Community-wide Surveillance for Carbapenemase Producing Organisms (CPO)
Statistical Report for 2023 Quarter 1*

**Report contains cumulative data from January 2023 through March 2023.*

Surveillance Definitions (year updated):

REPORT DATE (2023)

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

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) (SINCE 2010)

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.

DUPLICATES (SINCE 2010)

Duplicates are defined isolates from same patient, same organism, and same source within same year.

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, Quarter 1 2023

Month	Jan	Feb	Mar	Total
CRE	1	4	4	9
CRPA	0	3	4	7
CRA	0	0	0	0
Unknown	0	0	0	0
Other CROs	0	0	0	0
Total	1	7	8	16

Table 1-1: Descriptive Statistics for Reported CRO Cases, Washoe County, Quarter 1 2023

		Quarter 1	
Characteristics		No.	Percent (%)
Age	Median	70 years	NA
	Minimum	6 years	NA
	Maximum	88 years	NA
Gender	Male	9	56.25%
	Female	7	43.75%
Race/Ethnicity	White, non-Hispanic	13	81.25%
	White, Hispanic	1	6.25%
	Asian	1	6.25%
	Black	0	0.00%
	American Indian/Alaskan Native	1	6.25%
	Other	0	0.00%
	Unknown	0	0.00%
Washoe County Resident	Yes	13	81.25%
	No	3	18.75%
	Unknown	0	0.00%
Specimen Type	Urine	6	37.50%
	Respiratory	1	6.25%
	Wound	8	50.00%
	Rectal	0	0.00%
	Invasive (e.g., blood, cerebrospinal fluid)	1	6.25%
	Other	0	0.00%
	Surgical	0	0.00%
	Unknown*	0	0.00%
Facility Type	Inpatient	7	43.75%
	Outpatient	8	50.00%
	Long Term Acute Care	0	0.00%
	Intensive Care Unit	0	0.00%
	Skilled Nursing Facility	1	6.25%
Total**		16	100%

*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 Organisms (CPO)

Table 2: Characteristics of Reported CPO Cases, Washoe County, Quarter 1 2023

Month/ Year Reported	Resistance Mechanism	Organism	Active Infection or Colonization	Source of Detection	# of Contacts Identified for Screening	Case notes
02/2023	KPC	*Klebsiella pneumoniae*	Active	Routine Reporting	0	Within the 12 months prior to diagnosis, case had extensive hospital stay and antibiotic use. No travel history.

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

CPO cases reported 2023 = 1; Contacts identified = 0; Case-contact ratio = 0
Cumulative CPO case counts (2017- 2023) =45; Contacts identified (2017- 2023) = 111; Case-contact ratio = 2.22

Carbapenem Resistant Enterobacteriaceae (CRE)

Table 3: Carbapenem Resistant Enterobacteriaceae, Washoe County, 2019-Q1 2023

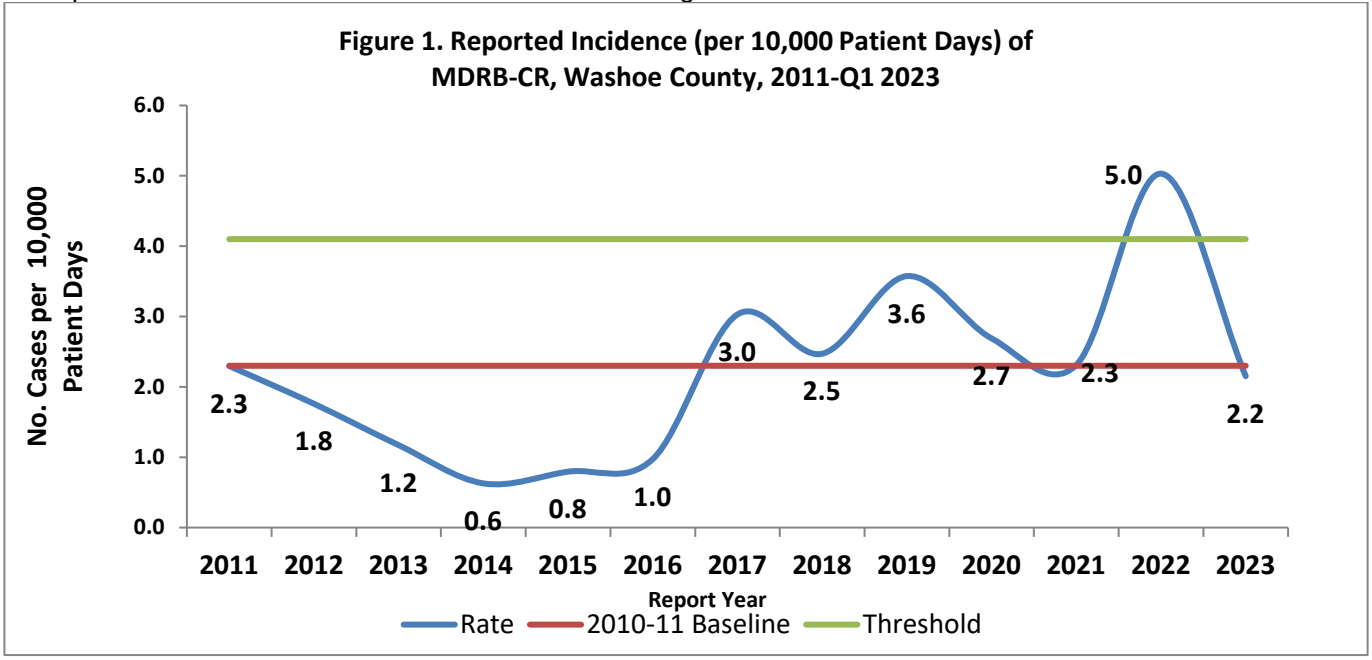
				CRE Organisms													
Year	Total N CRO	No. CRE	Proportion (%)	EC	EA	KP	E. coli	PM	CF	SM	CB	KO	PS	PR	MM	KA	Citro sp.
2019	94	27	28.7	13	1	9	3	0	0	0	0	0	0	0	0	0	1
2020	90	48	53.3	27	2	8	6	0	2	0	0	1	0	0	0	0	1
2021	77	36	46.8	21	3	5	2	0	0	2	0	1	1	0	1	0	0
2022	145	62	42.8	39	0	6	3	1	1	2	0	0	0	1	2	7	0
2023	16	9	56.3	5	0	2	1	0	0	0	0	0	0	0	0	1	0

