AUSTRALIAN COMMISSION
ON SAFETY AND QUALITY IN HEALTH CARE

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CARAlert Summary Report

1 April 2017–30 September 2017

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Summary

The National Alert System for Critical Antimicrobial Resistances (CARAlert) was established by the Australian Commission on Safety and Quality in Health Care (the Commission) in March 2016 to collect surveillance data on priority organisms with critical resistance to last-line antimicrobial agents.

In its second year of operation CARAlert is providing regular and timely antimicrobial resistance data to states and territories and nationally.

For the six-month period 1 April 2017 to 30 September 2017, azithromycin non-susceptible *Neisseria gonorrhoeae* were the most frequently reported CAR of all CAR types (46.6%), followed closely by carbapenemase-producing Enterobacteriaceae (CPE) either alone (41.4%) or in combination with ribosomal methyltransferases (RMT) (2.4%).

Fifty-three percent of CARs were detected from patients in the community (non-hospital patients or aged care home residents). There was an increase in the number of CARs reported compared to the same period last year (742 versus 423). This was due almost entirely to increases in azithromycin non-susceptible *N. gonorrhoeae* and an outbreak of OXA-48 producing *Escherichia coli* ST38 that was detected in Queensland, where 80 cases were reported between May 2017 and July 2017.

In response to the identification of the index case, the hospital where the outbreak occurred implemented a program that included:

- Identifying and screening contacts of the index case and newly admitted patients to identify others infected or colonised with OXA-48 producing *E. coli* ST38
- Ensuring the appropriate use of standard and contact infection control precautions
- Environmental cleaning and disinfection
- Reviewing and implementing appropriate antimicrobial stewardship measures

The outbreak was largely confined to a single facility, and was controlled within two months. Queensland Health hospitals have strategies in place to ensure early detection of any future CPE cases, and control and prevention of transmission.

The frequency of reporting of azithromycin non-susceptible *N. gonorrhoeae* has increased over the last two years. This has occurred in the context of significant increase in notifications of *N. gonorrhoeae*; and a decline in the proportion of isolates with elevated minimum inhibitory concentration (MIC) values to ceftriaxone in Australia. The frequency of reporting of CPE, and the Queensland outbreak, highlight the importance of the implementation of the Commission's Recommendations for the control of carbapenemase-producing Enterobacteriaceae: A guide for acute health facilities. [1]

The Commission continues to monitor records from CARAlert, prepare summary reports and ensure regular discussion with state and territory health departments about trends and potential CAR outbreaks to inform quality improvement initiatives and policies to reduce antimicrobial resistance.

[1] Australian Commission on Safety and Quality in Health Care. Recommendations for the control of carbapenemase-producing Enterobacteriaceae (CPE). A guide for acute care health facilities. Sydney: ACSQHC, 2017

Background

The Australian Commission on Safety and Quality in Health Care (the Commission) established the National Alert System for Critical Antimicrobial Resistances (CARAlert) in March 2016 as part of the Antimicrobial Use and Resistance in Australia (AURA) Surveillance System.

Critical antimicrobial resistances (CARs) are defined as resistance mechanisms, or profiles, known to be a serious threat to the effectiveness of last-line antimicrobial agents. They can result in significant morbidity and mortality in healthcare facilities, and in the community. The CARs reported under CARAlert are listed in Table 1. The CARs were drawn from the list of high-priority organisms and antimicrobials which are the focus of the AURA Surveillance System.[2]

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

- Collection and routine testing – the isolate is collected from the patient and sent to the originating laboratory for routine testing
- 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
- 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.

Table 1: List of critical antimicrobial resistances

Species	Critical Resistance
Enterobacteriaceae	Carbapenemase-producing, and/or ribosomal methyltransferase-producing
Enterococcus species	Linezolid non-susceptible
Mycobacterium tuberculosis	Multidrug-resistant – resistant to at least rifampicin and isoniazid
Neisseria gonorrhoeae	Ceftriaxone 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

[2] 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.

Results

This six-monthly report provides details on confirmed CARs collected between 1 April 2017 and 30 September 2017 and the results reported into CARAlert by 31 October 2017. It complements the CARAlert updates and reports published on the Commission's website to date.

As there is a time-lag in confirmation for some isolates, the cut-off date for data included in Commission updates and reports is four weeks after the end of each reporting period. The data in each update and report are based on the date that the isolate with a confirmed CAR was collected.

Critical antimicrobial resistances reported by state and territory

Between 1 April 2017 and 30 September 2017, 742 results from 65 originating laboratories across Australia were entered in the CARAlert system (Table 1). Azithromycin non-susceptible *Neisseria gonorrhoeae* were the most frequently reported CAR of all CAR types (46.6%), followed closely by carbapenemase-producing Enterobacteriaceae (CPE) either alone (41.4%) or in combination with ribosomal methyltransferases (RMT) (2.4%). No ceftriaxone non-susceptible *N. gonorrhoeae*, vancomycin non-susceptible *Staphylococcus aureus* or linezolid non-susceptible *S. aureus* were reported during this reporting period.

The majority of CARs continue to be reported from the three most populous states – New South Wales (28%), Victoria (35%) and Queensland (25%). CARs were the lowest in the Northern Territory (2), Tasmania (4) and South Australia (5); with only 1.5% (11/742) of all CARs reported from these states and territories. State or territory of residence was not available for two CPE reports that were subsequently found to have originated from New South Wales and Victoria. Five reports were from overseas residents; three azithromycin non-susceptible (low-level resistance [LLR], minimum inhibitory concentration [MIC] < 256 mg/L) *N. gonorrhoeae*, one CPE and one multidrug-resistant *Mycobacterium tuberculosis*.

There was a 75% increase in the total number of CARs reported for the corresponding reporting period in 2016. This was due to a significant increase of 182% in azithromycin non-susceptible (LLR < 256 mg/L) *N. gonorrhoeae* (121 to 342; P=<0.001) and an increase of 59% in the number of CPE that was not statistically significant (193 to 307). The context for these increases is discussed in the conclusion.

Table 2: Number of critical antimicrobial resistance isolates, by state and territory, 1 April 2017 to 30 September 2017

Critical antimicrobial resistance	NSW	Vic	Qld	SA	WA	Tas	NT	ACT	OS	Unk	2017 Apr–Sep	2017 YTD	2016 Apr–Sep	2016 Mar–Dec*	Trend† 16–Q4 17–Q3
Azithromycin non-susceptible (LLR < 256 mg/L) *Neisseria gonorrhoeae*	120	160	28	0	29	1	1	0	3	0	342	591	121	225	
Carbapenemase-producing Enterobacteriaceae	71	66	136	3	12	2	1	13	1	2	307	418	193	312	
Daptomycin non-susceptible *Staphylococcus aureus*	6	15	9	1	12	0	0	0	0	0	43	79	34	62	
Carbapenemase and ribosomal methyltransferase-producing Enterobacteriaceae	2	15	1	0	0	0	0	0	0	0	18	21	17	21	
Ribosomal methyltransferase-producing Enterobacteriaceae	2	4	3	0	1	0	0	1	0	0	11	16	12	16	
Ceftriaxone non-susceptible *Salmonella* species	2	0	6	1	1	0	0	0	0	0	10	14	11	17	
Azithromycin non-susceptible (HLR > 256 mg/L) *Neisseria gonorrhoeae*	1	2	1	0	0	0	0	0	0	0	4	4	3	4	
Multidrug-resistant *Shigella* species	1	1	0	0	0	1	0	0	0	0	3	8	10	15	
Linezolid non-susceptible *Enterococcus* species	2	0	0	0	1	0	0	0	0	0	3	4	5	9	
Multidrug-resistant *Mycobacterium tuberculosis*	0	0	0	0	0	0	0	0	1	0	1	5	13	20	
Ceftriaxone non-susceptible *Neisseria gonorrhoeae*	0	0	0	0	0	0	0	0	0	0	0	0	4	4	
Vancomycin non-susceptible *Staphylococcus aureus*	0	0	0	0	0	0	0	0	0	0	0	0	0	1	
Total (as at 30 September 2017)	**207**	**263**	**184**	**5**	**56**	**4**	**2**	**14**	**5**	**2**	**742**	**1160**	**423**	**706**	

HLR = high-level resistance; LLR = low-level resistance; OS = overseas; Unk = unknown; YTD = year to date

* CARAlert commenced on 17 March 2016. Data for 2016 are for the period 17 March 2016 to 31 December 2016

† Trend 16–Q4 17–Q3 = Trend Quarter 4 2016 to Quarter 3 2017

Critical antimicrobial resistances by species and month

The number and distribution of CARs reported nationally, and by state and territory, is shown in Figure 1. There was an average of 124 entries per month (range 84–188), with a peak in May 2017.

Figure 1. Critical antimicrobial resistances, number and distribution reported nationally, by state and territory, and by month, 1 April 2017 to 30 September 2017

