AUSTRALIAN COMMISSION ON SAFETY AND QUALITY IN HEALTH CARE

AURA Antimicrobial Use and Resistance in Australia

CARAlert THE NATIONAL ALERT SYSTEM FOR CRITICAL ANTIMICROBIAL RESISTANCE

CARAlert data update 15

1 September 2019–31 October 2019

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Data Summary

This report provides an update on data submitted to CARAlert for the reporting period: 1 September 2019 to 31 October 2019, and complements previous analyses of and updates on CARAlert data.

National overview:

- There was a 4.9% decrease in critical antimicrobial resistances (CARs) reported compared to the previous two-month reporting period (*n* = 274)
- Carbapenemase-producing Enterobacterales (CPE) (including those with ribosomal methyltransferase or transmissible resistance to colistin) remains the most frequently reported CAR (*n* = 133, 49%), followed by azithromycin non-susceptible (low-level resistance, MIC ≤ 256 mg/L) *Neisseria gonorrhoeae* (*n* = 51, 19%)
- The total number of CPE (either alone or in combination with other CARs) reported this year to date, compared to the same period last year, increased by 46.2% (*n* = 731 versus *n* = 500). There was an increase in the proportion of CPE from South Australia (9.0%; 12/133) compared to previous two-month period (2.7%; 4/147)
- The number of multidrug-resistant *Shigella* species (*n* = 21) was similar to that reported in the previous two-month reporting period
- There was a decrease in the number of ceftriaxone non-susceptible *Salmonella* species (*n* = 4, down 56%)
- There were two reports of multidrug-resistant *Mycobacterium tuberculosis*
- The majority of CARs, excluding those from *N. gonorrhoeae*, were reported from public hospitals (*n* = 155, 70%). There were 36 from community settings, 17 from aged care homes (10 daptomycin non-susceptible *S. aureus*, eight from Queensland; and seven CPE), and seven from private hospitals.

Carbapenemase-producing Enterobacterales:

- IMP (48.1%), NDM (32.3%), and OXA-48-like (14.3%) types accounted for 94.7% of all CPE reported during this period
- The total number of CPE declined (*n* = 133, down 9.5%), with decreases in the number of IMP-types and KPC-types (IMP: *n* = 64 versus *n* = 77; KPC: *n* = 2 versus *n* = 5) compared to the previous two-month period. However, there was an increase in the number of NDM-types (n = 43 versus n = 38)
- The number of NDM-types from South Australia increased compared to the previous two-month period (*n* = 10 versus *n* = 1); 70% were from screening specimens
- Two *Enterobacter cloacae* complex harbouring IMP-4 and mcr-9.1 were reported from Victoria; one isolate was from blood culture
- The majority of OXA-48-like types were reported from Victoria (15, 79%); 12/15 were from screening specimens
- There were two reports of KPC-producing *Klebsiella pneumoniae*; one from Victoria and one from Tasmania
- There were two OXA-23-like producing Enterobacterales; one *E. coli* reported from New South Wales, and one *Proteus mirabilis* reported from Queensland
- Excluding CARs for which the setting was unknown, 17% of CPE were reported from settings other than public hospitals; 4.5% (*n* = 6), 7.6% (*n* = 10) and 5.3% (*n* = 7) respectively from private hospitals, community and aged care
- Five hospitals had more than two notifications of IMP-types; these institutions were in New South Wales (*n* = 3), Queensland (n = 1) and Victoria (*n* = 1)
- Three hospitals had more than two notifications of NDM-types; two in Victoria and one in South Australia
- One hospital in Victoria had four notifications of OXA-181, from three patients. Another hospital had four notifications of an OXA-23-producing *Acinetobacter baumannii* complex

- There were sporadic reports of NDM-types in Western Australia and the Northern Territory; and no recent reports of CPE in the Australian Capital Territory and Tasmania.

Carbapenemase-producing *Acinetobacter baumannii* complex and *Pseudomonas aeruginosa:*

- Ten *A. baumannii* complex were reported; nine from Victoria (OXA-23 [*n* = 8], OXA-58 [*n* =1]), and one OXA-23-like-producing isolate from Queensland
- Nine carbapenemase-producing *Pseudomonas aeruginosa* were reported during this period; four from New South Wales (GES [*n* = 3], KPC [*n* = 1]), four from Victoria (VIM [*n* = 2], GES [*n* = 1], NDM+VIM [*n* = 1]), and one from Queensland (GES).

Azithromycin non-susceptible (low-level resistance, MIC ≤ 256 mg/L) *N. gonorrhoeae*:

- The total number of reports of this CAR declined (*n* = 51, down 11%). There was a decrease in the number from New South Wales (*n* = 19 versus *n* = 26) and an increase in the number from Queensland (*n* = 10 versus *n* = 5) compared to the previous two-month reporting period
- The majority of cases were reported from Victoria (*n* = 22, 43%).

Ceftriaxone non-susceptible or azithromycin non-susceptible (high-level resistance, MIC ≥ 256 mg/L) *N. gonorrhoeae:*

- There were three reports of azithromycin non-susceptible (high-level resistance) *N. gonorrhoeae*, two from Queensland and one from New South Wales.

***Salmonella* and *Shigella* species:**

- Ceftriaxone non-susceptible *Salmonella* species were only reported from New South Wales (*n* = 2), and Western Australia (*n* = 2)
- One typhoidal isolate producing ESBL (CTX-M group 1) was reported from a blood culture from a patient residing in New South Wales
- The majority of multidrug-resistant *Shigella* species were reported from New South Wales (n = 10, 48%); other reports were from Queensland (*n* = 5), Western Australia (*n* = 3), and the Australian Capital Territory (n = 3). All were *S. sonnei*.

***Candida auris*:**

- No *Candida auris* were reported during this period.

Daptomycin non-susceptible *Staphylococcus aureus*

- The total number of reports of this CAR increased (n = 34, up 13%). There was an increase in the numbers from Queensland (*n* = 14 versus *n* = 8) and Western Australia (*n* = 8 versus *n* = 4) compared to the previous two-month reporting period
- Eight of 14 daptomycin non-susceptible *S. aureus* reported from Queensland were from aged care homes.

National summary

Table 1: Number of critical antimicrobial resistances, by state and territory, 1 September 2019–31 October 2019, and 2018

		State or Territory								Bi-monthly			Year to date		
										2019	2019				
Species	**Critical resistance**	**NSW**	**Vic**	**Qld**	**SA**	**WA**	**Tas**	**NT**	**ACT**	**Sep-Oct**	**Jul-Aug**	**Relative change***	**2019**	**2018**	**Relative change***
Acinetobacter baumannii complex	Carbapenemase-producing†	0	9	1	0	0	0	0	0	10	6	▲ 66.7%	16	–	–
Candida auris	–†	0	0	0	0	0	0	0	0	0	1	▼ 100%	2	–	–
Enterobacterales	Carbapenemase-producing	44	40	24	12	5	2	1	1	129	138	▼ 6.5%	687	473	▲ 45.2
	Carbapenemase and ribosomal methyltransferase-producing	0	1	1	0	0	0	0	0	2	2	0.0%	32	27	▲ 18.5%
	Ribosomal methyltransferase-producing	1	0	1	0	0	0	0	0	2	0	–	7	10	▼ 30.0%
	Carbapenemase-producing and transmissible resistance to colistin†	0	2	0	0	0	0	0	0	2	7	▼ 71.4%	12	–	–
Enterococcus species	Linezolid non-susceptible	1	2	0	2	0	0	0	0	5	2	▲ 150%	11	13	▼ 15.4%
Mycobacterium tuberculosis	Multidrug-resistant – at least rifampicin- and isoniazid-resistant strains	1	0	0	1	0	0	0	0	2	3	▼ 33.3%	18	24	▼ 25.0%
Neisseria gonorrhoeae	Azithromycin non-susceptible (LLR < 256 mg/L)	19	22	10	0	0	0	0	0	51	57	▼ 10.5%	363	447	▼ 18.8%
	Azithromycin non-susceptible (HLR > 256 mg/L	1	0	2	0	0	0	0	0	3	2	▲ 50.0%	6	7	▼ 14.3%
	Ceftriaxone non-susceptible	0	0	0	0	0	0	0	0	0	1	▼ 100%	4	2	▲ 100%
	Ceftriaxone non-susceptible and azithromycin non-susceptible (LLR < 256 mg/L)	0	0	0	0	0	0	0	0	0	0	–	0	1	▼ 100%
	Ceftriaxone non-susceptible and azithromycin non-susceptible (HLR > 256 mg/L)	0	0	0	0	0	0	0	0	0	0	–	0	2	▼ 100%

