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

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Data Summary

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

National overview:

- There was an 4.7% decrease in critical antimicrobial resistances (CARs) reported compared to the previous two-month reporting period (*n* = 263)
- Carbapenemase-producing Enterobacterales (CPE) (including those with ribosomal methyltransferase or transmissible resistance to colistin) remains the most frequently reported CAR, (*n* = 134, 51%), followed by azithromycin non-susceptible (low-level resistance, MIC ≤ 256 mg/L) *Neisseria gonorrhoeae* (*n* = 55, 21%)
- The total number of CPE reported this year to date, compared to the same period last year, increased by 49.6%. There was an increase in the proportion of CPE from patients 0-4 age range (6.7%) compared to previous two-month period (4.2%), notably in New South Wales
- There was an increase in the number of reported daptomycin non-susceptible *Staphylococcus aureus* (*n* = 30, up 87%); with increased reports from Queensland and Victoria
- There was a decrease in the number of multidrug-resistant *Shigella* species (*n* = 19, down 34%) in this reporting period; the number reported this year to date, compared to the same period last year, has increased by 139%
- There was an increase in the number of ceftriaxone non-susceptible *Salmonella* species (*n* = 9, up 125%)
- There were no reports of multidrug-resistant *Mycobacterium tuberculosis*
- The majority of CARs, excluding those from *N. gonorrhoeae*, were reported from public hospitals (*n* = 143); there were 41 from community settings, 16 from private hospitals, and three from aged care homes (one OXA-23-producing *Acinetobacter baumannii* complex in Victoria, one KPC-producing *Klebsiella pneumoniae* in Victoria, and one daptomycin non-susceptible *S. aureus* in Queensland).

Carbapenemase-producing Enterobacterales:

- IMP (53.0%), NDM (25.4%), and OXA-48-like (13.4%) types accounted for 91.8% of all CPE reported during this period
- The total number of CPE declined (*n* = 134, down 6%) with decreases in the number of IMP-types and NDM-types (IMP: *n* = 71 versus *n* = 79; NDM: *n* = 34 versus *n* = 39) compared to the previous two-month period. However, there was in increase in the number of KPC-types (n = 5 versus n = 1)
- The number of NDM-types from South Australia decreased compared to the previous two-month period (*n* = 1 versus *n* = 10)
- There was an increase in the number of NDM-types reported from both clinical (n = 7 versus n = 3) and screening isolates (n = 10 versus n = 6) for Victoria
- There were five reports of KPC-producing *Klebsiella pneumoniae*; two from New South Wales public hospitals, two from Victoria (one public hospital and one aged care facility), and one from Queensland (community). Four isolates were from clinical specimens (urine)
- Seven Enterobacterales (six *Enterobacter cloacae* complex and one *Escherichia coli*) harbouring IMP-4 and mcr-9.1 were reported from Victoria; five were from one public hospital, and two isolates were from blood culture
- There was one IMI-2 producing *E. coli* and one SME-4 producing *Serratia marcescens* reported; both were from Victoria
- Excluding confirmed CARs for which the setting was unknown, 20% of CPE were reported from settings other than public hospitals; 12.1% (*n* = 16), 6.8% (*n* = 9) and 0.8% (*n* = 1) respectively from private hospitals, community and aged care

- Six hospitals had more than two notifications of IMP-types; these institutions were in New South Wales (*n* = 5), and Victoria (*n* = 1)
- One hospital in Victoria had six notifications of NDM-types (NDM-5 *E. coli* [2]; NDM-4 *E. coli* [1], *K. oxytoca* [1], *Citrobacter amalonaticus* [1]; and NDM-1 *K. pneumoniae* [1]); all were from screening isolates
- Two hospitals had more than two notifications of OXA-48-like types; one institution was in Queensland and one in Victoria
- The number of NDM-types reported from South Australia peaked in May 2019 and the number of OXA-48-like types reported in Victoria peaked in June 2019; both of these types reported from these states declined during this reporting period
- 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:*

- Six carbapenemase-producing *Pseudomonas aeruginosa* were reported during this period; five from New South Wales (IMP [*n* = 2,] VIM [*n* = 1], KPC [*n* = 1], and GES+IMP [*n* = 1]); and one from Victoria (IMP-7)
- Five *A. baumannii* complex were reported; four from Victoria (OXA-23-like [*n* = 3], NDM+OXA-23-like [*n* =1]), and one NDM-producing isolate from Western Australia. One OXA-23-like *A. baumannii* complex was reported from an aged care home in Victoria.

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

- The total number of reports of this CAR declined (*n* = 55, down 29%) with decreases in the number from New South Wales and Victoria (NSW: *n* = 26 versus *n* = 39; Vic: *n* = 22 versus *n* = 30) compared to the previous two-month reporting period
- The majority of cases were reported from NSW (*n* = 26, 47%)
- This CAR was also reported from Victoria (*n* = 22), Queensland (*n* = 5), the Australian Capital Territory (*n* = 1), and Western Australia (*n* = 1).

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

- There was one report of an azithromycin non-susceptible (high-level resistance) *N. gonorrhoeae* from Tasmania; and one report of a ceftriaxone non-susceptible *N. gonorrhoeae* from Victoria during this reporting period.

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

- The total number of ceftriaxone non-susceptible *Salmonella* species increased (n = 9, up 125%) compared to the previous two-month period; with reports from New South Wales (*n* = 4), Queensland (*n* = 4) and Western Australia (*n* = 1)
- Three of seven non-typhoidal species were isolated from children 0–4 age range. The two typhoidal isolates were from blood cultures from the same patient who attended two different institutions in New South Wales
- The majority of multidrug-resistant *Shigella* species were reported from Queensland (n = 11, 58%); other reports were from New South Wales (*n* = 5), South Australia (*n* = 1), Western Australia (n = 1), and the Australian Capital Territory (n = 1)
- The decrease in multidrug-resistant *Shigella* species reported this period was mostly due to the decline in the number reports of *S. flexneri* (*n* = 1 versus *n* = 8)
- A multidrug-resistant *S. boydii* was reported for the first time, from a patient in Western Australia.

***Candida auris*:**

- There was one report of *Candida auris* during this reporting period, from a public hospital in Western Australia, collected in August 2019.

