

Division of Epidemiology & Public Health Preparedness (EPHP) 775-328-2447

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Surveillance Definitions (Years Updated)

Report Date (2023)

For this report, the date of specimen collection is used for case counts by months.

Carbapenemase-Producing Organisms (CPO) (2023)

Any specimen that meets confirmatory laboratory evidence:

- Positive phenotypic test for carbapenemase production **OR**
- Molecular test detecting a carbapenemase gene **OR**
- Next generation sequencing detecting a carbapenemase gene.

CPO cases will be classified as either clinical case (collected for diagnosing/treating disease), or as screening case (collected for detecting colonization), however since reason for collecting specimens is not reported, the specimen site denotes CPO case classification. Typically a CPO identified through a rectal, peri-rectal, axilla, groin, or stool specimen would be considered screening.

Duplicates (2023)

Duplicates are defined as the same organism/carbapenemase combination regardless of collection source and date. A screening case can be counted as a new clinical case if, for example, they developed a blood stream infection, found to be due to the same organism/carbapenemase combination, but a clinical case cannot be counted as a new screening case with same organism/carbapenemase combination.

Carbapenem Resistant *Enterobacteriaceae* (CRE) (2022)

Enterobacteriaceae that meets the following criteria:

- Resistant to ANY carbapenem antimicrobial (i.e., MIC of ≥ 4 mcg/ml for doripenem, meropenem, or imipenem **OR** ≥ 2 mcg/ml for ertapenem) **OR**
- Documented to produce carbapenemase

In addition:

- For bacteria that have intrinsic imipenem nonsusceptibility (i.e., *Morganella morganii*, *Proteus spp.*, *Providencia spp.*), resistant to carbapenems other than imipenem is required.

Carbapenem Resistant *Pseudomonas aeruginosa* (CRPA) (2022)

Pseudomonas aeruginosa isolated from any body site* that meets the following criteria:

- Resistant to imipenem, meropenem, or doripenem based on current Clinical and Laboratory Standards Institutes Standards (CLSI) M100 standards (≥ 8 mcg/mL);
AND/OR
- Demonstrates production of a carbapenemase by a recognized method (e.g., CarbaNP or Polymerase chain reaction (PCR) or other methods).

**Excluding isolates from patients with cystic fibrosis (CF).*

Carbapenem Resistant *Acinetobacter* (CRA) (2022)

Acinetobacter isolated from any body site that meets the following criteria:

- Resistant to imipenem, meropenem, or doripenem based on current Clinical and Laboratory Standards Institutes Standards (CLSI) M100 standards (≥ 8 mcg/mL);
AND/OR
- Demonstrates production of a carbapenemase by a recognized method (e.g., CarbaNP or PCR or other methods).

Carbapenem Resistant Organisms (CRO) (2017)

Any organisms meeting the above definitions for CRE, CRPA, and CRA are considered CRO.

Carbapenemase Producing Organisms (CPO) (2017)

Any organisms producing carbapenemase which is laboratory-confirmed are defined as CPO.

Multi-Drug Resistant Bacilli – Carbapenem Resistant (MDRB-CR) (2010-2016)

A case is defined as an infection with an MDRB-CR organism of one patient per hospitalization per year regardless of resident status. Infection with a second species of MDRB-CR organism in the same patient is counted as a separate case. Infections with those Gram-negative bacilli that are constitutively resistant to carbapenems, specifically *Stenotrophomonas*, *Aeromonas* & *Chryseobacterium*, are not counted as cases.

MDRB-CR organisms refer to Gram negative bacilli that are resistant to three or more classes of antibiotics, one of which must be Carbapenem.

Patient's Residency (SINCE 2010)

Patients from out of jurisdiction (OOJ) are included in the surveillance report as long as isolates meet the above surveillance definitions.

Major Findings

Table 1: Reported CRO by Month, Washoe County, 2023

Month	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Total
CRE	1	4	4	5	6	1	2	3	6	5	2	3	42
CRPA	0	3	4	2	10	4	3	5	1	0	1	5	38
CRA	0	0	0	0	0	0	0	0	0	1	0	0	1
Unk	0	0	0	0	0	0	0	0	0	0	0	0	0
Other	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	1	7	8	7	16	5	5	8	7	6	3	8	81

Table 1-1: Descriptive Statistics for Reported CRO Cases, Washoe County, Q4 2023 & 2023 Cumulative