HLR = high-level resistance; LLR = low-level resistance; – = not applicable; † = new CAR reported from July 2019

Table 1 (continued)

										Bimonthly			Year to Date		
										2019	2019				
Species	**Critical resistance**	**NSW**	**Vic**	**Qld**	**SA**	**WA**	**Tas**	**NT**	**ACT**	**Sep-Oct**	**Jul-Aug**	**Relative change***	**2019**	**2018**	**Relative change***
Pseudomonas aeruginosa	Carbapenemase-producing†	4	4	1	0	0	0	0	0	9	**8**	▲ 12.5%	18	0	–
Salmonella species	Ceftriaxone non-susceptible	2	0	0	0	2	0	0	0	4	9	▼ 55.6%	31	46	▼ 32.6%
Shigella species	Multidrug-resistant	10	0	5	0	3	0	0	3	21	22	▼ 4.5	121	46	▲ 163%
Staphylococcus aureus	Daptomycin non-susceptible	4	8	14	0	8	0	0	0	34	30	▲ 13.3%	126	101	▲ 24.8%
	Daptomycin and vancomycin non-susceptible	0	0	0	0	0	0	0	0	0	0	–	0	0	–
	Linezolid non-susceptible	0	0	0	0	0	0	0	0	0	0	–	0	1	▼ 100%
	Vancomycin non-susceptible	0	0	0	0	0	0	0	0	0	0	–	0	0	–
Streptococcus pyogenes	Penicillin reduced susceptibility	0	0	0	0	0	0	0	0	0	0	–	0	0	–
	Total (reported by 30 November 2019)	**87**	**88**	**59**	**15**	**18**	**2**	**1**	**4**	**274**	**288**	**▼ 4.9%**	**1,454**	**1,200**	**▲ 21.2%**

HLR = high-level resistance; LLR = low-level resistance; – = not applicable; † = new CAR reported from July 2019

* Relative change = absolute change between period in 2018 and same period in 2019, for each CAR, expressed as a percentage of 2018 base

Table 2: Number of critical antimicrobial resistance isolates, by setting, national, 1 September 2019–31 October 2019

Species	Critical resistance	Setting					Total
		Public hospital	Private hospital	Aged care home	Community	Unknown	
Acinatobacter baumannii complex	Carbapenemase-producing	9	1	0	0	0	10
Candida auris	–	0	0	0	0	0	0
Enterobacterales	Carbapenemase-producing	107	6	7	8	1	129
	Carbapenemase and ribosomal methyltransferase-producing	0	0	0	2	0	2
	Ribosomal methyltransferase-producing	1	0	0	1	0	2
	Transmissible resistance to colistin	0	0	0	0	0	0
	Transmissible resistance to colistin and carbapenemase-producing	2	0	0	0	0	2
Enterococcus species	Linezolid non-susceptible	5	0	0	0	0	5
Mycobacterium tuberculosis	Multidrug-resistant – at least rifampicin- and isoniazid-resistant	2	0	0	0	0	2
Neisseria gonorrhoeae	Azithromycin non-susceptible (LLR < 256 mg/L)	1	0	0	31	19	51
	Azithromycin non-susceptible (HLR > 256 mg/L	0	0	0	2	1	3
	Ceftriaxone non-susceptible	0	0	0	0	0	0
	Ceftriaxone non-susceptible and azithromycin non-susceptible (LLR < 256 mg/L)	0	0	0	0	0	0
	Ceftriaxone non-susceptible and azithromycin non-susceptible (HLR > 256 mg/L)	0	0	0	0	0	0
Pseudomonas aeruginosa	Carbapenemase-producing	6	0	0	3	0	9
Salmonella species	Ceftriaxone non-susceptible	3	0	0	1	0	4
Shigella species	Multidrug-resistant	7	0	0	11	3	21
Staphylococcus aureus	Daptomycin non-susceptible	13	0	10	10	1	34
	Daptomycin and vancomycin non-susceptible	0	0	0	0	0	0
	Linezolid non-susceptible	0	0	0	0	0	0
	Vancomycin non-susceptible	0	0	0	0	0	0
Streptococcus pyogenes	Penicillin reduced susceptibility	0	0	0	0	0	0
	Total (reported by 30 November 2019)	**156**	**7**	**17**	**69**	**25**	**274**

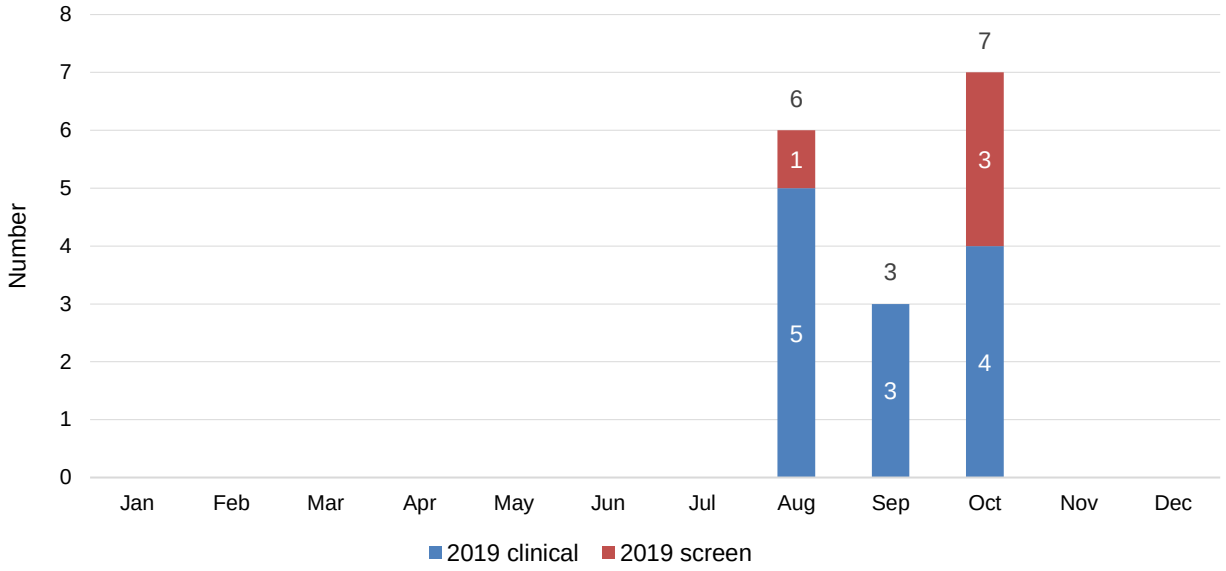
* Information on setting for *Neisseria gonorrhoeae* is often not available

Summary by CAR

Acinetobacter baumannii complex

National data

Figure 1: Carbapenemase-producing *Acinetobacter baumannii* complex, number reported by specimen type for 2019*, national



* New CAR reported from July 2019

State and territory

Figure 2: Carbapenemase-producing *Acinetobacter baumannii* complex, number reported by carbapenemase type and specimen type, by state and territory, 1 September 2019–31 October 2019

