

# Community-wide Surveillance for Carbapenemase Producing Organisms (CPO) Statistical Report for 2021

## Surveillance Definitions (year updated):

### REPORT DATE (2021)

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

### Carbapenem Resistant Enterobacteriaceae (CRE) (2017)

*Enterobacteriaceae* that meets the following criteria:

- Resistant to ANY carbapenem antimicrobial (i.e., MIC of  $\geq 4$  mcg/ml for doripenem, meropenem, or imipenem OR  $\geq 2$  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) (2017)

*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 ( $\geq 8$  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) (2017)

*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; 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, 2021**

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
CRE	2	6	1	3	2	1	5	5	0	5	4	2	36
CRPA	7	2	5	4	1	0	5	5	3	3	0	6	41
CRA	0	0	0	0	0	0	0	0	0	0	0	0	0
Other CROs	0	0	0	0	0	0	0	0	0	0	0	0	0
<b>Total</b>	<b>9</b>	<b>8</b>	<b>6</b>	<b>7</b>	<b>3</b>	<b>1</b>	<b>10</b>	<b>10</b>	<b>3</b>	<b>8</b>	<b>4</b>	<b>8</b>	<b>77</b>

**Table 1-1: Descriptive Statistics for Reported CRO Cases, Washoe County, 2021**

Characteristics		No.	Percent (%)
Age	Median	66 years	NA
	Minimum	1 years	NA
	Maximum	99 years	NA
Gender	Male	46	59.7%
	Female	31	40.3%
Race/Ethnicity	White, non-Hispanic	63	81.8%
	White, Hispanic	7	9.1%
	Asian	1	1.3%
	Black	1	1.3%
	American Indian/Alaskan Native	2	2.6%
	Other	1	1.3%
	Unknown	2	2.6%
Washoe County Resident	Yes	60	77.9%
	No	17	22.1%
	Unknown	0	0.0%
Specimen Type	Urine	39	50.6%
	Respiratory	16	20.8%
	Wound	15	19.5%
	Rectal	1	1.3%
	Invasive (e.g., blood, cerebrospinal fluid)	0	0.0%
	Other	4	5.2%
	Surgical	2	2.6%
	Unknown*	0	0.0%
Facility Type	Inpatient	46	59.7%
	Outpatient	29	37.7%
	Long Term Acute Care	1	1.3%
	Intensive Care Unit	1	1.3%
	Skilled Nursing Facility	0	0%
<b>Total**</b>		<b>16</b>	<b>100%</b>

\*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, 2021

Month/Year Reported	Resistance Mechanism	Organism	Active Infection or Colonization	Source of Detection	# of Contacts Identified for Screening	Case notes
January-21	VIM	<i>Pseudomonas aeruginosa</i>	active infection	Routine Reporting	3	Case had previous international travel history and became ill and had a 1 day stay at local hospital.
January-21	VIM	<i>Pseudomonas putida</i>	active infection	Routine Reporting	3	Case had previous international travel history and became ill and had a 1 day stay at local hospital.
January-21	Novel	<i>Pseudomonas putida</i>	active infection	hospital screening	1	Case had no travel history but was previously hospitalized twice in 2020. Patient passed away.
October-21	Novel	<i>Enterobacter cloacae</i>	active infection	Routine Reporting	0	No travel history. Case did have an amputation previously during the year and health started to decline. Patient passed away.
November-21	KPC	<i>E. coli</i>	active infection	Routine Reporting	0	Case was transferred between facilities and suffered from complications of COVID-19. Case transferred to a SNF for recovery.

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

CPO cases reported 2021 = 5; Contacts identified 2019 = 4; Case-contact ratio = 1.25

Cumulative CPO case counts (2017- 2021) =40; Contacts identified (2017- 2021) = 109; Case-contact ratio = 2.73

## Carbapenem Resistant Enterobacteriaceae (CRE)

Table3: Carbapenem Resistant Enterobacteriaceae, Washoe County, 2017-2021

Year	Total N CRO	No. CRE	Proportion (%)	CRE Organisms											
				EC	EA	KP	E. coli	PM	CF	SM	CB	KO	PS	MM	Citro sp.
2017	137	36	26.3	15	7	6	4	2	1	1	0	0	0	0	0
2018	135	43	31.9	17	4	9	7	2	1	0	2	1	0	0	0
2019	94	27	28.7	13	1	9	3	0	0	0	0	0	0	0	1
2020	90	48	53.3	27	2	8	6	0	2	0	0	1	0	0	1
2021	77	36	46.8	21	3	5	2	0	0	2	0	1	1	1	0

