South Australian Department for Health and Wellbeing
Communicable Disease Control Branch
Infection Control Service

Healthcare Associated Infection (HAI) Surveillance Program

Multidrug-resistant Organism (MRO) Surveillance Annual Report

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SA Healthcare Associated Infection (HAI) Surveillance Program
Multidrug-resistant Organism (MRO) Annual Report 2022

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This annual report can be accessed
at the Department for Health and Wellbeing
Internet site www.sahealth.sa.gov.au/HAIstatistics

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Disclaimer

The data presented in this report were correct at the time of publication and reflect rates based on the numerator and denominator data supplied from contributing Local Health Networks (LHN). Minor discrepancies with previous reports may occur as data adjustments are made retrospectively.

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Introduction

The Infection Control Service (ICS), Communicable Disease Control Branch (CDCB), of South Australian (SA) Department for Health and Wellbeing coordinates the collection of surveillance data for healthcare associated bloodstream infections (BSI), targeted surgical site infections (SSI), multidrug resistant organisms (MRO), including methicillin-resistant *Staphylococcus aureus* (MRSA), vancomycin-resistant enterococci (VRE), multidrug-resistant Gram-negative (MRGN) organisms and *Clostridioides difficile* infection (CDI). SA Health surveillance includes data on emerging organisms identified as having critical antimicrobial resistance which limit antimicrobial treatment options, refer page 13 for further details.

Hospitals are required to undertake healthcare associated infection (HAI) surveillance as per the National Safety and Quality Health Service Standards[1]. The SA Health Healthcare Associated Infection (HAI) Surveillance Program provides a quality assured and consistent methodology to undertake this activity.

Continuous ongoing surveillance of multidrug-resistant organisms in hospitals is an important quality assurance and improvement activity. Surveillance and reporting contribute to safer care for patients, enables detection of cases and potential outbreaks as well as informing strategies to improve practice and minimise MRO cross-transmission.

SA Health recognises that statewide health priorities incorporate partnerships with non-government and private sector stakeholders and promotes working together in the current SA Health and Wellbeing Strategy 2020-2025 [2]. As patients move between public and private hospitals to undergo treatment in accordance with public-private partnerships, incorporating private facility HAI surveillance data into the SA HAI surveillance program assists with identifying potential differences in HAI incidence/morbidity rates and prompt collaborative discussions regarding practices across these sectors.

In conjunction with this MRO annual report, MRO data is also reported internally via SA Health Quality, Information and Performance Hub (QIP HUB) reports for a sub-group of contributors, as well as SA HAI surveillance program benchmarking reports sent regularly to contributors by the ICS. Contributors are required to ensure they have internal procedures and activities that are undertaken in response to their internally generated surveillance activities and reports, in addition to HAI surveillance reports provided by the ICS.

There is currently no data collection for MROs as part of the national surveillance program, with the exception of methicillin-resistant *Staphylococcus aureus* bloodstream infections, consequently the SA jurisdictional surveillance program is an important feature of the South Australian health care system.

This MRO data set comprises of nine private hospitals which participate in the state HAI program voluntarily and 71 acute care public hospitals, including those hospitals defined as public psychiatric hospitals in the Local Hospital Networks/Public hospital establishments national minimum data set (NMDS), refer to Table 1.

For benchmarking purposes, public hospitals are grouped according to their size and acuity based on the current Australian Institute of Health and Welfare (AIHW) peer groups. Private hospitals are grouped separately. Refer to page 5 for applicable definitions.

This report focuses on the analysis of HAI MROs acquired by patients in SA hospitals (public and private) who contribute to the SA HAI surveillance program. Cumulative data gathered by the ICS as part of the SA Health Infection Control HAI Surveillance Program are presented as incidence (acquisition) and morbidity (infection) rates for the identified targeted organisms and updates the previous report published in 2020.

Multidrug-resistant organisms included in the SA HAI surveillance program include:

- methicillin-resistant *Staphylococcus aureus* (MRSA)
- vancomycin-intermediate/resistant *Staphylococcus aureus* (VISA/VRSA)
- vancomycin-resistant enterococci (VRE)
- extended-spectrum beta-lactamase producing Gram-negative organisms (ESBL)*
- multidrug-resistant *Pseudomonas aeruginosa* (MRPAER)*
- carbapenem-resistant *Acinetobacter* species and *Enterobacterales* (CRGNB)*
- plasmid-mediated AmpC beta-lactamase producers (AMPC)*
- metallo beta-lactamase producers (MBL)*.

*collectively referred to as multidrug-resistant Gram-negatives (MRGN) in this report.

Summary of Key Findings

- The aggregate rate of MRSA infection for all contributing hospitals decreased slightly from 0.7 per 10,000 bed-days in 2021 to 0.6 per 10,000 bed-days in 2022.
    - Of the 124 healthcare associated MRSA infections reported in 2022, 36% (n=45) occurred in patients known to be colonised with this organism.
- The aggregate rate of infection with VRE increased from 0.3 per 10,000 bed-days in 2021 to 0.5 per 10,000 bed-days in 2022.
    - The increased VRE infection rate was predominantly driven by increases in Type 1 and Private facilities.
- The aggregate rate of infection caused by MRGNs decreased slightly from 1.3 per 10,000 bed-days in 2021 to 1.2 per 10,000 bed-days in 2022.
    - ESBL continues to be the main MRGN reported, the rate of acquisition remained stable at 0.9 per 10,000 bed-days in 2022.
    - The rate of healthcare associated carbapenemase-producing organism acquisition has increased from 0.03 per 10,000 bed-days in 2021 to 0.08 per 10,000 bed-days in 2022.
- While the intensive care unit MRSA infection rate in sterile sites decreased from 1.2 per 10,000 bed-days in 2021 to 0.5 per 10,000 bed-days in 2022, the rate of MRSA infection in non-sterile body sites increased from 0.8 per 10,000 bed-days in 2021 to 2.4 per 10,000 bed-days in 2022.
- In 2022, the primary body site of acquisition (excluding screening specimens) for MRSA was skin or wound (n=78, 74%), for VRE and MRGN; it was urinary tract at 59% (n=64) and 60% (n=172) respectively.

Methods

Healthcare associated MRO data are collected by the Infection Prevention and Control Units of participating hospitals (n=80) in accordance with the agreed statewide surveillance definitions. Current state definitions are available via the ICS website: http://www.sahealth.sa.gov.au/HAIsurveillance. Data are submitted monthly to the ICS and Rural Support Service (RSS) healthcare associated surveillance programs, which undertake data quality checks prior to data being loaded to the SA Health HAI surveillance database.

The definitions and methodology stipulated by the ICS and used by contributors, are based on the national definitions for multidrug-resistant organisms originally developed by the Australian Infection Control Association (AICA) National Advisory Board[3].

Numerator

The numerator includes all new healthcare associated MRO acquisitions and infections identified during the period of surveillance. Episodes are classified as either intensive care unit (ICU) or non-ICU related and defined as representing infection or colonisation. ICU surveillance includes data from adult (AICU), neonatal (NICU) and paediatric (PICU) units.

MRGN data analysis summarises MRO episodes recorded by resistance type (i.e. patients may be counted more than once in aggregate MRGN counts and rates if they have an infection with more than one MRO type).

