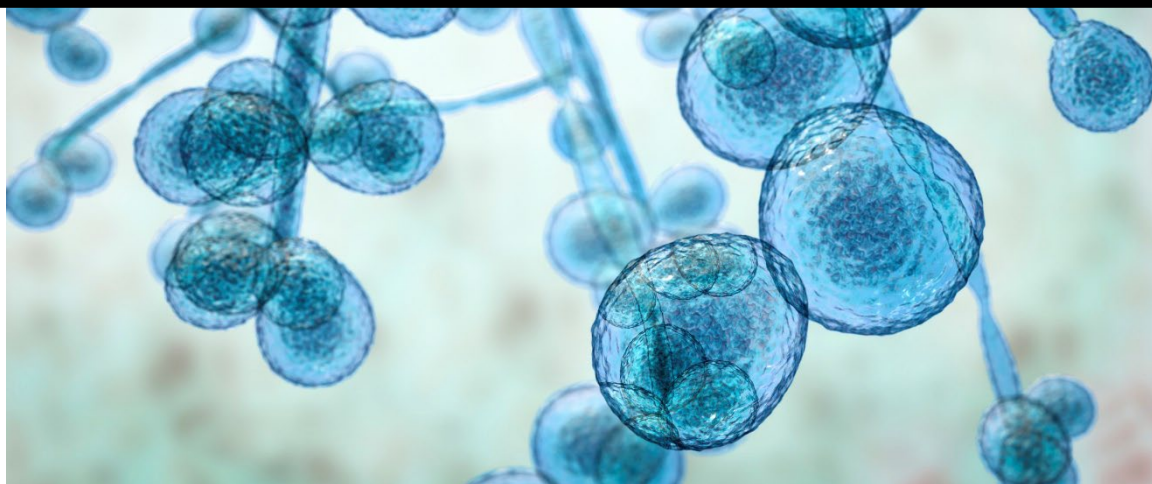


Los Angeles County 2022 Multi-Drug Resistant Organism (MDRO) Report



COUNTY OF LOS ANGELES
Public Health

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Executive Summary

Background

Multi-drug resistant organisms (MDROs) are microorganisms that are resistant to one or more classes of antimicrobial agents and have been designated by the Centers for Disease Control and Prevention (CDC) as an urgent public health priority. MDROs are common causes of healthcare-associated infections (HAIs) and those with severe disease, are immunocompromised, and have had longer healthcare stays are at higher risk for infection¹. A 2019 analysis estimates antibiotic-resistant bacteria and fungi cause over 2.8 million infections and 35,900 deaths annually². As MDROs continue to emerge and spread in healthcare settings, further efforts are needed to detect and prevent transmission.

The Los Angeles County Department of Public Health (LAC DPH) Healthcare Outreach Unit monitors select MDROs mandated reportable by LAC DPH and the California Department of Public Health (CDPH). This includes *Candida auris* (*C. auris*), carbapenem-resistant Enterobacterales (CRE), carbapenemase-producing organisms (CPO), vancomycin-resistant *Staphylococcus aureus* (VRSA), and pan-resistant organisms.

MDROs are reportable to LAC DPH in a number of ways. CRE became a mandated reportable condition in [2017](#) and is reported by hospitals (general acute care hospitals [GACHs] and long-term acute care hospitals [LTACHs]) into the Centers for Disease Control and Prevention’s National Healthcare Surveillance Network (NHSN) per an LAC Health Office Order³. The remaining MDROs in this summary are reported to LAC DPH by provider or laboratory as shown in [Table 1](#) via the LAC DPH REDCap reporting portal, Integrated Reporting, and Investigation System (IRIS) community module report, Electronic Laboratory Report (ELR), or by fax. Skilled nursing facilities (SNF) have not implemented reporting CRE in NHSN and instead report using the methods described above. While CP-CRE should also be captured by NHSN CRE reporting, validation analysis by LAC DPH has found that NHSN reporting of carbapenemase detections is not reliable (i.e., missing, or inaccurate) when compared to laboratory data. In 2019 LAC DPH issued a Health Officer Order adding CPOs, *C. auris*, VRSA, and pan-resistant organisms to the laboratory list of reportable conditions. In addition, CDPH updated Title 17 in 2022 to include CPOs as a laboratory reportable condition, however CPO reporting is likely incomplete due to laboratory challenges implementing ELR reporting.

