Antibiograms
to optimise antibiotic prescribing in Residential Aged Care Facilities (RACFs)

18th November 2024

AC-IPC Conference

Dipti Khatri (PhD, BPharm, MClinPharm)

Advisors: A/Prof Chris Freeman, Dr. Nazanin Falconer,

Dr. Sonali Coulter, Prof. Len Gray & Prof. David Paterson

[No disclosures or conflicts]

Background

Antimicrobial Resistance (AMR) and Antimicrobial use

- From 1990 to 2021 – Deaths from AMR increased by 80% for adults 70 years and older[1]
- Higher prevalence of AMR in RACFs[2]
- High antimicrobial use in elderly and RACFs[2,3]
- In 2023 → 68.6% of Australian RACFs residents were dispensed a systemic antibacterial, compared to 45.6% in the community[3]

Background

Empirical Prescribing

- Prescribing of **antibiotics prior** to receipt of **results from microbiological** investigations
- ~60-85% of antibiotic prescribing in RACFs may be empirical[4,5]
- Sub-optimal empirical antibiotic prescribing →
  - Infection related harm
  - Broad spectrum antibiotics
  - Increased risk of AMR
- Confirming **clinical criteria for infection** and **knowledge of local resistance** patterns can optimise empirical prescribing[4,7]

Background

Role for Antibiograms[8,9]

- Cumulative antimicrobial susceptibility test data
- Provide local resistance data

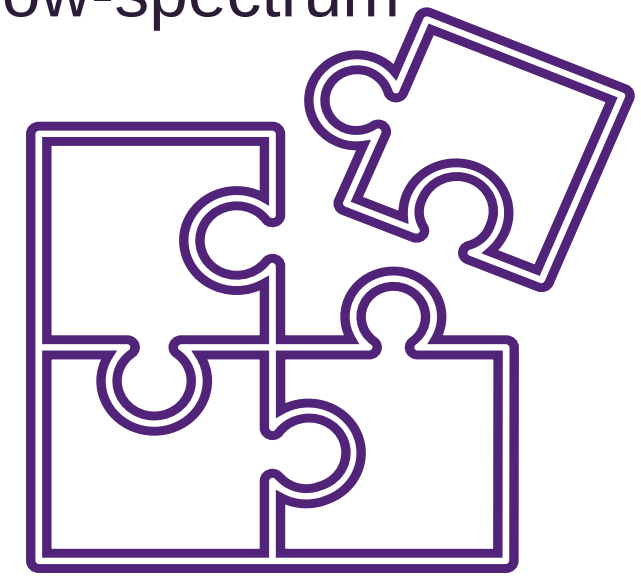
Organism	Amikacin		Amoxicillin		Ceftriaxone		Ceftazidime		Cefalothin		Ciprofloxacin	
	%S	n	%S	n	%S	n	%S	n	%S	n	%S	n
Acinetobacter baumannii	90.2	41	3.1	32	42.9	42	50	38	0	32	70.5	44
Escherichia coli	100	484	54.7	525	99.8	492	100	428	69.4	520	99.0	514

- Example: 54.7% of *E.coli* susceptible to amoxicillin → High resistance → Inappropriate empirical antibiotic choice

Background

Role for Antibiograms[8,9]

- ✓ Promote empirical prescribing of effective narrow-spectrum antibiotics
- ✓ Informs treatment guidelines
- ✓ Surveillance of resistance patterns
- ✓ Hospital settings X RACF settings



Role of antibiogram as an AMS tool in Australian RACF settings?