National summary

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

Species	Critical resistance	State or Territory								Bi-monthly			Year to date		
										2018	2019				
		NSW	Vic	Qld	SA	WA	Tas	NT	ACT	Jul-Aug	May-Jun	Relative change*	2019	2018	Relative change*
***Acinetobacter baumannii* complex**	**Carbapenemase-producing†**	**0**	**4**	**0**	**0**	**1**	**0**	**0**	**0**	**5**	**0**	**–**	**5**	**–**	**–**
Candida auris	–†	0	0	0	0	1	0	0	0	1	1	–	2	–	–
Enterobacterales	Carbapenemase-producing	46	37	31	1	6	0	3	2	126	130	▼ 3.1%	545	367	▲ 48.5
	Carbapenemase and ribosomal methyltransferase-producing	1	0	0	0	0	0	0	0	1	10	▼ 90.0%	28	19	▲ 47.4%
	Ribosomal methyltransferase-producing	0	0	0	0	0	0	0	0	0	2	▼ 100%	5	7	▼ 28.6%
	Carbapenemase-producing and transmissible resistance to colistin†	0	7	0	0	0	0	0	0	7	3	–	10	–	–
Enterococcus species	Linezolid non-susceptible	0	1	1	0	0	0	0	0	2	0	–	6	12	▼ 50.0%
Mycobacterium tuberculosis	Multidrug-resistant – at least rifampicin- and isoniazid-resistant strains	0	0	0	0	0	0	0	0	0	0	–	7	19	▼ 63.2%
Neisseria gonorrhoeae	Azithromycin non-susceptible (LLR < 256 mg/L)	26	22	5	0	1	0	0	1	55	78	▼ 29.5%	310	360	▼ 13.9%
	Azithromycin non-susceptible (HLR > 256 mg/L	0	0	0	0	0	1	0	0	1	1	0.0%	2	6	▼ 66.7%
	Ceftriaxone non-susceptible	0	1	0	0	0	0	0	0	1	1	0.0%	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)

Species	Critical resistance	State or territory								Bi-monthly			Year to date		
										2019	2019				
		NSW	Vic	Qld	SA	WA	Tas	NT	ACT	Jul-Aug	May-Jun	Relative change*	2019	2018	Relative change*
Pseudomonas aeruginosa	**Carbapenemase-producing†**	**5**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**6**	**1**	**–**	**7**	**–**	**–**
Salmonella species	Ceftriaxone non-susceptible	4	0	4	0	1	0	0	0	9	4	▲ 125%	27	41	▼ 34.1%
Shigella species	Multidrug-resistant	5	0	11	1	1	0	0	1	19	29	▼ 34.5%	91	38	▲ 139%
Staphylococcus aureus	Daptomycin non-susceptible	6	11	8	0	4	0	0	1	30	16	▲ 87.5%	92	81	▲ 13.6%
	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 September 2019)	**93**	**84**	**60**	**2**	**15**	**1**	**3**	**5**	**263**	**276**	**▼ 4.7%**	**1,141**	**956**	**▲ 19.4%**

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 July 2019–31 August 2019

Species	Critical resistance	Setting					Total
		Public hospital	Private hospital	Aged care home	Community	Unknown	
Acinatobacter baumannii complex	Carbapenemase-producing	4	0	1	0	0	5
Candida auris	–	1	0	0	0	0	1
Enterobacterales	Carbapenemase-producing	99	16	1	8	2	126
	Carbapenemase and ribosomal methyltransferase-producing	1	0	0	0	0	1
	Ribosomal methyltransferase-producing	0	0	0	0	0	0
	Transmissible resistance to colistin	0	0	0	0	0	0
	Transmissible resistance to colistin and carbapenemase-producing	6	0	0	1	0	7
Enterococcus species	Linezolid non-susceptible	2	0	0	0	0	2
Mycobacterium tuberculosis	Multidrug-resistant – at least rifampicin- and isoniazid-resistant	0	0	0	0	0	0
Neisseria gonorrhoeae	Azithromycin non-susceptible (LLR < 256 mg/L)	0	0	0	26	29*	55
	Azithromycin non-susceptible (HLR > 256 mg/L	0	0	0	1	0	1
	Ceftriaxone non-susceptible	0	0	0	1	0	1
	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	4	0	0	2	0	6
Salmonella species	Ceftriaxone non-susceptible	4	0	0	4	2	10
Shigella species	Multidrug-resistant	5	0	0	14	0	19
Staphylococcus aureus	Daptomycin non-susceptible	18	0	1	11	0	30
	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 September 2019)	**144**	**16**	**3**	**68**	**33**	**264**

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

Summary by CAR

Acinetobacter baumannii complex

State and territory

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

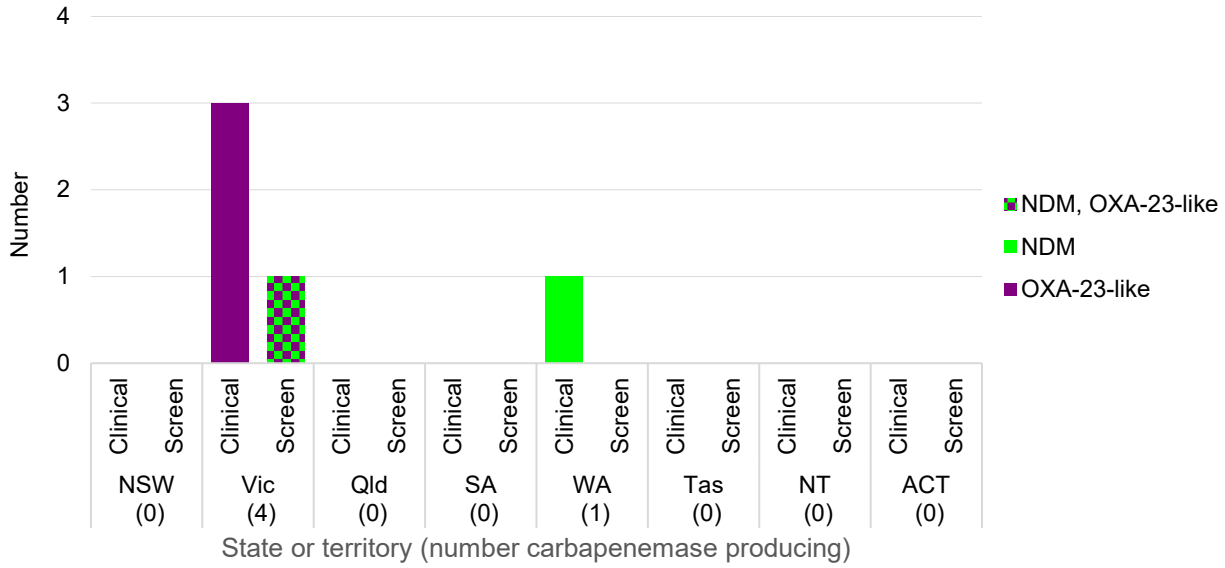


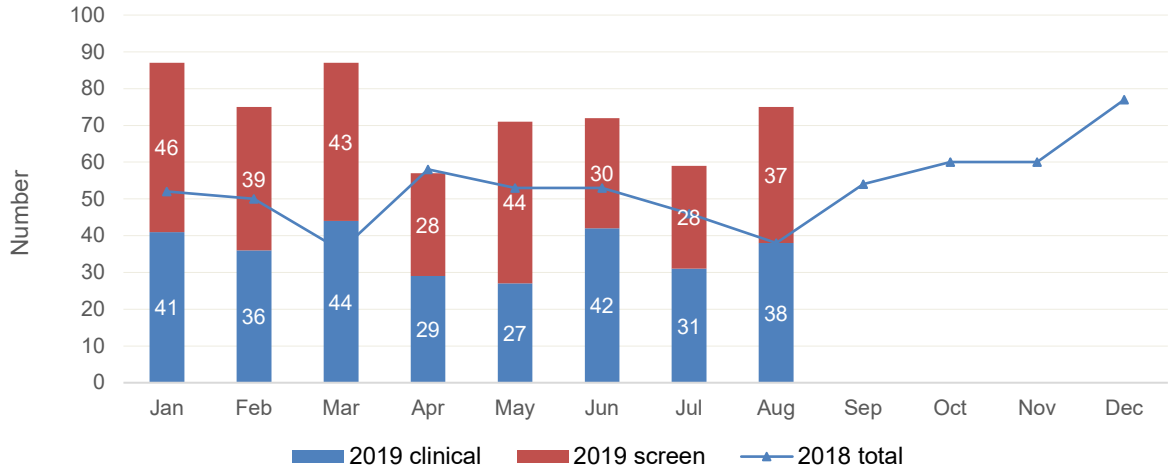
Table 3: Carbapenemase-producing *Acinetobacter baumannii* complex, number reported by setting, by state and territory, 1 July 2019–31 August 2019