Denominator

The denominator used for rate calculations in this report is called “bed-days” and includes same day admissions and unqualified newborns[#]. Bed-days are a combination of patient days and occupied bed days depending on the collection source. There is minimal variance between yearly patient-day and occupied bed-day calculations (less than 1%)[4].

- Total bed-days = total patient days
- ICU bed-days = adult ICU patient days + paediatric ICU occupied bed-days + neonatal ICU occupied bed-days
- Non-ICU bed-days = total bed-days – ICU bed-days

[#]An unqualified new-born is 9 days old or less and meets one of the following criteria[5]:

- is a single live birth or the first live born infant in a multiple birth, whose mother is currently an admitted patient,
- is not admitted to an intensive care facility in a hospital, being approved by the commonwealth minister for the purpose of the provision of special care.

Surveillance definitions

Surveillance definitions can be found at the following SA Health web page: http://www.sahealth.sa.gov.au/HAIsurveillance

Hospital Type

Contributing hospitals are divided into categories based on a combination of the size and characteristics described by the AIHW Peer Groups[4, 6].

Type 1	Public acute group A and principal referral hospitals including specialist women’s and children’s hospitals
Type 2	Public acute group B and 6 large country hospitals from public acute group C which contribute directly to the SA Health HAI surveillance program via the ICS surveillance data collection process
Type 2s	Public acute group C hospitals which undertake surgical procedures
Type 3	Rehabilitation, psychiatric and public acute group D hospitals
PRIV	Private contributors have been grouped together into the PRIV category

Participating hospitals

Table 2: Contributing SA Health public hospitals and private hospitals (n=80)

Hospital Type	Contributor Name	Hospital Type	Contributor Name
Type 1	Flinders Medical Centre	Type 3	Balaklava Soldier's Memorial District Hospital
	Lyell McEwin Hospital		Barmera Hospital
	Modbury Hospital		Booleroo Centre District Hospital and Health
	Queen Elizabeth Hospital		Burra Hospital
	Repatriation General Hospital		Central Yorke Peninsula Hospital (Maitland)
	Royal Adelaide Hospital		Cleve District Health and Aged Care
	Women's And Children's Hospital		Coober Pedy Hospital & Health Services
Type 2	Berri Hospital		Cowell District Hospital
	Mount Gambier Hospital		Cummins and District Memorial Hospital
	Noarlunga Public Hospital		Elliston Hospital
	Port Augusta Hospital		Eudunda Hospital
	Port Lincoln Hospital		Glenside Hospital
	Port Pirie Hospital		Gumeracha District Soldiers Memorial Hospital
	Whyalla Hospital		Hampstead Rehabilitation Centre
PRIV	Ashford Hospital		Hawker Memorial Hospital
	Burnside Hospital		Karoonda & Districts Soldiers' Memorial Hospital
	Calvary Adelaide Hospital		Kimba District Hospital and Aged Care
	Calvary Hospital		Kingston Soldiers' Memorial Hospital
	Flinders Private Hospital		Lameroo District Health Services
	Memorial Hospital		Laura & Districts Hospital
	North Eastern Hospital		Mannum District Hospital
	St Andrew's Hospital		Meningie & Districts Memorial Hospital & Health
	Western Hospital		Mount Pleasant District Hospital
Type 2s	Angaston District Hospital		Orroroo & District Health Service
	Bordertown Memorial Hospital		Penola War Memorial Hospital
	Ceduna District Health Service		Peterborough Soldiers' Memorial Hospital
	Clare Hospital		Pinnaroo Soldiers' Memorial Hospital
	Crystal Brook and District Hospital		Port Broughton District Hospital & Health Services
	Gawler Health Service		Riverton District Soldiers' Memorial Hospital
	Jamestown Hospital & Health Service		Roxby Downs Health Services
	Kangaroo Island Health Service		Snowtown Hospital
	Kapunda Hospital		Southern Yorke Peninsula Health (Yorketown)
	Loxton Hospital Complex		Streaky Bay Hospital
	Millicent & District Hospital & Health Services		Tailem Bend District Hospital
	Mount Barker District Soldiers' Memorial Hospital		Tumby Bay Hospital and Health Services
	Murray Bridge Soldiers' Memorial Hospital		Wudinna Hospital
	Naracoorte Health Service		
	Northern Yorke Peninsula Health Service (Wallaroo)		
	Renmark Paringa District Hospital		
	South Coast District Hospital		
	Strathalbyn and District Health Service		
	Tanunda War Memorial Hospital		
	Waikerie Hospital & Health Services		

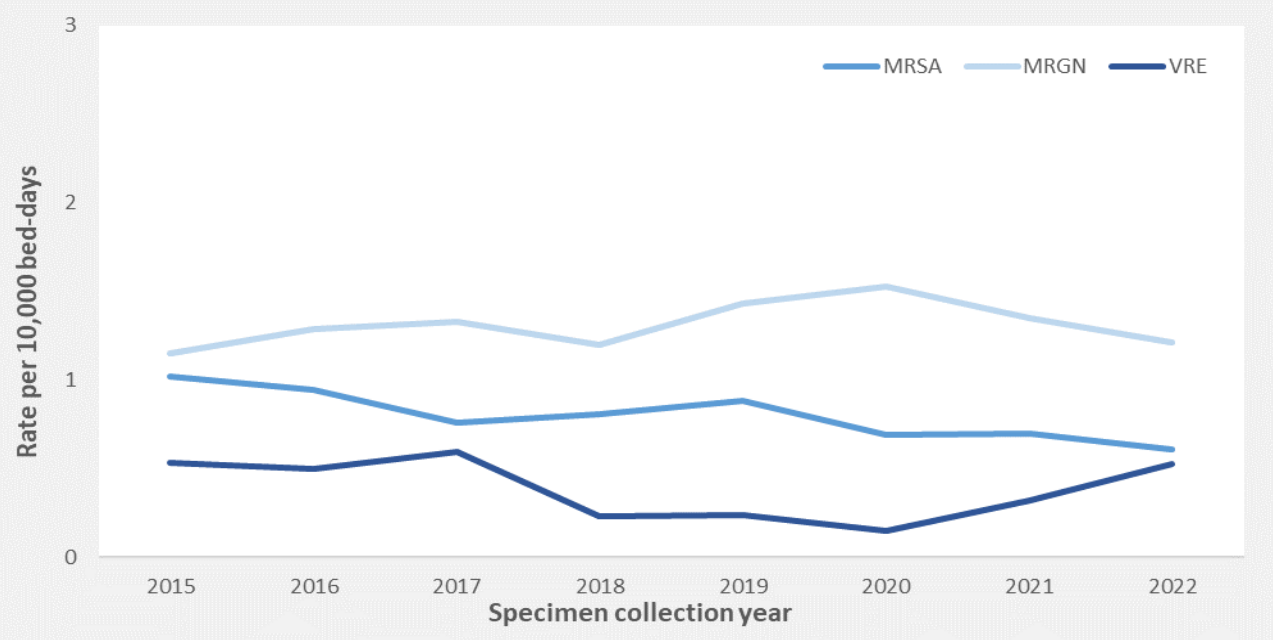
Results

1. Overall trends in healthcare infection caused by MROs

The most robust indicator of MRO control in hospitals is the infection rate given that laboratory confirmed infections are unlikely to be influenced by changes in hospital MRO screening practices. MRO acquisition rates include cases detected by screening which can be directly affected by a hospital's local screening practices.