Systematic Review

- AMS interventions that utilise antibiograms as an integral component are effective
- Lack of studies in RACFs
- Lack of studies in Australian context

Contents lists available at ScienceDirect

American Journal of Infection Control

journal homepage: www.ajicjournal.org

State of the Science Review

Clinical impact of antibiograms as an intervention to optimize antimicrobial prescribing and patient outcomes—A systematic review

Dipti Khatri MClinPharm, PhD [a,*], Christopher Freeman PhD [b,c,d,*], Nazanin Falconer PhD [a,b,e], Soraia de Camargo Catapan PhD [a,f], Leonard C. Gray MBBS [a], David L. Paterson MBBS [c,d,g]

Stakeholder analysis

- Lack of knowledge about antibiograms in RACFs
- RACF-specific antibiogram development may be challenging
- Education and Presentation of antibiograms important for usability
- Important roles for AMS champions/pharmacists to drive implementation

Contents lists available at ScienceDirect

Research in Social and Administrative Pharmacy

journal homepage: www.elsevier.com/locate/rsap

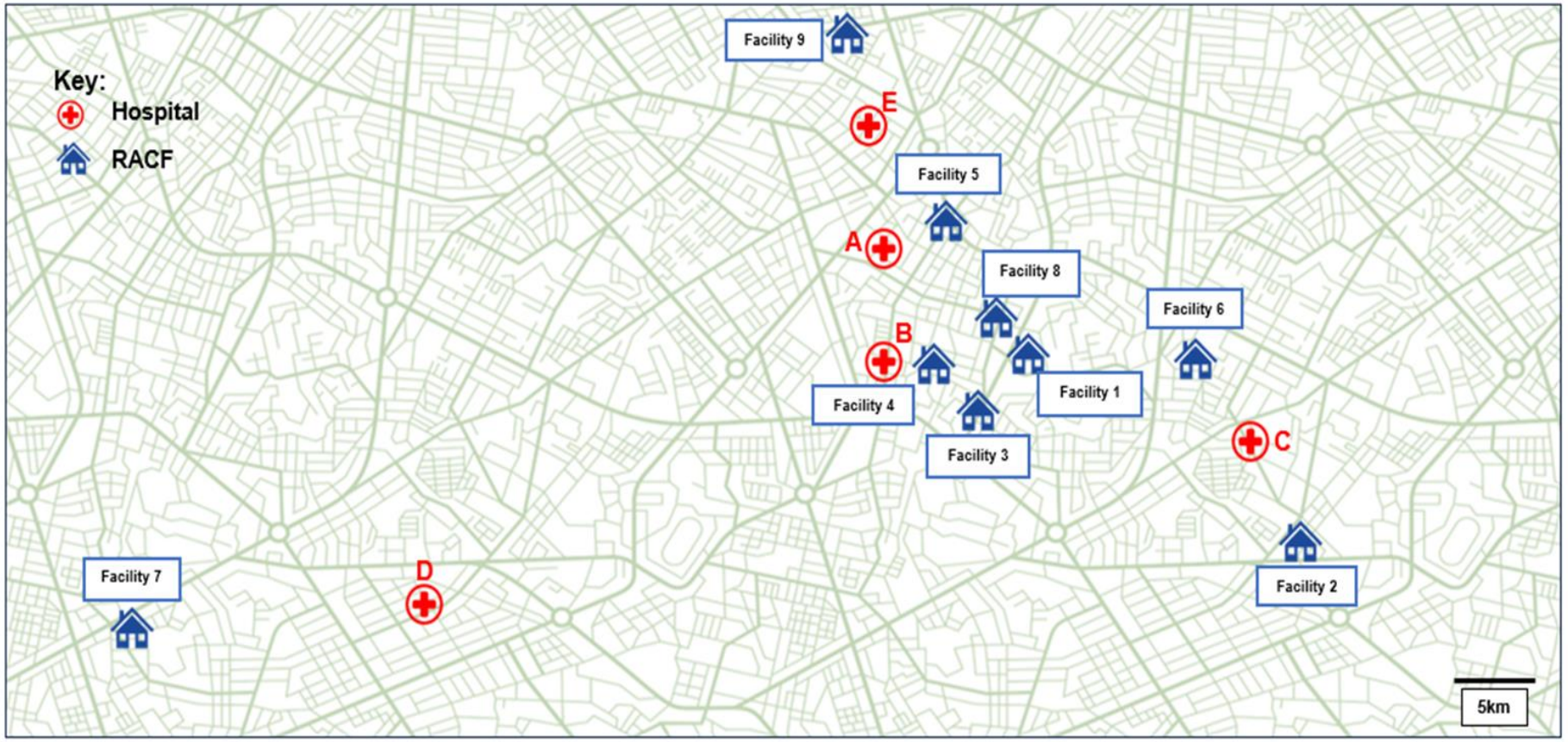
Original Research

Exploring stakeholders' perspectives on antibiogram use, development, and implementation in residential aged care settings