	State or territory								
Setting	**NSW**	**Vic**	**Qld**	**SA**	**WA**	**Tas**	**NT**	**ACT**	**Total**
Total	**0**	**4**	**0**	**0**	**1**	**0**	**0**	**0**	**5**
Public hospital	0	3	0	0	1	0	0	0	4
Private hospital	0	0	0	0	0	0	0	0	0
Aged care home	0	1	0	0	0	0	0	0	1
Community	0	0	0	0	0	0	0	0	0

Enterobacterales

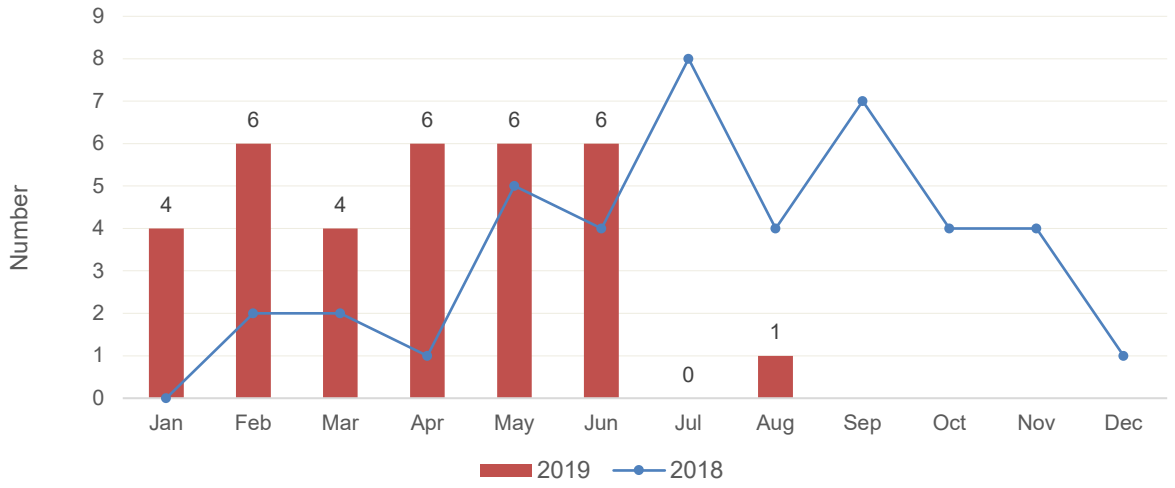
National data

Figure 2: Carbapenemase-producing Enterobacterales*, number reported by specimen type for 2019, compared with the total for previous year, national



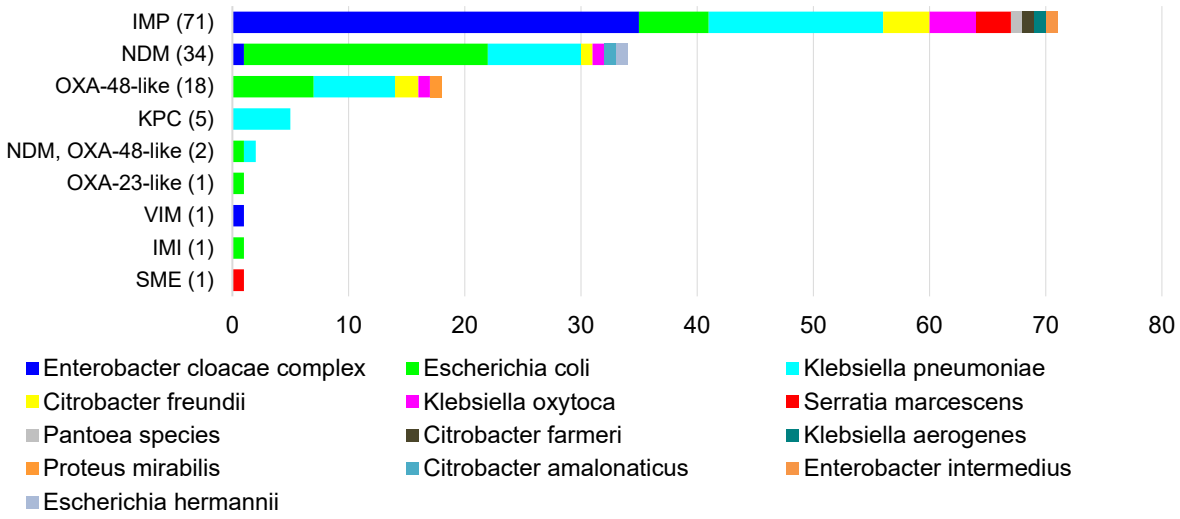
* Carbapenemase-producing alone or in combination with ribosomal methyltransferases

Figure 3: Ribosomal methyltransferase-producing Enterobacterales*, number reported for 2019 by month, compared with the previous year, national



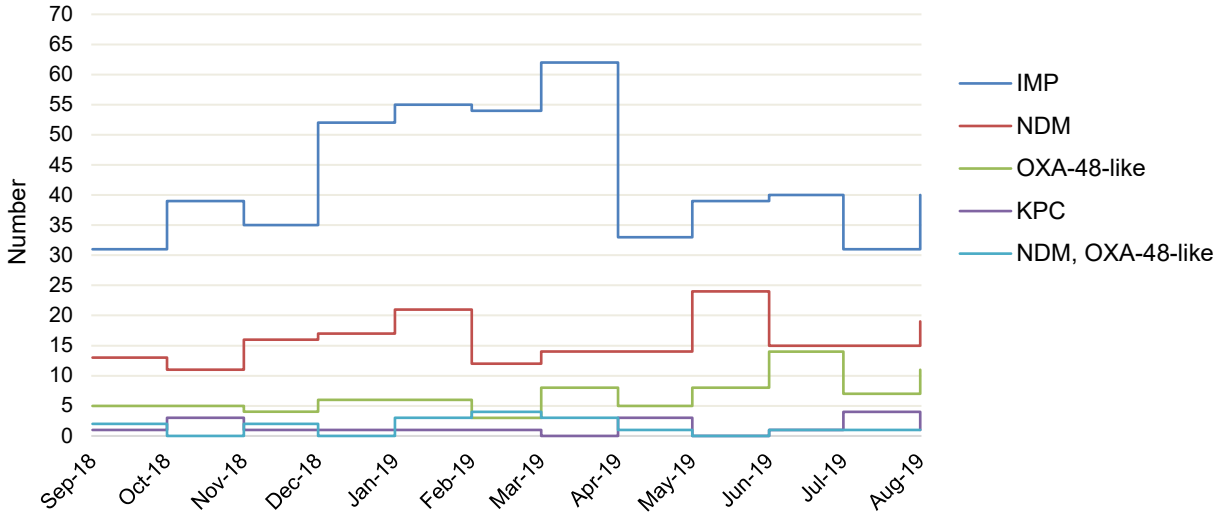
* Ribosomal methyltransferases alone, or in combination with carbapenemases