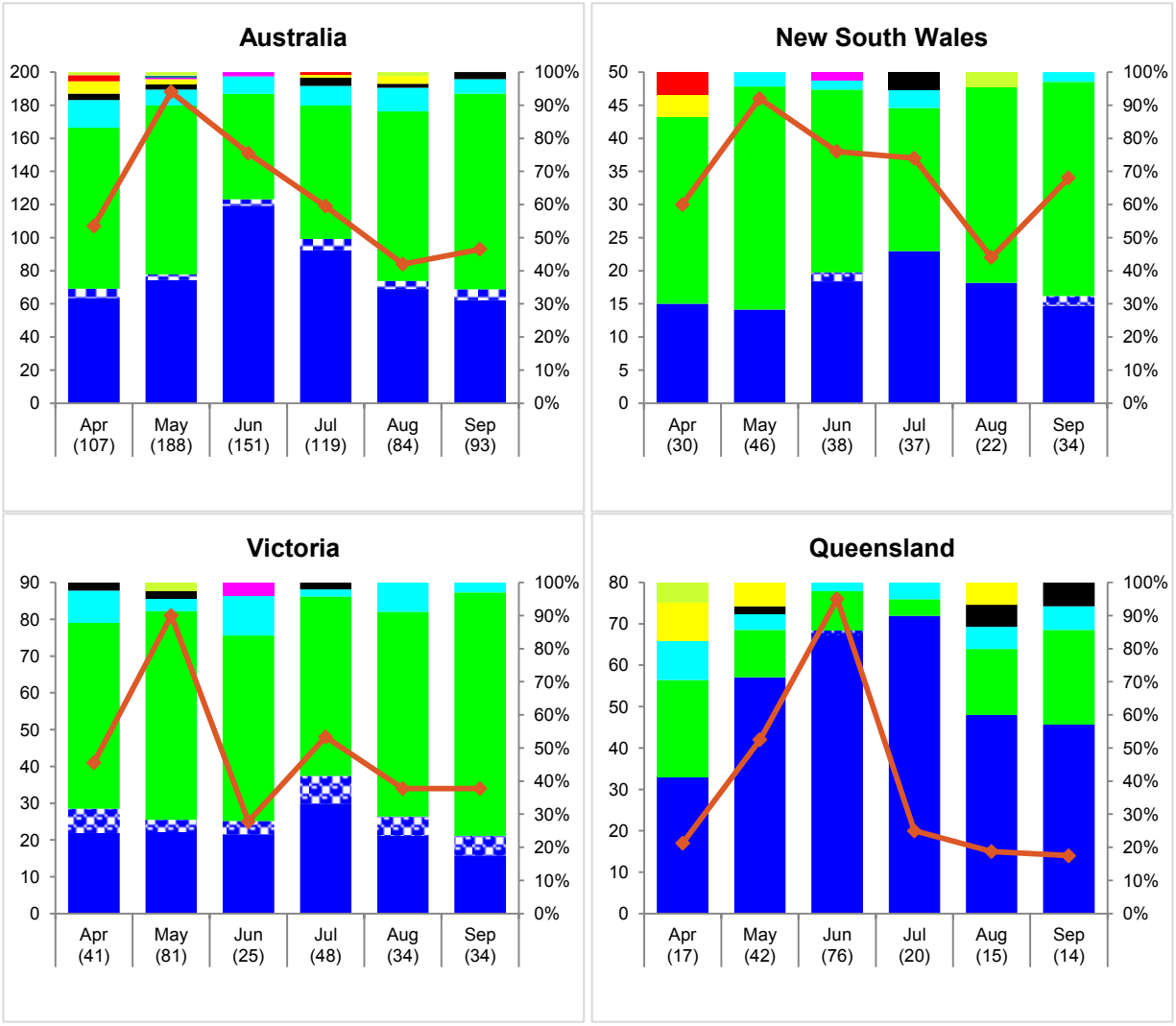
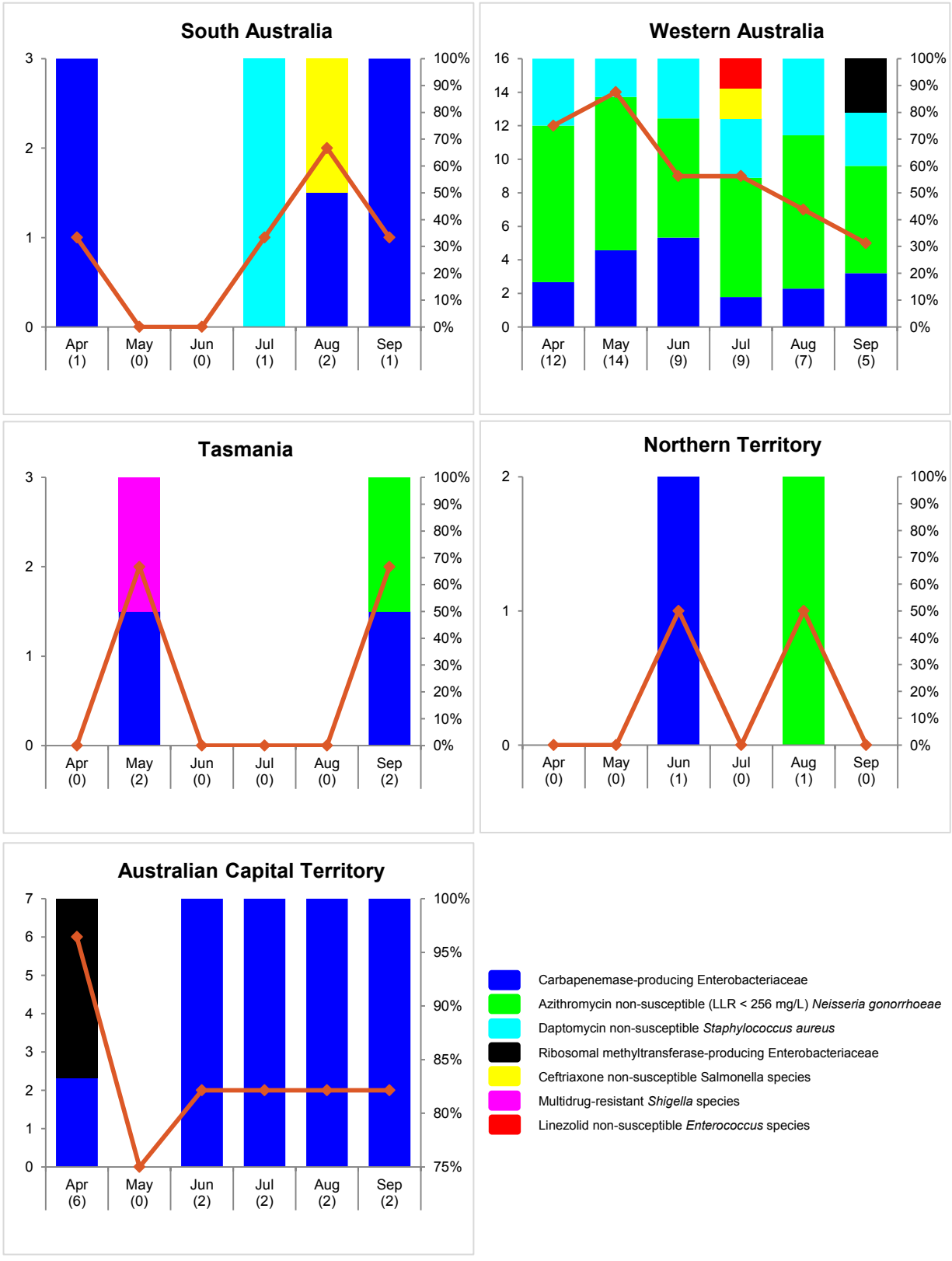


Figure 1. (continued). Critical antimicrobial resistances, number and distribution reported nationally, by state and territory, and by month, 1 April 2017 to 30 September 2017

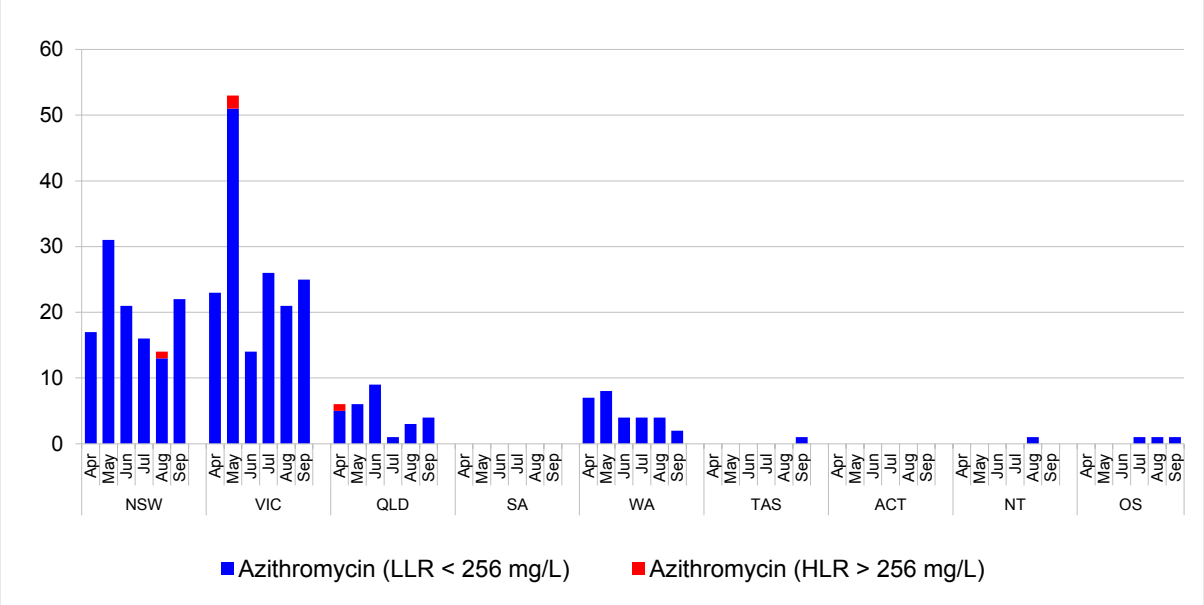


Nationally, azithromycin non-susceptible *N. gonorrhoeae* continued to be the most frequent CAR reported each month, except for June and July 2017, when CPE dominated. The outbreak of OXA-48 producing *Escherichia coli* detected in Queensland peaked in June 2017, and subsided in July and August; no cases were reported for September 2017.

Daptomycin non-susceptible *S. aureus* were reported from five states/territories, with 35% (15/43) from Victoria, 28% (12/43) from Western Australia and 21% (9/43) from Queensland.

There was a large increase in the number of reports of azithromycin non-susceptible *N. gonorrhoea* originating from Victoria in May 2017 (Figure 2). No reports were received from South Australia and the Australian Capital Territory. Four strains with high-level azithromycin non-susceptibility (MIC ≥ 256 mg/L) were confirmed from three states; Queensland (1, April 2017), Victoria (2, May 2017), and New South Wales (1, August 2017).