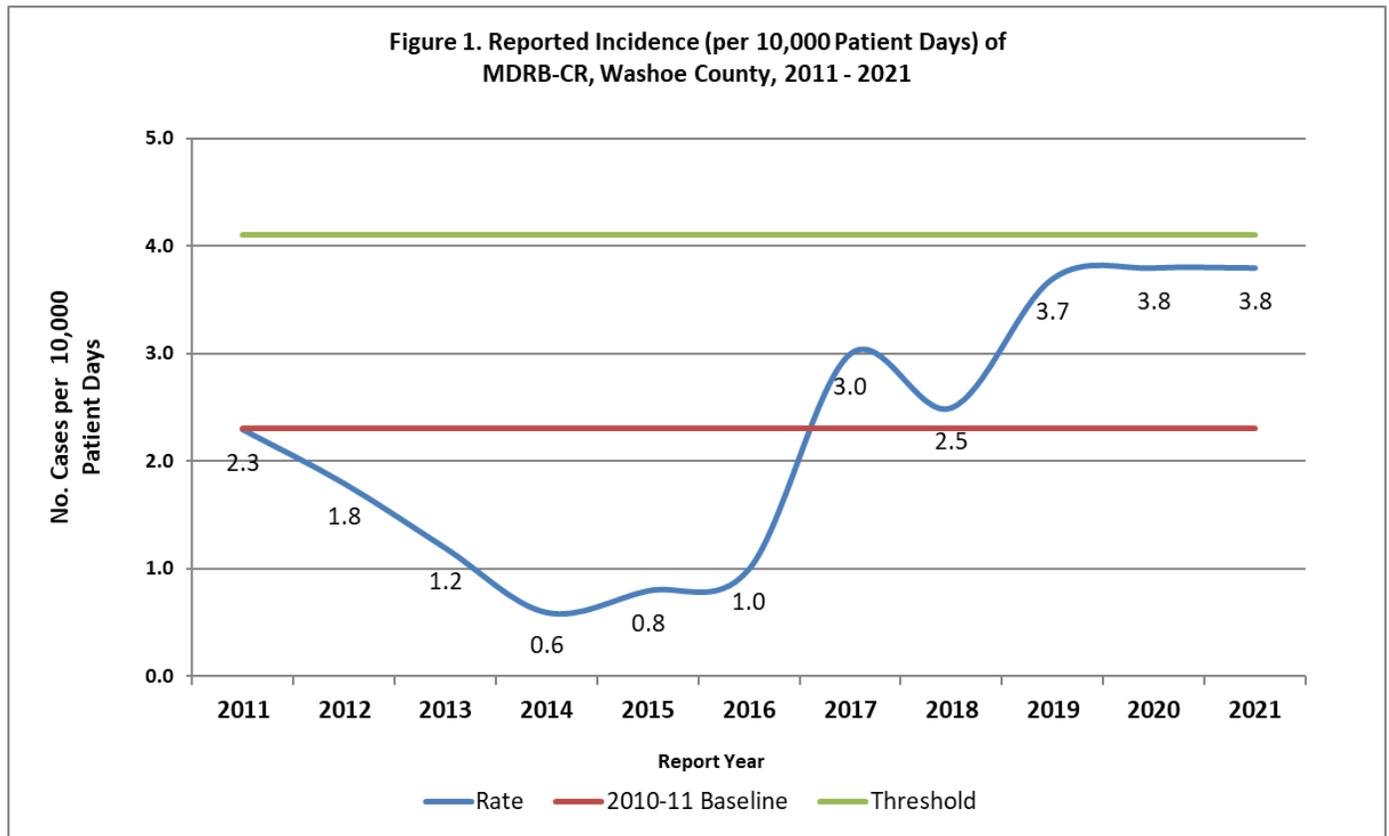
EC-Enterobacter cloacae , EA-Enterobacter aerogenes , KP-Klebsiella pneumonia , PM-Proteus mirabilis,

CF-Citrobacter freundii , SM-Serratia marcescen, CB-Citrobacter braakii, KO-Klebsiella oxytoca,

PS- Providencia stuartii, MM- Morganella morganii , Citro sp.-Citrobacter species

### Reported Incidence of MDRB-CR (2019):

The reported incidence for 2021 was 3.8 cases per 10,000 patient days. Figure 1 illustrates the reported incidence rate of MDRB-CR from 2011 through 2021.