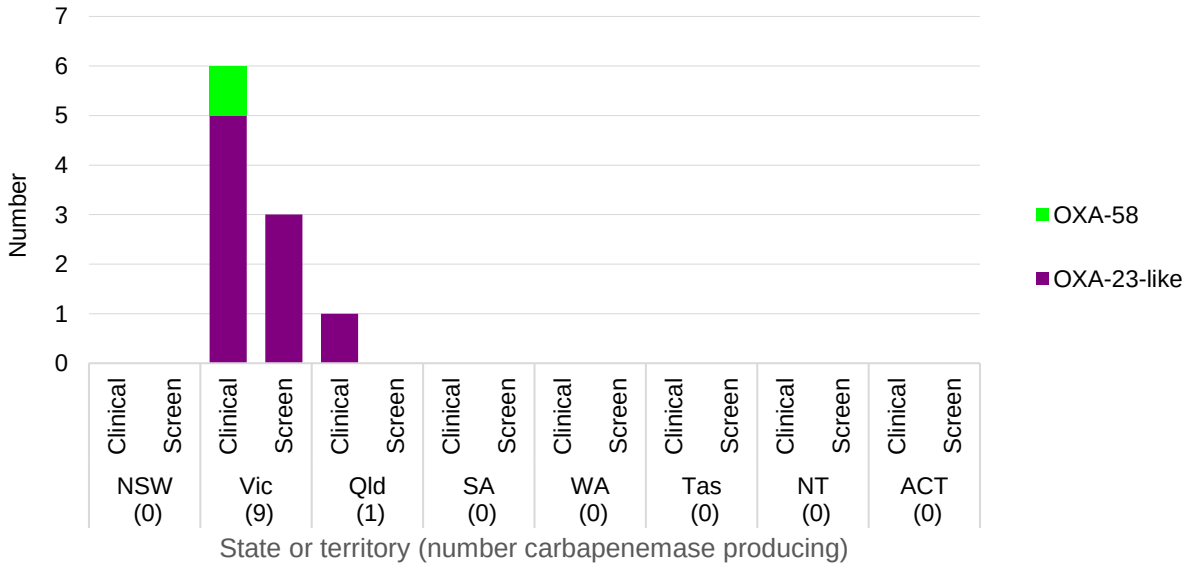


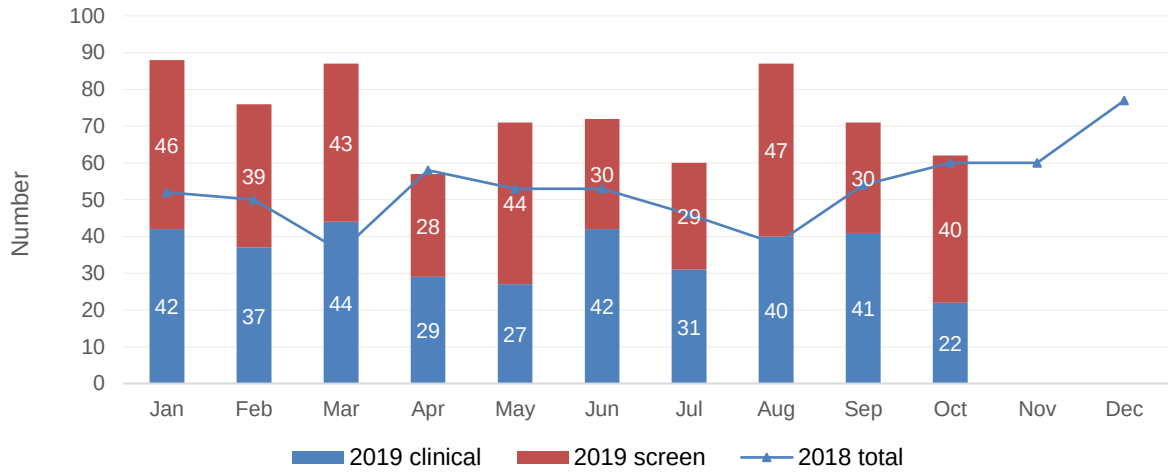
Table 3: Carbapenemase-producing *Acinetobacter baumannii* complex, number reported by setting, by state and territory, 1 September 2019–31 October 2019

Setting	State or territory								Total
	NSW	Vic	Qld	SA	WA	Tas	NT	ACT	
Total	**0**	**9**	**1**	**0**	**0**	**0**	**0**	**0**	**10**
Public hospital	0	8	1	0	0	0	0	0	9
Private hospital	0	1	0	0	0	0	0	0	1
Aged care home	0	0	0	0	0	0	0	0	0
Community	0	0	0	0	0	0	0	0	0

Enterobacterales

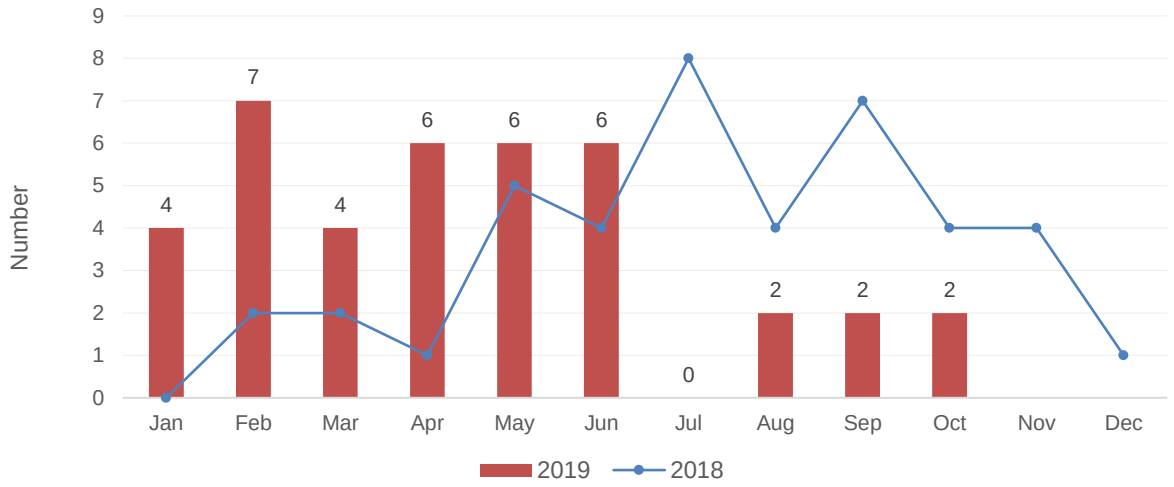
National data

Figure 3: Carbapenemase-producing Enterobacterales*, number reported by specimen type for 2019, compared with the total for previous year, national



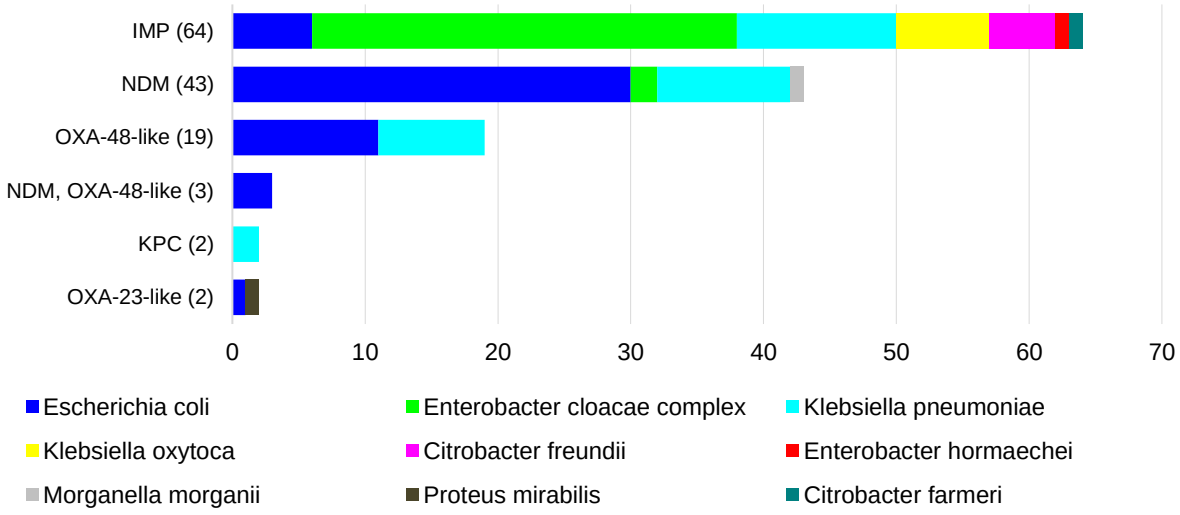
* Carbapenemase-producing alone or in combination with ribosomal methyltransferases

Figure 4: Ribosomal methyltransferase-producing Enterobacterales*, number reported for 2019 by month, compared with the previous year, national



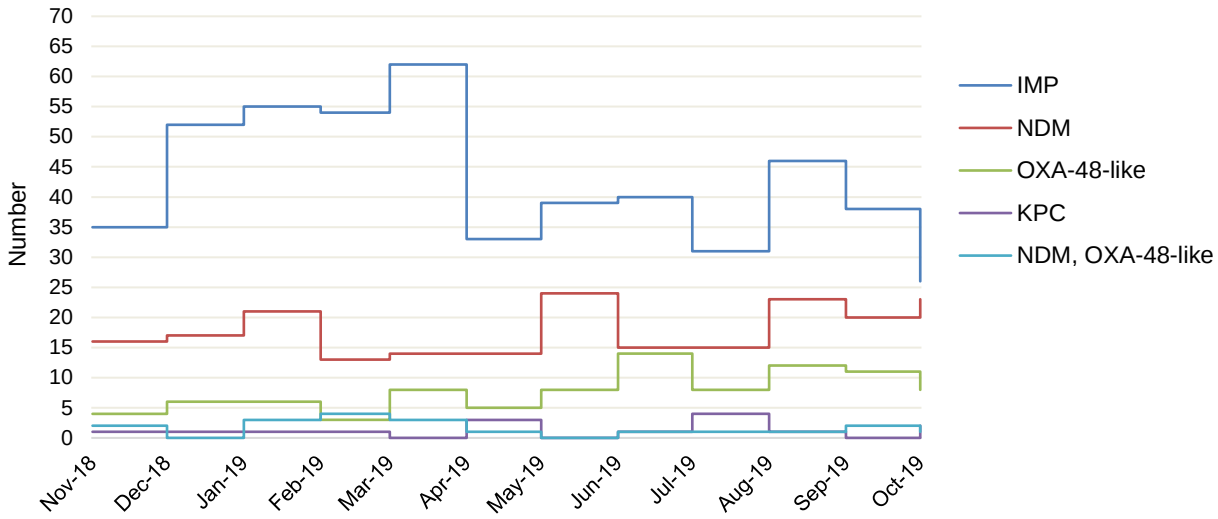
* Ribosomal methyltransferases alone, or in combination with carbapenemases