Figure 2. *Neisseria gonorrhoeae*, number reported by state and territory, and month of collection*, 1 April 2017 to 30 September 2017

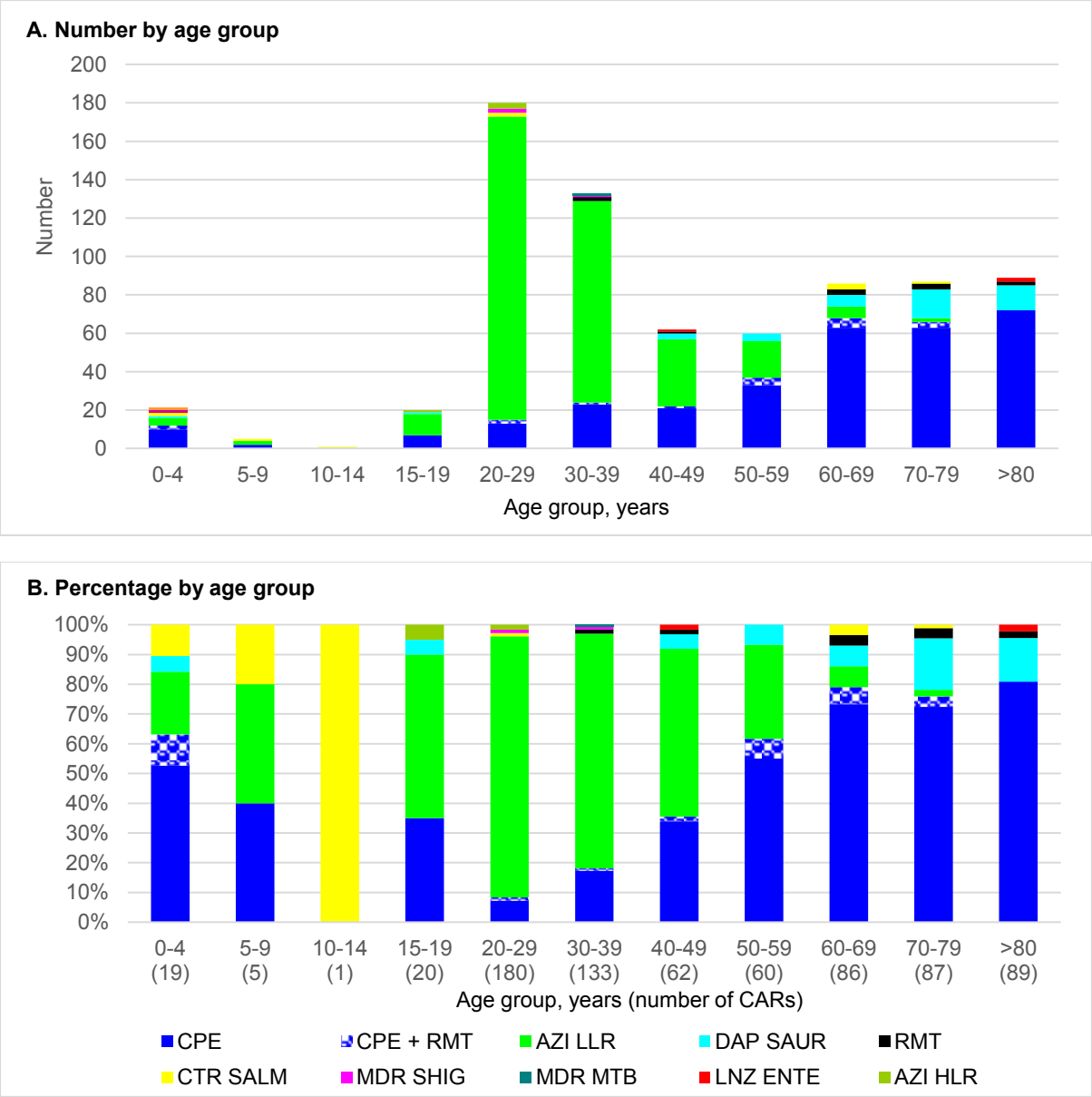


* Where state and territory of residence is unknown, the state of the originating laboratory has been assigned

Critical antimicrobial resistances by age group

CARs were isolated from patients of all ages, from birth to those aged greater than 80 years, with a median age of 40–49 years (Figure 3). Sixty-three per cent (206/325) of CPE were from people aged 60 years and older. Azithromycin non-susceptible *N. gonorrhoeae* were the predominant CAR reported among the age groups 15–19 years, 20–29 years, 30–39 years and 40–49 years. Only 3.4% (25/742) of all CARs were reported in children aged less than 15 years; CPE, either alone (48%) or with RMT (8%) were common in this age group. No trends have been observed in the age distribution since the commencement of the program.

Figure 3. Critical antimicrobial resistances by age group, 1 April 2017 to 30 September 2017



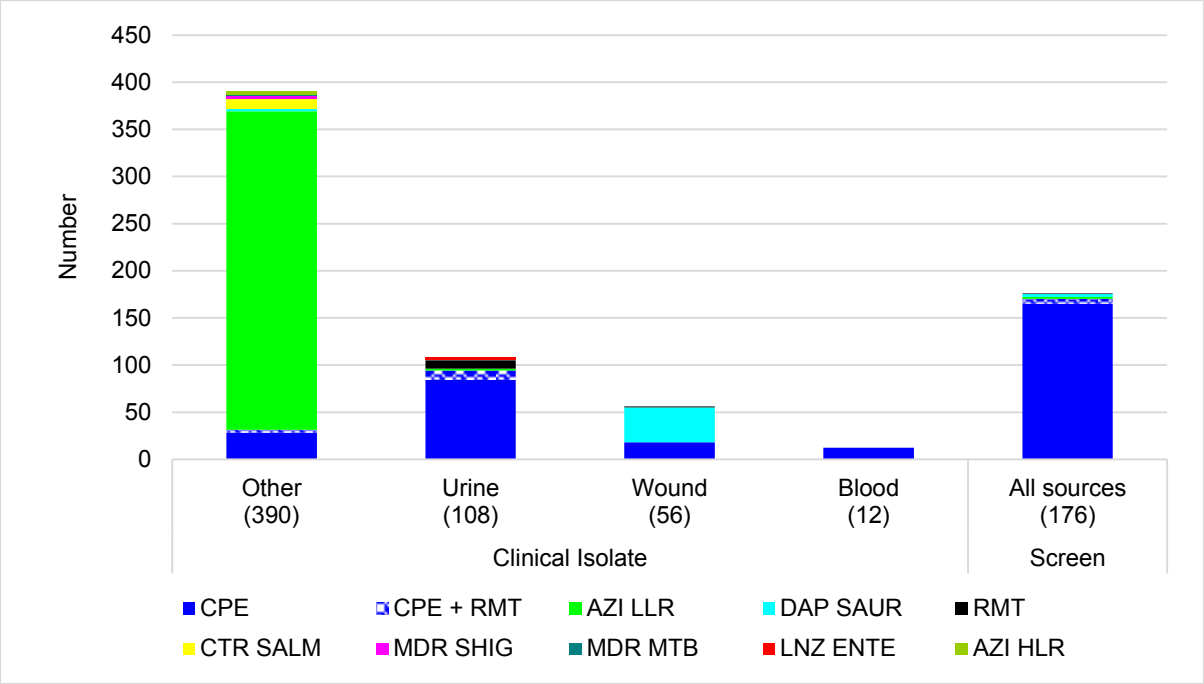
CPE = carbapenemase-producing-Enterobacteriaceae; RMT = ribosomal methyltransferase-producing Enterobacteriaceae; CPE+RMT = carbapenemase- and ribosomal methyltransferase-producing Enterobacteriaceae; LNZ ENTE = linezolid non-susceptible *Enterococcus* species; AZI LLR = azithromycin non-susceptible, low level resistance (LLR, MIC < 256 mg/L) *Neisseria gonorrhoeae*; AZI HLR = azithromycin non-susceptible, high level resistance (HLR, MIC > 256 mg/L) *Neisseria gonorrhoeae*; DAP SAUR = daptomycin non-susceptible *Staphylococcus aureus*; CTR SALM = ceftriaxone non-susceptible *Salmonella* species; MDR SHIG = multidrug-resistant *Shigella* species; MDR MTB = multidrug-resistant *Mycobacterium tuberculosis*

Critical antimicrobial resistances by specimen type

Seventy-six per cent of all CARs were from clinical specimens (specimens collected for diagnostic purposes, rather than for screening). These include urine, wound, blood and other (such as genital or respiratory) specimens (Figure 4).

Forty-eight per cent (155/325) of CPE isolates were from clinical specimens; 61% (94/155) of these were from urine, and 8% (12/155) from blood cultures. Urine is an important specimen for certain CARs such as CPE, and the urinary tract is a common site of infection. CPE were the only CAR reported from blood cultures.

Figure 4. Critical antimicrobial resistances, number reported by specimen type, 1 April 2017 to 30 September 2017



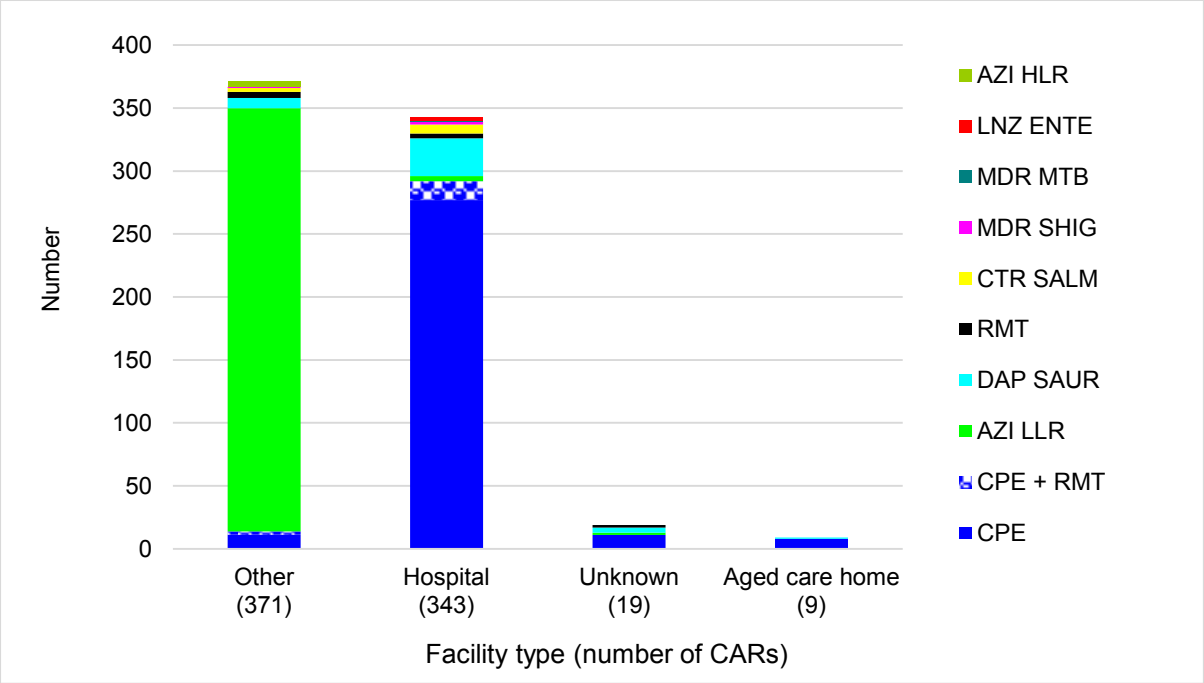
Other specimen type: not urine, wound, or blood (for example, genital, faecal, respiratory)

CPE = carbapenemase-producing-Enterobacteriaceae; RMT = ribosomal methyltransferase-producing Enterobacteriaceae; CPE+RMT = carbapenemase- and ribosomal methyltransferase-producing Enterobacteriaceae; LNZ ENTE = linezolid non-susceptible *Enterococcus* species; AZI LLR = azithromycin non-susceptible, low level resistance (LLR, MIC < 256 mg/L) *Neisseria gonorrhoeae*; AZI HLR = azithromycin non-susceptible, high level resistance (HLR, MIC > 256 mg/L) *Neisseria gonorrhoeae*; DAP SAUR = daptomycin non-susceptible *Staphylococcus aureus*; CTR SALM = ceftriaxone non-susceptible *Salmonella* species; MDR SHIG = multidrug-resistant *Shigella* species; MDR MTB = multidrug-resistant *Mycobacterium tuberculosis*

Critical antimicrobial resistances by facility type

CARs were detected in the community (50%, 371/742), in hospitalised patients or hospital outpatients (46%, 343/742), and in aged care home residents (1%, 9/742) (Figure 5). Facility type for azithromycin non-susceptible *N. gonorrhoeae* was difficult to obtain as most isolates are referred to a public health laboratory for confirmation, and as such may reflect the facility from which the isolate was sent rather than the facility that the patient attended.