Dipti Khatri [a,*], Nazanin Falconer [a,b,c], Soraia de Camargo Catapan [a,d], Sonali Coulter [e], Leonard C. Gray [a], David L. Paterson [f,g,h], Christopher Freeman [b,g,h]

Antibiogram development

Aim: Explore feasibility of RACF- specific antibiograms



Recruited 9 RACFs (South Queensland)

Bed numbers
50 - 179

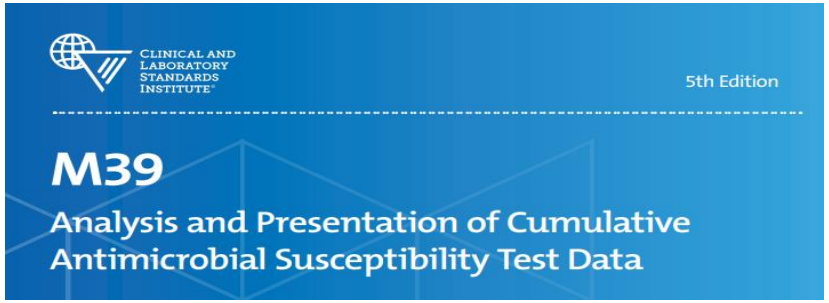
x 2 (≤ 60 beds)

x 1 (61-100 beds)

x 6 (≥ 101 beds)

Antibiogram development

- CLSI-M39 – Rules for Antibiogram Development[8]
  - E.g. ≥ 30 isolates, first isolate only



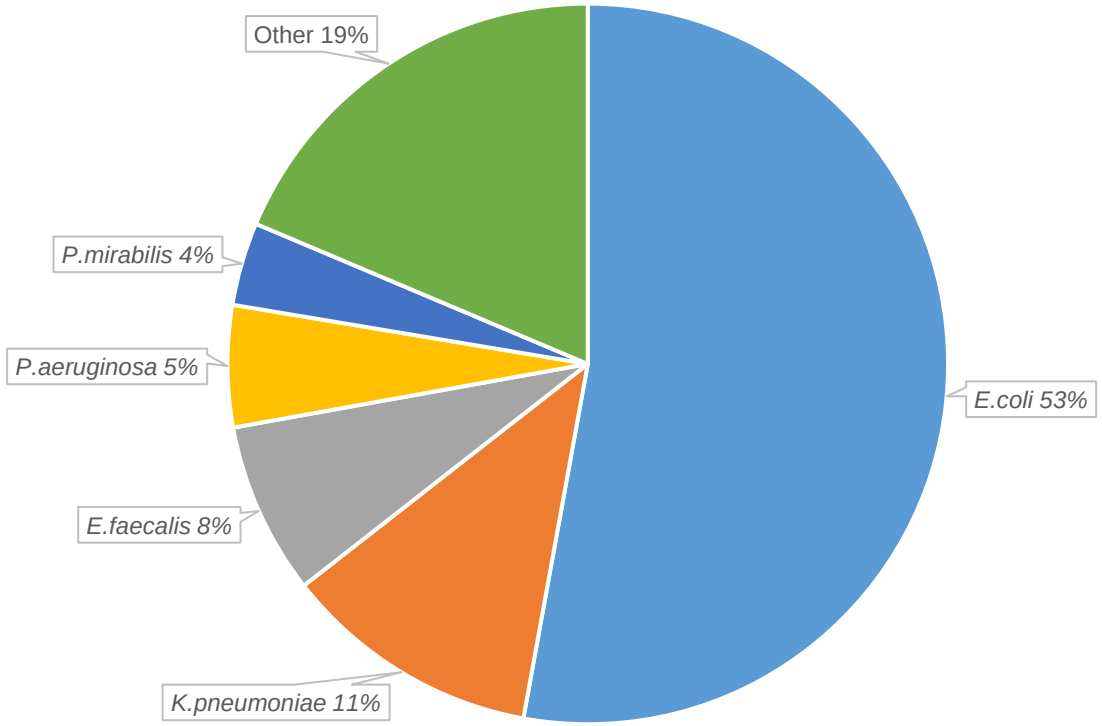
- All positive culture results
  - All residents
  - Three years – 2020, 2021, 2022

