sterile site
 - Clinical non-sterile site
 - Surveillance or research specimens
 - Other (please specify below):
-

Specify other:

51b. How long are carbapenem-resistant isolates saved?

52. To your knowledge, are there any public health reporting mandates that require your laboratory to report the identification of any carbapenem-resistant organisms to public health?

- Yes (please specify below):
 No
-

52a. Please describe the public health reporting mandates:

(e.g., what organisms and/or resistance mechanisms, specimen sources, animals, and/or situations are covered by the mandate?)

53. May we contact your laboratory via AAVLD with questions about your survey responses?

Yes No

54. Any additional comments you wish to share: