Community-wide Surveillance for Carbapenemase Producing Organisms (CPO)
*Statistical Report for 2022 Quarter 3**

**Report contains cumulative data from January 2022 through September 2022.*

Surveillance Definitions (year updated):
REPORT DATE Q1 (2022)

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 3 2022

Month	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Total
CRE	1	3	4	2	7	3	8	6	10	44
CRPA	6	4	4	8	8	5	5	7	3	50
CRA	0	0	0	0	0	0	0	0	0	0
Unknown	0	0	0	0	0	0	0	0	1	1
Other CROs	0	0	0	0	0	0	0	0	0	0
Total	7	7	8	10	15	8	13	13	14	95

Table 1-1: Descriptive Statistics for Reported CRO Cases, Washoe County, Quarter 3 2022

Characteristics		No.	Percent (%)
Age	Median	68 years	NA
	Minimum	3 months	NA
	Maximum	91 years	NA
Gender	Male	45	47.4%
	Female	50	52.6%
Race/Ethnicity	White, non-Hispanic	82	86.3%
	White, Hispanic	4	4.2%
	Asian	2	2.1%
	Black	4	4.2%
	American Indian/Alaskan Native	1	1.1%
	Other	1	1.1%
	Unknown	1	1.1%
Washoe County Resident	Yes	78	82.0%
	No	17	18.0%
	Unknown	0	0.0%
Specimen Type	Urine	55	58.0%
	Respiratory	12	13.0%
	Wound	15	16.0%
	Rectal	1	1.0%
	Invasive (e.g., blood, cerebrospinal fluid)	6	6.0%
	Other	0	0.0%
	Surgical	3	3.0%
	Unknown*	3	3.0%
Facility Type	Inpatient	44	46.3%
	Outpatient	45	47.4%
	Long Term Acute Care	2	2.1%
	Intensive Care Unit	4	4.2%
	Skilled Nursing Facility	0	0.0%
Total**		95	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 3 2022

Month/Year Reported	Resistance Mechanism	Organism	Active Infection or Colonization	Source of Detection	# of Contacts Identified for Screening	Case notes
7/2022	Novel	*Klebsiella Pneumoniae*	Active	Routine Reporting	1	Case has history of being transferred to multiple healthcare facilities starting in March 2022. No travel or invasive procedures prior.
7/2022	OXA-48	Unable to type	Active	Hospital Screening	0	Case had previous international hospitalizations and had been hospitalized in two separate local facilities.

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

CPO cases reported Q1-3 2022 = 2; Contacts identified Q1 = 1; Case-contact ratio Q1 = 0.5
Cumulative CPO case counts (2017- Q3 2022) =42; Contacts identified (2017- Q1 2022) = 110; Case-contact ratio = 2.62

Carbapenem Resistant Enterobacteriaceae (CRE)