Incomplete identification of MDROs limits the ability for LAC DPH to accurately describe incidence. A minority of clinical laboratories conduct the necessary testing to accurately identify CPOs. Often, CPOs are detected during outbreak investigation where serial point-prevalence surveys (PPS) and response-based testing are conducted by the LAC Public Health Laboratory and the regional [Antimicrobial Resistance Laboratory Network](#) (ARLN) located at the Washington State Department of Public Health. *C. auris* cases are also identified mainly during PPS conducted by LAC DPH in outbreak sites and endemic healthcare facilities. In addition, starting in 2022, select healthcare facilities voluntarily partnered with LAC DPH as part of the “Los Angeles County Multi-Drug Resistant Organism Point-Prevalence Survey” (MEASURE project) to conduct proactive PPS to assess the prevalence of CPOs.

¹ <https://www.cdc.gov/infectioncontrol/pdf/guidelines/mdro-guidelines.pdf>

² <https://www.cdc.gov/drugresistance/pdf/threats-report/2019-ar-threats-report-508.pdf>

³ <https://www.cdc.gov/nhsn/index.html>

The last published summary report describing MDRO prevalence in LAC was published in [2019](#) and described MDRO surveillance from 2017-2018. Since then, new, and emerging resistance patterns along with the regional *C. auris* outbreak and the COVID pandemic have changed the landscape of MDROs drastically. This report aims to summarize reportable MDROs detected in Los Angeles County for the calendar year 2022. In addition, LAC DPH will soon release a dynamic MDRO dashboard that includes the CPOs and *C. auris* where data can be viewed by organism, facility type and location, prior healthcare exposure, and other demographics. Prospective years' data will be updated on this dashboard.

The MDROs covered in this report are listed below and represent those that are the most clinically significant to patients and healthcare facilities:

- CPO: carbapenemase-producing organisms
 - CP-CRE, carbapenemase-producing carbapenem-resistant Enterobacterales
 - CP-AB, carbapenemase-producing *Acinetobacter baumannii*
 - CP-PA, carbapenemase-producing *Pseudomonas aeruginosa*
- Common carbapenemases:
 - KPC, *Klebsiella pneumoniae* carbapenemase
 - NDM, New Delhi Metallo-beta-lactamase
 - VIM, Verona Integron-Encoded Metallo-beta-lactamase
 - IMP, Imipenemase
 - OXA, Oxacillinase
- *C. auris*: *Candida auris*, including atypical *Candida auris* (defined as *C. auris* with a more concerning resistance pattern than typically observed in Southern California/LAC)
- VRSA: Vancomycin resistant *Staphylococcus aureus*
- Pan-resistant organisms: pan-drug resistant (PDR) gram-negative organisms that are non-susceptible (intermediate or resistant) to all antimicrobials tested. Note, the agents included vary by clinical laboratory and confirmatory testing by CDC is required to confirm a true PDR case.

Data Sources Included in this Report

Providers and laboratories report MDROs to LACDPH described in the table below.

Table 1. MDRO criteria and reporting sources

Organism	Disease categories	Criteria	Reporting source
<i>Candida auris</i> (<i>C. auris</i>)	<i>C. auris</i>	<i>Candida auris</i>	Lab and provider
Carbapenem-resistant Enterobacterales (CRE)*	CRE	Enterobacterales that are resistant to one or more carbapenems, including carbapenemase positive CRE (CP-CRE)	Provider only
Carbapenemase-producing Organisms (CPO)	CP-Enterobacterales, CP- <i>Acinetobacter</i> spp., CP- <i>Pseudomonas</i> spp., other	Carbapenemase positive by phenotypic or molecular test	Lab only
Vancomycin-resistant <i>Staphylococcus aureus</i> (VRSA)	VRSA	<i>S. aureus</i> with a vancomycin MIC ≥ 16	Lab only



Pan-resistant organisms (Suspect pan-drug resistant [PDR])	Suspect PDR	Gram negative bacteria that are non-susceptible to all antibiotics tested	Lab only
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*Includes *E. coli*, *Klebsiella oxytoca*, *Klebsiella pneumoniae*, *Enterobacter spp.* as defined by NHSN

Summary

CPOs

In 2022, a total of 350 CRE cases were reported in NHSN by GACHs and LTACHs. Laboratories reported 106 total CP-CRE cases via faxed lab/ELR/REDCap. The most common CPO reported was CP-CRE (39%), the majority of which were KPC ([Table 3](#)). Since 2019, KPC-CRE has been classified as endemic to LAC and single case follow-up was discontinued. The next most common CPO reported was “carbapenemase gene unknown” (28%), shown in [Figure 1](#). A value of “unknown” in this context represents that only phenotypic testing was conducted and molecular testing to identify a resistance gene was not done, highlighting the need for expanded carbapenemase testing.