Figure 5. Critical antimicrobial resistances, number reported by facility type, 1 April 2017 to 30 September 2017



Other: Community (non-hospital and non-aged care home)

CPE = carbapenemase-producing-Enterobacteriaceae; RMT = ribosomal methyltransferase-producing Enterobacteriaceae; CPE+RMT = carbapenemase- and ribosomal methyltransferase-producing Enterobacteriaceae; LNZ ENTE = linezolid non-susceptible *Enterococcus* species; AZI LLR = azithromycin non-susceptible, low level resistance (LLR, MIC < 256 mg/L) *Neisseria gonorrhoeae*; AZI HLR = azithromycin non-susceptible, high level resistance (HLR, MIC > 256 mg/L) *Neisseria gonorrhoeae*; DAP SAUR = daptomycin non-susceptible *Staphylococcus aureus*; CTR SALM = ceftriaxone non-susceptible *Salmonella* species; MDR SHIG = multidrug-resistant *Shigella* species; MDR MTB = multidrug-resistant *Mycobacterium tuberculosis*

Carbapenemase-producing Enterobacteriaceae type by state and territory

Six different carbapenemase types (IMP, OXA-48-like, NDM, KPC, VIM, OXA-23, and IMI) were reported throughout Australia. Three carbapenemase types – IMP (44%, 142/325), OXA-48-like (30%, 98/325) and NDM (15%, 49/325) – accounted for 89% of all Enterobacteriaceae with a confirmed carbapenemase.

Regional differences in the carbapenemase types reported are shown in Figure 6. IMP type carbapenemases comprised the majority (>65%) of CPE in New South Wales (66%, 48/73), and the Australian Capital Territory (85%, 11/13). No IMP-producing Enterobacteriaceae

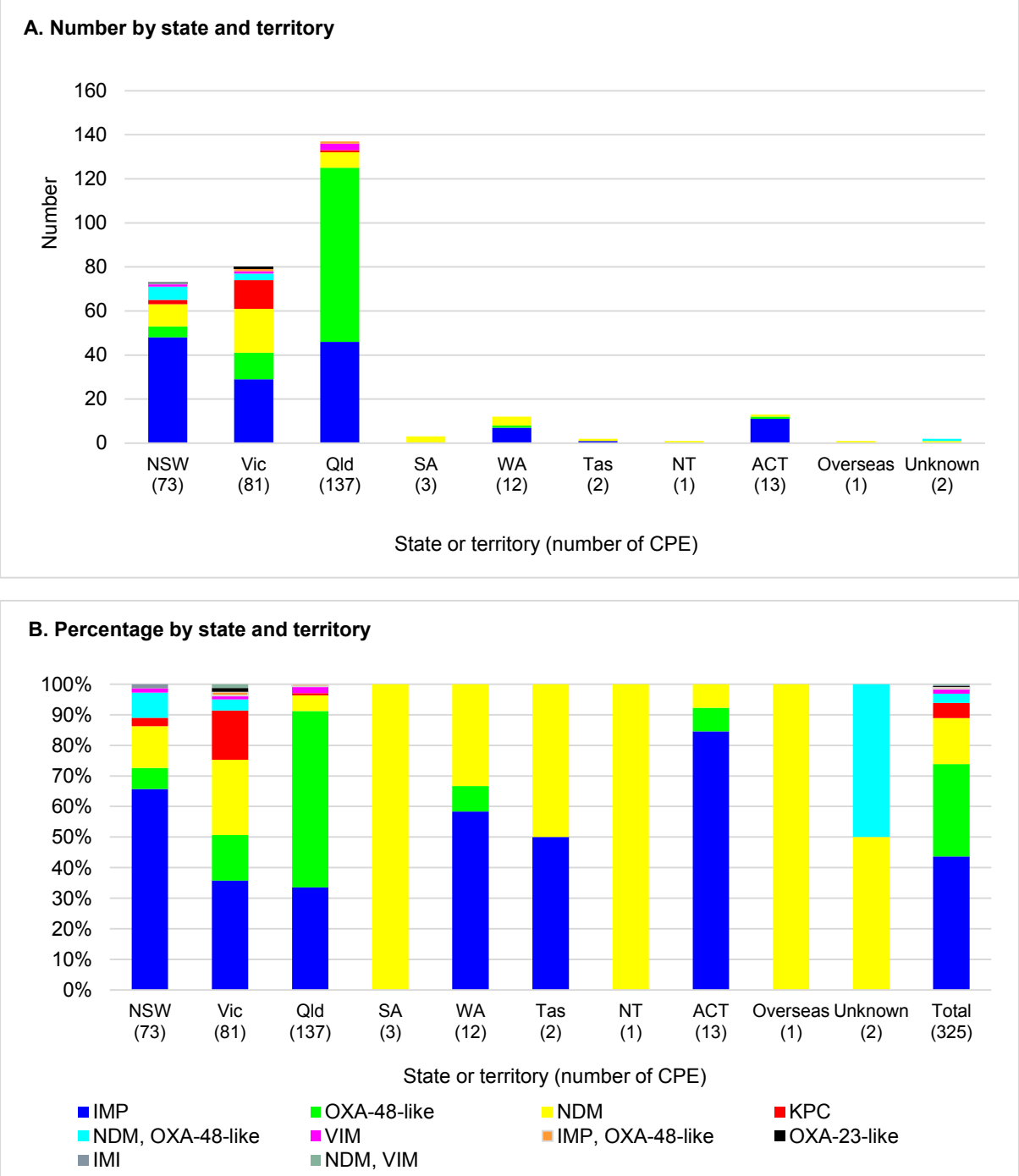
were reported from South Australia or the Northern Territory. All the strains that have been genetically sequenced in this period (50%, 72/144) are *bla*$_{IMP-4}$.

NDM types were found in all states and territories. NDM types contributed to 30% (24/81) of all types in Victoria, 22% (16/73) in New South Wales, and 33% (4/12) in Western Australia. NDM+OXA-48-like (10/60) and NDM+VIM (n=1/60), were reported. Five of the six isolates from New South Wales with NDM+OXA-48-like were found in *Klebsiella pneumoniae*. Four different NDM genes were found in the strains sequenced to date: *bla*$_{NDM-1}$ (47%, 14/30), *bla*$_{NDM-5}$ (40%, 12/30), *bla*$_{NDM-4}$ (10%, 3/30), and *bla*$_{NDM-7}$ (3%, 1/30). NDM types most often have their origin in the Indian subcontinent, and are strongly associated with other last line resistances, including aminoglycosides and fluoroquinolones.

Ribosomal methyltransferases were often detected among isolates containing NDM types (22%, 13/60; *rmtB* [9], *rmtC* [2], *armA* [1] and *rmtF* [1]).

K. pneumoniae carbapenemase (KPC) types were mostly confined to Victoria (81%, 13/16), although there were reports from two other states (New South Wales, n = 2; and Queensland, n = 1).

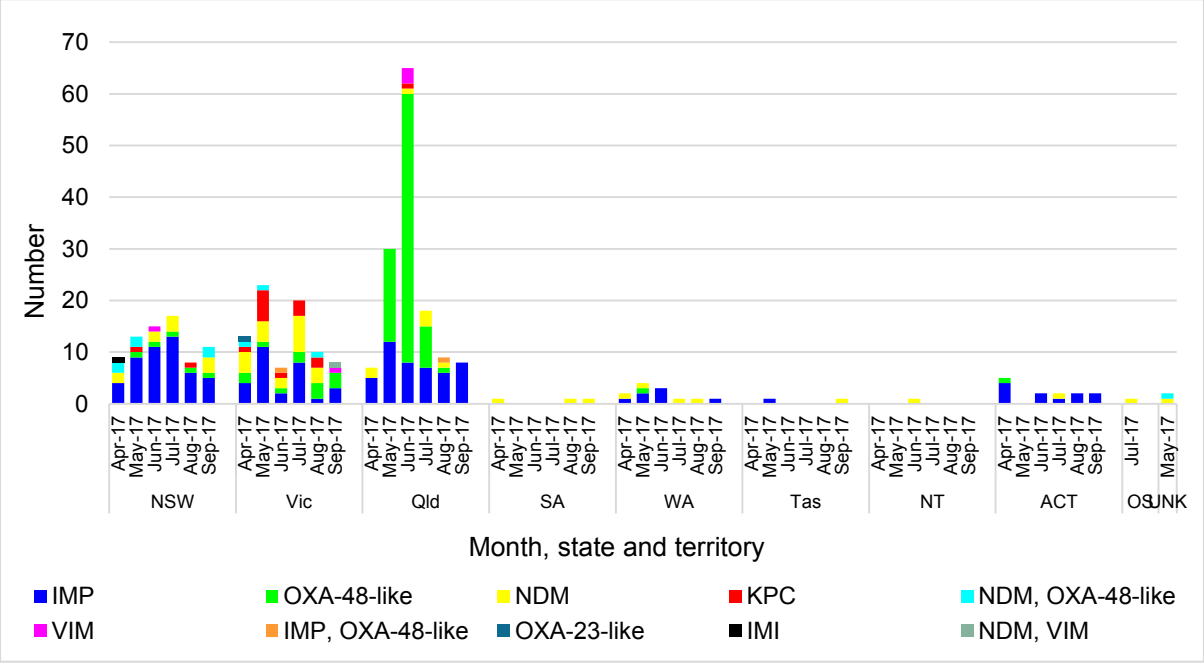
Figure 6. Carbapenemase-producing Enterobacteriaceae*, by carbapenemase type, number (A) and percentage (B) reported by state and territory, 1 April 2017 to 30 September 2017



* Carbapenemase-producing Enterobacteriaceae (n = 307), carbapenemase- and ribosomal methyltransferase-producing Enterobacteriaceae (n = 18)

The distribution of carbapenemase types by state and territory and month of confirmation is shown in Figure 7. The significant increase noted in May 2017 and June 2017 for Queensland reflects a clonal outbreak of an OXA-48 producing *E. coli.* The 12-month trend data for the top four carbapenemase types is shown in Figure 8.