Figure 5: Carbapenemase-producing Enterobacterales*, number reported by carbapenemase type and species, national, 1 September 2019–31 October 2019



* Carbapenemase-producing Enterobacterales (*n* = 129), carbapenemase- and ribosomal methyltransferase-producing Enterobacterales (*n* = 2); carbapenemase-producing and transmissible resistance to colistin Enterobacterales (*n* = 2)

Figure 6: Twelve-month trend for the top four reported carbapenemase types, national, 1 November 2018–31 October 2019



State and territory

Figure 7: Carbapenemase-producing Enterobacterales, number reported by state and territory, 1 September 2019–31 October 2019

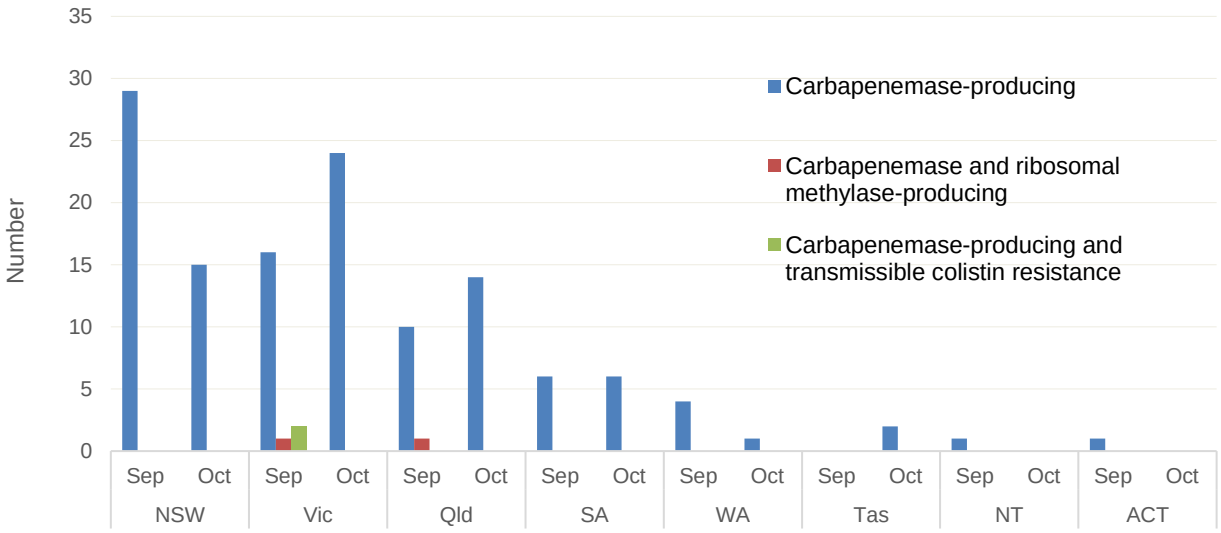


Figure 8: Two-year trend for the top four reported carbapenemase types from Enterobacterales, by state and territory and nationally, (three-month moving average), 1 November 2017–31 October 2019

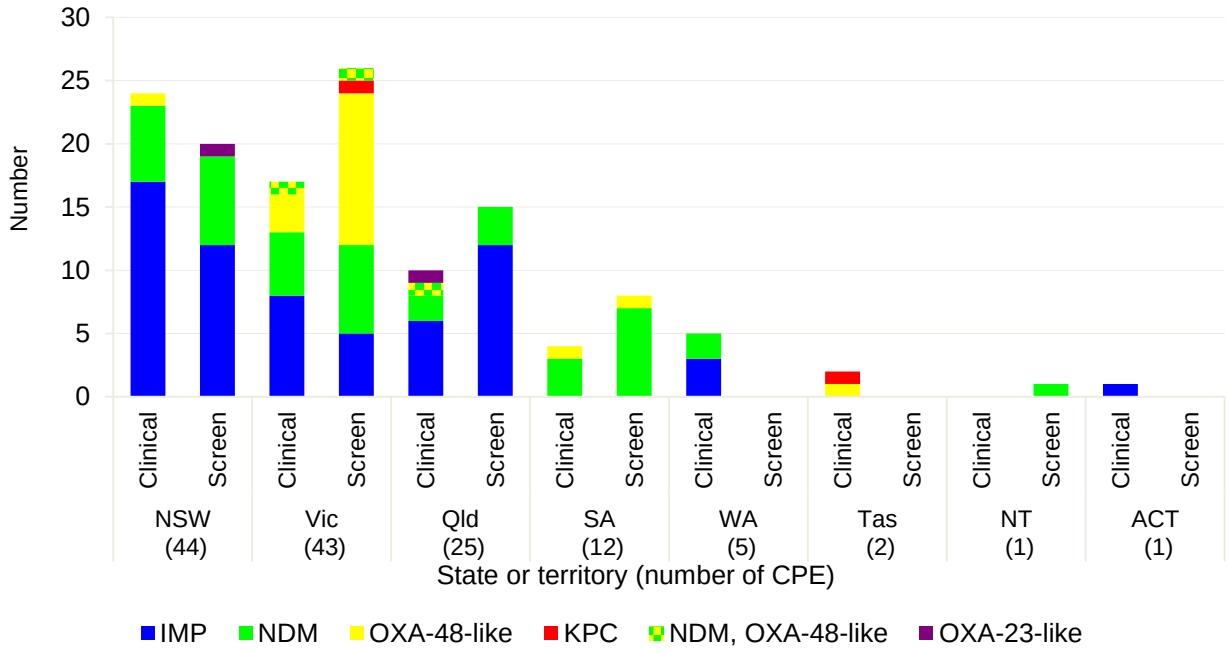
Type	NSW	Vic	Qld	SA	WA	Tas	NT	ACT	Australia
IMP	20 5	23 0	12 9	0 0	4 1	0 0	1 0	2 0	57 22
NDM	8 1	7 1	6 1	4 0	2 0	0 0	1 0	1 0	22 7
OXA-48-like	3 1	6 0	2 0	1 0	1 0	0 0	0 0	0 0	11 4
KPC	1 0	3 0	1 0	0 0	0 0	0 0	0 0	0 0	3 1
All types	28 11	35 2	19 10	5 0	6 1	1 0	1 0	2 0	84 39

Line graphs represent three-month moving average for the period 1 September 2017 to 31 October 2019, for each type, where maximum monthly average was greater than one.

Straight green line in cell = no carbapenemase type for that state or territory during the reporting period

Blank cell = maximum monthly average was one or less

Figure 9: Carbapenemase-producing Enterobacterales*, number reported by carbapenemase type and specimen type, by state and territory, 1 September 2019–31 October 2019



* Carbapenemase-producing Enterobacterales (*n* = 129), carbapenemase- and ribosomal methyltransferase-producing Enterobacterales (*n* = 2); carbapenemase-producing and transmissible resistance to colistin Enterobacterales (*n* = 2);

Notes:

1. An increase in screening isolates may be due to a change in screening practice or indicate that an outbreak is being managed
2. NDM-type is primarily associated with overseas acquisition; increases in NDM-type screening isolates may be due to increased overseas acquisition in local patients. Local transmission requires enhanced surveillance and response.