Figure 1 shows the overall trend in HAI rates for methicillin-resistant *Staphylococcus aureus* (MRSA), vancomycin-resistant enterococci (VRE) and multidrug-resistant Gram-negative organisms (MRGN) infections for all HAI surveillance program contributors.

Figure 1: Healthcare associated infection rates for MRSA, VRE and MRGN by year, SA, 2015-2022

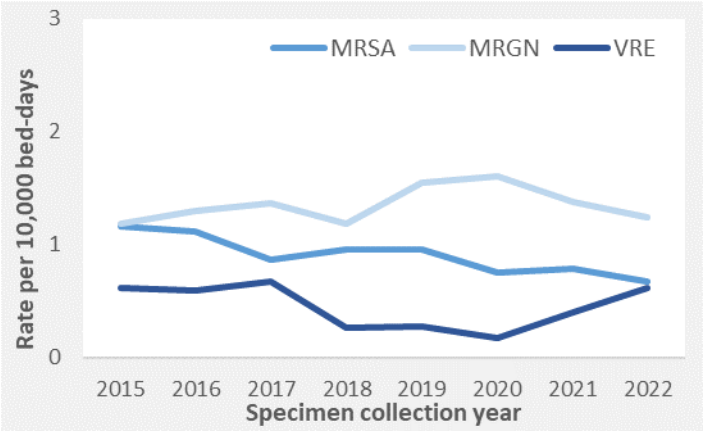


The overall MRSA infection rate has decreased from 0.7 per 10,000 bed-days in 2021 to 0.6 per 10,000 bed-days in 2022. Similarly, there has been a decrease in the rate of infection with MRGN from 1.3 per 10,000 bed-days in 2021 to 1.2 per 10,000 bed-days in 2022, however the VRE infection rate has continued to increase from the low of 0.1 per 10,000 bed-days in 2020 to 0.3 per 10,000 bed-days in 2021 to 0.5 per 10,000 bed-days in 2022.

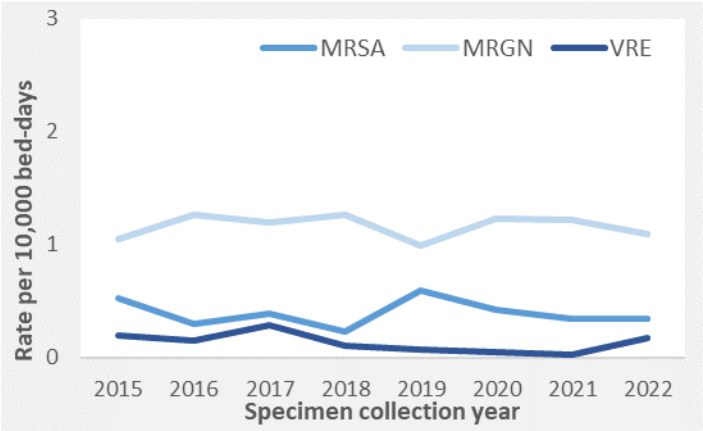
The increase in the VRE infection rates for 2021 and 2022 predominantly represent increases in three Type 1 facilities, across blood culture, urine, and skin/wound specimen categories.

Figure 2a and 2b: Healthcare associated infection rates for MRSA, VRE and MRGN, private hospitals and public hospitals by year, SA, 2015-2022

2a: Public hospitals (all combined)



2b: Private hospitals

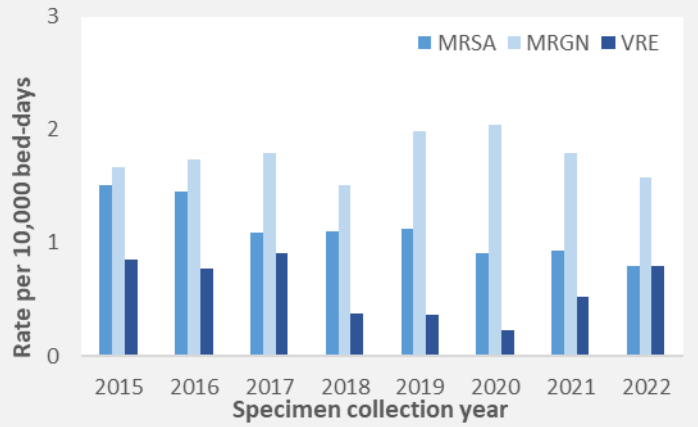


While it appears that private hospitals have consistently lower VRE infection rates than public hospitals, comparisons are limited by small numbers and lack of risk adjustment to reflect patient case-mix differences.

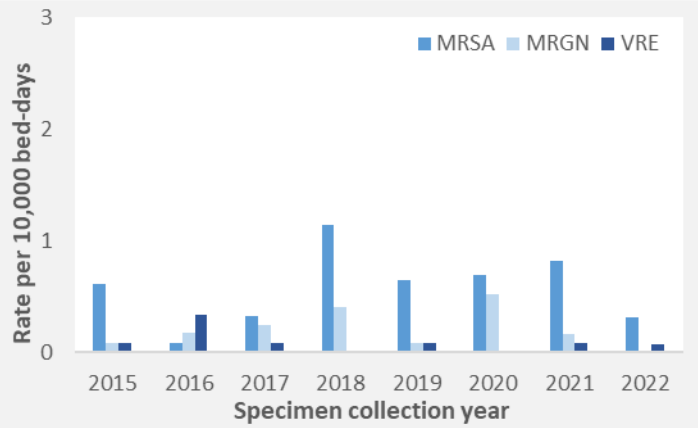
Higher MRGN infection rates are observed in private hospitals compared to Type 2 public facilities, this may also be due to differences in patient risk factors or may reflect a degree of patient movement between the public and private sector as part of public/private partnership agreements.

Figures 3a to 3d: Healthcare associated infection rates for MRSA, VRE and MRGN, public hospitals by hospital group and year, SA, 2015-2022 (Presented as columns for ease of comparison given low rates in some groups)