EC-*Enterobacter cloacae*, EA-*Enterobacter aerogenes*, KP-*Klebsiella pneumoniae*, PM-*Proteus mirabilis*, CF-*Citrobacter freundii*, SM-*Serratia marcescen,* CB-*Citrobacter braakii*, KO-*Klebsiella oxytoca*, PS- *Providencia stuartii*, PR- *Providencia rettgeri*, MM- *Morganella morganii*, Citro sp.-*Citrobacter species*, KA-*Klebsiella aerogenes*

Reported Incidence of MDRB-CR (2023):

The reported incidence for January 2023 March 2023 was 2.2 cases per 10,000 patient days. Figure 1 illustrates the reported incidence rate of MDRB-CR from 2011 through 2023.

Figure 1. Reported Incidence (per 10,000 Patient Days) of MDRB-CR, Washoe County, 2011-Q1 2023



Note: Beginning 2017, reporting criteria expanded from MDRB-CR to CRO. Cases for previous years might be under-reported

Table 4: Reported MDRB-CR Cases by Month, Washoe County, 2010-Q1 2023

Year	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Total
2010	6	2	2	3	1	7	7	4	6	6	7	5	56
2011	9	8	9	13	5	5	4	3	4	6	2	9	77
2012	3	2	4	5	3	4	3	5	3	8	3	7	50
2013	8	3	5	5	4	3	2	0	1	0	2	0	33
2014	2	5	3	1	0	0	1	3	2	0	1	0	18
2015	0	0	2	4	2	2	3	0	2	4	2	4	25
2016	2	2	3	0	3	2	2	7	5	2	1	3	32
2017*	4	8	8	7	12	15	8	6	8	8	8	10	102
2018	7	5	7	3	5	8	9	6	7	13	6	10	86
2019	11	9	11	6	10	9	9	13	3	9	3	6	99
2020	5	8	6	4	4	8	9	9	1	8	16	7	85
2021	8	7	6	7	3	0	10	8	2	6	4	5	66
2022	5	8	5	8	11	8	11	7	12	6	8	4	93
2023	1	4	4	0	0	0	0	0	0	0	0	0	9
Total	71	71	75	66	63	71	78	71	56	76	63	70	831

*Beginning 2017, reporting criteria changed

Severity of Drug-Resistance among CRO (2023):

- Proportion of resistance to three classes of antibiotics: 68.75% (11/16)
- Proportion of resistance to four or more classes of antibiotics: 56.25% (9/16)
- Proportion pan-resistance*: 0.00% (0/16)

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

CPO Testing

Table 5: Pan-resistance Rate, Washoe County, 2010-2023

Year	Total N Cases	No. Pan-resistance	Proportion (%)	Organisms (No. pan-resistant)
2010*	54	1	1.9	*Acinetobacter* (1)
2011	76	11	14.5	*Acinetobacter* (7), *Pseudomonas aeruginosa* (4)
2012	50	14	328.0	*Acinetobacter* (14)
2013	28	8	28.6	*Acinetobacter* (8)
2014	17	1	5.9	*Pseudomonas aeruginosa* (1)
2015	0	0	0	-
2016	32	1	3.1	*Klebsiella pneumoniae* (1)**
2017	137	14	10.2	*Pseudomonas fluorescens* (1), *Pseudomonas aeruginosa* (2), *Acinetobacter* (11)
2018	130	5	3.8	*Acinetobacter* (2), *Pseudomonas aeruginosa* (2), *Klebsiella pneumoniae* (1)
2019	91	3	3.3	*Pseudomonas aeruginosa* (1), *Klebsiella pneumoniae* (2)
2020	89	2	2.2	*Citrobacter spp.* (1), *K. pneumoniae* (1)
2021	76	0	0.0	-
2022	145	1	0.7	*Pseudomonas aeruginosa* (1)
2023	16	0	0	-

*may be under-reported retrospectively during January-May 2010 ** Pan-resistance reported by CDC

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 does not reflect the positive PCR test as the specimen was only able be identified through PCR for type of mechanism.