- WHONET® software to manage and analyse susceptibility data

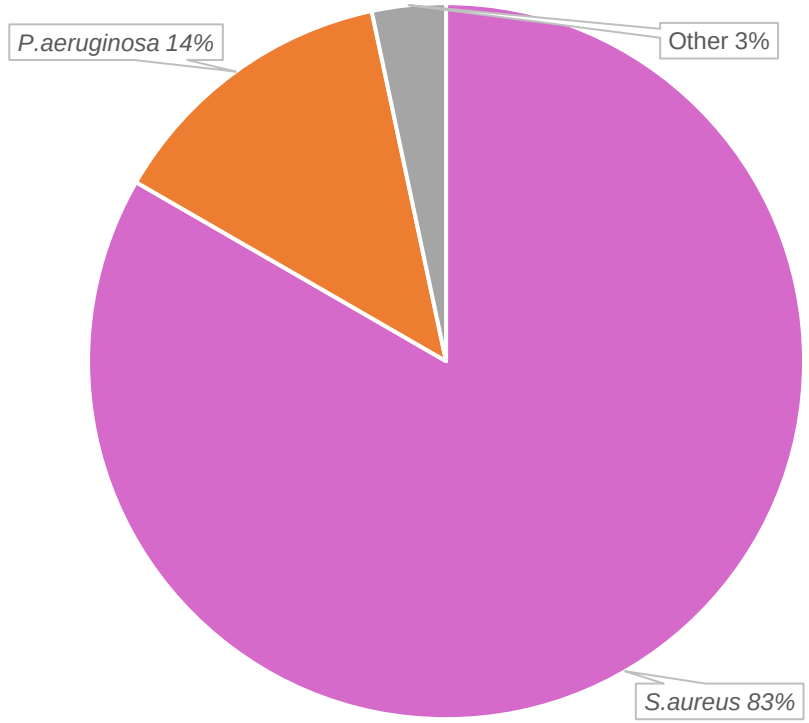
Antibiogram development

Most prevalent isolates = *Escherichia coli* and *Staphylococcus aureus*