3a: Type 1 hospitals

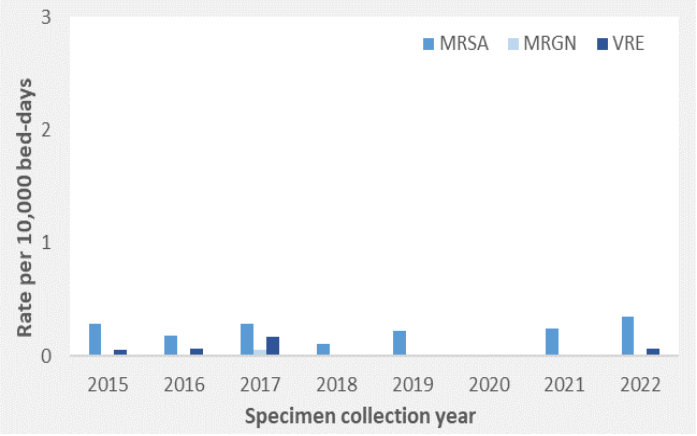


3b: Type 2 hospitals

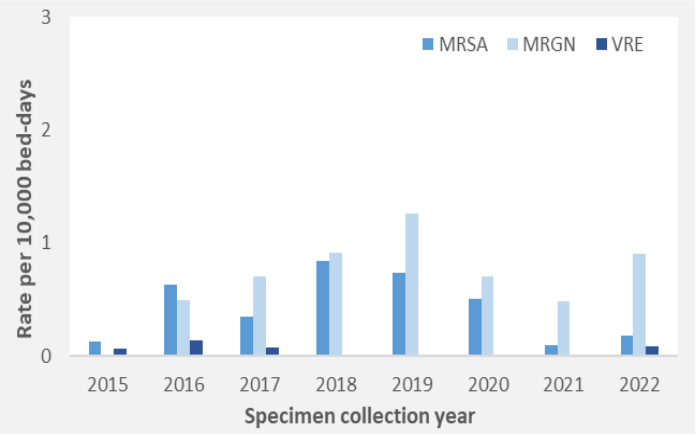


Type 1 hospitals have shown a small reduction in the overall MRSA infection rate for from 0.9 per 10,000 bed-days in 2021 to 0.8 per 10,000 bed-days in 2022 and the rate of infection with MRGN from 1.8 per 10,000 bed-days in 2021 to 1.6 per 10,000 bed-days in 2022. However the VRE infection rate has continued to increase from the low of 0.2 per 10,000 bed-days in 2020 to 0.5 per 10,000 bed-days in 2021 to 0.8 per 10,000 bed-days in 2022.

3c: Type 2s hospitals



3d: Type 3 hospitals



The overall MRO infection rates for other hospital peer groups are generally lower than for Type 1 hospitals, which is consistent with the usually higher risk patient population and more complex procedures encountered in Type 1 facilities.

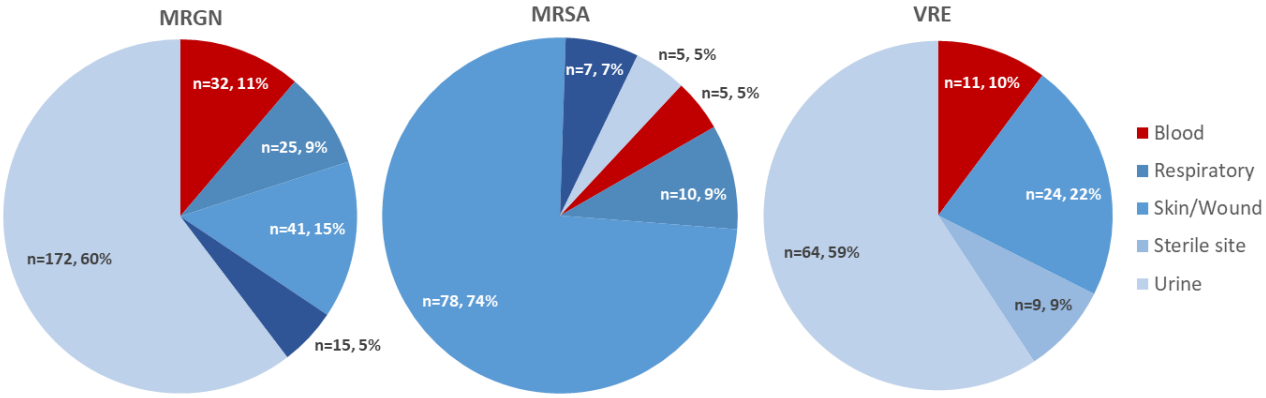
No conclusions on trends for smaller facility groups can be made due to the low numbers of cases and high degree of variability each year.

Primary site of MRO acquisition for all contributors

A large percentage of total new acquisitions for MRSA (42%) and VRE (78%) are identified through routine screening of patients on admission, long stay patients or of those with known risk factors, in contrast, for MRGN almost all new acquisitions are detected in clinical specimens. This could be in part due to the lack of routine screening recommendations for MRGNs, with the exception of carbapenemase-producing *Enterobacterales* (CPE). For CPE there is published risk-based screening recommendations of patients with identified risk factors including overseas or interstate healthcare encounters in a prescribed time frame and recent overseas travel. This is an important surveillance activity, as early detection of CPE facilitates timely implementation of infection prevention and control actions, mitigating risks relating to cross transmission.

Error! Reference source not found.4 shows the distribution of new MRO acquisitions by specimen collection site for 2022, excluding routine screening specimens. The primary site of acquisition recorded for MRSA was skin/wound (74%), and the primary site was urinary tract (urine) for MRGN (60%) and VRE (59%).

Figure 4: Cases and proportions of MRO by the primary site of acquisition (excluding screening), SA, 2022



**Tissue or body fluid collected from a sterile body site other than blood.*

a. MRO bloodstream infections for all contributors

The following table (table 2) shows the number of bloodstream infections (BSI) caused by multidrug resistant organisms over recent years (2015 -2022). In 2022, the most frequently identified MROs causing BSI was Vancomycin-resistant *Enterococcus faecium* (n=31) followed by multidrug resistant *Escherichia coli* (n=22). The number of BSI episodes per individual organisms are too small to draw conclusions regarding trends over time. However 2020 data was notably lower than other years presented in the table, possibly influenced by the COVID-19 pandemic and onward impacts on activity and infection control actions undertaken in hospitals during that time. For further discussion of bloodstream infections, refer to the SA Health Healthcare associated Bloodstream Infection Report.

Table 3: MRO bloodstream infections by organism and year, SA, 2015-2022

Resistance	Organism	2015	2016	2017	2018	2019	2020	2021	2022
MRSA	Methicillin resistant *Staphylococcus aureus*	23	28	26	24	18	16	22	14
VRE	Vancomycin-resistant *Enterococcus faecium*	28	21	32	18	17	4	20	31
MRGN	*Acinetobacter baumannii*	1							
	Citrobacter freundii			1		1	2		1
	Enterobacter aerogenes				2				
	Enterobacter cloacae	1	1	1	1	1			1
	Enterobacter sp	3	1	3				2	1
	Escherichia coli	21	15	19	19	28	14	27	22
	Klebsiella oxytoca				1				
	Klebsiella pneumoniae	7	2	2	4	6	3	5	7
	Klebsiella sp		1						1
	Multi-resistant Pseudomonas aeruginosa	6	3	7	7	4	2	1	3
	Pseudomonas aeruginosa								2
	Proteus mirabilis								1
	Serratia marcescens					1			
	Serratia sp		1						
	Total	**90**	**73**	**91**	**76**	**76**	**41**	**77**	**84**