Single case investigations and outbreaks

LAC DPH investigates single cases, outbreaks, and clusters of targeted MDROs, of which there were a total of 74 in 2022. Targeted MDROs include rare CPOs (such as non-KPC-CRE, CP-PA, and non-OXA-23-CP-AB), VRSA, and atypical *C. auris*. Of the 106 CPO identifications reported, LACDPH investigated 30 single cases of targeted CPOs (28%). In addition, DPH investigated 38 suspect clusters resulting in 7 outbreaks being opened and investigated in 2022.

The seven MDRO outbreaks in 2022 included 1 CP-PA and 6 *C. auris* outbreaks ([Table 8](#)). Approximately half of the *C. auris* outbreaks were in ventilator-capable skilled nursing facilities (vSNFs), and one CP-PA in an outpatient setting ([Figure 2](#)). For each inpatient outbreak, DPH recommended repeat PPS every two weeks to identify new colonized cases until transmission was controlled ([Table 4 & 7](#)).

The single CP-PA outbreak LAC DPH investigated in 2022 in an outpatient setting was unusual as this organism is rarely identified in this setting. This outbreak included 4 cases of VIM-CP-PA identified at an LAC ophthalmology clinic that were later found to be linked to a [nationwide outbreak associated with artificial tears](#). No PPS were performed for the CP-PA outbreak given the type of healthcare setting. Details were discussed in the quarterly lab MDRO newsletter [issue #11](#).

[Table 5](#) summarizes the types of CPO PPS that were conducted by LAC DPH in 2022. Response-based CPO PPS yielded a CPO positivity rate of 35.1%, while proactive PPS yielded positivity rates of 5.9%. Proactive PPS were most frequently conducted in LTACHs. Of the 2 response-based PPS, CPOs were only detected at one facility.

C. auris

In 2022, 939 *C. auris* cases were reported in LAC, which include both clinical and colonized cases ([Table 6](#)). Since 2020, all LAC *C. auris* clinical isolates typically demonstrated resistance only to fluconazole when antifungal susceptibility testing (AFST) was performed at ARLN. However, in 2022, LAC DPH investigated the first two cases echinocandin-resistant *C. auris*. These cases were identified at different LTACHs with no connection to one another, and transmission was not detected at either facility. Details, including AFST and treatment recommendations, were discussed in the quarterly lab MDRO newsletter [issue #11](#).

VRSA

There were no VRSA cases detected in 2022.