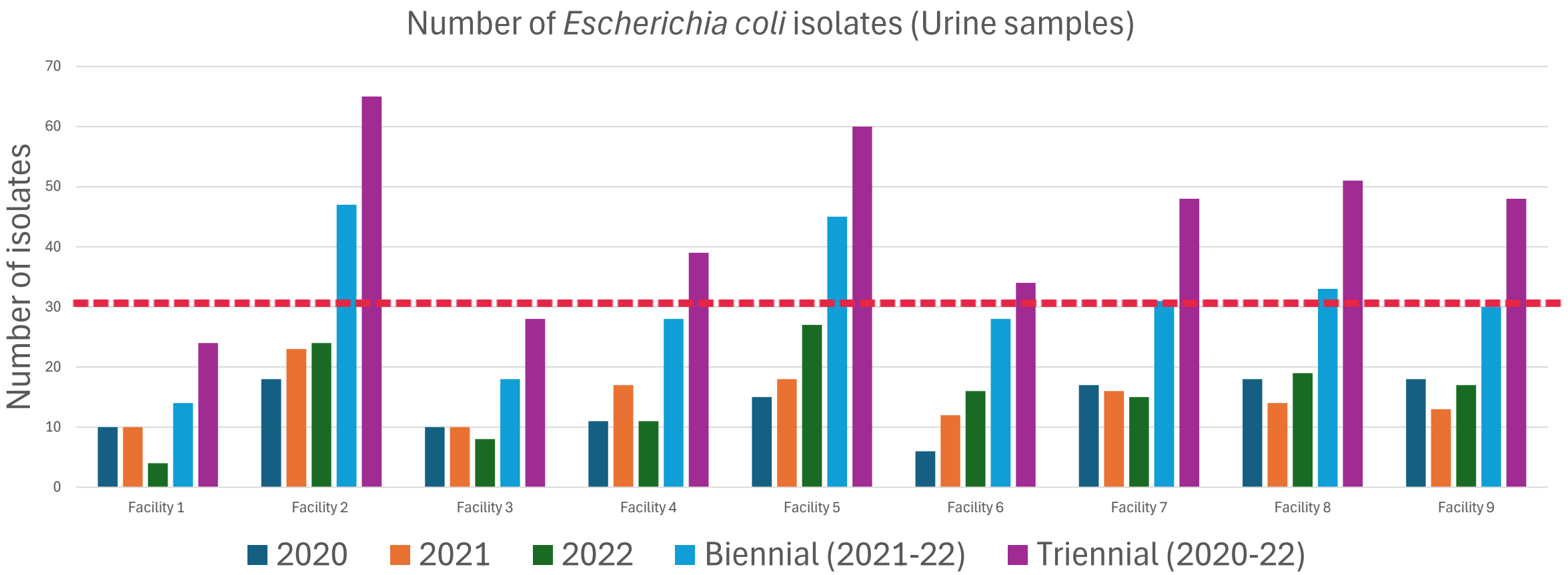
Organisms (species) identified from **urinary isolates** 2020-2022



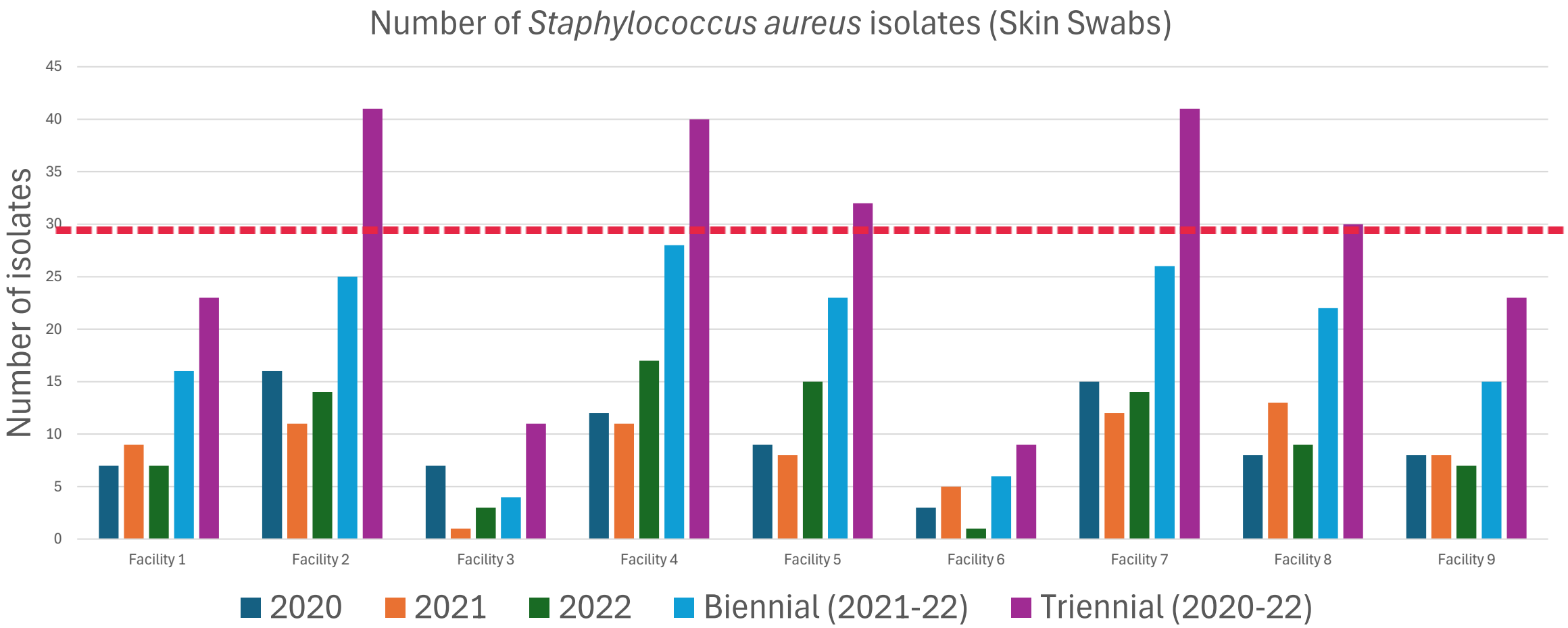
Organisms (species) identified from **skin/soft-tissue isolates** 2020-2022