Characteristics		Quarter 4		2023 Cumulative	
		No.	Percent (%)	No.	Percent (%)
Age	Median	65 years	NA	69 years	NA
	Minimum	41 years	NA	1 year	NA
	Maximum	86 years	NA	93 years	NA
Gender	Male	10	58.82%	41	50.62%
	Female	7	41.18%	40	49.38%
Race/Ethnicity	White, non-Hispanic	13	76.47%	65	80.25%
	White, Hispanic	0	0.00%	6	7.41%
	Asian	0	0.00%	1	1.23%
	Black	3	17.65%	5	6.17%
	American Indian/Alaskan Native	1	5.88%	2	2.47%
	Other	0	0.00%	2	2.47%
	Unknown	0	0.00%	0	0.00%
Washoe County Resident	Yes	12	70.59%	68	83.95%
	No	5	29.41%	13	16.05%
	Unknown	0	0.00%	0	0.00%
Specimen Type	Urine	10	58.82%	44	54.32%
	Respiratory	1	5.88%	9	11.11%
	Wound	3	17.65%	18	22.22%
	Rectal	0	0.00%	0	0.00%

	Invasive (e.g., blood, cerebrospinal fluid)	0	0.00%	3	3.70%
	Other	1	5.88%	1	1.23%
	Surgical	2	11.76%	2	2.47%
	Unknown*	0	0.00%	4	4.94%
Facility Type	Inpatient	8	47.06%	34	41.98%
	Outpatient	8	47.06%	37	45.68%
	Long Term Acute Care	1	5.88%	5	6.17%
	Intensive Care Unit	0	0.00%	1	1.23%
	Skilled Nursing Facility	0	0.00%	4	4.94%
Total**		17	100.00	81	100.00

*Initial result not received from testing hospital.

**Represents number of testing events. A single person may count more than once if not considered a duplicate isolate (see definition of "Duplicates")

Carbapenemase Producing Organism (CPO)

Table 2: Characteristics of Reported CPO Cases, Washoe County, 2023

Month/ Year Reported	Resistance Mechanism	Organism	Active Infection or Colonization	Source of Detection	# of Contacts	Case notes
2/2023	KPC	<i>Klebsiella pneumoniae</i>	Active	Routine Reporting	0	Within the 12 months prior to diagnosis, case had extensive hospital stay and antibiotic use. No travel history.
5/2023	KPC	<i>Klebsiella pneumoniae</i>	Active	Routine Reporting	0	SNF and ACH hospitalizations within the past 12 months. History of antibiotic use.
5/2023	NDM	<i>E. coli</i>	Active	Routine Reporting	0	Self cath's Indiana pouch. Extensive antibiotic history. No international or domestic hospitalizations

						within the past 12 months.
5/2023	NDM	<i>Klebsiella pneumoniae</i>	Active	Routine Reporting	0	Recent discharge from LTAC. Extensive antibiotic and dialysis history.
10/2023	KPC	<i>Klebsiella pneumoniae</i>	Active	Routine Reporting	0	ACH stay where gallbladder removed and extensive antibiotic use.

KPC-Klebsiella pneumonia carbapenemase, NDM-New Delhi Metallo-β-lactamase, VIM-Verona Integron-encoded Metallo-β-lactamase

Carbapenem Resistant *Enterobacteriaceae* (CRE)

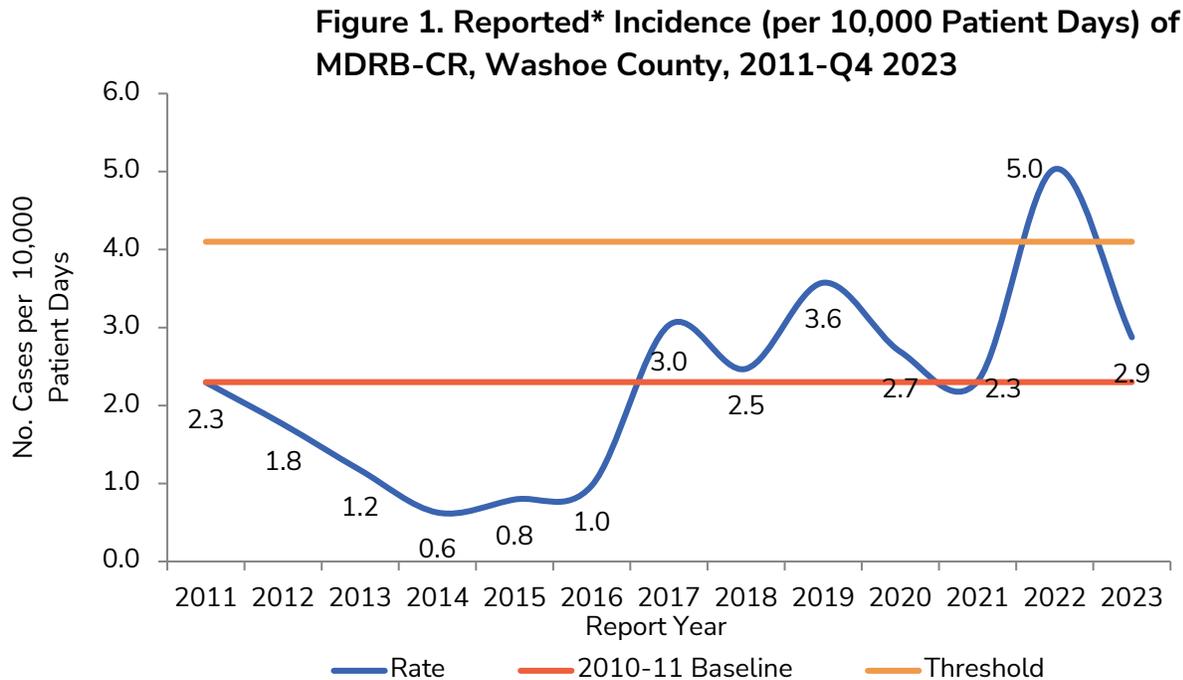
Table3: Carbapenem Resistant Enterobacteriaceae, Washoe County, 2019-2023