Figure 4: Carbapenemase-producing Enterobacterales*, number reported by carbapenemase type and species, national, 1 July 2019–31 August 2019



* Carbapenemase-producing Enterobacterales (*n* = 126), Carbapenemase-producing and transmissible resistance to colistin (*n* = 7); Enterobacterales carbapenemase- and ribosomal methyltransferase-producing Enterobacterales (*n* = 1)

Figure 5: Twelve-month trend for the top four reported carbapenemase types, national, 1 July 2018–31 August 2019



State and territory

Figure 6: Carbapenemase-producing Enterobacterales, number reported by state and territory, 1 July 2019–31 August 2019

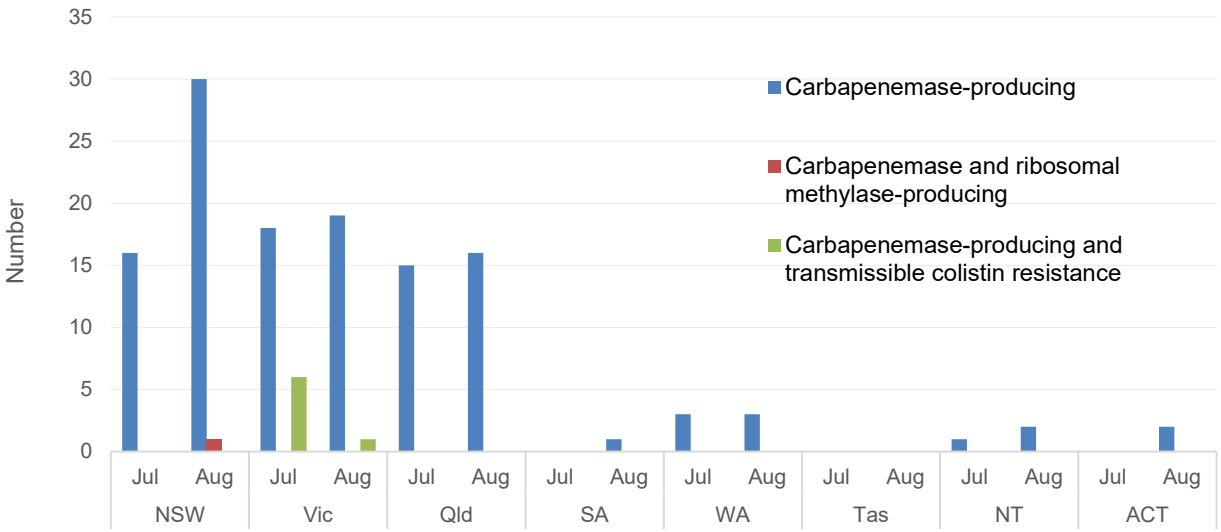


Figure 7: Two-year trend for the top four reported carbapenemase types from Enterobacterales, by state and territory and nationally, (three-month moving average), 1 July 2017–31 August 2019

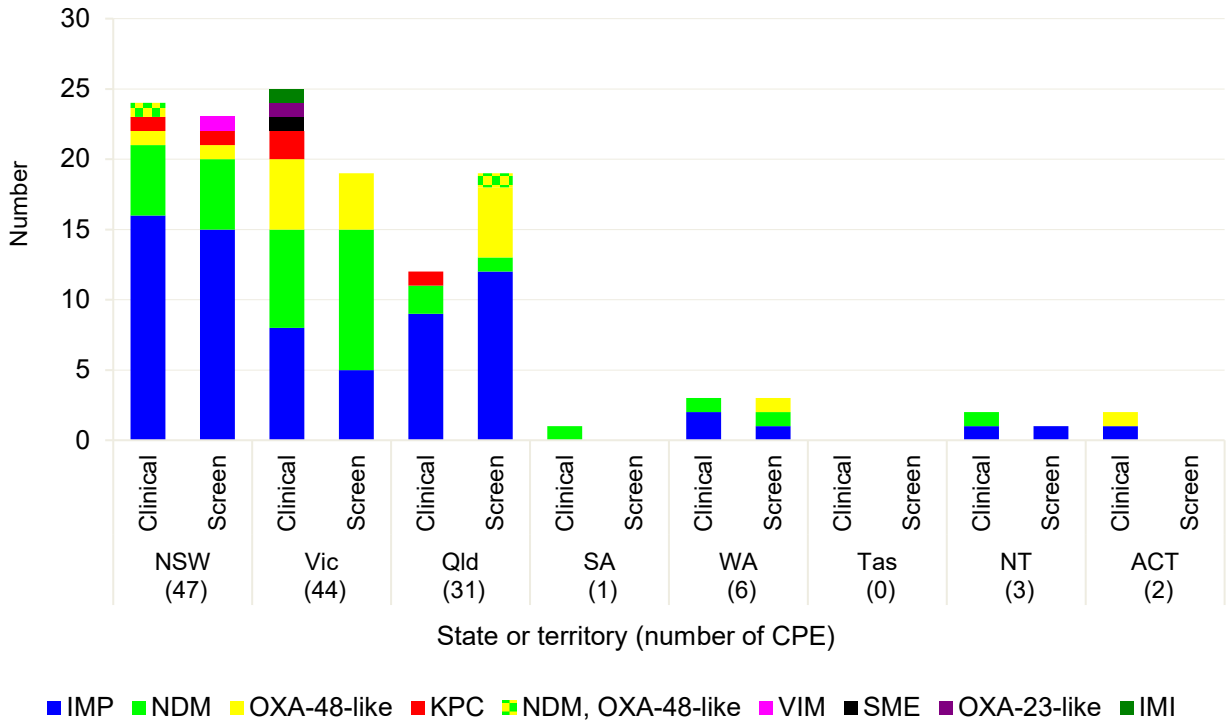
Type	NSW	Vic	Qld	SA	WA	Tas	NT	ACT	Australia
IMP	20 5	23 2	12 7	0 0	4 0	0 0	1 0	2 0	57 20
NDM	5 1	7 3	6 1	3 0	2 0	0 0	1 0	1 0	18 6
OXA-48-like	3 1	6 1	3 0	1 0	1 0	0 0	0 0	0 0	11 4
KPC	1 0	3 0	1 0	0 0	0 0	0 0	0 0	0 0	3 1
All types	28 9	35 11	19 9	4 0	6 1	1 0	1 0	2 0	83 36

Line graphs represent three-month moving average for the period 1 July 2017 to 31 August 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 8: Carbapenemase-producing Enterobacterales*, number reported by carbapenemase type and specimen type, by state and territory, 1 July 2019–31 August 2019