Table 6: Modified Carbapenem Inactivation Method (mCIM) Testing, Washoe County, 2019-Q1 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	7.8
2020	81	5	2	0	0	0	0	0	0	0	6.1
2021	71	5	0	2	1	1	1	0	0	0	7.0
2022**	109	3	1	1	0	0	1	0	0	0	2.8
2023	14	1	1	0	0	0	0	0	0	0	7.1
Total	352	20	10	3	1	1	2	0	0	0	5.7

**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 marcescen*, EC-*Enterobacter cloacae*

Table 7: Polymerase Chain Reaction (PCR) Testing, Washoe County, 2019-Q1 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	58.3
2020	7	5	4	0	0	1	0	0	0	71.4
2021	6	3	0	1	1	1	0	0	0	50.0
2022	6	4	1	1	0	0	0	1	1	66.7
2023	1	1	1	0	0	0	0	0	0	100.0
Total	32	20	12	5	1	2	1	3	1	62.5

KP-*Kleibsiella 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 CRGNB Q1 2023

Antimicrobial Class or Subclass	CRE (n=9)			CRPA (n=7)			CRGNB[1]		
	# Tested	# Susceptible	% Susceptible	# Tested	# Susceptible	% Susceptible	# Tested	# Susceptible	% Susceptible
Penicillins									
Ampicillin	15	0	0%	5	0	0%	0	0	0%
Piperacillin	0	0	0%	1	1	0%	0	0	0%
Cephems									
Cefazolin	17	0	0%	0	0	0%	0	0	0%
Cefepime	17	6	35%	10	10	100%	0	0	0%
Cefotaxime	0	0	0%	0	0	0%	0	0	0%
Cefotetan	2	1	50%	0	0	0%	0	0	0%
Cefoxitin	0	0	0%	0	0	0%	0	0	0%
Ceftazidime	9	1	11%	7	7	100%	0	0	0%
Ceftriaxone	17	2	12%	0	0	0%	0	0	0%
Cefuroxime	7	1	14%	0	0	0%	0	0	0%
Cephalothin	0	0	0%	0	0	0%	0	0	0%
β-Lactam/β-lactamase inhibitor combinations									
Amoxicillin-clavulanic acid	2	0	0%	0	0	0%	0	0	0%
Ampicillin-sulbactam	17	0	0%	5	0	0%	0	0	0%
Piperacillin-tazobactam	18	2	11%	9	8	89%	0	0	0%
Ticarcillin-clavulanic acid	0	0	0%	1	0	0%	0	0	0%
Fluoroquinolones									
Ciprofloxacin	17	11	65%	12	9	75%	0	0	0%
Levofloxacin	12	7	58%	7	4	57%	0	0	0%
Moxifloxacin	4	4	100%	0	0	0%	0	0	0%
Aminoglycosides									
Amikacin	9	9	100%	11	11	100%	0	0	0%
Gentamicin	18	18	100%	12	12	100%	0	0	0%
Tobramycin	16	14	88%	12	12	100%	0	0	0%
Sulfonamides									
Trimethoprim	0	0	0%	0	0	0%	0	0	0%
Trimethoprim-sulfamethoxazole	18	14	78%	0	0	0%	0	0	0%
Monobactams									
Aztreonam	9	1	11%	6	2	33%	0	0	0%
Tetracyclines									
Tetracycline	9	7	78%	1	1	100%	0	0	0%
Tigecycline	7	7	100%	0	0	0%	0	0	0%
Nitrofurans									
Nitrofurantoin	5	2	40%	0	0	0%	0	0	0%

Carbapenems									
Imipenem	1	0	0%	5	0	0%	0	0	0%
Meropenem	11	5	45%	11	4	36%	0	0	0%
Doripenem	0	0	0%	0	0	0%	0	0	0%
Ertapenem	16	2	13%	0	0	0%	0	0	0%

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

Surveillance changes in 2017

1. Surveillance is expanded from MDRB-CR to CRO surveillance. CRO is a reportable condition in Washoe County effective in 2017. WCHD begins investigating CPO cases.
2. The quarterly report contents are modified.
3. NSPHL starts implementing modified carbapenem inactivation method (mCIM) for screening carbapenemase and PCR testing for resistance mechanism among CRO. Details are described in surveillance protocol.
4. Washington state lab will be the regional lab for advanced testing and/or colonization screening if needed.
5. This surveillance is funded by CDC ELC grant and an epidemiologist has been assigned for this surveillance project in Washoe County.

Surveillance changes in 2018

1. There were no changes made to surveillance methods, but the report was improved by adding more tables.

Surveillance changes in 2019, 2020, and 2021

1. Updated definition for duplicate sample to be more clear on the timeframe of “year” to reflect this means calendar year.

Surveillance changes in Quarter 1 2022

1. CLSI standards for intermediate results were updated and Washoe County will no longer be requiring intermediate susceptibilities to be sent to NSPHL.

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