Table3: Carbapenem Resistant Enterobacteriaceae, Washoe County, Quarter 3 2022

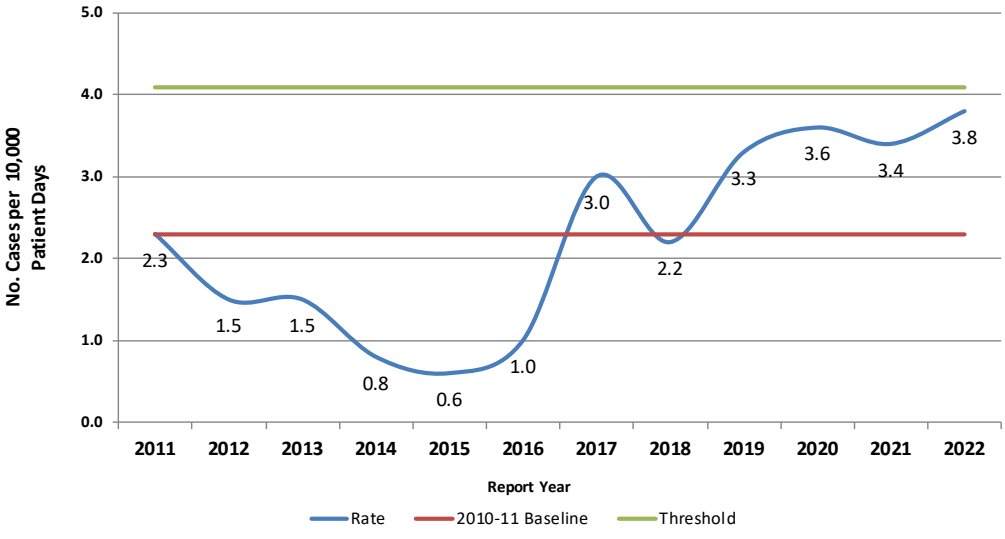
				CRE Organisms													
Year	Total N CRO	No. CRE	Proportion (%)	EC	EA	KP	E. coli	PM	CF	SM	CB	KO	PS	PR	MM	KA	Citro sp.
2017	137	36	26.3	15	7	6	4	2	1	1	0	0	0	0	0	0	0
2018	135	43	31.9	17	4	9	7	2	1	0	2	1	0	0	0	0	0
2019	94	27	28.7	13	1	9	3	0	0	0	0	0	0	0	0	0	1
2020	90	24	26.7	27	2	8	6	0	2	0	0	1	0	0	0	0	1
2021	57	25	43.9	16	2	2	1	0	0	2	0	1	1	0	0	0	0
2022	95	44	46.3	31	0	2	1	0	1	1	0	0	0	1	2	5	0

EC-*Enterobacter cloacae* , EA-*Enterobacter aerogenes* , KP-*Klebsiella pneumonia* , 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 (2022):

The reported incidence for cumulative Quarter 1 through Quarter 3 (January-September 2022) was 3.8 cases per 10,000 patient days. Figure 1 illustrates the reported incidence rate of MDRB-CR from 2011 through Quarter 3 2022.

Figure 1. Reported Incidence (per 10,000 Patient Days) of MDRB-CR, Washoe County, 2011 - Q3 2022



(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- Quarter 3 2022

Year	Jan	Feb	Mar	Apr	May	June	July	August	Sept	Total
2010	6	2	2	3	1	7	7	4	6	38
2011	9	8	9	13	5	5	4	3	4	60
2012	3	2	4	5	3	4	3	5	3	32
2013	8	3	5	5	4	3	2	0	1	31
2014	2	5	3	1	0	0	1	3	2	17
2015	0	0	2	4	2	2	3	0	2	15
2016	2	2	3	0	3	2	2	7	5	26
2017*	4	8	8	7	12	15	8	6	8	76
2018	7	5	7	3	5	8	9	6	7	57
2019	11	9	11	6	10	9	9	13	3	81
2020	5	8	6	4	4	8	9	9	1	54
2021	8	7	6	7	3	0	10	8	2	51
2022	7	7	7	10	14	8	12	9	11	85
Total	72	66	73	68	66	71	79	73	55	623

*Beginning 2017, reporting criteria changed

Severity of Drug-Resistance among CRO (Q3 2022):

- Proportion of resistance to three classes of antibiotics: 89% (85/95)
- Proportion of resistance to four or more classes of antibiotics: 74% (70/95)
- Proportion pan-resistance*: 0% (0/95)

*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-Quarter 3 2022

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	28.0	Acinetobacter (14)
2013	28	8	28.6	Acinetobacter (8)
2014	17	1	5.9	Pseudomonas aeruginosa (1)
2015	0	0	undefined	
2016	32	1	3.1	K. 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), K. pneumoniae (1)
2019	91	3	3.3	Pseudomonas aeruginosa (1), K. pneumoniae (2)
2020	89	2	2.2	Citrobacter sp. (1), K. pneumoniae (1)
2021	76	0	0.0	
2022	95	0	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. The Washoe County Health District is in the process of updating surveillance definitions and still tracking intermediate results which are not consistently forwarded to the Nevada State Public Health Lab for susceptibility testing.