* Carbapenemase-producing Enterobacterales (*n* = 126), Carbapenemase-producing and transmissible resistance to colistin (*n* = 7); Enterobacterales carbapenemase- and ribosomal methyltransferase-producing Enterobacterales (*n* = 1)

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 9: Top four reported carbapenemase-producing Enterobacterales type by specimen type, by state and territory, 1 July 2019–31 August 2019

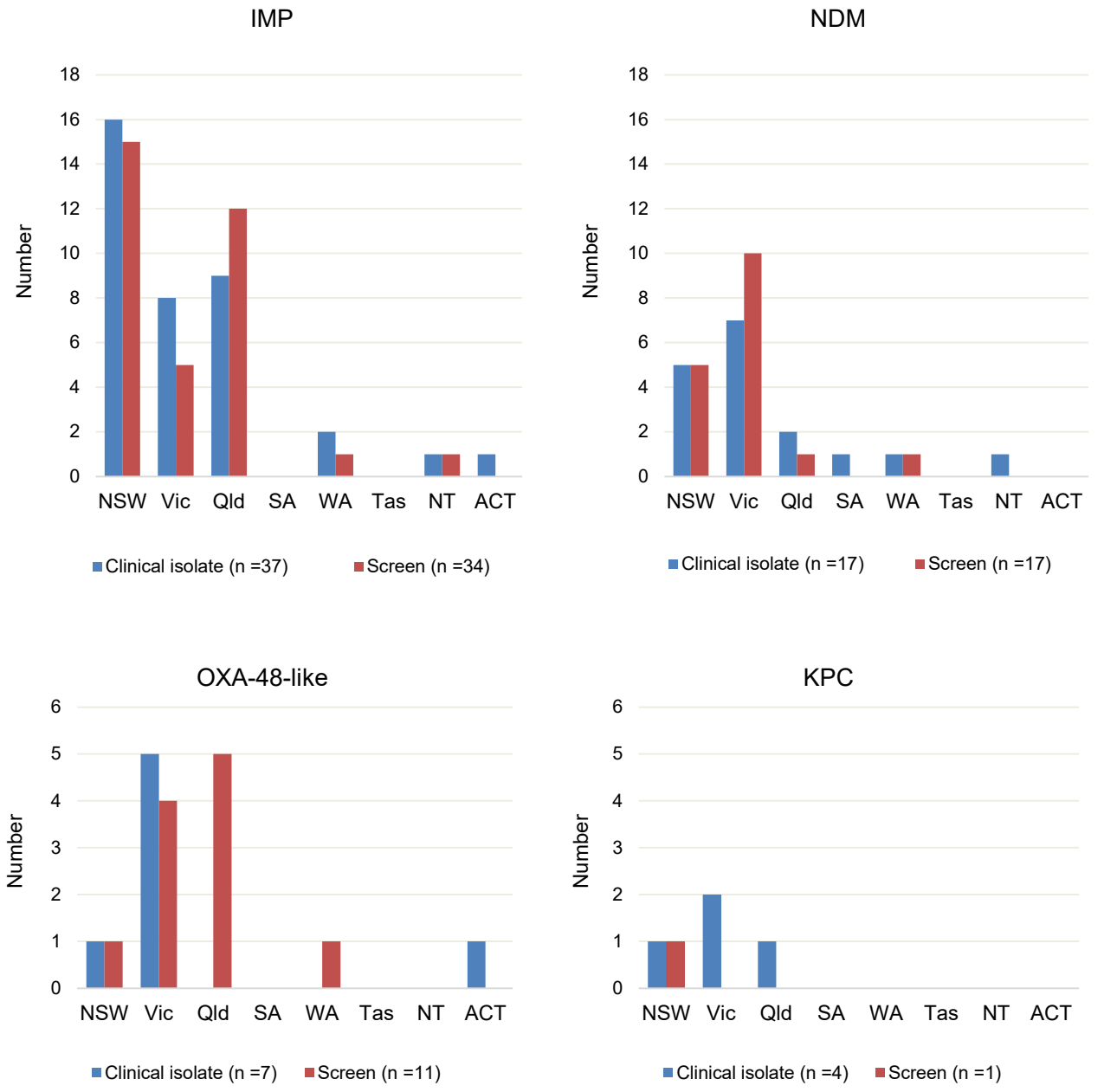


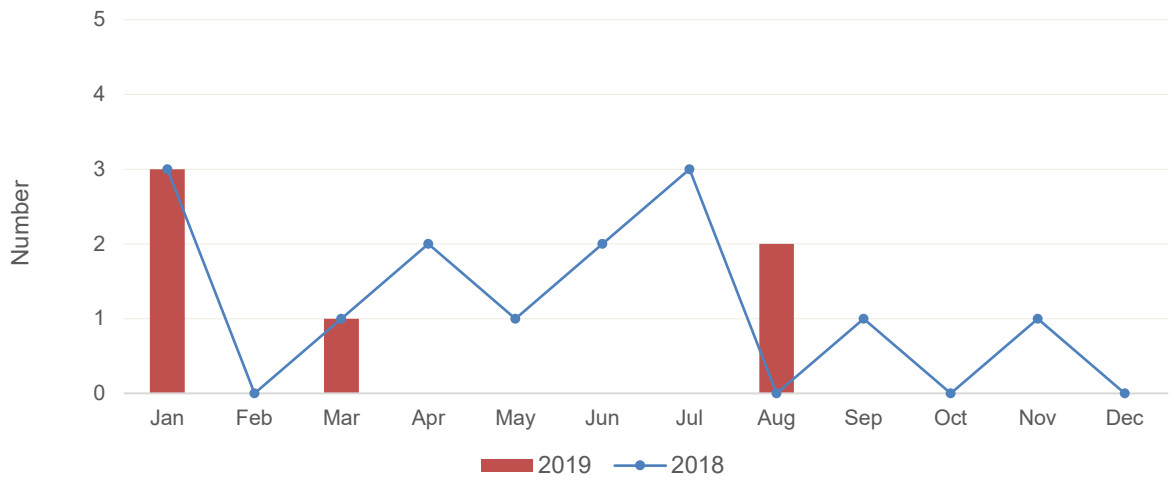
Table 4: Top four carbapenemase types from Enterobacterales, number reported by setting, by state and territory, 1 July 2019–31 August 2019

