

# CALIFORNIA LIVESTOCK ANTIBIOGRAMS: A USER GUIDE

California Department of Food and Agriculture Antimicrobial Use and Stewardship

UC Davis California Animal Health and Food Safety Laboratory







### Table of Contents

Introduction	ii
Using Antibiograms in Veterinary Practice	- 1
Anatomy of an Antibiogram	
Simple Antibiogram	3
Detailed Antibiogram	. 4
How to Read an Antibiogram	
Simple Antibiogram	5
Detailed Antibiogram	6

### Introduction

Antibiograms represent cumulative antimicrobial susceptibility data for a particular bacterial organism and host species combination. They provide information about the proportion of bacterial isolates that are susceptible to the drugs tested. Antibiograms can be used by veterinarians as a clinical tool to target antibiotic therapy and assess trends in antibiotic resistance. Although widely used in human health systems, antibiograms are not often available in veterinary medicine, particularly for livestock species. The California Department of Food and Agriculture Antimicrobial Use and Stewardship program (CDFA AUS) and the UC Davis California Animal Health and Food Safety Laboratory (CAHFS) created this document to promote the use of antibiograms in large animal veterinary medicine.



Antibiograms are often specific to a certain region or populace, such as a human hospital. This allows for a more precise evaluation of antibiotic resistance profiles among the target population.

Antimicrobial resistance patterns can change over time and are influenced by factors such as geographic region, production type, and management practices. Therefore, antibiograms are most useful when they are up to date and specific to the population of interest. CDFA AUS and CAHFS aim to educate veterinary clinicians on the use of antibiograms so they can be effectively used to direct empiric antibiotic selection, improve treatment outcomes, and assess antibiotic resistance prevalence and trends in California. All client information is kept confidential at CAHFS. For more information on how CAHFS analyzes antibiotic susceptibility, please see: https://www.cdfa.ca.gov/AHFSS/aus/docs/AntibiogramDevelopment.pdf

It is vital for the creation of antibiograms that clinical samples continue to be submitted to CAHFS for susceptibility testing. Antibiograms are useful to guide initial empiric therapy but should not replace casespecific testing to determine a more definitive diagnosis for appropriate therapy. More targeted antibiograms require detailed information on submission forms that **include the age of the animal, production class, location, and previous treatments**. For questions regarding sample submission, please contact CAHFS at (530) 752-8700.

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Lab Use Animal Name/Specimen ID	Sex Breed (F/M)	Sex (F/M)         Age in Units (days, weeks, months, years)         Oty         Specimen Type         Test(s) Requested							



To sign up for antibiograms from CAHFS, please scan the QR code (pictured left) or use this link: http://tinyurl.com/AntibiogramSignup

### Using Antibiograms in Veterinary Practice

#### What is an antibiogram?

An antibiogram represents a summary of cumulative antimicrobial susceptibility test data for a given drug-bug-host combination over a specified time-period (e.g. one year) and population subset (e.g. region, farm, production-type, etc.).

#### How can I use an antibiogram?

**DO** use antibiograms to:



Guide empiric therapy



Assess local susceptibilities

\_\_\_\_

Monitor resistance trends





Replace culture & sensitivity



Extrapolate results to other regions

Extrapolate results to other populations

### What data is used in CAHFS antibiograms?

Unless otherwise specified, CAHFS antibiograms will:

- Contain only isolates from animals with clinical disease associated with the bacterial organism tested.
- Be based on a **minimum of 30 isolates**.
- Be **updated annually**. If fewer than 30 isolates are available, the time between updates will be extended as needed.

According to the **Clinical & Laboratory Standards Institute (CLSI)**, estimates of percent susceptibility have less statistical validity when there are fewer than 30 isolates. If needed, CAHFS will extend the timeframe of the antibiogram until there are 30 or more isolates available for inclusion.

#### What do these terms mean?

**Breakpoint** – The minimum inhibitory concentration (MIC) used to categorize an organism as susceptible (S), intermediate (I), or resistant (R).

The S/I/R categorization is derived from microbiological characteristics, pharmacokinetic/pharmacodynamic (PK/PD) parameters, and/or clinical outcome data. CAHFS utilizes breakpoints established by CLSI.

Susceptible (S) – The bacterial isolate is inhibited by a concentration of drug that is usually achievable at the site of infection.

Intermediate (I) – The bacterial isolate has an MIC that falls between the breakpoints for susceptible and resistant. Clinical efficacy might be achieved dependent on dose and target body site.

**Resistant (R)** – The bacterial isolate is not inhibited by the concentrations of drug that are usually achievable at the site of infection.

Not susceptible (NS) – The isolate is either resistant or not completely susceptible to one or more antibiotics.

**No Interpretation (NI)** – When No Interpretation (NI) is available because breakpoints are either Not Established (NE) or are Outside of the Range (OOR) of concentrations tested.

#### Where can I find more information?

For many veterinary species. breakpoints have not been established. In these instances. breakpoints are used from other host species (such as human) or other closelyrelated bacterial organisms.