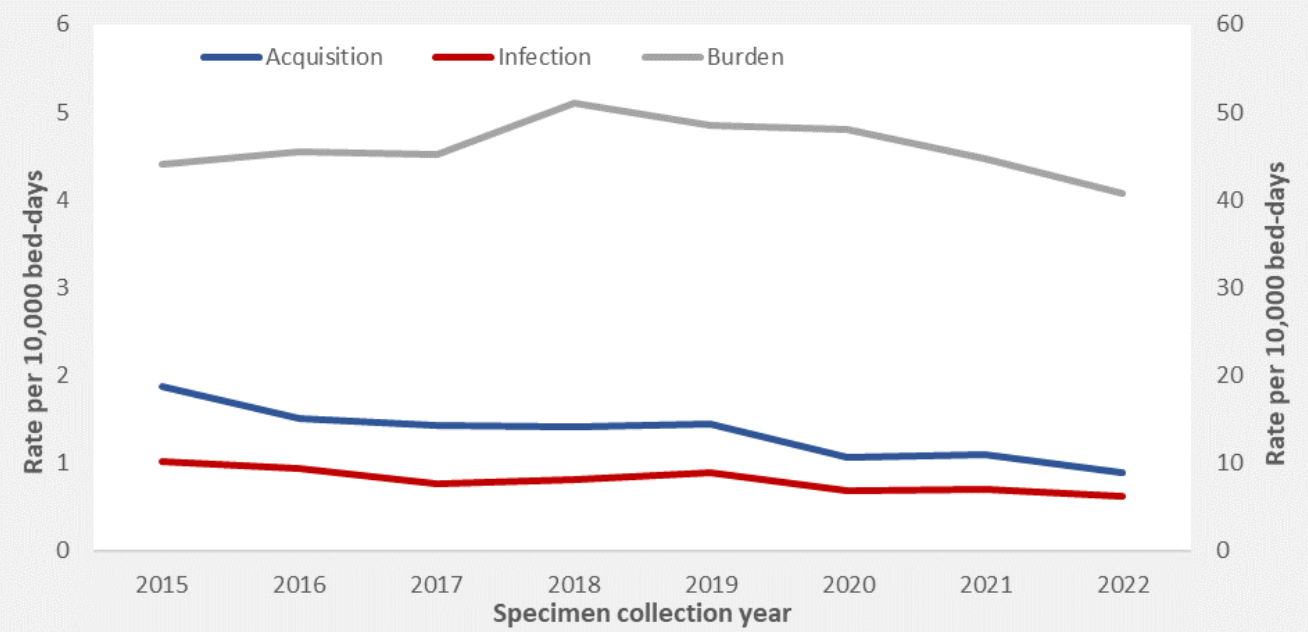
2. Methicillin-resistant *Staphylococcus aureus* (MRSA) for all contributors

HAIs caused by MRSA can be difficult to treat and are associated with poor outcomes for hospitalised patients.

Data are collected and reported monthly by all contributing hospitals on three key MRSA indicators, i.e. burden, acquisition and morbidity identified during the reporting period.

The infection rate includes all patients who develop HAI, both newly identified MRSA and known MRSA carriers who develop a new infection. The acquisition rate includes all cases of newly identified MRSA colonisation and infection. The burden is a measure of the total number of known and newly identified MRSA positive patients (infected and colonised) who have been discharged from the hospital during the month of surveillance, excluding patients admitted and discharged on the same day. Figure 5 summarises trends for all three indicators.

Figure 5: MRSA infection and acquisition rates compared to the overall burden of MRSA, SA, 2015-2022



The most robust measure of MRSA control is the infection rate since this is not affected by variation in screening practices over time. This rate has decreased from 0.7 per 10,000 bed-days in 2021 to 0.6 per 10,000 bed-days in 2022. A total of 125 cases of healthcare associated MRSA infections were reported in 2022, compared to 135 in 2021.

Previous colonisation with MRSA has been shown to be associated with an increased risk of MRSA infection(7, 8). Of the 125 healthcare associated MRSA infections reported in 2022, 45 (36%) occurred in patients known to be already colonised MRSA.

The aggregate rate of MRSA acquisition has declined substantially over eight years from 1.9 per 10,000 bed-days in 2015 to 1.2 per 10,000 bed-days in 2022. Although this rate can be affected by changes in screening practices, there is no evidence that hospital screening policies for MRSA have changed substantially over this period of surveillance.

a. Intensive Care Unit associated MRSA for contributors with intensive care units

The rate of MRSA infection in ICU patients is relatively higher than for non-ICU patients, reflecting the increased risk of acquiring infection in intensive care units partly due to the highly invasive nature of medical intervention in patients requiring ICU care. However, the total number of infections in ICU patients remains reasonably small.

Table 4 shows numbers of MRSA infections in 2022 stratified by ICU status and specimen site (sterile vs non-sterile body sites). Sterile site infections include blood, normally sterile tissues and aseptically collected fluids such as joint, pleural, and peritoneal fluids. The dataset includes non-ICU associated cases from all contributors and ICU associated cases from contributors with adult, paediatric and neonatal intensive care units.

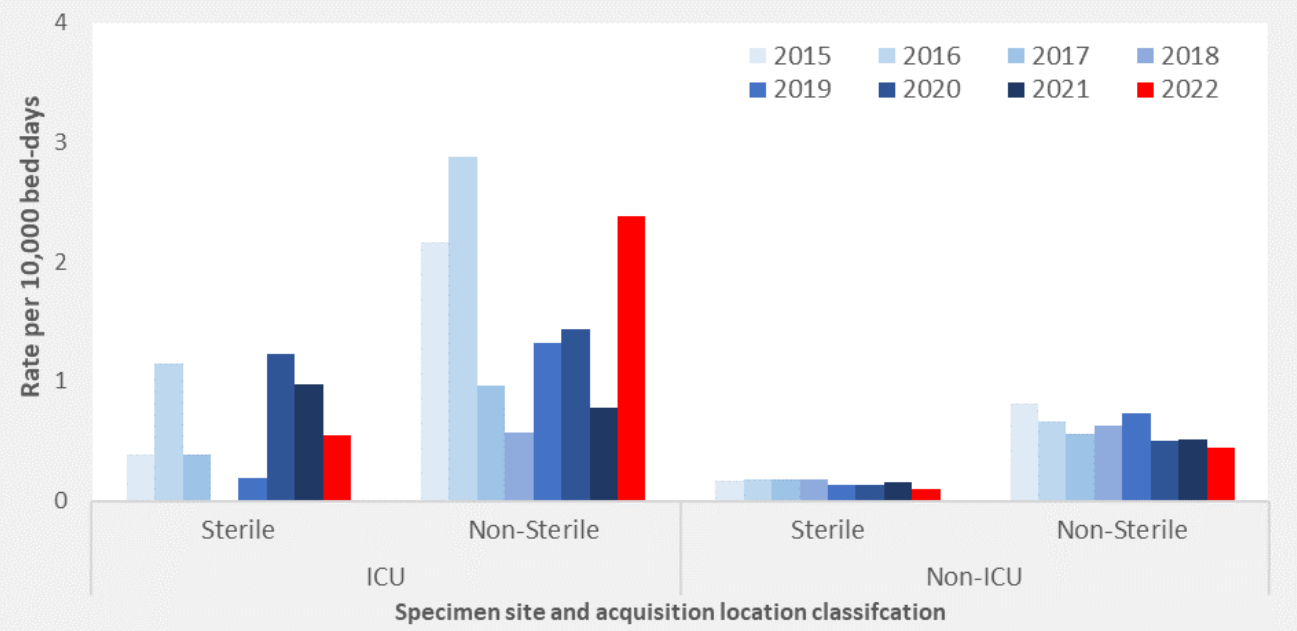
Table 4: MRSA and total MRO infections by patient location and specimen classification, SA, 2022