Carbapenemase type	Setting	State or territory								Total
		NSW	Vic	Qld	SA	WA	Tas	NT	ACT	
IMP	**Total**	**31**	**13**	**21**	**0**	**3**	**0**	**2**	**1**	**71**
	Public hospital	28	12	11	0	3	0	2	1	57
	Private hospital	2	0	9	0	0	0	0	0	11
	Aged care home	0	0	0	0	0	0	0	0	0
	Community	1	1	0	0	0	0	0	0	2
	Unknown	0	0	1	0	0	0	0	0	1
NDM	**Total**	**10**	**17**	**3**	**1**	**2**	**0**	**1**	**0**	**34**
	Public hospital	10	13	0	1	1	0	1	0	26
	Private hospital	0	2	2	0	0	0	0	0	4
	Aged care home	0	0	0	0	0	0	0	0	0
	Community	0	2	1	0	0	0	0	0	3
	Unknown	0	0	0	0	1	0	0	0	1
OXA-48-like	**Total**	**2**	**9**	**5**	**0**	**1**	**0**	**0**	**1**	**18**
	Public hospital	2	9	5	0	1	0	0	0	17
	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	0	0	0	0	0	0	1	1
	Unknown	0	0	0	0	0	0	0	0	0
KPC	**Total**	**2**	**2**	**1**	**0**	**0**	**0**	**0**	**0**	**5**
	Public hospital	2	1	0	0	0	0	0	0	3
	Private hospital	0	0	0	0	0	0	0	0	0
	Aged care home	0	1	0	0	0	0	0	0	1
	Community	0	0	1	0	0	0	0	0	1
	Unknown	0	0	0	0	0	0	0	0	0

* Top four carbapenemase types account for 95% (128/134) of all carbapenemase-producing Enterobacterales reported for this period

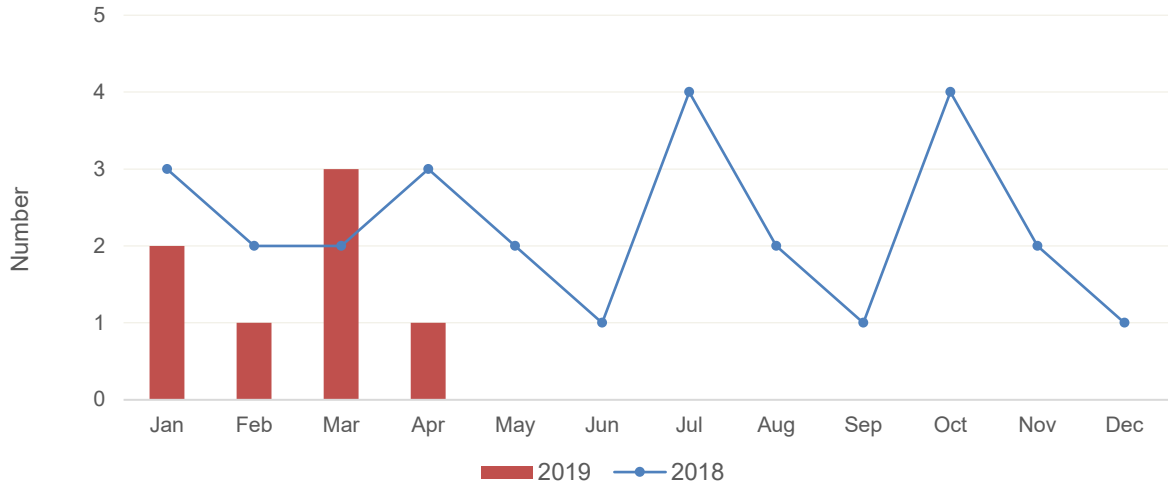
Enterococcus species

Figure 10: Linezolid non-susceptible *Enterococcus* species, number reported for 2019, by month, compared with the previous year, national



Mycobacterium tuberculosis

Figure 11: Multidrug-resistant *Mycobacterium tuberculosis,* number reported for 2019 by month, compared with the previous year, national

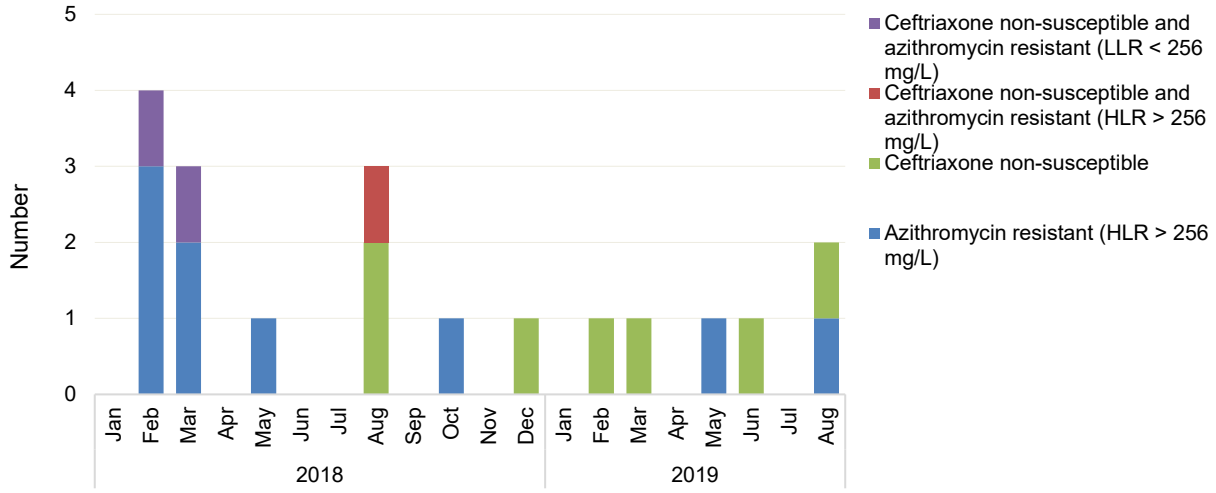


Note: No multidrug-resistant *Mycobacterium tuberculosis* were reported in the two-month period (July-August 2019).

Neisseria gonorrhoeae

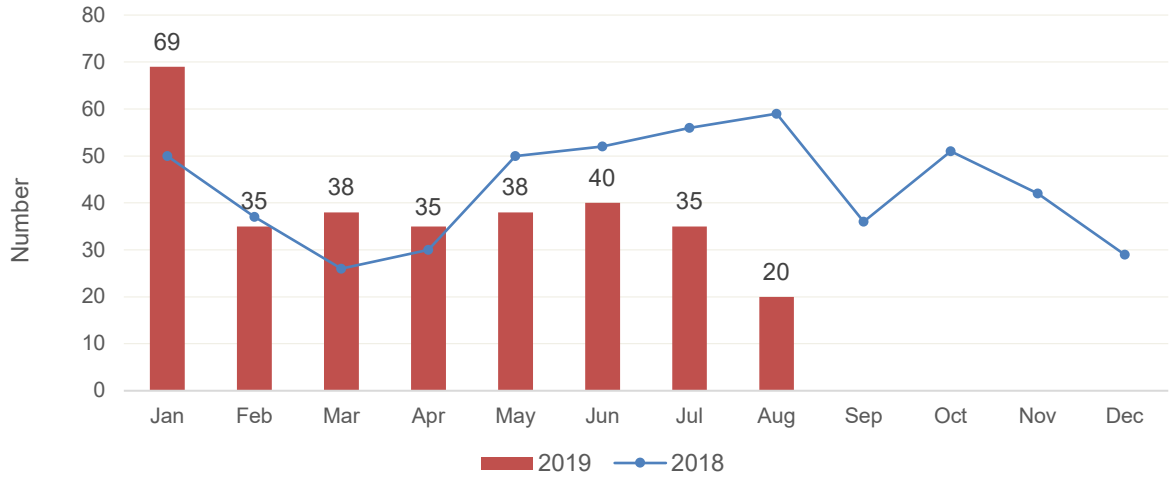
National data

Figure 12: Ceftriaxone non-susceptible and/or azithromycin non-susceptible (HLR > 256 mg/L) *Neisseria gonorrhoeae,* number reported by month, 1 January 2018–31 August 2019