Figure 10: Top four reported carbapenemase-producing Enterobacterales type by specimen type, by state and territory, 1 September 2019–31 October 2019

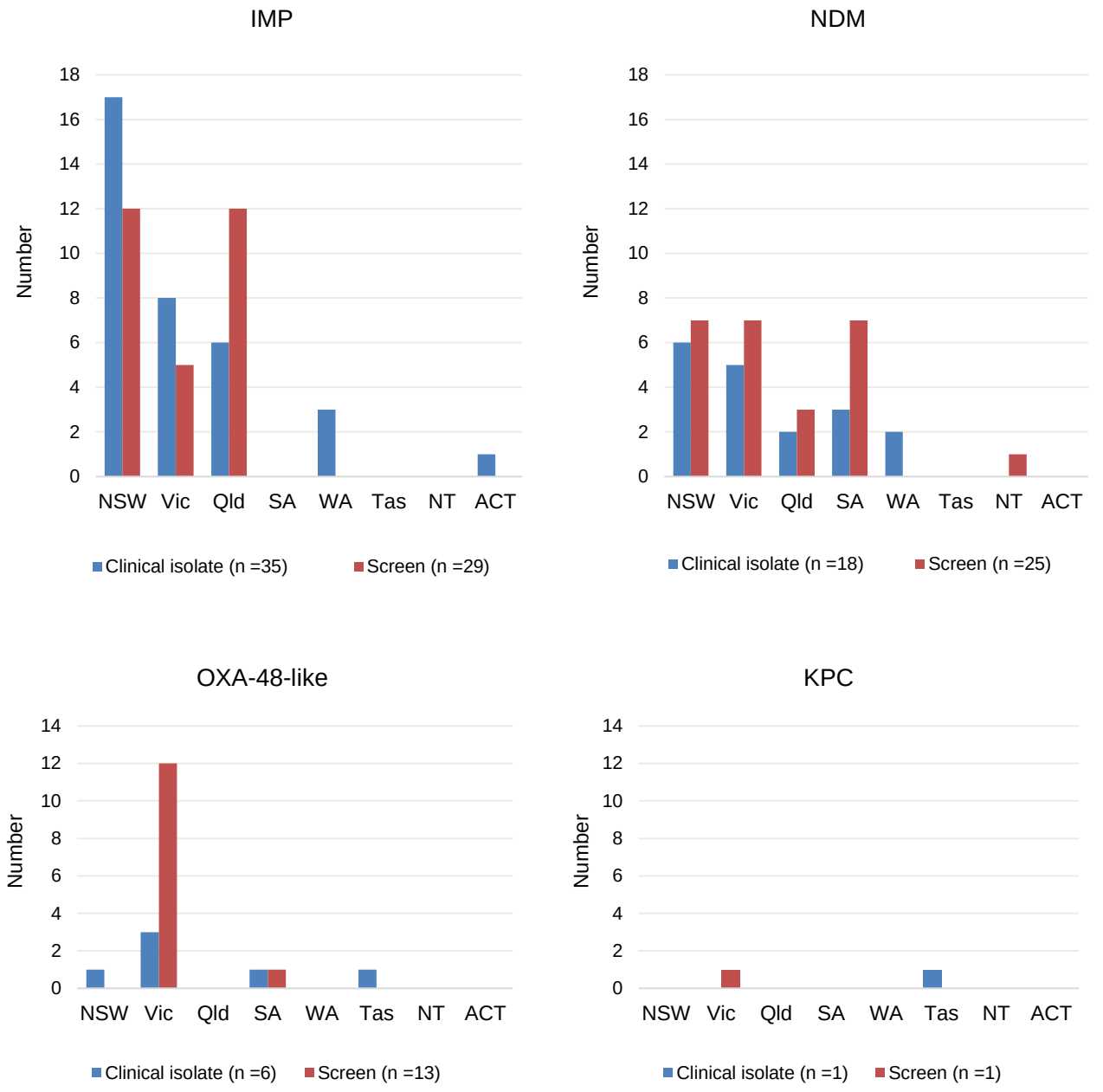


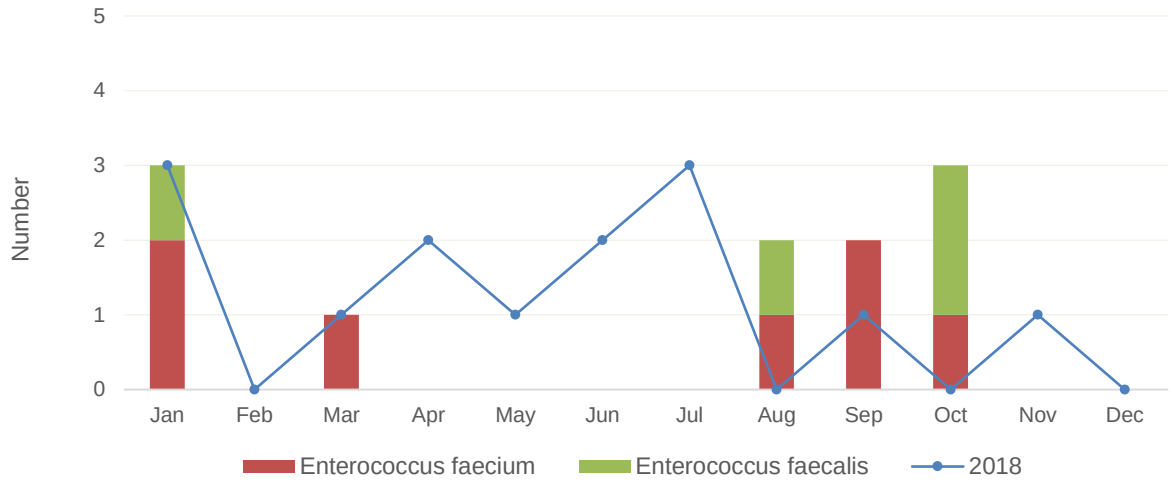
Table 4: Top four carbapenemase types from Enterobacterales, number reported by setting, by state and territory, 1 September 2019–31 October 2019

Carbapenemase type	Setting	State or territory								Total
		NSW	Vic	Qld	SA	WA	Tas	NT	ACT	
IMP	**Total**	**29**	**13**	**18**	**0**	**3**	**0**	**0**	**1**	**64**
	Public hospital	28	10	12	0	3	0	0	1	54
	Private hospital	0	2	2	0	0	0	0	0	4
	Aged care home	1	0	3	0	0	0	0	0	4
	Community	0	1	0	0	0	0	0	0	1
	Unknown	0	0	1	0	0	0	0	0	1
NDM	**Total**	**13**	**12**	**5**	**10**	**2**	**0**	**1**	**0**	**43**
	Public hospital	10	10	2	7	1	0	1	0	31
	Private hospital	1	0	1	0	0	0	0	0	2
	Aged care home	0	0	0	3	0	0	0	0	3
	Community	2	2	2	0	1	0	0	0	7
	Unknown	0	0	0	0	0	0	0	0	0
OXA-48-like	**Total**	**1**	**15**	**0**	**2**	**0**	**1**	**0**	**0**	**19**
	Public hospital	1	14	0	2	0	1	0	0	18
	Private hospital	0	0	0	0	0	0	0	0	0
	Aged care home	0	0	0	0	0	0	0	0	0
	Community	0	1	0	0	0	0	0	0	1
	Unknown	0	0	0	0	0	0	0	0	0
NDM, OXA-48-like	**Total**	**0**	**2**	**1**	**0**	**0**	**0**	**0**	**0**	**3**
	Public hospital	0	1	1	0	0	0	0	0	2
	Private hospital	0	0	0	0	0	0	0	0	0
	Aged care home	0	0	0	0	0	0	0	0	0
	Community	0	1	0	0	0	0	0	0	1
	Unknown	0	0	0	0	0	0	0	0	0

* Top four carbapenemase types account for 97% (129/133) of all carbapenemase-producing Enterobacterales reported for this period. Other types were KPC (n = 2, Vic and Tas) and OXA-23-like (n = 2, NSW and Qld)

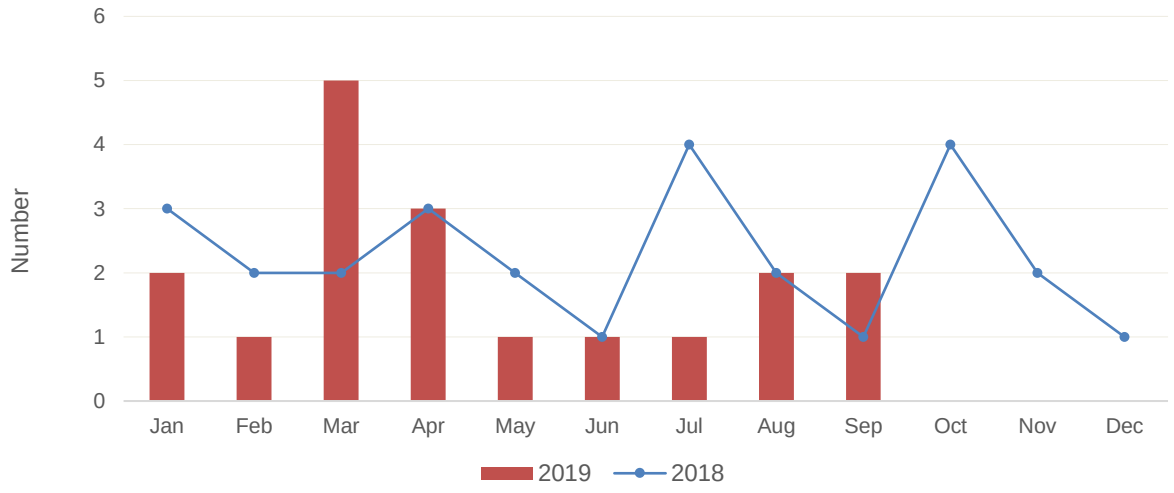
Enterococcus species

Figure 11: Linezolid non-susceptible *Enterococcus* species, number reported for 2019, by month, compared with the previous year, national