Pan-resistant gram-negative organisms

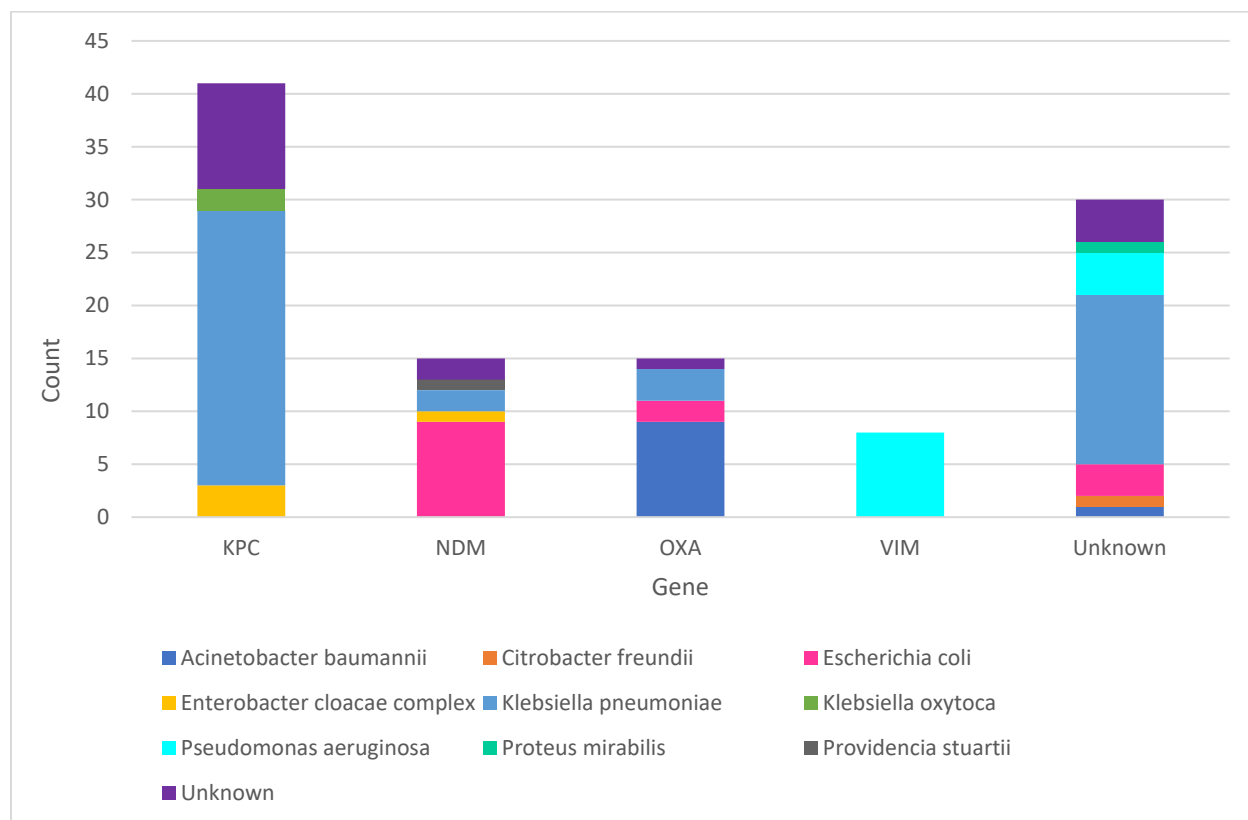
Seventy suspect pan-nonsusceptible gram-negative isolates were reported to LACDPH by clinical laboratories. The antimicrobial susceptibility test (AST) panel used by individual clinical labs vary widely and further testing is needed to confirm true pan-resistance, however due to limited resources during this period additional testing was not supported.

Summary Tables and Figures

Table 2. LAC MDRO Demographics 2022		
	CPOs n (%)	<i>C. auris</i> n (%)
# Reported	106	939
# Investigated	30 (28)	46 (5)
Male	56 (57)	490 (56)
Age (median, range)	65 (0-94)	70 (21-112)
Race		
White	28 (36)	261 (41)
Black or African American	8 (10)	115 (18)
Asian	9 (12)	57 (9)
Native Hawaiian or Pacific Islander	1 (1)	1 (<1)
American Indian or Alaska Native	1 (1)	2 (<1)
Other	30 (39)	196 (31)
Missing	28	307
Reporting Facility Type		
GACH	94 (90)	226 (24)
LTACH	10 (9)	692 (74)
SNF	1 (1)	21 (2)
Case Type		
Colonization*	13 (12)	661 (71)
Colonization to Clinical [†]	NA	69 (7)
Clinical [^]	92 (88)	209 (22)

Note that all cases are counted by case and facility type at time of first positive specimen collection. *Swab collected for the purpose of screening for *C. auris* colonization. ^ Specimen collected for clinical purposes. † Cases who were first identified via screening swab and later had one or more positive clinical specimen(s).

Figure 1. Frequency of carbapenemase gene and organism, LAC, 2022 (n=106)



Sub-variants (i.e., OXA-23,235 & VIM-2, VIM-80) have been collapsed into broader categories

Table 3. Reported CPO by Gene Frequency, LAC, 2022 (n=106)

Organism	N	KPC	NDM	OXA	OXA-23	OXA-235	VIM-80	VIM-2	VIM	Unknown [^]
<i>Acinetobacter baumannii</i>	9				8	1				1
<i>Citrobacter freundii</i>	1									1
<i>Escherichia coli</i>	14		9	2						3
<i>Enterobacter cloacae complex</i>	4	3	1							
<i>Klebsiella pneumoniae</i>	45	26	2	3						16
<i>Klebsiella oxytoca</i>	2	2								
<i>Pseudomonas aeruginosa</i>	12						4	2	2	4
<i>Proteus mirabilis</i>	1									1
<i>Providencia stuartii</i>	1		1							