**(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, 2010-2021**

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
2010	6	2	2	3	1	7	7	4	4	6	7	5	54
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	9	8	8	10	103
2018	7	5	7	3	5	8	9	6	7	13	6	10	86
2019	10	8	10	7	10	8	11	14	4	9	3	6	100
2020	5	8	6	4	4	8	9	9	1	8	15	7	84
2021	5	6	5	7	3	0	7	5	1	6	4	5	54
<b>Total</b>	<b>61</b>	<b>57</b>	<b>64</b>	<b>59</b>	<b>52</b>	<b>62</b>	<b>66</b>	<b>62</b>	<b>43</b>	<b>70</b>	<b>54</b>	<b>66</b>	<b>716</b>

\*Beginning 2017, reporting criteria changed

## Severity of Drug-Resistance among CRO (2021):

- Proportion of resistance to three classes of antibiotics: 90% (69/77)
- Proportion of resistance to four or more classes of antibiotics: 70% (54/77)
- Proportion pan-resistance\*: 0% (0/77)

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

## CPO Testing

**Table 5: Pan-resistance Rate, Washoe County, 2010-2021**

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	77	0	0.0	

\* may be under-reported retrospectively during January-May 2010

\*\* Pan-resistance reported by CDC

**Table 6: Modified Hodge Test (MHT), Washoe County, 2010-2017**

Year	Total N Tested**	No. Positive							Positivity (%)
		Total	A	EC	EA	KP	PA	SM	
2010*	53	4	1	2				1	7.5
2011	65	4		4					6.2
2012	39	18	13	1		3	1		46.2
2013	14	6	3	2			1		42.9
2014	7	5	2			3			71.4
2015	3	1						1	33.3
2016	6	3			1	2			50.0
2017 (As of Q2)	37	0							0.0
Total	224	41	19	9	1	8	2	2	18.3

\* May be under-reported retrospectively during January-May 2010

\*\* Including those isolates which did not meet case definition

A=Acinetobacter

EC=Enterobacter Cloacae

EA=Enterobacter aerogenens

KP=Klebsiella pneumoniae

PA=Pseudomonas aeruginosa

SM=Serratia marcescens

MHT was discontinued as of May 24, 2017 by NSPHL; therefore, the above table was kept in this report for reviewing historical data only and will no longer be updated.

Due to carbapenamase in *Serratia* spp. being common and posing a low public health risk, it is not investigated as a CPO case. Some CRO isolates were not submitted to NSPHL for a carbapenamase screening test; therefore, the total N tested is smaller than total N reported (Tables 7 and 8).

**Table 7: Modified Carbapenam Inactivation Method (mCIM) Testing, Washoe County, 2017-2021**

Year	Total N Tested	No. Positive									Positivity (%)
		Total	KP	PA	PF/PP	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	77	6	6	0	0	0	0	0	0	0	7.8
2020	81	5	2	0	0	0	0	0	0	0	6.2
2021	71	5	0	2	1	1	1	0	0	0	7.0
Total	410	40	16	4	1	11	2	1	1	1	9.8

\* PCR testing by NSPHL started May 24, 2017

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

**Table 8: Polymerase Chain Reaction (PCR) Testing, Washoe County, 2017-2021**

Year	Total N Tested	No. Positive								Positivity (%)
		Total	KP	PA	PF/PP	E. coli	KO	EC	Organism not isolated	
2017*	15	6	2	1	0	3	0	0	0	40.0
2018	20	17	6	1	0	7	1	1	1	85.0
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
Total	60	38	18	6	1	12	2	3	1	63.3

\* PCR testing by NSPHL started May 24, 2017

KP-*Klebsiella pneumoniae*, PA-*Pseudomonas aeruginosa*, PF/PP-*Pseudomonas fluorescens/putida*  
EC-*Enterobacter cloacae*, KO-*Klebsiella oxytoca*