Patient Location: Specimen Site	Number of bed-days	HAI MRSA		Total HAI MRO	
		Count	Rate per 10,000 bed-days [CI_{95}]	Count	Rate per 10,000 bed-days [CI_{95}]
ICU : Sterile Site	54621	3	0.55 [0.44 - 1.06]	20	3.66 [1.42 - 1.99]
ICU : Non-sterile Site	54621	13	2.38 [1.11 - 1.69]	45	8.24 [2.23 - 2.79]
Total ICU	**54621**	**16**	**2.93 [1.25 - 1.83]**	**65**	**11.9 [2.72 - 3.27]**
Non-ICU : Sterile Site	1985115	21	0.11 [0.04 - 0.06]	99	0.5 [0.09 - 0.11]
Non-ICU : Non-sterile Site	1985115	88	0.44 [0.09 - 0.1]	312	1.57 [0.17 - 0.18]
Total Non-ICU	**1985115**	**109**	**0.55 [0.1 - 0.11]**	**411**	**2.07 [0.2 - 0.21]**
Grand Total	**2039736**	**125**	**0.61 [0.1 - 0.12]**	**476**	**2.33 [0.2 - 0.22]**

NOTE: ICU data include records from all intensive care units, including adult, paediatric and neonatal.

Figure 6 shows the trend in MRSA infections by infection type and patient location (ICU or non-ICU) over the past 8 years.

Figure 6: MRSA infection rate by patient location and specimen classification by year, SA, 2015-2022



NOTE: Data include records from all intensive care units, including adult, paediatric and neonatal.

The rate of ICU non-sterile MRSA infections increased from a rate of 0.8 per 10,000 bed-days in 2021 to 2.4 per 10,000 bed-days in 2022, while the ICU rate of MRSA in sterile sites declined from 1.0 per 10,000 bed-days in 2021 to 0.5 per 10,000 bed-days in 2022.

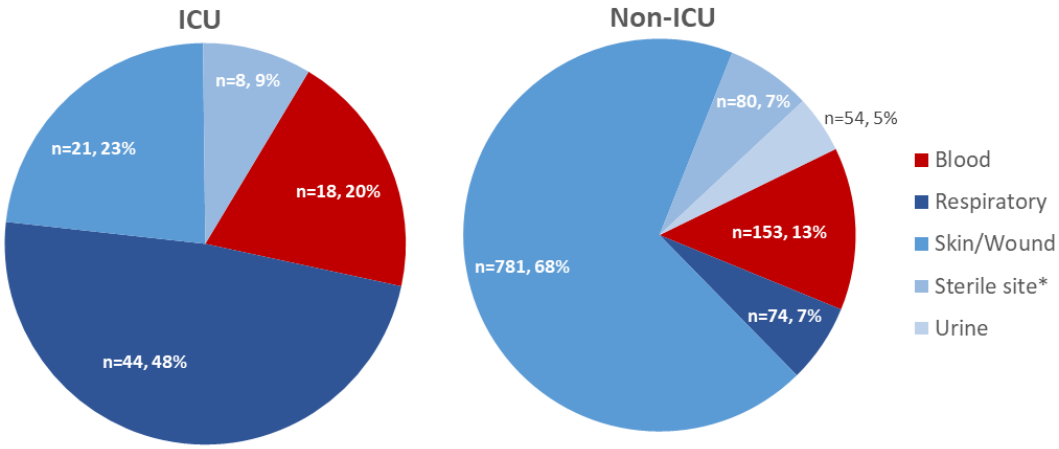
In 2021, 4 facilities reported 1 non-sterile MRSA isolate from ICU patients, while 2022 saw 7 facilities report a total of 13 non-sterile MRSA isolates from ICU patients (range n=1-5). The increased infection rate for non-sterile specimens in ICU patients is observed across both Type 1 and private hospitals however this increase represents very low facility numbers restricting the application of statistical analysis.

b. Primary body site of MRSA infection for all contributors

The data presented in Figure 7 below, show marked differences in the primary body site of infection with MRSA according to patient location. The data are combined for the 2015-2022 reporting period due to the small number of annual infections in ICU patients.

The predominant site of MRSA infection in ICU patients was the respiratory tract (49%) compared to non-ICU patients where the predominant site of infection was skin or wound (68%). Among non-ICU patients a sizable proportion of MRSA infections also occur in the bloodstream and other sterile body sites (20% in total).

Figure 7: Cases and proportions of MRSA infections by primary site and patient location, SA, 2015-2022 combined

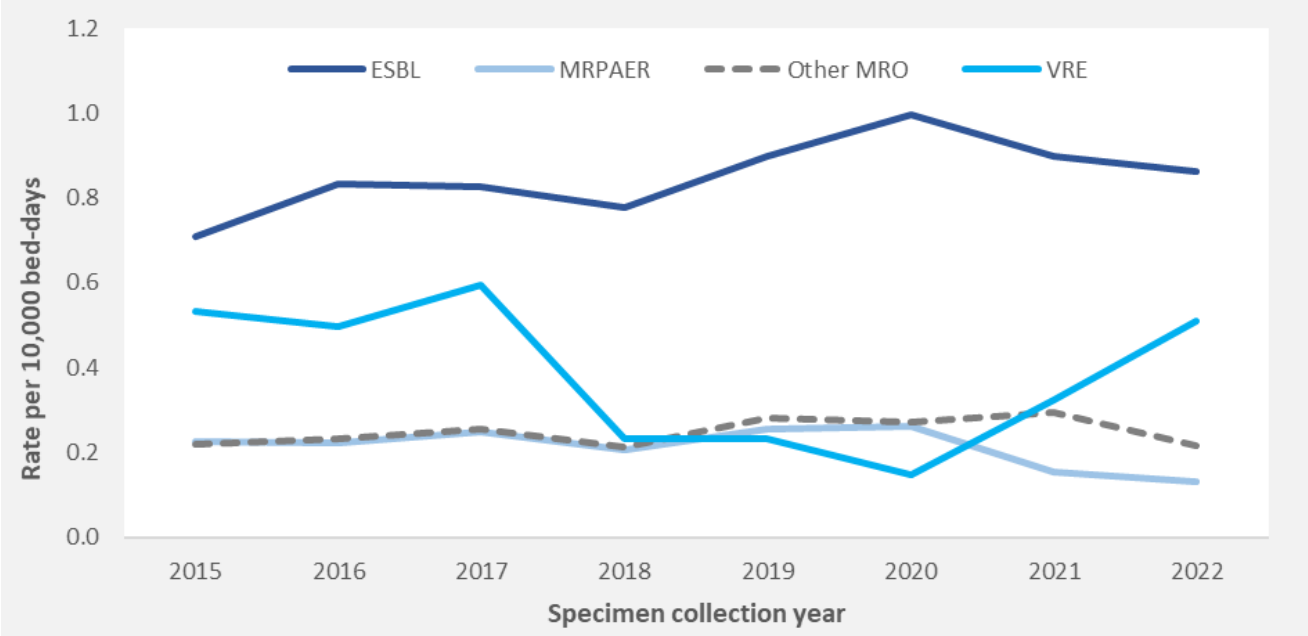


** Tissue or body fluid collected from a sterile body site other than blood.*

3. Multidrug-resistant organisms (other than MRSA) for all contributors

Figure 8 shows the trend in annual infection rates for multidrug-resistant organisms other than MRSA. The highest infection rates for this group of MROs are seen in extended spectrum beta-lactamase producers (ESBL), however the largest increase for 2022 was seen in VRE infections.