LLR: Low level resistance; HLR: High level resistance

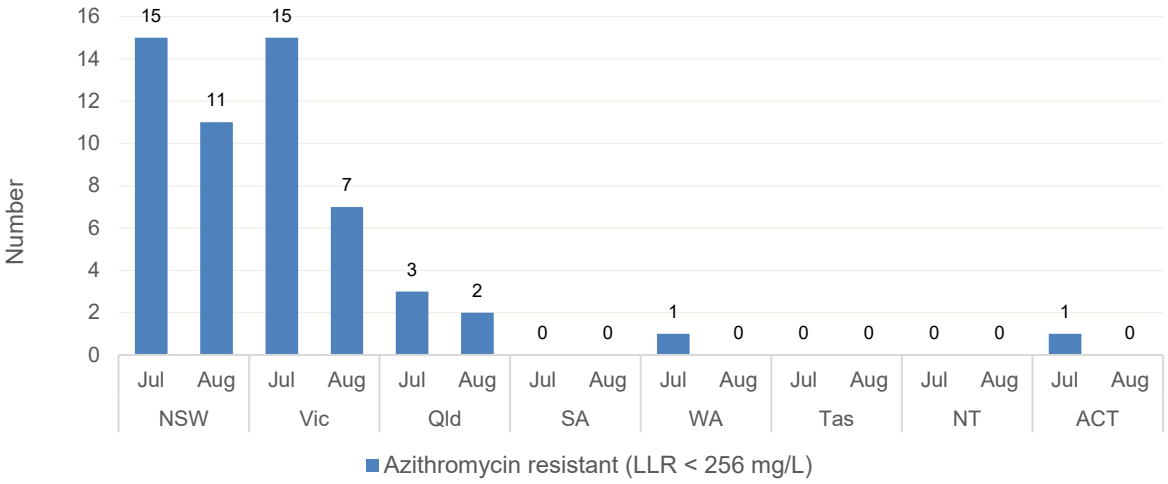
Figure 13: Azithromycin non-susceptible (LLR < 256 mg/L) *Neisseria gonorrhoeae,* number reported for 2019 by month, compared with the previous year, national



LLR: Low level resistance

State and territory

Figure 14: Azithromycin non-susceptible (LLR < 256 mg/L) *Neisseria gonorrhoeae,* number reported by state and territory, 1 July 2019–31 August 2019



Pseudomonas aeruginosa

State and territory

Figure 15: Carbapenemase-producing *Pseudomonas aeruginosa*, number reported by carbapenemase type and specimen type, by state and territory, 1 July 2019–31 August 2019

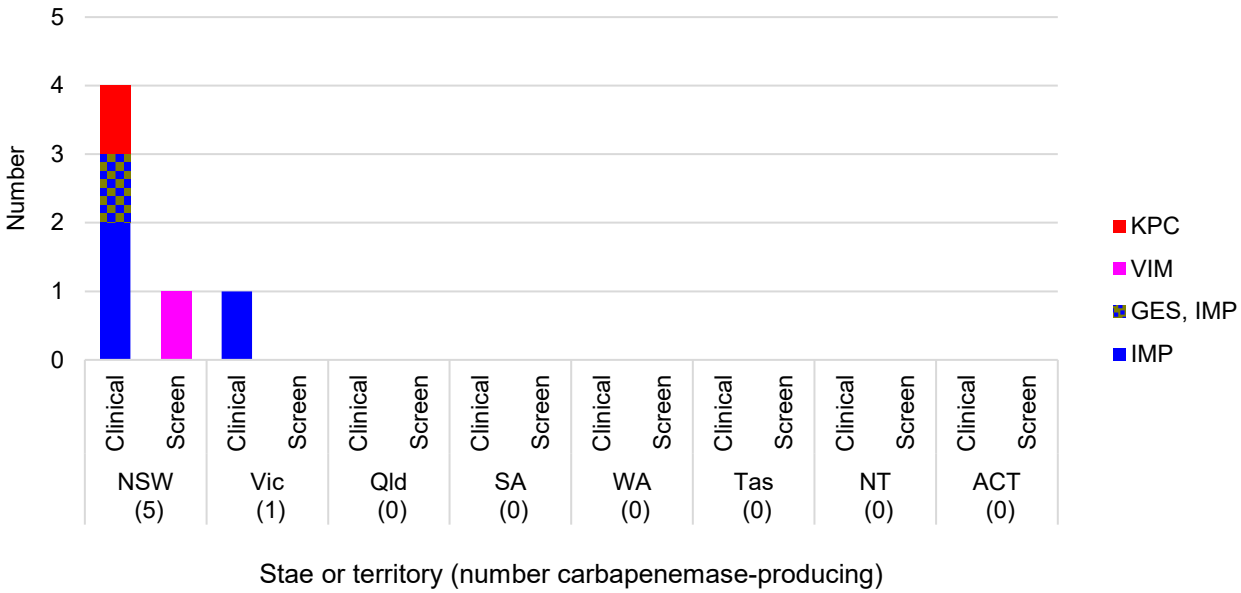
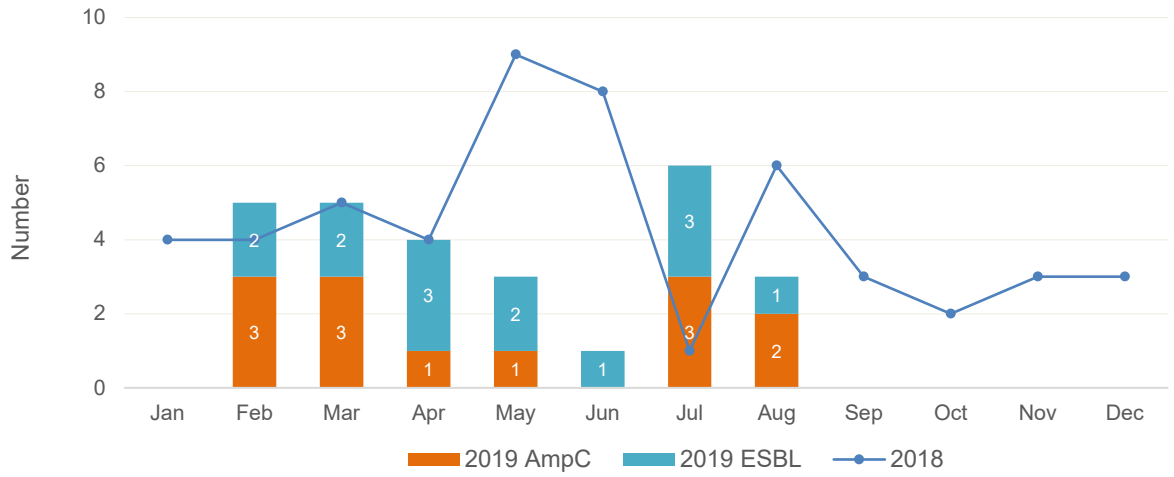