Figure 7. Carbapenemase types, number reported by month and state and territory, 1 April 2017–30 September 2017



OS = overseas; UNK = unknown

Figure 8. Twelve-month trend data for the top four carbapenemase types, by state and territory and nationally, 1 October 2016 to 30 September 2017

Type	NSW	Vic	Qld	SA	WA	Tas	NT	ACT	Australia
IMP									
OXA-48-like									
NDM									
KPC									

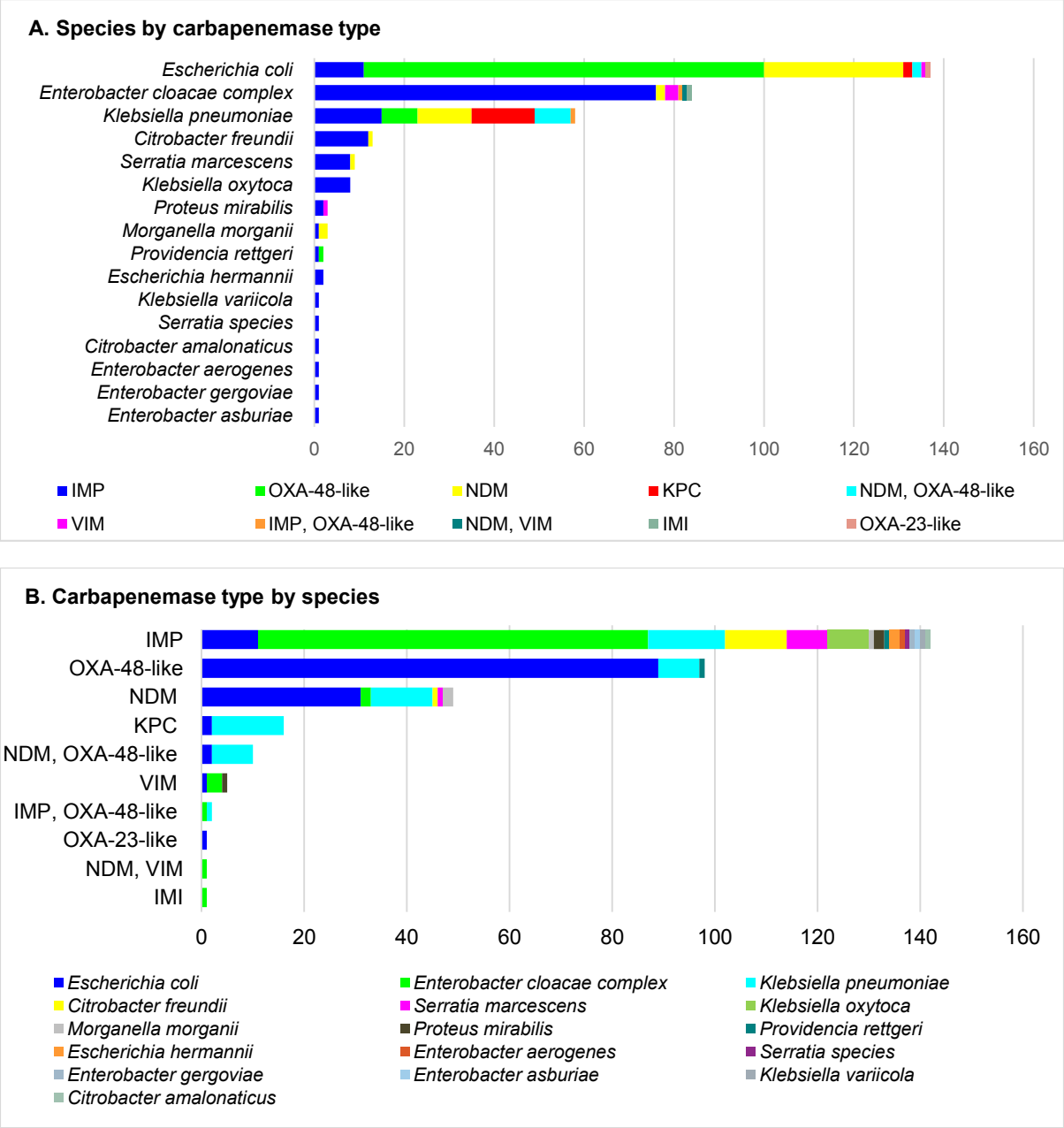
Line graphs for the period 1 October 2016 to 30 September 2017, for each type, with significant trends (χ^2 for trend) shaded red.

Carbapenemase-producing Enterobacteriaceae by species and carbapenemase type

Carbapenemases were found in 16 species of Enterobacteriaceae representing eight genera (*Citrobacter*, *Enterobacter*, *Escherichia*, *Klebsiella*, *Morganella*, *Proteus*, *Providencia*, *Serratia*). *E. coli* contributed to 42% (137/325) of all species, with 65% (89/137) containing OXA-48-like carbapenemases (Figure 9). IMP-types accounted for 43.7% (142/325) of all carbapenemases, and were found in 16 different species. *E. cloacae* complex accounted for 53% (76/142) of all IMP type carbapenemases and 26% (84/325) of all CPE. OXA-48-like and NDM carbapenemase types were found mainly in *E. coli* (91%, 89/98; 63%, 31/49, respectively); however, when both NDM and OXA-48-like types were found together, they were mainly in *K. pneumoniae* (80%, 8/10).

Two KPC (12%, 2/16) were found in *E. coli* in Victoria. IMI was detected for the first time in April 2017, in an *E. cloacae* complex from a patient residing in New South Wales.

Figure 9. Carbapenemase-producing Enterobacteriaceae*, number reported by (A) species and (B) carbapenemase type, 1 April 2017 to 30 September 2017



* Carbapenemase-producing Enterobacteriaceae (n = 307), carbapenemase- and ribosomal methyltransferase-producing Enterobacteriaceae (n = 18)

Other Critical Antimicrobial Resistance types

Ribosomal methyltransferases were detected in 29 Enterobacteriaceae, across six different species; 62% (18/29) of these isolates also harboured a carbapenemase. Four ribosomal methyltransferase genes were found: *rmtB* (55%; 16/29); *armF* (21%, 6/29), *armA* (17%; 5/29); and *rmtC* (7%; 2/29).

Ten ceftriaxone non-susceptible *Salmonella* species were confirmed from Queensland (6), New South Wales (2), and one each from South Australian and Western Australia. Six had plasmid-borne *ampC* genes, either alone (4) or with an ESBL (2); and four had ESBLs alone.

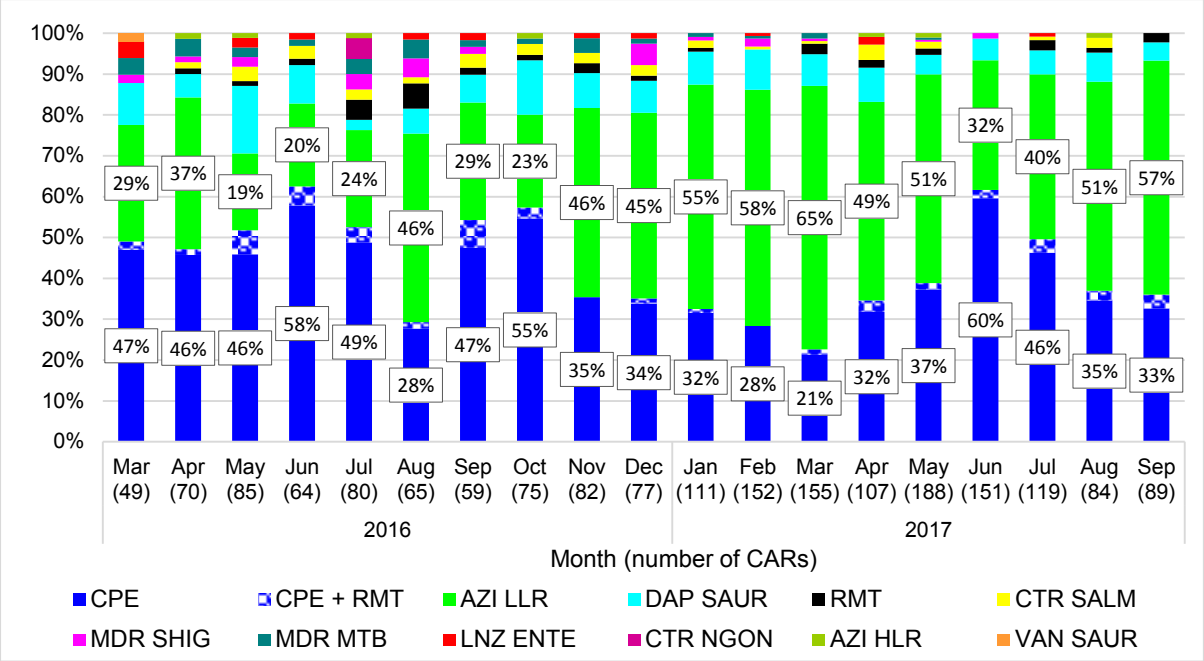
There were three reports of multidrug-resistant *Shigella* species, from patients residing in New South Wales, Tasmania and Victoria.

Three linezolid non-susceptible *Enterococcus* species were reported, all were *E. faecalis*.