Table 6: Modified Carbapenem Inactivation Method (mCIM) Testing, Washoe County, 2017- Quarter 3 2022

Year	Total N Tested	No. Positive									Positivity (%)
		Total	KP	PA	PP/PF	E. coli	EC	KO	SM	Organism not isolated	
2017 *	67	7	2	1	0	3	0	0	1	0	10.4
2018	114	17	6	1	0	7	1	1	0	1	14.9
2019	72	6	6	0	0	0	0	0	1	0	8.3
2020	53	2	2	0	0	0	0	0	0	0	3.8
2021	51	3	0	2	1	0	0	0	0	0	5.9
2022**	95	1	0	0	0	1	0	0	0	0	1.1
Total	452	36	16	4	1	11	1	1	2	1	8.0

* PCR testing by NSPHL started May 24, 2017

**Only one mCIM was reported to WCHD during Quarters 1-3. One CPO is not included in Table 6 as they were only identified using PCR testing.

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, 2017- Quarter 3 2022

Year	Total N Tested	No. Positive								Positivity (%)
		Total	KP	PA	PP/PF	E. coli	KO	EC	Organism not isolated	
2017*	15	6	2	1	0	0	0	0	0	40.0
2018	20	17	6	1	0	7	1	1	1	85.0
2019	9	6	4	1	0	1	0	0	0	66.7
2020	5	5	4	0	0	1	0	0	0	100.0
2021	4	2	0	1	1	0	0	0	0	50.0
2022	2	2	0	0	0	1	0	0	1	100.0
Total	55	38	16	4	1	10	1	1	2	69.1

* PCR testing by NSPHL started May 24, 2017

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 Quarter 3 2022

Antimicrobial Class or Subclass	CRE (n=44)			CRPA (n=50)			CRGNB[1]		
	# Tested	# Susceptible	% Susceptible	# Tested	# Susceptible	% Susceptible	# Tested	# Susceptible	% Susceptible
Penicillins									
Ampicillin	58	0	0%	0	0	0%	0	0	0%
Piperacillin	0	0	0%	0	0	0%	0	0	0%
Cephems									
Cefazolin	65	0	0%	2	0	0%	0	0	0%
Cefepime	62	41	66%	87	50	57%	0	0	0%
Cefotaxime	2	0	0%	0	0	0%	0	0	0%
Cefotetan	5	0	0%	0	0	0%	0	0	0%
Cefoxitin	0	0	0%	0	0	0%	0	0	0%
Ceftazidime	35	4	11%	65	35	54%	0	0	0%
Ceftriaxone	73	10	14%	45	1	0%	0	0	0%
Cefuroxime	32	5	16%	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	7	0	0%	0	0	0%	0	0	0%
Ampicillin-sulbactam	56	0	0%	0	0	0%	0	0	0%
Piperacillin-tazobactam	69	16	23%	90	60	67%	0	0	0%
Ticarcillin-clavulanic acid	0	0	0%	3	0	0%	0	0	0%
Fluoroquinolones									
Ciprofloxacin	65	50	77%	91	39	43%	0	0	0%
Levofloxacin	54	48	89%	73	29	40%	0	0	0%
Moxifloxacin	11	11	100%	0	0	0%	0	0	0%
Aminoglycosides									
Amikacin	34	34	100%	85	84	99%	0	0	0%
Gentamicin	69	67	97%	95	84	88%	0	0	0%
Tobramycin	67	65	97%	86	84	98%	0	0	0%
Sulfonamides									
Trimethoprim	0	0	0%	0	0	0%	0	0	0%
Trimethoprim-sulfamethoxazole	70	59	84%	44	3	7%	0	0	0%
Monobactams									
Aztreonam	29	3	10%	27	10	37%	0	0	0%
Tetracyclines									
Tetracycline	30	18	60%	45	0	0%	0	0	0%
Tigecycline	31	26	0%	0	0	0%	0	0	0%
Nitrofurans									
Nitrofurantoin	52	10	19%	0	0	0%	0	0	0%
Carbapenems									
Imipenem	12	0	0%	0	0	0%	0	0	0%
Meropenem	38	36	95%	91	29	32%	0	0	0%
Doripenem	0	0	0%	0	0	0%	0	0	0%
Ertapenem	58	0	0%	47	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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