Year	Total N CRO	No. CRE	Proportion (%)	CRE Organisms													
				EC	EA	KP	E. coli	PM	CF	SM	CB	KO	PS	PR	MM	KA	Citro spp.
2019	94	27	28.72	13	1	9	3	0	0	0	0	0	0	0	0	0	1
2020	90	48	53.33	27	2	8	6	0	2	0	0	1	0	0	0	0	1
2021	77	36	46.75	21	3	5	2	0	0	2	0	1	1	0	1	0	0
2022	145	62	42.76	39	0	6	3	1	1	2	0	0	0	1	2	7	0
2023*	81	42	51.85	19	0	7	7	0	1	0	0	0	0	0	0	5	0

EC-*Enterobacter cloacae*, EA-*Enterobacter aerogenes*, KP-*Klebsiella pneumonia*, PM-*Proteus mirabilis*,
CF-*Citrobacter freundii*, SM-*Serratia marcescens*, CB-*Citrobacter braakii*, KO-*Klebsiella oxytoca*,
PS- *Providencia stuartii*, PR- *Providencia rettgeri*, MM- *Morganella morganii*, Citro sp.-*Citrobacter species*
KA- *Klebsiella aerogenes*
*1 *Klebsiella ozaenae*, 2 *Hafnia alvei* not included in table organisms

Reported Incidence of CRO (2023)

The reported incidence for January 2023-December 2023 was 2.9 cases per 10,000 patient days. Figure 1 illustrates the reported incidence rate of CRO from 2011 through 2023.



*Only 4 out of 7 health facilities reported all four quarters in 2023.

Table 4: CRO Cases Resistant to 3+ Classes of Antibiotics by Month, Washoe County, 2019-2023

Year	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec	Total
2019	11	9	11	6	10	9	9	13	3	11	3	7	102
2020	5	8	6	4	4	8	9	9	1	8	15	7	84
2021	8	7	6	7	3	0	10	8	2	6	4	8	69
2022	5	8	5	8	11	8	12	8	12	6	8	5	96
2023	1	5	5	6	14	4	3	4	4	6	3	7	62
Total	30	37	33	31	42	29	43	42	22	37	33	34	413

*Beginning 2017, reporting criteria changed

Severity of Drug-Resistance among CRO (2023)

- Proportion of resistance to three classes of antibiotics: 76.54% (62/81)
- Proportion of resistance to four or more classes of antibiotics: 60.49% (49/81)
- Proportion pan-resistance*: 1.23% (1/81)

*Pan-resistance is defined as non-susceptible to all tested drugs at the clinical lab.

CPO Testing (2023)

Table 5: Pan-resistance Rate, Washoe County, 2019-2023

Year	Total N Cases	No. Pan-resistance	Proportion (%)	Organisms (No. pan-resistant)
2019	91	3	3.30	<i>Pseudomonas aeruginosa</i> (1), <i>K. pneumoniae</i> (2)
2020	89	2	2.25	<i>Citrobacter sp.</i> (1), <i>K. pneumoniae</i> (1)
2021	76	0	0.00	-
2022	145	1	0.69	<i>Pseudomonas aeruginosa</i>
2023	81	1	1.23	<i>Acinetobacter baumannii</i>

Table 6 and 7 may not equal the total isolates recorded. Not all specimens are forwarded to the Nevada State Public Health Laboratory for testing. Table 7 may not identify the organisms that were PCR positive as some specimens were only tested for mechanism.

Table 6: Modified Carbapenem Inactivation Method (mCIM) Testing, Washoe County, 2019-2023

Year	Total N Tested	No. Positive									Positivity (%)
		Total	KP	PA	PP/PF	E. coli	EC	KO	SM	Organism not isolated	
2019	77	6	6	0	0	0	0	0	0	0	7.79
2020	81	5	2	0	0	0	0	0	0	0	6.17
2021	71	5	0	2	1	1	1	0	0	0	7.04
2022*	109	3	1	1	0	0	1	0	0	0	2.75
2023	68	5	4	0	0	1	0	0	0	0	7.35
Total	406	24	13	3	1	2	2	0	0	0	5.91

* One CPO is not included in Table 6 as they were identified by PCR testing and not mCIM.