Trends since March 2016

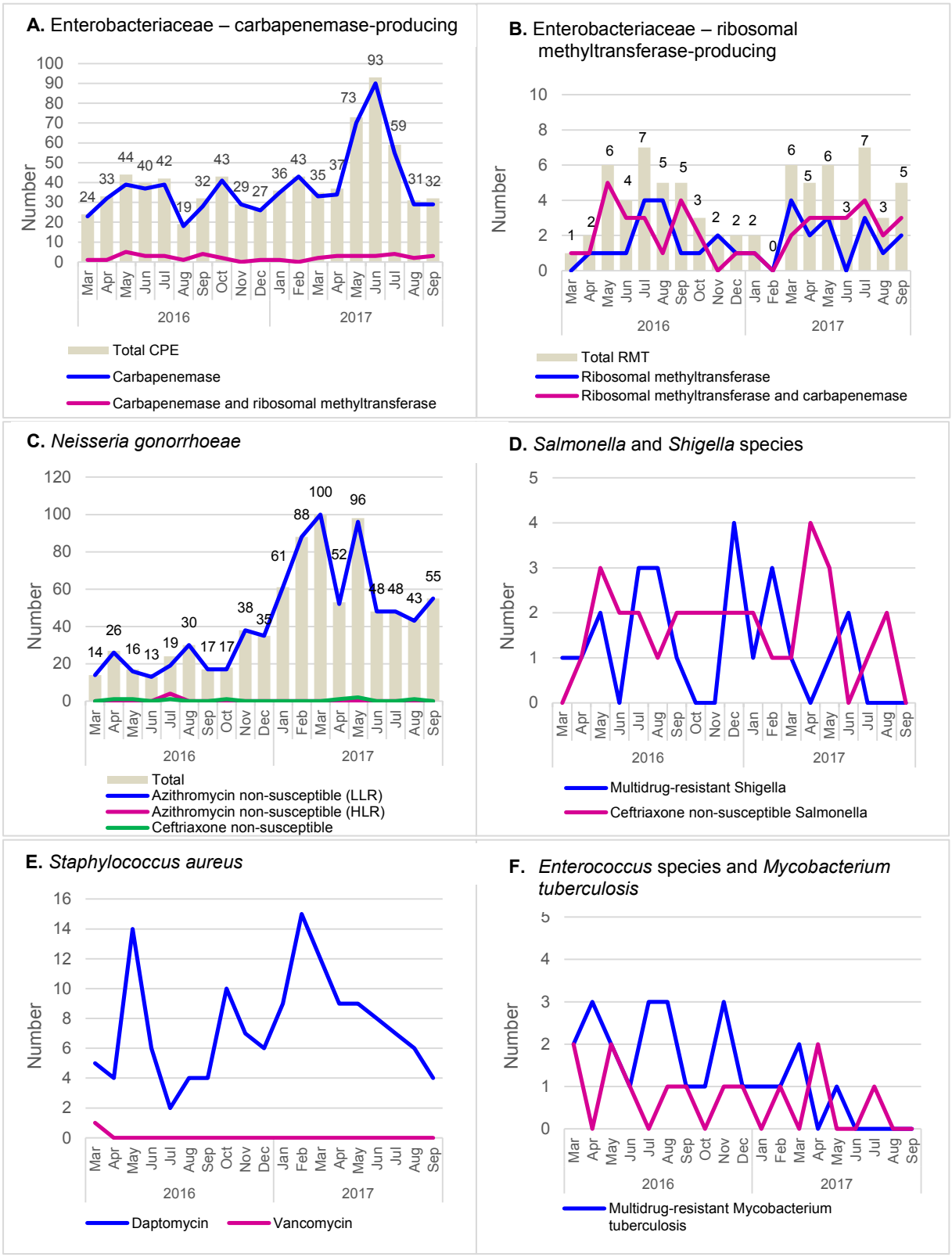
The proportion of CARs associated with priority organisms since 17 March 2016 is shown in Figure 10. The number of CARs reported by species and month is shown in Figure 11. The number and proportion reported nationally, and by state and territory is shown in Figure 12. The fluctuations in reporting of CARs, particularly CPE and azithromycin non-susceptible *N. gonorrhoeae*, and state and territory variations have already been noted.

Figure 10. Critical antimicrobial resistances (CARs), as a percentage of all CARs, reported by month, 17 March 2016–30 September 2017



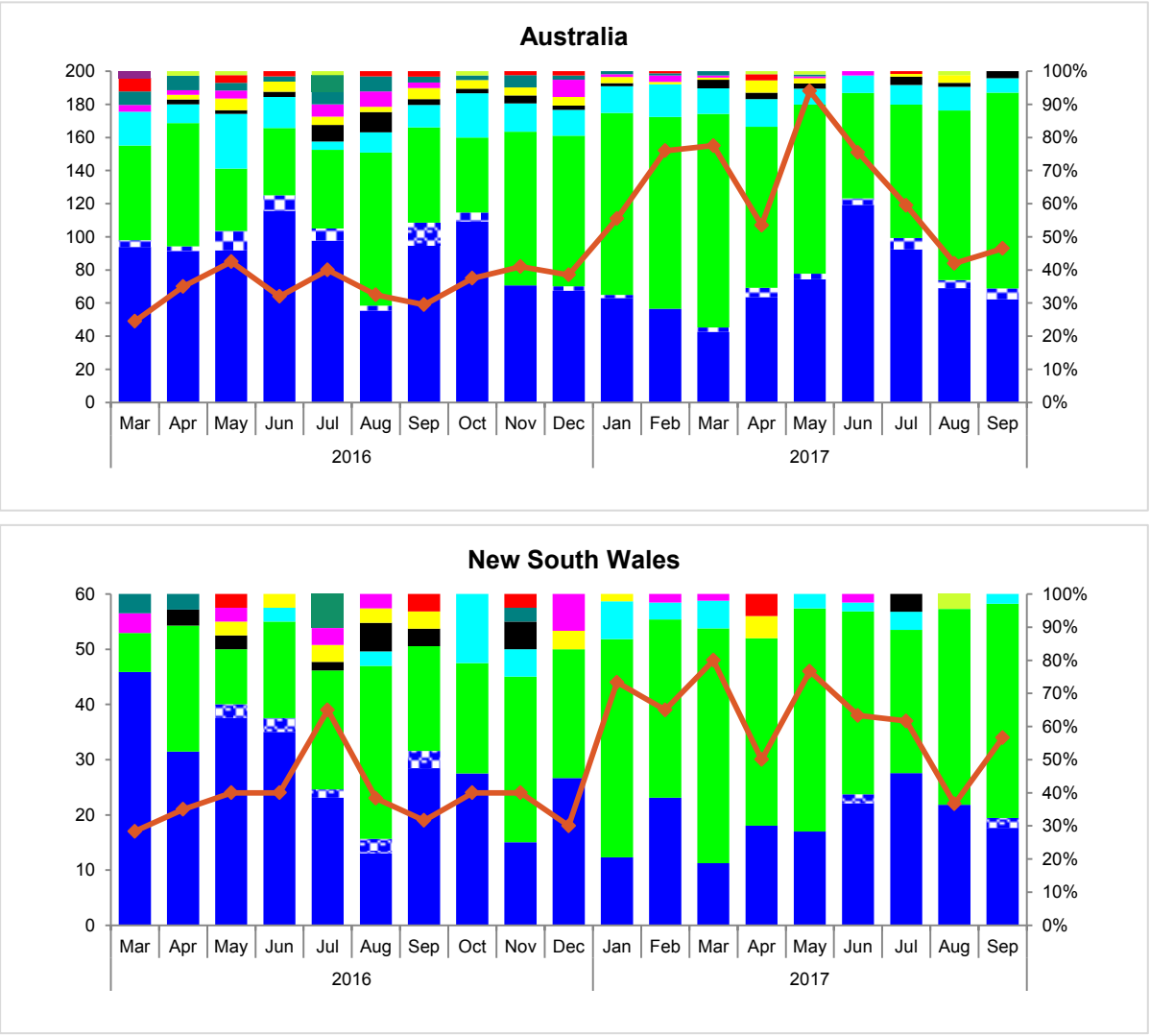
CPE = carbapenemase-producing-Enterobacteriaceae; RMT = ribosomal methyltransferase-producing Enterobacteriaceae; CPE+RMT = carbapenemase- and ribosomal methyltransferase-producing Enterobacteriaceae; LNZ ENTE = linezolid non-susceptible *Enterococcus* species; AZI LLR = azithromycin non-susceptible, low level resistance (LLR, MIC < 256 mg/L) *Neisseria gonorrhoeae*; AZI HLR = azithromycin non-susceptible, high level resistance (HLR, MIC > 256 mg/L) *Neisseria gonorrhoeae*; CTR NGON = ceftriaxone non-susceptible *Neisseria gonorrhoeae*; DAP SAUR = daptomycin non-susceptible *Staphylococcus aureus*; VAN SAUR = vancomycin non-susceptible *Staphylococcus aureus*; CTR SALM = ceftriaxone non-susceptible *Salmonella* species; MDR SHIG = multidrug-resistant *Shigella* species; MDR MTB = multidrug-resistant *Mycobacterium tuberculosis*

Figure 11. Critical antimicrobial resistances, number reported by species and month, 17 March 2016–30 September 2017



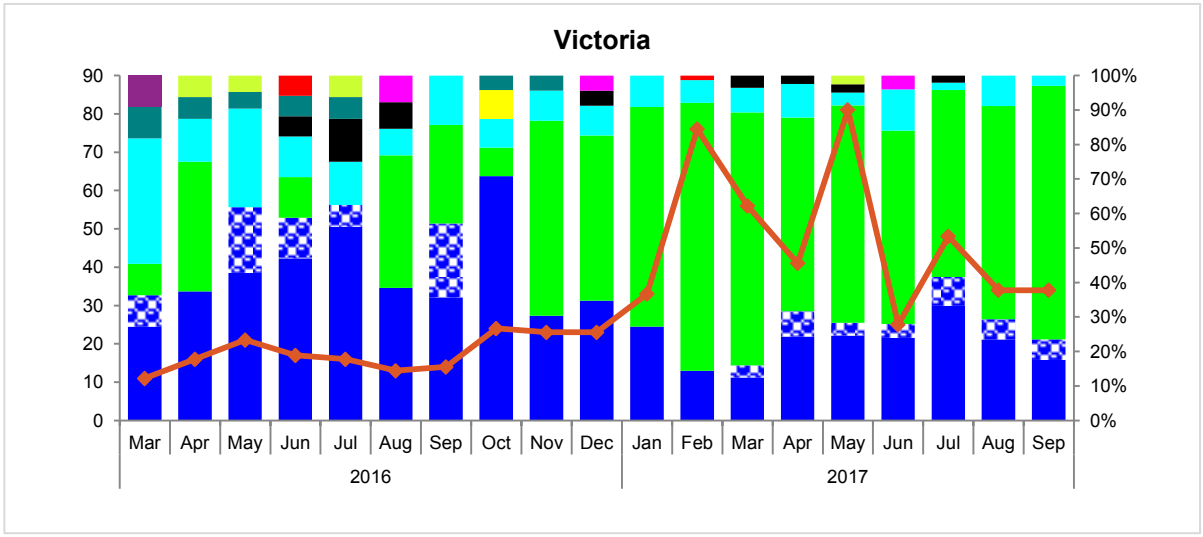
CPE = carbapenemase-producing-Enterobacteriaceae; RMT = ribosomal methyltransferase-producing Enterobacteriaceae; LLR = low level resistance; HLR = high level resistance