Clinical & Laboratory Standards Institute (CLSI) publications:								
<b>CLSI M39:</b> Analysis and Presentation of Cumulative Antimicrobial Susceptibility Test Data	CLSI VET09: Understanding Susceptibility Test Data as a Component of Antimicrobial Stewardship in Veterinary Settings							
<b>CLSI VET01/VET01S:</b> Performance Standards for Antimicrobial Disk and Dilution Susceptibility Tests for Bacteria Isolated From Animals	CLSI VET08: Performance Standards for Antimicrobial Disk and Dilution Susceptibility Tests for Bacteria Isolated From Animals							
Link to MIC/Antibiogram Process Visual: https://www.cdfa.ca.gov/AHFSS/aus/docs/AntibiogramDevelopment.pdf								

### Anatomy of a Simple Antibiogram

#### **Antimicrobial agents**

**tested:** this is usually determined based on the animal host and microbial organism (drug names removed for this example)

**Title:** identifies the host species, organism profile and timeframe for the antibiogram This example displays three **different microbial organisms**, labeled X, Y, and Z, with the total number of microbial isolates in parentheses next to the name of each organism

		CA	HFS Bovine	Respiratory	Pathogens /	Antibiogram	n July 2019 -	June 2020		
<u>Antimicrobial<sup>a</sup></u>		Organism X (n=83)			Org	<i>anism</i> Y (n=	=90)	Organism Z (n=45)		
		% S	% I	% R	% S	% I	% R	% S	% I	% R
<u>Class 1</u>	Drug 1a	75%	15%	10%	95%	2%	3%	80%	11%	9%
	Drug 1b	49%	29%	22%	94%	4%	2%	96%	0%	4%
<u>Class 2</u>	Drug 2a <sup>c</sup>	99%	0%	1%	100%	0%	0%	84%	5%	11%
<u>Class 3</u>	Drug 3a <sup>c</sup>	41%	20%	39%	47%	25%	28%	90%	4%	6%
	Drug 3b	41%	31%	28%	49%	20%	31%	98%	0%	2%
<sup>a</sup> S (Susceptible) based on the Clinical Laboratory Standards Institute (CLSI) cattle-specific breakpoints for each drug/bug combination.										
<sup>b</sup> New criteria indicates this isolate is susceptible to Drug 1a (if MIC less than 0.06) which current methods cannot evaluate.										

No CLSI breakpoint for *Organism Z* in cattle, extrapolated from *Organism X* CLSI breakpoints.

No CLSI breakpoint for Organism Y or Organism Z in cattle, extrapolated from Organism X CLSI breakpoints.

**Important notes and disclaimers** about the data presented; may include disclaimer if breakpoints from other host species or organisms are used or notes about extra-label drug use

Percentage of isolates classified as susceptible, intermediate, or resistant to this antimicrobial



## Anatomy of a **Detailed Antibiogram**

**Antimicrobial agents tested:** 

this is usually determined by the animal host and microbial organism tested (drug names removed for this example)

> **Breakpoints:** minimum inhibitory concentrations (MIC) of the drug at which the microbial organism is classified as susceptible, intermediate, or resistant

Title: identifies the bacterial organism, animal host and timeframe for the antibiogram (drug and organism names removed for this example)



Antimicrobial

Class 1

Drug 1a

Drug 1b Class 2

Drug 2a

Drug 3a

Drug 3b

Drug 4a

Drug 4b

Class 3

Class 4

Susceptible

≤0.03

<0.25

<2

≤0.25

≤0.25

NE

<4

### How to Read a Simple Antibiogram

CAHFS Bovine Respiratory Pathogens Antibiogram July 2019 - June 2020										
<u>Antimicrobial<sup>a</sup></u>		Organism X (n=83)			Org	<i>anism</i> Y (n=	=90)	Organism Z (n=45)		
		% S	% I	% R	% S	% I	% R	% S	% I	% R
<u>Class 1</u>	Drug 1a	75%	15%	10%	95%	2%	3%	80%	11%	9%
	Drug 1b	49%	29%	22%	94%	4%	2%	96%	0%	4%
Class 2	Drug 2a <sup>c</sup>	99%	0%	1%	100%	0%	0%	84%	5%	11%
Class 3	Drug 3a <sup>c</sup>	41%	20%	39%	47%	25%	28%	90%	4%	6%
	Drug 3b	41%	31%	28%	49%	20%	31%	98%	0%	2%

<sup>a</sup> S (Susceptible) based on the Clinical Laboratory Standards Institute (CLSI) cattle-specific breakpoint is for each drug/bug combination.
 <sup>b</sup> New criteria indicates this isolate is susceptible to Drug 1a (if MIC less than 0.06) which current n
 <sup>c</sup> No CLSI breakpoint for *Organism Z* in cattle, extrapolated from *Organism X* CLSI breakpoints.
 <sup>d</sup> No CLSI breakpoint for *Organism Y* or *Organism Z* in cattle, extrapolated from *Organism X* CLSI breakpoints.

In general, the higher the percentage susceptible, the greater the chance of treatment success.

If you are unsure which organism is causing the disease, you should pick an antibiotic with a high percentage of susceptible isolates for all possible organisms. In this example, Drug 2a should be chosen over Drug 3a. Percentage of microbial isolates tested of each organism that were susceptible, intermediate, or resistant to this antibiotic

### How to Read a Detailed Antibiogram



### Get Involved

# Californian veterinarians have options to expand their knowledge:

- Request additional information on antibiograms
- Plan a continuing education seminar for your local veterinary medical association or practice
- Provide feedback or request a particular species, production type or pathogen-focused antibiogram



Please continue to submit samples with complete submission forms for culture and antibiotic susceptibility testing so CAHFS can create robust livestock antibiograms!



To **sign up for antibiograms** from CAHFS, please scan the QR code (*pictured left*) or use this link: http://tinyurl.com/AntibiogramSignup



For **requests or questions** regarding California-focused livestock antibiograms, please contact CDFA AUS at: **CDFA\_AUS@CDFA.CA.GOV**