KP-*Klebsiella pneumoniae*, PA-*Pseudomonas aeruginosa*, PP/PR-*Pseudomonas fluorescens/putida*, KO-*Klebsiella oxytoca*, SM-*Serratia marcescens*, EC-*Enterobacter cloacae*

Table 7: Polymerase Chain Reaction (PCR) Testing, Washoe County, 2019-2023

Year	Total N Tested	No. Positive								Positivity (%)
		Total	KP	PA	PP/PF	E. coli	KO	EC	Organism not isolated	
2019	12	7	6	3	0	0	1	2	0	58.33
2020	7	5	4	0	0	1	0	0	0	71.43
2021	6	3	0	1	1	1	0	0	0	50.00
2022	6	4	1	1	0	0	0	1	1	66.67
2023	38	5	4	0	0	1	0	0	0	13.16
Total	69	24	15	5	1	3	1	3	1	34.78

KP-Klebsiella pneumoniae, PA-Pseudomonas aeruginosa, PP/PR-Pseudomonas fluorescens/putida

EC-Enterobacter cloacae, KO-Klebsiella oxytoca

Antibiotic Susceptibility

Table 8. Antibiotic Susceptibility for CRE, CRPA and CRAB 2023

Antimicrobial Class or Subclass	CRE (n=42)			CRPA ¹ (n=38)			CRAB ¹ (n=1)		
	# Tested	# Susceptible	% Susceptible	# Tested	# Susceptible	% Susceptible	# Tested	# Susceptible	% Susceptible
Penicillins									
Ampicillin	63	0	0.00	33	0	0.00	0	0	0.00
Piperacillin	0	0	0.00	6	5	83.33	0	0	0.00
Cephems									
Cefazolin	72	0	0.00	0	0	0.00	0	0	0.00
Cefepime	73	31	42.47	66	52	78.79	2	0	0.00
Cefotaxime	0	0	0.00	0	0	0.00	0	0	0.00
Cefotetan	4	1	25.00	0	0	0.00	0	0	0.00
Cefoxitin	0	0	0.00	0	0	0.00	0	0	0.00
Ceftazidime	40	4	10.00	42	32	76.19	1	0	0.00
Ceftriaxone	75	54	72.00	0	0	0.00	1	0	0.00
Cefuroxime	32	2	6.25	0	0	0.00	0	0	0.00
Cephalothin	0	0	0.00	0	0	0.00	0	0	0.00
β-Lactam/β-lactamase inhibitor combinations									
Amoxicillin-clavulanic acid	13	0	0.00	0	0	0.00	0	0	0.00
Ampicillin-sulbactam	68	0	0.00	33	0	0.00	2	0	0.00

Piperacillin-tazobactam	76	16	21.05	61	43	70.49	0	0	0.00
Ticarillin-clavulanic acid	0	0	0.00	4	0	0.00	0	0	0.00
Fluoroquinolones									
Ciprofloxacin	73	46	63.01	63	43	22.00	2	0	0.00
Levofloxacin	64	43	67.19	49	29	59.18	2	0	0.00
Moxifloxacin	9	8	88.89	0	0	0.00	0	0	0.00
Aminoglycosides									
Amikacin	40	38	95.00	54	52	96.30	2	0	0.00
Gentamicin	76	76	100.00	69	53	76.81	2	0	0.00
Tobramycin	72	62	86.11	60	56	93.33	2	0	0.00
Sulfonamides									
Trimethoprim	0	0	0.00	0	0	0.00	0	0	0.00
Trimethoprim-sulfamethoxazole	76	52	68.42	0	0	0.00	2	0	0.00
Monobactams									
Aztreonam	36	4	11.11	45	17	37.78	0	0	0.00
Tetracyclines									
Tetracycline	40	27	67.50	1	1	100.00	0	0	0.00
Tigecycline	29	27	93.10	0	0	0.00	0	0	0.00
Nitrofurans									
Nitrofurantoin	28	13	46.43	0	0	0.00	0	0	0.00
Carbapenems									
Imipenem	11	0	0.00	24	0	0.00	0	0	0.00
Meropenem	48	28	58.33	68	20	29.41	2	0	0.00
Doripenem	0	0	0.00	0	0	0.00	0	0	0.00
Ertapenem	67	6	8.96	0	0	0.00	0	0	0.00

¹ *Pseudomonas aeruginosa* and *Acinetobacter* have intrinsic resistance to Ertapenem.