Figure 8: The rate of MRO infections for all contributors by resistance category (excluding MRSA) and year, SA, 2015-2022.



**"Other" includes carbapenem-resistant Enterobacterales & Acinetobacter sp.*

a. Vancomycin-resistant Enterococci (VRE) for all contributors

The state aggregate VRE infection rate has increased from 0.3 per 10,000 bed-days in 2021 to 0.5 per 10,000 bed-days in 2022.

Of the 104 VRE infections reported in 2022, 38% were in patients known to be already colonised with VRE. The predominant sites of VRE infection in 2022 were the urinary tract (33%), skin/wound (29%) and blood (27%).

b. Multidrug-resistant Gram-negative bacteria (MRGN)

The MRGN group includes surveillance on the following resistance types: multidrug-resistant *Pseudomonas aeruginosa* (MRPAER), extended spectrum beta-lactamase producers (ESBL), carbapenem-resistant *Acinetobacter species* and Enterobacterales (CRGNB) and plasmid-mediated Amp C beta-lactamase producers (AMPC).

Of the resistance types grouped as MRGNs, ESBL-producing organisms continue to be the most prevalent. However, the rate of infections caused by ESBL-producing organisms has remained stable in 2022 at 0.9 per 10,000 bed-days. The main species found to be harbouring ESBL resistance determinants in 2022 were *E. coli* (76%) and *Klebsiella species* (13%).

c. Critical antimicrobial resistance (CAR)

Carbapenemase-producing bacteria are organisms that have developed resistance to carbapenems, which are considered a class of last resort antibiotics for the treatment of serious infections with multidrug-resistant strains.

The numbers of healthcare associated carbapenemase-producing organisms (CPO) increased from 5 isolates from 5 cases in 2021 for a rate of 0.03 per 10,000 bed-days to 17 isolates from 14 cases in 2022 for a rate of 0.08 per 10,000 bed-days. Around 70% (n=10/14) of 2022 cases were genomically linked to a previous outbreak at a Type 1 facility.

Table 5: Healthcare associated critical antimicrobial resistance acquisitions, by organism type, critical resistance type and year, 2015-2022

Organism	Critical resistance	2015	2016	2017	2018	2019	2020	2021	2022
Acinetobacter sp	OXA-23	1							
Citrobacter freundii	NDM								1
Citrobacter sp	NDM								
Enterobacter sp	NDM								
Escherichia coli	KPC					1			
Escherichia coli	NDM			1	1	5	1	1	5
Escherichia coli	OXA-48				1		1	1	
Klebsiella oxytoca	NDM						1		1
Klebsiella pneumoniae	KPC								
Klebsiella pneumoniae	NDM				2	15	3		10
Klebsiella pneumoniae	OXA-48				1			2	
Pseudomonas aeruginosa	AIM		1						
Pseudomonas aeruginosa	GES			2	1				
Pseudomonas aeruginosa	IMP		1						
Raoultella sp	NDM							1	
Grand Total		**1**	**2**	**3**	**6**	**21**	**6**	**5**	**17**

**Includes specimens with more than one resistant organism i.e. patients may be included more than once.*

Additional information and national reports on critical antimicrobial resistance in Australia are available from the Australian Commission on Safety and Quality in Health Care (ACSQHC) critical antimicrobial resistance webpage. See National Alert System for Critical Antimicrobial Resistances (CARAlert)

d. Intensive Care Unit associated MRO (other than MRSA) for all contributors

The following dataset includes non-ICU associated cases from all contributors and ICU associated cases from adult, paediatric and neonatal intensive care units.

Intensive care patients have the highest risk for acquisition of MROs predominantly due to their increased exposure to antibiotics and a high level of invasive medical intervention. This is illustrated by notably higher rates of MRGN acquisition and infection seen in ICU patients compared to that for patients in the general wards.

Figure 9: MRGN new acquisition rate, by ICU/non-ICU, infection status and year, SA, 2015-2022

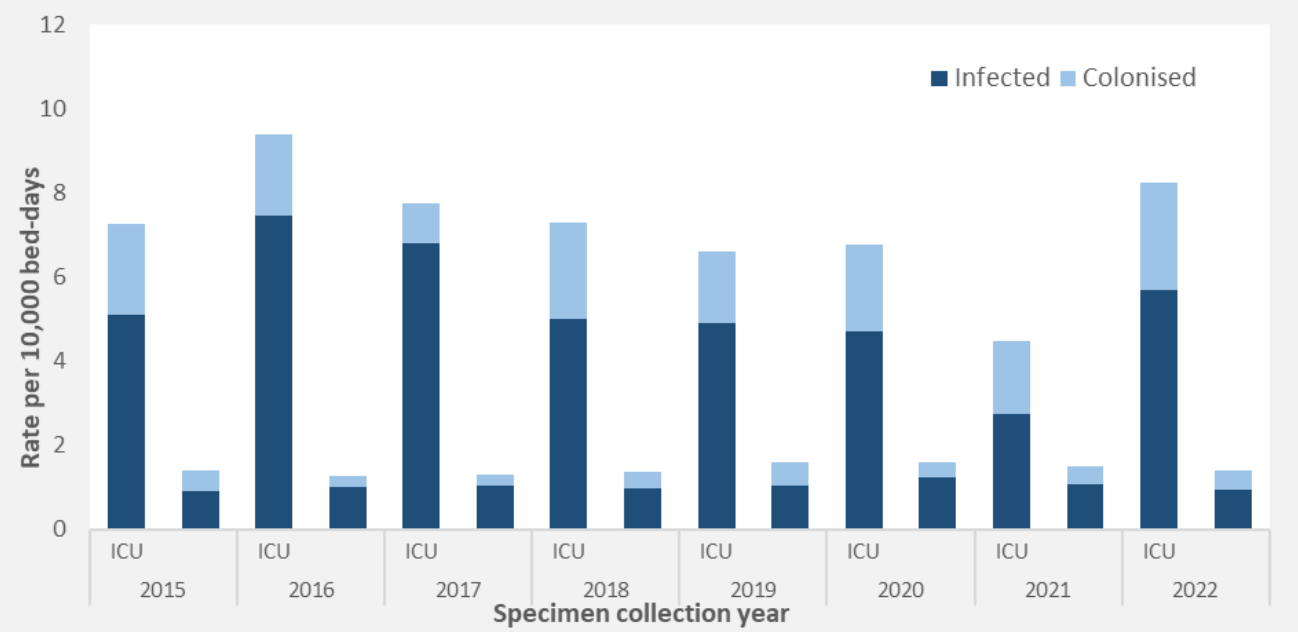


Table 6a and 5b show the number of MRO infections (excluding MRSA) per year stratified by resistance category and patient location.