## Antibiotic Susceptibility

Table 9. Antibiotic Susceptibility for CRE, CRPA and CRGNB 2021

Antimicrobial Class or Subclass	CRE	CRE # Tested	CRE # Susceptible	CRE % Susceptible	CRPA <sup>1</sup>	CRPA # Tested	CRPA # Susceptible	CRPA % Susceptible	CRGNB <sup>1</sup>	CRGNB # Tested	CRGNB # Susceptible	CRGNB % Susceptible
<b>Total N. Identified</b>	<b>36</b>				<b>41</b>				<b>0</b>			
<b>Penicillins</b>												
Ampicillin		33	0	0%		4	0	0%		0	0	0%
Piperacillin		0	0	0%		0	0	0%		0	0	0%
<b>Cephems</b>												
Cefazolin		10	0	0%		0	0	0%		0	0	0%
Cefepime		27	15	56%		18	6	0%		0	0	0%
Cefotaxime		1	0	0%		0	0	0%		0	0	0%
Cefotetan		1	0	0%		0	0	0%		0	0	0%
Cefoxitin		0	0	0%		0	0	0%		0	0	0%
Ceftazidime		23	12	52%		16	11	0%		0	0	0%
Ceftriaxone		20	2	10%		10	0	0%		0	0	0%
Cefuroxime		0	0	0%		0	0	0%		0	0	0%
Cephalothin		0	0	0%		0	0	0%		0	0	0%
<b>β-Lactam/β-lactamase inhibitor combinations</b>												
Amoxicillin-clavulanic acid		1	2	200%		0	0	0%		0	0	0%
Ampicillin-sulbactam		8	0	0%		0	0	0%		0	0	0%
Piperacillin-tazobactam		29	20	69%		19	17	89%		0	0	0%
Ticarcillin-clavulanic acid		0	0	0%		1	0	0%		0	0	0%
<b>Fluoroquinolones</b>												
Ciprofloxacin		31	18	58%		21	10	48%		0	0	0%
Levofloxacin		26	16	62%		17	8	47%		0	0	0%
Moxifloxacin		1	1	0%		0	0	0%		0	0	0%
<b>Aminoglycosides</b>												
Amikacin		24	24	100%		18	18	100%		0	0	0%
Gentamicin		31	31	100%		21	19	90%		0	0	0%
Tobramycin		28	28	100%		18	18	100%		0	0	0%
<b>Sulfonamides</b>												
Trimethoprim		0	0	0%		1	0	0%		0	0	0%
Trimethoprim-sulfamethoxazole		17	8	47%		7	0	0%		0	0	0%
<b>Monobactams</b>												
Aztreonam		19	11	58%		13	10	77%		0	0	0%
<b>Tetracyclines</b>												
Tetracycline		16	3	19%		10	0	0%		0	0	0%
Tigecycline		3	2	67%		0	0	0%		0	0	0%
<b>Nitrofurans</b>												
Nitrofurantoin		7	1	14%		0	0	0%		0	0	0%
<b>Carbapenems</b>												
Imipenem		6	0	0%		6	0	0%		0	0	0%
Meropenem		27	13	48%		20	6	30%		0	0	0%
Doripenem		0	0	0%		0	0	0%		0	0	0%
Ertapenem		18	0	0%		10	0	0%		0	0	0%

<sup>1</sup> *Pseudomonas aeruginosa* and *Acinetobacter* have intrinsic resistance to Ertapenem.

## Surveillance changes in 2013

Beginning in 2013, there are several changes for this surveillance.

1. The Nevada Public Health State Lab does not perform MHT on *Pseudomonas aeruginosa*.
2. The Nevada Public Health State Lab will ship isolates positive for MBL E-test to CDC for a further confirmation.
3. WCHD will contact hospital labs to obtain original reports for those isolates which are reported by the Nevada Public Health but missed reporting from hospital labs.
4. Began reporting case count on pan-resistant cases.

5. Began reporting case count for drug-resistant Acinetobacter for clinician's information.
6. Statistical report will be distributed to the working group on a quarterly basis.

### Surveillance changes in 2014

None.

### Surveillance changes in 2015

1. Infection preventionists (IP) only need to report monthly denominator data every quarter. The report due date will be the 20<sup>th</sup> of the month following the end of every quarter. For example, January 20<sup>th</sup> is the due date to report denominator data for October, November, and December.
2. Anecdotal feedback from local IPs report the utility of this surveillance project in their respective hospital's infection control plan.

### Surveillance changes in 2016

1. Report quality has been improved. Table and figure number are added in the report. Two new trend graphs (Figure 2 and 4) on the reported incidence rate of MDRB-CR by year are also added in the report.
2. Reporting criteria for hospitals is now added in the report on page 1.
3. In May 2016, WCHD collaborated with the Nevada State Public Health Laboratory (NSPHL) and Nevada Division of Public and Behavioral Health (NDPBH) to apply for a CDC's grant to increase the laboratory tests among carbapenem resistant *Pseudomonas aeruginosa* isolates to find out more about emerging resistance mechanism per CDC's grant guideline. CDC funded Nevada State on August 1, 2016. The laboratory testing for the resistance mechanism of CRE and CRPA is expected to start in 2017.
4. Effective September 23, 2016, WCHD requests local hospitals to report cases meeting CRE definition to WCHD and ship isolates meeting CRE definition to NSPHL for further testing due to one rare case of New Delhi Metallo-beta-lactamase CRE identified the community. The case acquired the infection in a foreign country. CRE definition is described on page 1.

### 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.

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