Table 5: Carbapenemase-producing *Pseudomonas aeruginosa*, number reported by setting, by state and territory, 1 July 2019–31 August 2019

Setting	State or territory								Total
	NSW	Vic	Qld	SA	WA	Tas	NT	ACT	
Total	**5**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**6**
Public hospital	5	0	0	0	0	0	0	0	5
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

Salmonella species

Figure 16: Ceftriaxone non-susceptible *Salmonella* species, number reported for 2019 by month, compared with the previous year, national

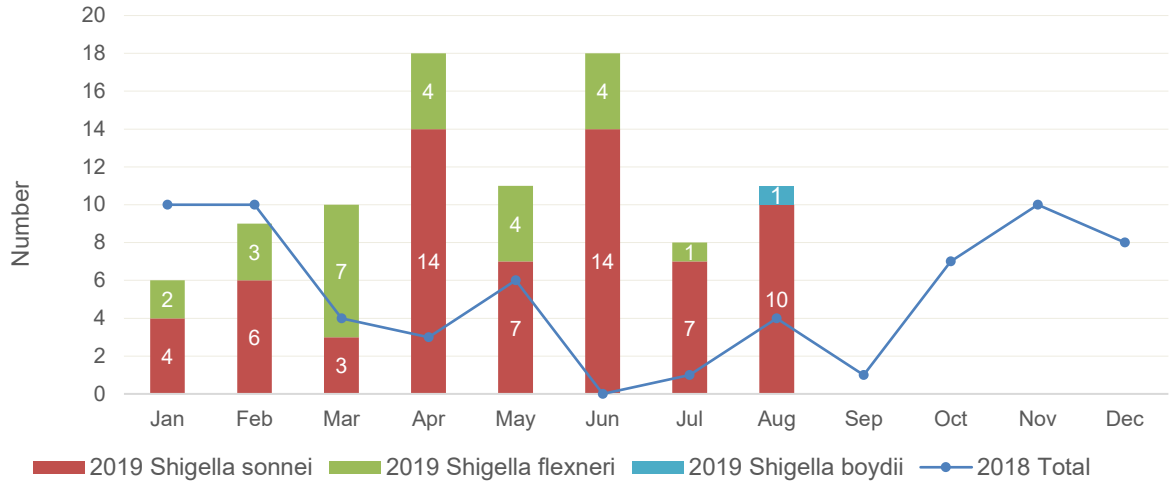


Notes (1 July 2019—31 August 2019)

1. Non-typhoidal *Salmonella* species (n = 7) and typhoidal *Salmonella* species (n = 2)

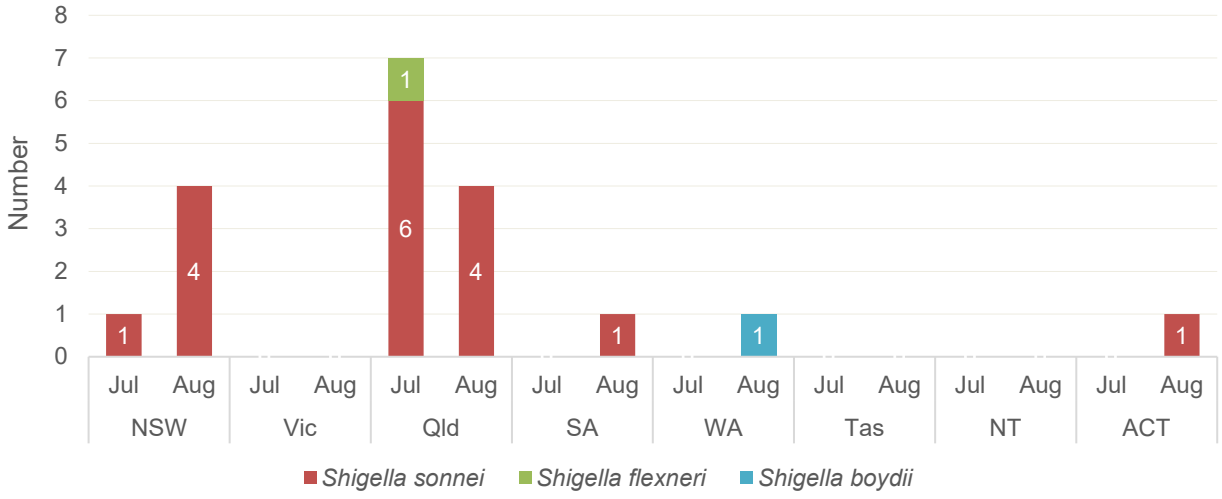
Shigella species

Figure 17: Multidrug-resistant *Shigella* species, number reported for 2019 by month, compared with the previous year, national



State and territory

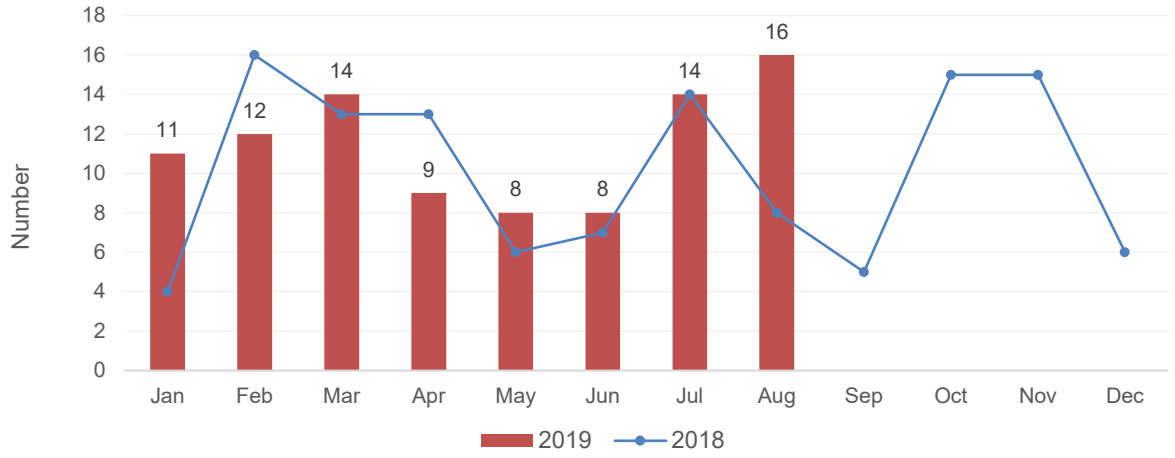
Figure 18: Multidrug-resistant *Shigella* species, number reported by state and territory, 1 July 2019–31 August 2019



Staphylococcus aureus

National data

Figure 19: 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 July 2019–31 August 2019

	State or territory								
Setting	**NSW**	**Vic**	**Qld**	**SA**	**WA**	**Tas**	**NT**	**ACT**	**Total**
Total	**6**	**11**	**8**	**0**	**4**	**0**	**0**	**1**	**30**
Public hospital	5	6	2	0	4	0	0	1	18
Private hospital	0	0	0	0	0	0	0	0	0
Aged care home	0	0	1	0	0	0	0	0	1
Community	1	5	5	0	0	0	0	0	11

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 states 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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