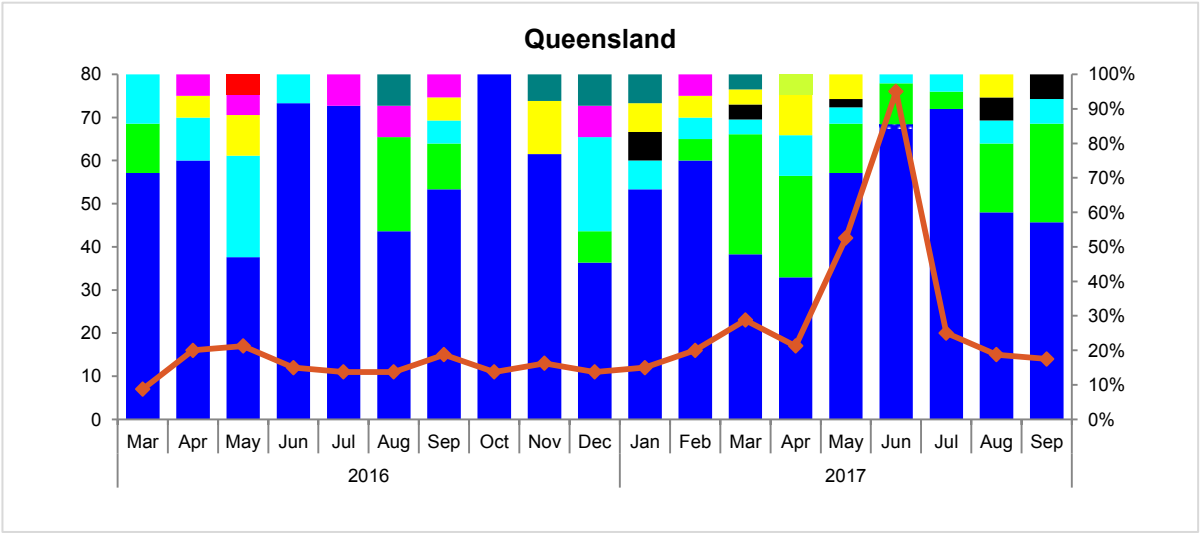
Figure 12. Critical antimicrobial resistances, number and distribution reported nationally, and by state and territory, 16 March 2016 to 30 September 2017



- Carbapenemase-producing Enterobacteriaceae
- Carbapenemase and ribosomal methyltransferase-producing Enterobacteriaceae
- Azithromycin non-susceptible (LLR < 256 mg/L) *Neisseria gonorrhoeae*
- Daptomycin non-susceptible *Staphylococcus aureus*
- Ribosomal methyltransferase-producing Enterobacteriaceae
- Ceftriaxone non-susceptible Salmonella species
- Multidrug-resistant *Shigella* species
- Multidrug-resistant *Mycobacterium tuberculosis*
- Linezolid non-susceptible *Enterococcus* species
- Ceftriaxone non-susceptible *Neisseria gonorrhoeae*
- Azithromycin non-susceptible (HLR > 256 mg/L) *Neisseria gonorrhoeae*
- Vancomycin non-susceptible *Staphylococcus aureus*

Figure 12 (continued). Critical antimicrobial resistances, number and distribution reported nationally, and by state and territory, 16 March 2016 to 30 September 2017





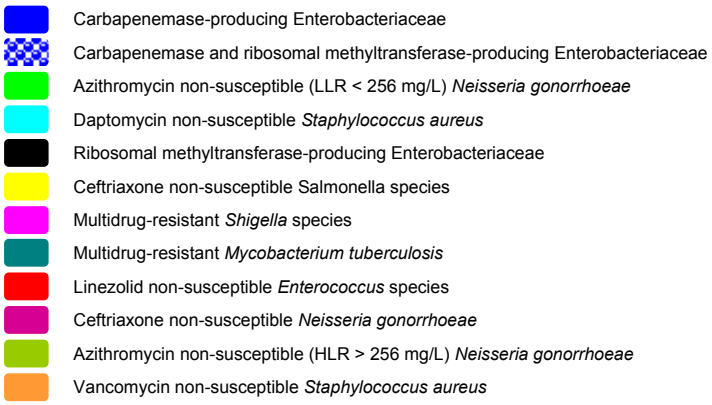


Figure 12 (continued). Critical antimicrobial resistances, number and distribution reported nationally, and by state and territory, 16 March 2016 to 30 September 2017

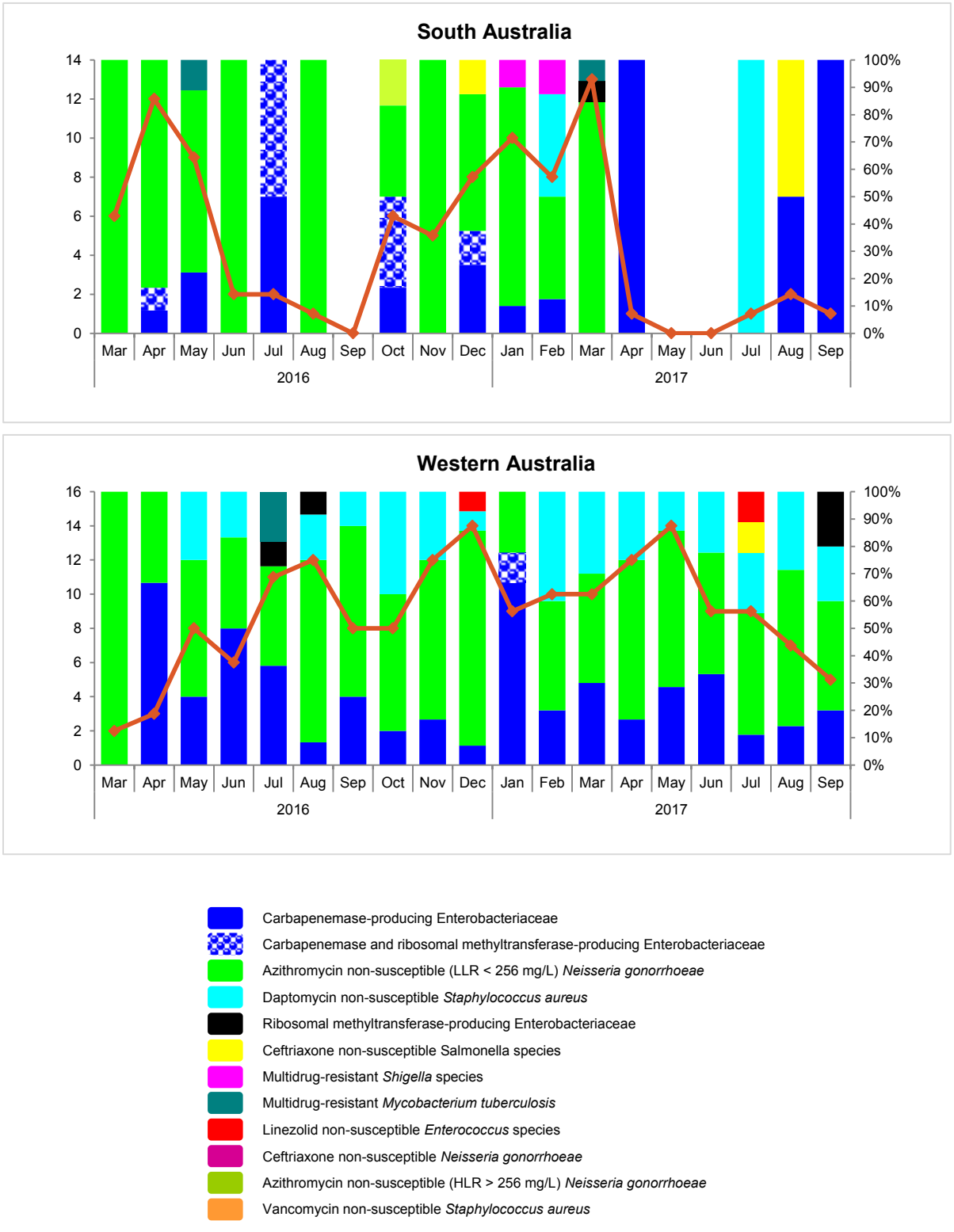


Figure 12 (continued). Critical antimicrobial resistances, number and distribution reported nationally, and by state and territory, 16 March 2016 to 30 September 2017