Unknown [^]	17	10	2	1						4
Total	106	41	15	6	8	1	4	2	2	30

*Isolates may have multiple carbapenemase genes detected but are only counted once in the organism total count

[^]Unknown organism and/or gene is indicative of testing (i.e., lack of molecular testing) or reporting limitations (i.e., information missing from ELR transmission)

Table 4. CPO PPS performed by DPH, 2022

		# of PPS	# of Tests	% Positive Tests
Reason for Testing				
	Response-based	2	69	29.0%
	Proactive	3	135	5.9%
Facility Type				
	GACH	1	35	0%
	LTACH	3	157	17.8%
	SNF	1	12	0.0%
Total		5	204	13.7%

*Definitions: Response-based= PPS performed in response to suspected transmission; Proactive= PPS performed to identify any organisms at a facility without a known exposure.

Table 5. Number of CPO Tests and Positivity by Reason for Testing and Facility Type

Reason for testing	LTACH		SNF		GACH	
	# Tested	% Positive	# Tested	% Positive	# Tested	% Positive
Response-based	57	35.1%	12	0.0%	NA	NA
Proactive	100	8.0%	NA	NA	35	0.0%

Table 6. Reported *C. auris* Cases in LAC, 2022

HCF Type	Clinical	Colonized	Colonized-to-clinical	Grand Total
Hospital (GACH)	139	77	10	226
Long-Term Acute Care Hospital (LTACH)	65	569	58	692
Skilled Nursing Facility (SNF)	5	15	1	21
Grand Total	209	661	69	939



Table 7. *C. auris* point prevalence surveys (PPS) performed by DPH, 2022

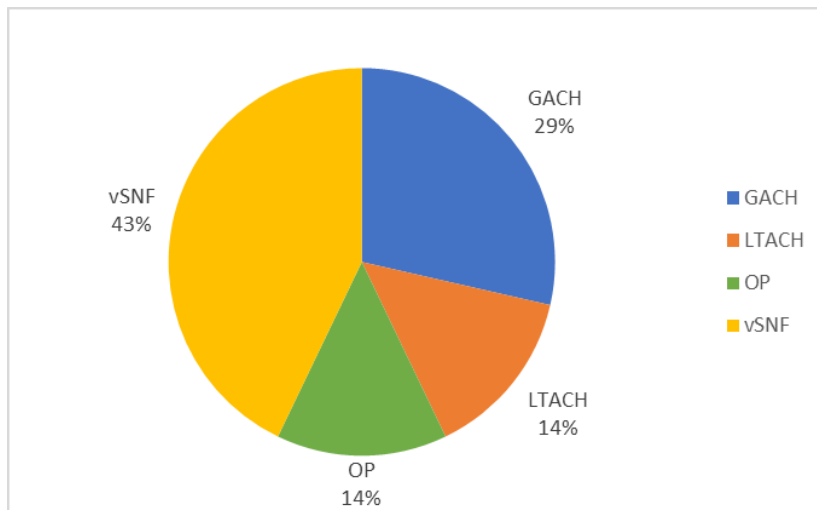
	# of PPS	# of Tests	% Positive Tests
Reason for Testing*			
Outbreak	17	541	2.96%
Response-based	13	303	7.59%
Endemic	123	2983	14.3%
Facility Type			
GACH (n=1)	1	16	0%
LTACH (n=8)	130	3085	14.2%
vSNF (n=6)	22	726	3.72%
Total	153	3827	12.2%

*Definitions: Outbreak= PPS performed for an active *C. auris* outbreak; Response-based= PPS performed in response to suspected transmission; Endemic= PPS performed regularly at LAC LTACHs where transmission is ongoing.

Table 8. MDRO outbreaks by disease, 2022 (n=7)

MDRO	No. of outbreak	No. of cases	Cases per outbreak (average)	Cases per outbreak (range)
<i>C. auris</i>	6	45	7.5	4-14
CPPA	1	4	4	4

Figure 2. MDRO Outbreaks by Setting Type, 2022 (n=7)



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