Mycobacterium tuberculosis

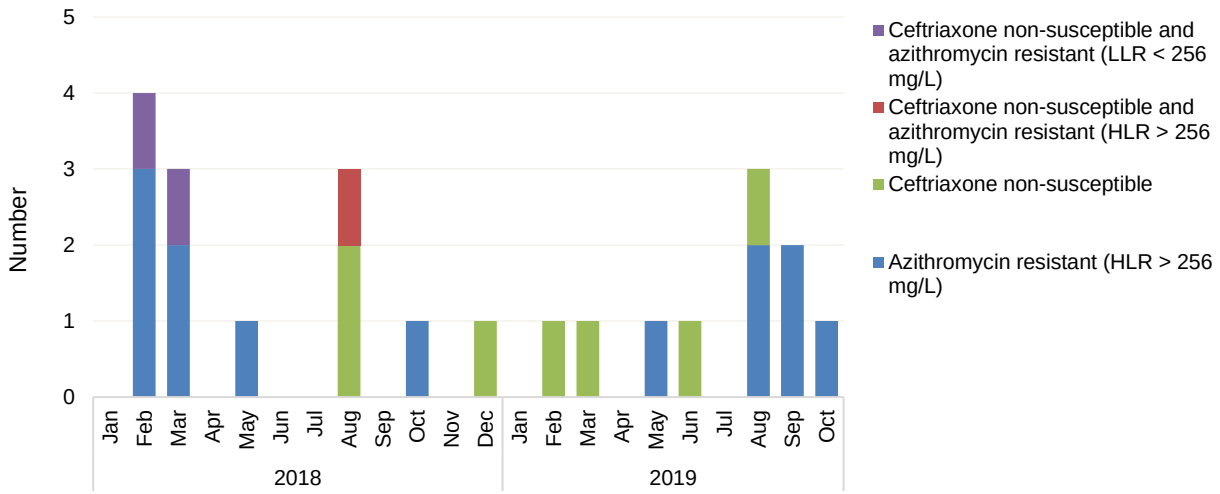
Figure 12: Multidrug-resistant *Mycobacterium tuberculosis,* number reported for 2019 by month, compared with the previous year, national



Neisseria gonorrhoeae

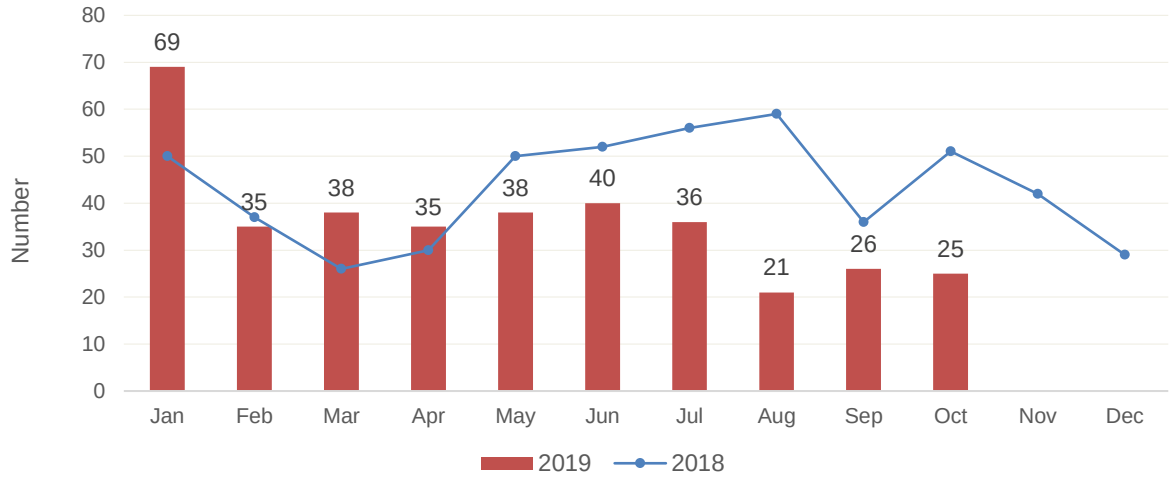
National data

Figure 13: Ceftriaxone non-susceptible and/or azithromycin non-susceptible (HLR > 256 mg/L) *Neisseria gonorrhoeae*, number reported by month, 1 January 2018–31 October 2019



LLR: Low level resistance; HLR: High level resistance

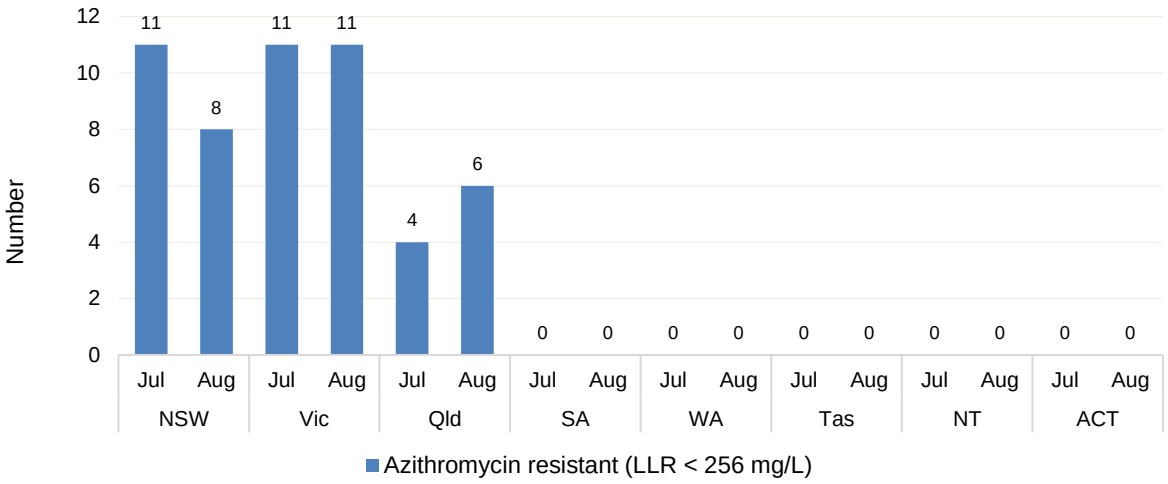
Figure 14: Azithromycin non-susceptible (LLR < 256 mg/L) *Neisseria gonorrhoeae*, number reported for 2019 by month, compared with the previous year, national



LLR: Low level resistance

State and territory

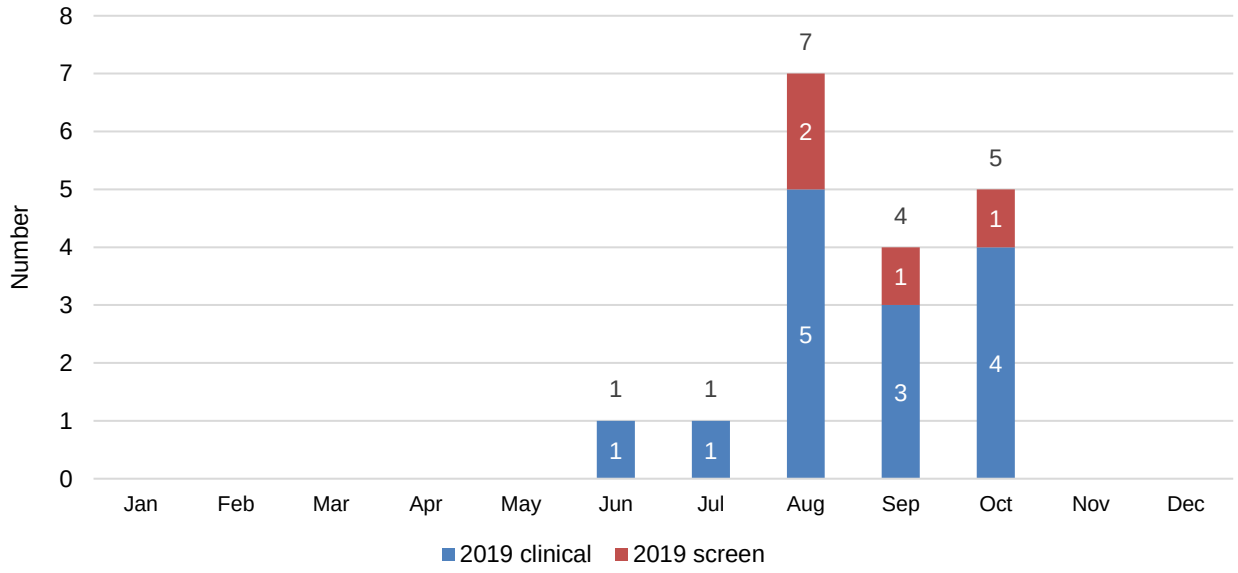
Figure 15: Azithromycin non-susceptible (LLR < 256 mg/L) *Neisseria gonorrhoeae,* number reported by state and territory, 1 September 2019–31 October 2019