Table 6a: MRO (excluding MRSA) infections* by resistance category – ICU by year, SA, 2015-2022

Resistance Code	2015	2016	2017	2018	2019	2020	2021	2022
AMPC	3	6	8	10	1	3	0	7
CRGNB[#]	2	1	0	0	1	1	0	3
ESBL	15	28	18	12	19	14	13	22
MRPAER (inc CRPAER)[#]	11	10	11	4	11	9	2	3
VRE	10	11	11	8	6	3	8	19
Grand Total	**41**	**56**	**48**	**34**	**38**	**30**	**23**	**54**

Table 5b: MRO (excluding MRSA) infections* by resistance category – non-ICU by year, SA, 2015-2022

Resistance Code	2015	2016	2017	2018	2019	2020	2021	2022
AMPC	37	36	40	31	46	45	52	29
CRGNB[#]	0	1	1	0	6	1	5	5
ESBL	121	129	142	138	154	169	161	154
MRPAER (inc CRPAER)[#]	32	32	37	36	38	39	28	24
VRE	92	83	104	37	39	24	54	88
Grand Total	**282**	**281**	**324**	**242**	**283**	**278**	**300**	**300**

** Note: these datasets also include infections from previously colonised patients.*
[#] includes cases of transferable plasmid-mediated carbapenemase

National/Jurisdictional MRO Benchmarking

For MROs, there is no national benchmarking data or reporting available, with the exception of HAI MRSA BSI. The only readily available benchmarking data in Australia are for MRSA infection and colonisation in ICU patients collected by the Healthcare Infection Surveillance program in Western Australia (HISWA)[9] and VRE bloodstream infections in ICU patients collected by the Australian Council on Healthcare Standards (ACHS)[10].

The ACHS is an independent, not-for-profit organisation representing governments, consumers, and peak health bodies throughout Australia, including several South Australian hospitals and primary care organisations.

The HISWA comparison data are presented in Table 6 below. While there is a slight difference in the denominator definition used by SA compared to that used by HISWA, the yearly variance between them is minimal (less than 1%)[4] and is unlikely to significantly affect the overall rates.

Table 7: MRSA clinical indicator descriptions and comparative data, SA versus HISWA

Indicator number and description		Infection rate per 10,000 denominator			
		South Australia*		HISWA*	
		2020/21	2021/22	2020/21	2021/22
5.1	AICU-associated new MRSA infections in a ***sterile site***	1.24	0.97	0.60	0.60
5.2	AICU-associated new MRSA infections in a ***non-sterile*** site	1.73	2.43	1.99	1.00
5.3	Non-ICU-associated new MRSA infections in a ***sterile site***	0.12	0.13	0.16	0.25
5.4	Non-ICU-associated new MRSA infections in a ***non-sterile*** site	0.50	0.43	0.72	0.49

**SA data are calculated using bed-days, whereas HISWA are calculated using occupied bed days.*
Table excludes data from paediatric and neonatal intensive care units.
Western Australian data excludes data from inpatient psychiatric wards.

The South Australian 2021/22 MRSA infection rate for indicators 5.1 and 5.4 remain lower than those reported for 2020/21. However, MRSA infections from adult ICU sterile and non-sterile sites continue to be above those reported by Western Australia.

Table 8: ICU VRE bloodstream infections and comparative data, SA versus Australian Council on Healthcare Standards (ACHS), 2015-2022

Year	South Australia			Australian Council on Healthcare		
	Count of VRE BSI	Count of bed-days	rate per 10000 bed-days	Count of VRE BSI	Count of bed-days*	rate per 10000 bed-days
2015	4	41265	0.97	49	138896	3.53
2016	4	41841	0.96	27	197927	1.36
2017	5	42620	1.17	23	183018	1.26
2018	4	42783	0.93	29	165964	1.75
2019	2	43260	0.46	18	181743	0.99
2020	1	39282	0.25	29	156000	1.85
2021	4	40561	0.99	16	146789	1.09
2022	6	44060	1.36	N/A	N/A	N/A

**Where ACHS bed-day data was not explicitly reported, figures have been extrapolated from the numerator and rate figures to facilitate reporting of rates per 10,000 bed-days.*

The South Australian ICU-associated VRE bloodstream infection rate for 2021 remains below that reported by the ACHS. ACHS data for 2022 was not available at the time of reporting.

Discussion

The prevalence of antimicrobial resistance in bacteria is driven primarily by antibiotic use (appropriate or inappropriate) and poor infection control practices, which can lead to transfer of resistant organisms between patients in healthcare settings. Infections with antimicrobial resistant organisms are associated with poorer outcomes for patients [(11)], therefore it is important to minimise both the emergence of new antimicrobial resistances and the spread of existing resistant organisms.

The data for 2020 presented in this report corresponds with the coronavirus disease (COVID-19) pandemic. During this period, it appears increases in adherence to infection prevention and control practices such, as hand hygiene and personal protective equipment use, resulting from efforts to control the pandemic, may have lowered the acquisition risk of MROs. Along with this, the notable reduction in number of carbapenemase producing organisms identified was likely further impacted by border closures, given returned travellers from countries with high burden of these organisms are likely to be a source of continual introduction into South Australian healthcare facilities. Carbapenemase producing organisms are not currently considered endemic within South Australia.

The epidemiology and dynamics of spread of these organisms is complex, nevertheless, continued statewide hospital MRO surveillance, particularly in high-risk patient populations such as those returning from high-risk countries or patients in intensive care, is required to alert clinicians to the potential emergence of new resistances or outbreaks. Along with infection control measures, antimicrobial stewardship and quality improvement initiatives, ongoing adherence to local screening practices is an important aspect of MRO management and assists with early detection, suitable patient placement and isolation resulting in the reduced risk of MRO cross-transmission.

Sustaining reductions achieved in MRO acquisition and infections due to the spotlight put on infection prevention and control practices during the COVID19 pandemic, should be a focus of local IPC units to ensure this trend continues in the post-pandemic environment.

Acronyms

Table 9: Acronyms

AICU	Adult intensive care unit
AIHW	Australian Institute of Health and Welfare
AIM	Adelaide Imipenemase
AMPC	Plasmid-mediated AmpC beta-lactamase
CPE	Carbapenemase-producing *Enterobacterales*
CRGNB	Carbapenem-resistant *Acinetobacter species* and *Enterobacterales*
ESBL	Extended-spectrum beta-lactamase producing organisms
GES	Guiana extended-spectrum (GES) β-lactamases
HAI	Healthcare associated infections
HISWA	Healthcare Infection Surveillance Western Australia
ICP	Infection control professional
ICU	Intensive care unit
MBL	Metallo beta-lactamase
MRGN	Multidrug-resistant Gram-negative bacteria
MRO	Multidrug-resistant organism
MRPAER	Multidrug-resistant *Pseudomonas aeruginosa*
MRSA	Methicillin-resistant *Staphylococcus aureus*
NDM	New Delhi Metallo-beta-lactamase
NICU	Neonatal intensive care unit
OXA	Oxacillinase
PICU	Paediatric intensive care unit
VRE	Vancomycin-resistant enterococci

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For more information

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