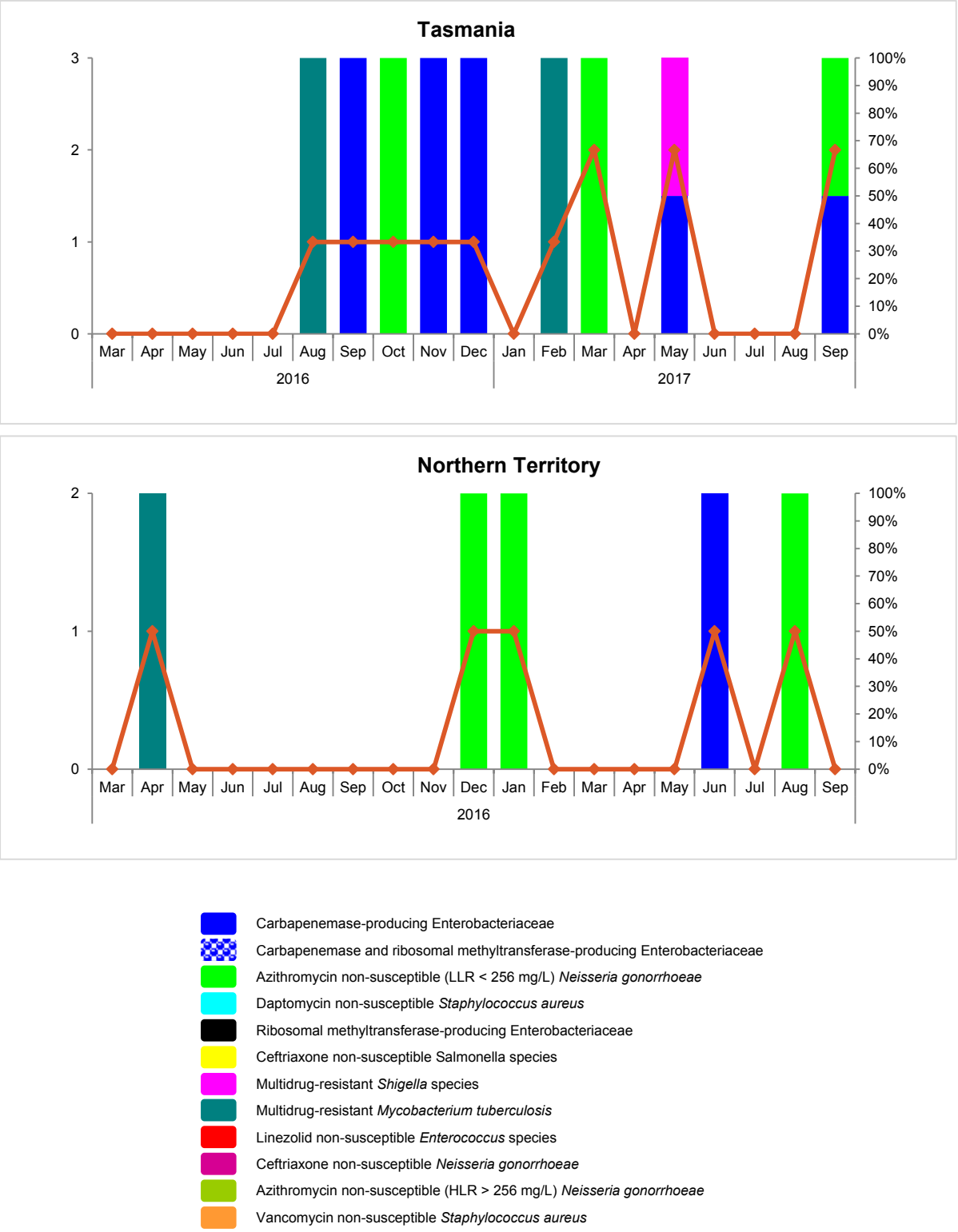
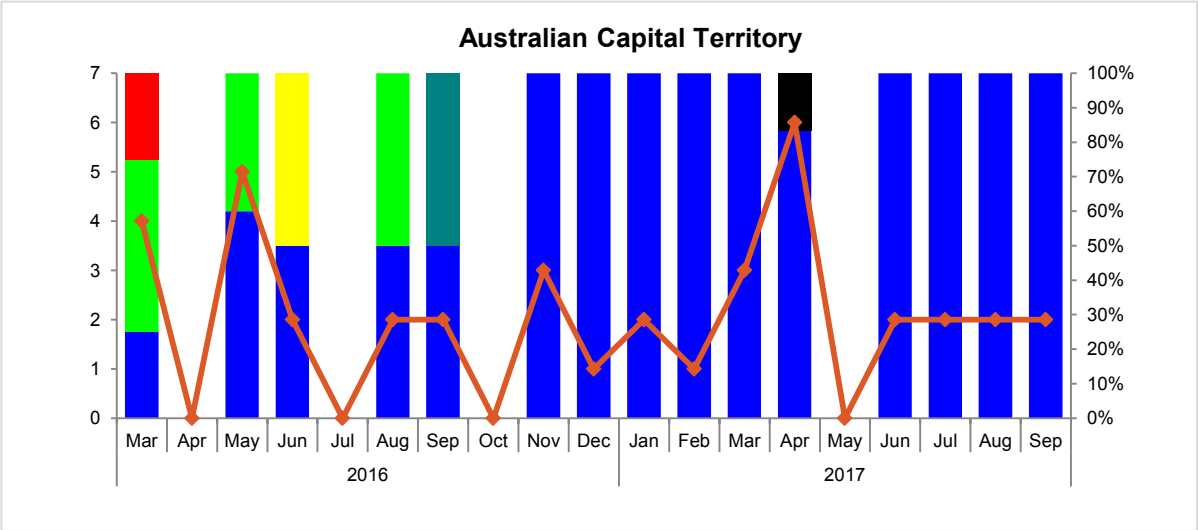
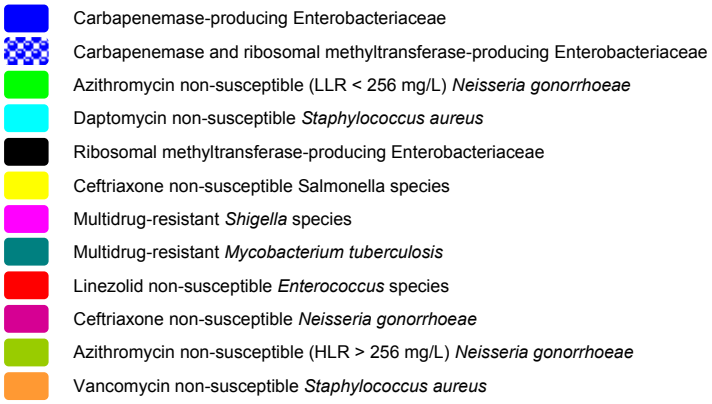


Figure 12 (continued). Critical antimicrobial resistances, number and distribution reported nationally, and by state and territory, 16 March 2016 to 30 September 2017





Conclusion

The establishment of CARAlert in 2016 was a significant enhancement of the AURA Surveillance System, which has provided timely national data on CARs to inform quality improvement initiatives and policies to reduce antimicrobial resistance.

As at 30 September 2017, 85 originating laboratories have contributed CARs that have been reported by the 28 confirming laboratories. All states and territories have had at least one CAR reported.

CPE were the most frequently recorded CAR of all CARs reported until November 2016, either alone or in combination with RMT. From December 2016, azithromycin non-susceptible *N. gonorrhoeae* were most frequently reported, and have continued to dominate reports until September 2017, except for June 2017 and July 2017, where CPE peaked. This was due to an outbreak of OXA-48 producing *E. coli* ST38 in Queensland, where 80 cases were reported between May 2017 and July 2017.

In response to the identification of the index case, the hospital where the outbreak occurred implemented a program that included:

- Identifying and screening contacts of the index case and newly admitted patients to identify others infected or colonised with OXA-48 producing *E. coli* ST38
- Ensuring the appropriate use of standard and contact infection control precautions
- Environmental cleaning and disinfection
- Reviewing and implementing appropriate antimicrobial stewardship measures

The outbreak was largely confined to a single facility, and was controlled within two months. Queensland Health hospitals have strategies in place to ensure early detection of any future CPE cases, and control and prevention of transmission.

The IMP-type carbapenemase (mainly IMP-4) is clearly well established on the eastern seaboard of Australia in several species of Enterobacteriaceae; particularly *E. cloacae*, and is appearing intermittently in other states and territories.

The frequency of reporting of CPE and the outbreak in Queensland highlights the importance of the implementation of the Commission's Recommendations for the control of carbapenemase-producing Enterobacteriaceae: a guide for acute health facilities. [3]

The frequency of reporting of azithromycin non-susceptible *N. gonorrhoeae* has increased over the last 2 years, initially in South Australia in 2016 [4] [5], then across all jurisdictions in 2017. Azithromycin non-susceptible *N. gonorrhoeae* are now common in Australia and this likely reflects the emergence and spread of resistance clones. This has occurred in the context of significant increase in notifications of *N. gonorrhoeae* by 63% (62 to 101 per 100 000) between 2012 and 2016. Azithromycin was added to ceftriaxone as part of a dual treatment strategy to delay the emergence of ceftriaxone non-susceptible *N. gonorrhoeae* in

[3] Australian Commission on Safety and Quality in Health Care. Recommendations for the control of carbapenemase-producing Enterobacteriaceae (CPE). A guide for acute care health facilities. Sydney: ACSQHC, 2017

[4] Lahra MM. Australian Gonococcal Surveillance Program Quarter 3 2017 Report. Communicable Diseases Intelligence. In press.

[5] Lahra M, Ward A, Trembizki E, Hermanson J, Clements E, Lawrence A, et al. Treatment guidelines after an outbreak of azithromycin-resistant *Neisseria gonorrhoeae* in South Australia. The Lancet Infectious Diseases 2017; 17(2):133–134.

Australia in 2014 and this has coincided with the decline in the proportion of isolates with elevated MIC values to ceftriaxone in Australia [6] as shown in Figure 11 C.

The data on azithromycin non-susceptible and ceftriaxone non-susceptible *N. gonorrhoeae* reported to CARAlert complement the comprehensive long term Commonwealth and state and territory systems that monitor and report antimicrobial resistance as part of national surveillance activities to inform treatment guidelines and sexually transmitted infection prevention and control strategies.

Other CARs remain at very low levels, providing reassurance that none have become established in Australia.

A review of CARs reported to CARAlert is planned for early 2018. The review will

- Assess the CARs which are currently reported to CARAlert to determine that they continue to be priorities
- Identify additional CARs that should be captured by CARAlert
- Update the list of laboratories that perform confirmatory testing for CARs
- Update the CARAlert Handbook to reflect changes arising from the review.

Enquiries regarding either this report or the CARAlert System should be submitted to CARAlert@safetyandquality.gov.au.

[6] Lahra MM, Enriquez RP. Australian Gonococcal Surveillance Program Annual Report 2016. Communicable Diseases Intelligence. In press.

Glossary of Terms and Abbreviations

Term/Abbreviation	Definition
Clinical specimen	Clinical specimens are collected for diagnostic purposes. They include urine, wound, blood and other (e.g. genital or respiratory) specimens
Screen specimen	Specimens taken for the purpose of screening for resistances
Confirming laboratory	The laboratory which performs the necessary confirmatory tests for a CAR. Confirming laboratories: • Notify the originating laboratory of test outcomes through the usual communication channels, regardless of whether a CAR is confirmed or not • Enter data for each confirmed CAR into the CARAlert web-portal. State and territory health authorities and the Public Health Laboratory Network have contributed to identification of confirming laboratories for the purpose of CARAlert.
Critical Antimicrobial Resistances (CARs)	CARs are resistance mechanisms, or profiles, known to be a serious threat to the effectiveness of last-line antimicrobial agents
Originating laboratory	The laboratory to which a specimen is initially referred by a general practice or hospital for routine testing of isolates. If an originating laboratory identifies an isolate that may have the potential to be a CAR, it: • Notifies the requesting clinician of the test results, and the suspected CAR • Sends the suspected isolate onto a confirming laboratory for confirmation.
AZI (HLR)	Azithromycin non-susceptible, high level resistance (HLR, MIC > 256 mg/L) *Neisseria gonorrhoeae*
AZI (LLR)	Azithromycin non-susceptible, low level resistance (LLR, MIC < 256 mg/L) *Neisseria gonorrhoeae*
CPE	carbapenemase-producing Enterobacteriaceae
CPE+RMT	carbapenemase- and ribosomal methyltransferase-producing Enterobacteriaceae
CTR NGON	ceftriaxone non-susceptible *Neisseria gonorrhoeae*
CTR SALM	ceftriaxone non-susceptible *Salmonella* species
DAP SAUR	daptomycin non-susceptible *Staphylococcus aureus*
LNZ ENTE	linezolid non-susceptible *Enterococcus* species
MDR MTB	multidrug-resistant *Mycobacterium tuberculosis*
MDR SHIG	multidrug-resistant *Shigella* species
MIC	Minimum inhibitory concentration

Term/Abbreviation	Definition
RMT	ribosomal methyltransferase-producing Enterobacteriaceae
VAN SAUR	vancomycin non-susceptible *Staphylococcus aureus*

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