Pseudomonas aeruginosa

National data

Figure 16: Carbapenemase-producing *Pseudomonas aeruginosa*, number reported by specimen type for 2019*,



* New CAR reported from July 2019

State and territory

Figure 17: Carbapenemase-producing *Pseudomonas aeruginosa*, number reported by carbapenemase type and specimen type, by state and territory, 1 September 2019–31 October 2019

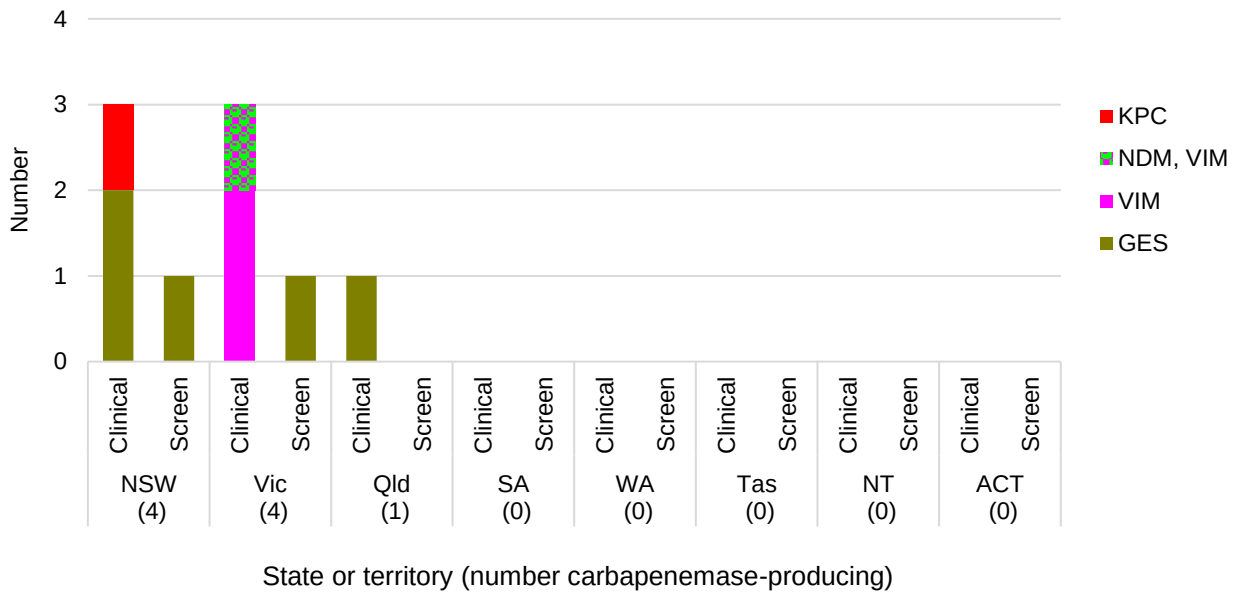
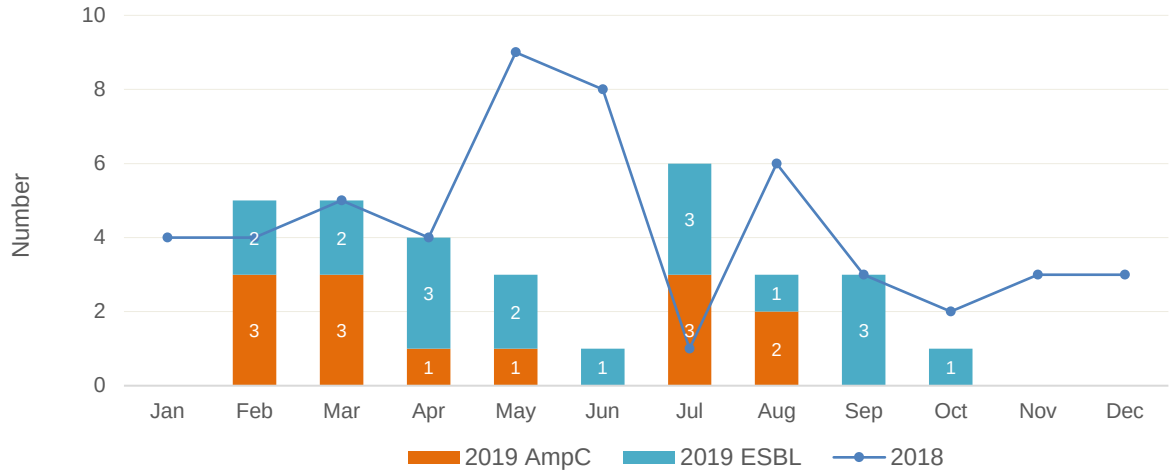


Table 5: Carbapenemase-producing *Pseudomonas aeruginosa*, number reported by setting, by state and territory, 1 September 2019–31 October 2019

Setting	State or territory								Total
	NSW	Vic	Qld	SA	WA	Tas	NT	ACT	
Total	**4**	**4**	**1**	**0**	**0**	**0**	**0**	**0**	**9**
Public hospital	4	2	0	0	0	0	0	0	6
Private hospital	0	0	0	0	0	0	0	0	0
Aged care home	0	0	0	0	0	0	0	0	0
Community	0	2	1	0	0	0	0	0	3

Salmonella species

Figure 18: Ceftriaxone non-susceptible *Salmonella* species, number reported for 2019 by month, compared with the previous year, national

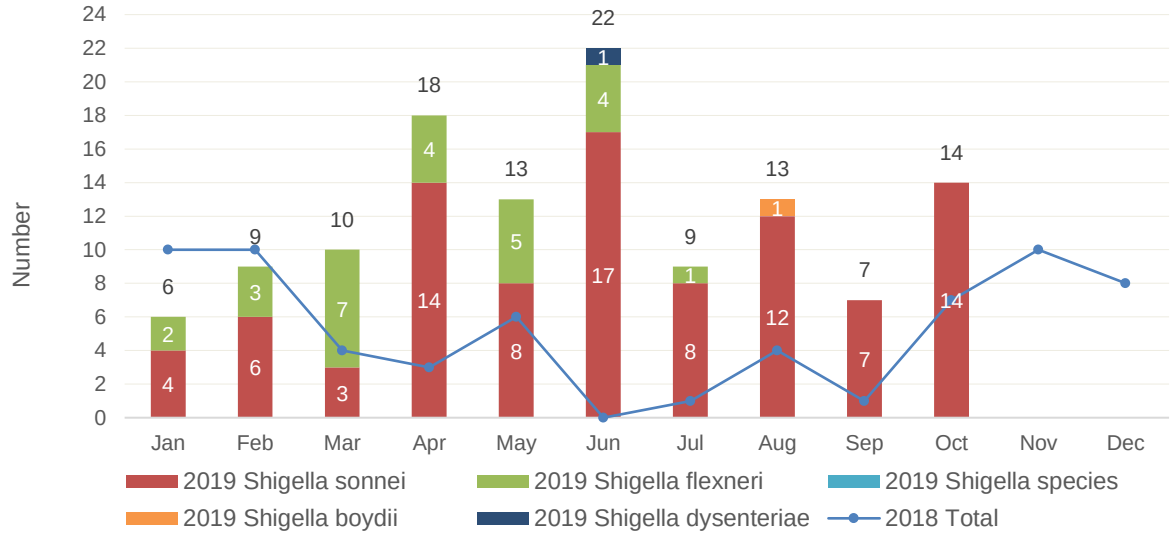


Notes (1 September 2019—31 October 2019)

1. Non-typhoidal *Salmonella* species (n = 2) and typhoidal *Salmonella* species (n = 1)
2.

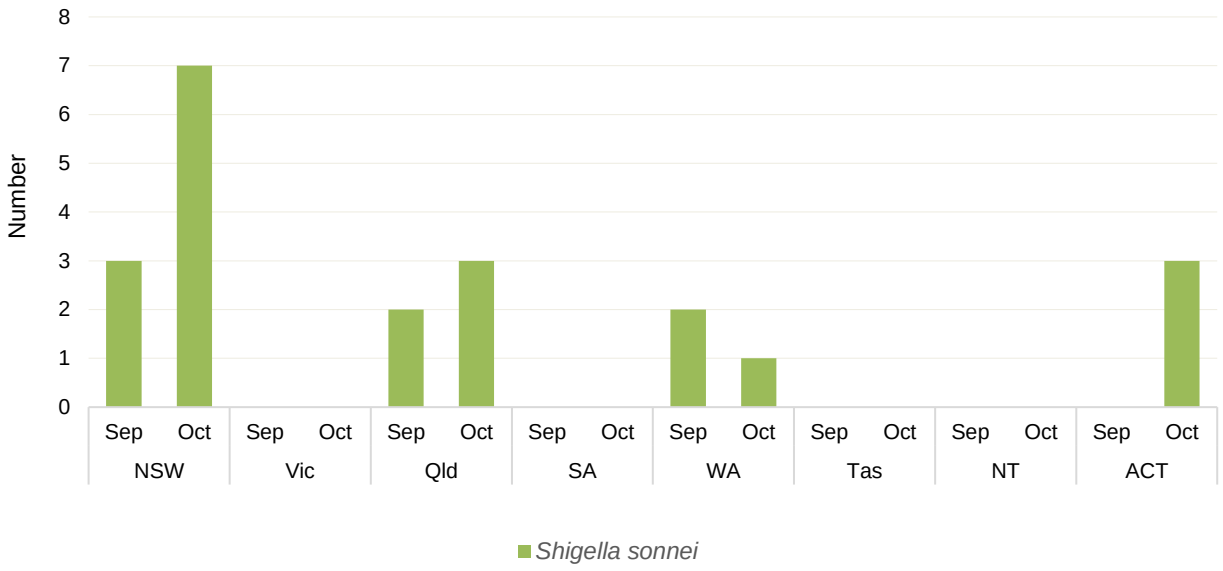
Shigella species

Figure 19: Multidrug-resistant *Shigella* species, number reported for 2019 by month, compared with the previous year, national



State and territory

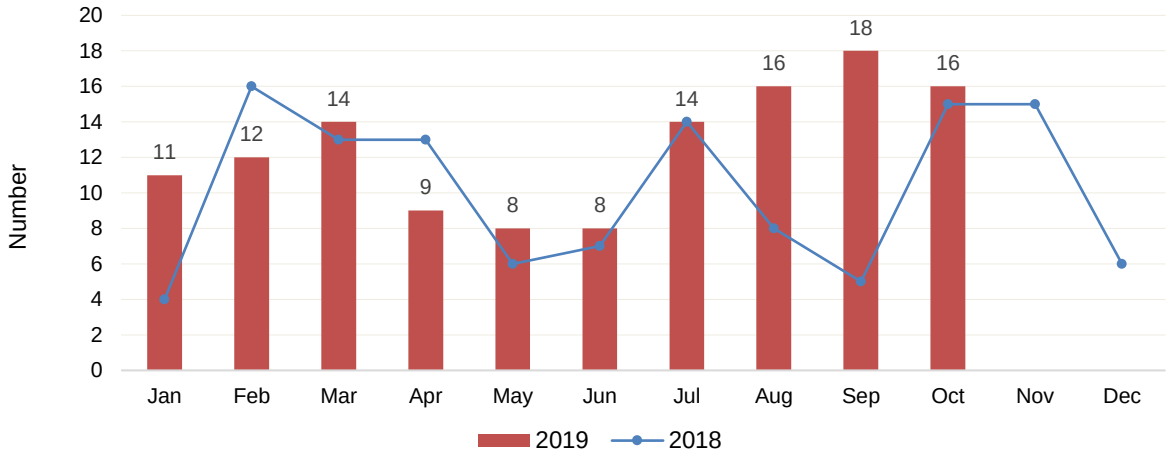
Figure 20: Multidrug-resistant *Shigella* species, number reported by state and territory, 1 September 2019–31 October 2019



Staphylococcus aureus

National data

Figure 21: Daptomycin non-susceptible *Staphylococcus aureus,* number reported for 2019 by month, compared with the previous year, national



Note: No linezolid non-susceptible *S. aureus* or vancomycin non-susceptible *S. aureus* were reported in the two-month period (July–August 2019).

State and territory

Table 6. Daptomycin non-susceptible *Staphylococcus aureus,* number reported by setting and state and territory, 1 September 2019–31 October 2019

	State or territory								
Setting	**NSW**	**Vic**	**Qld**	**SA**	**WA**	**Tas**	**NT**	**ACT**	**Total**
Total	**4**	**8**	**14**	**0**	**8**	**0**	**0**	**0**	**34**
Public hospital	4	3	0	0	6	0	0	0	13
Private hospital	0	0	0	0	0	0	0	0	0
Aged care home	0	1	8	0	1	0	0	0	10
Community	0	4	5	0	1	0	0	0	10
Unknown	0	0	1	0	0	0	0	0	1

Appendix

Data Notes

The following are important considerations for interpreting CARAlert data:

1. The data are based on the date that the isolate with the confirmed CAR was collected.
2. States and territories refer to the state or territory where the CAR was detected. If place of residence is unknown or overseas, the state or territory of the originating laboratory is reported.
3. Comparison between reports may be influenced by delayed detection or late submissions of CARs.
4. Number of CARs reported does not always equal the number of patients, as patients may have more than one CAR, or species, detected in a specimen.
5. Cut-off date for data that are included in updates and reports is four weeks after the end of each reporting period.
6. National summary data is provided; comparison across states and territories is provided for organisms where there are large numbers reported and a comparison is meaningful.
7. Authorised officers in each state and territory health department can access the CARAlert web portal directly for further information about their jurisdiction, including the name of the public hospital where a patient with a confirmed CAR was cared for, and to extract reports on their data.

About CARAlert

CARAlert is a component of the Antimicrobial Use and Resistance in Australia (AURA) Surveillance System. CARAlert was established by the Australian Commission on Safety and Quality in Health Care in March 2016.

The AURA Surveillance System provides essential information to develop and implement strategies to prevent and contain antimicrobial resistance in human health and improve antimicrobial use across the acute and community healthcare settings. AURA also supports the National Safety and Quality Health Service (NSQHS) Standard Preventing and Controlling Healthcare-Associated Infection and Australia's National Antimicrobial Resistance Strategy (2015–2019). Funding for AURA is provided by the Australian Government Department of Health and state and territory health departments.

Critical antimicrobial resistances (CARs) are resistance mechanisms known to be a serious threat to the effectiveness of last-line antimicrobial agents. CARs can result in significant morbidity and mortality.

The CARs reported under CARAlert are listed in Table A1. The CARs were drawn from the list of high-priority organisms and antimicrobials which are the focus of the AURA Surveillance System.[1]

Table A1: List of critical antimicrobial resistances reported to CARAlert

Species	Critical Resistance
Acinetobacter baumannii complex	Carbapenemase-producing*
*Candida auris**	–
Enterobacterales	Carbapenemase-producing, and/or ribosomal methyltransferase-producing
Enterobacterales	Transmissible colistin resistance*
Enterococcus species	Linezolid resistant
Mycobacterium tuberculosis	Multidrug-resistant – resistant to at least rifampicin and isoniazid
Neisseria gonorrhoeae	Ceftriaxone non-susceptible or azithromycin non-susceptible
Salmonella species	Ceftriaxone non-susceptible
Shigella species	Multidrug-resistant
Staphylococcus aureus†	Vancomycin, linezolid or daptomycin non-susceptible
Streptococcus pyogenes	Penicillin reduced susceptibility
Pseudomonas aeruginosa	Carbapenemase-producing*

* If the specimen with a confirmed CAR was collected in 2019, it can be submitted retrospectively

† For CARAlert, *S. aureus* includes *S. argenteus*

The CARAlert system is based on the following routine processes used by pathology laboratories for identifying and confirming potential CARs:

1. Collection and routine testing – the isolate is collected from the patient and sent to the originating laboratory for routine testing
2. Confirmation – if the originating laboratory suspects that the isolate is a CAR, it sends the isolate to a confirming laboratory that has the capacity to confirm the CAR
3. Submission to the CARAlert system – the confirming laboratory advises the originating laboratory of the result of the test, and the originating laboratory reports back to the health service that cared for the patient from whom the specimen was collected; the confirming laboratory then submits the details of the resistance and organism into the secure CARAlert web portal.

[1] Australian Commission on Safety and Quality in Health Care (ACSQHC). AURA 2017: Second Australian report on antimicrobial use and resistance in human health. Sydney: ACSQHC; 2017.

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