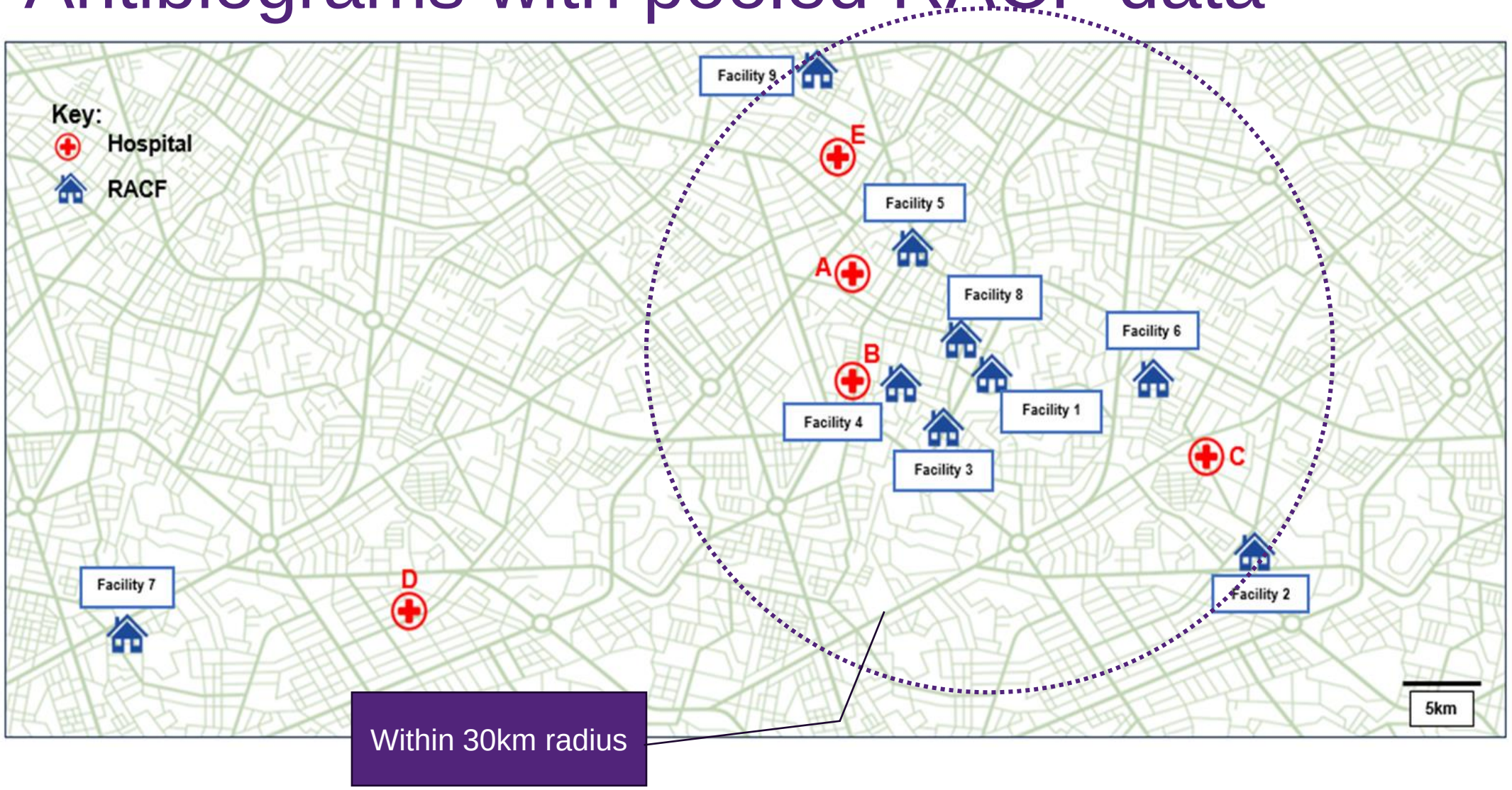
Antibiogram development



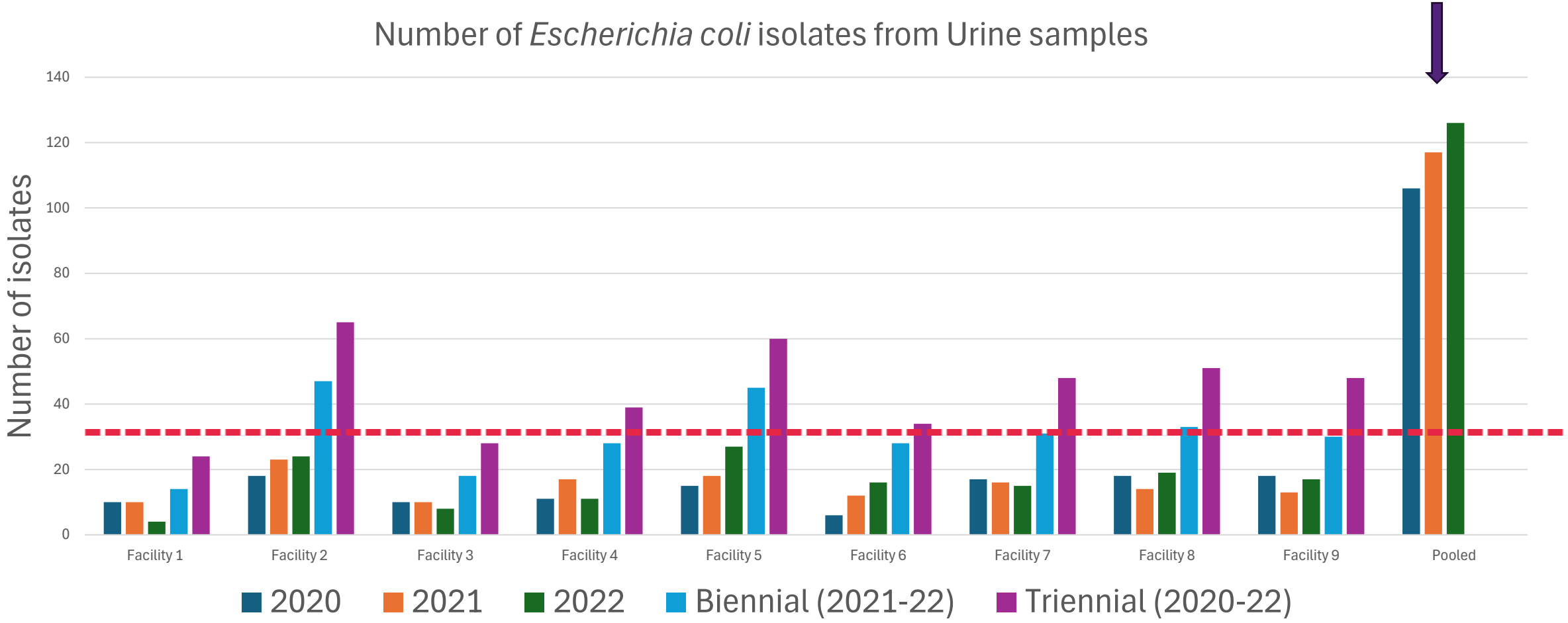
Antibiogram development



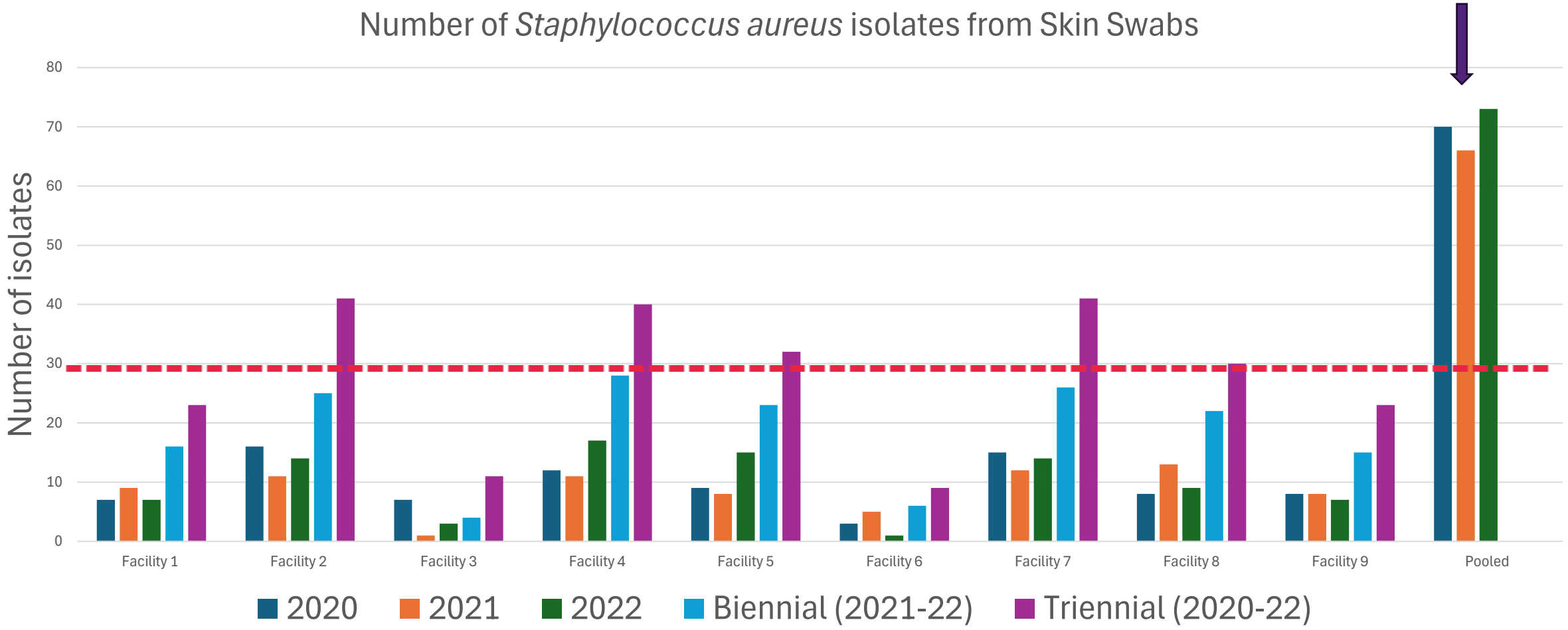
Antibiograms with pooled RACF data



Antibiograms with pooled RACF data



Antibiograms with pooled RACF data



Pooled data antibiogram – Urinary isolates

Organism			Pooled Metropolitan Brisbane RACF antibiogram 1 January 2022 – 31 December 2022 Cumulative Antimicrobial Susceptibility Test Data – Urine Antibiogram								
			PERCENTAGE (%) SUSCEPTIBLE[#]								
	No. isolates		Amoxicillin	Amoxicillin/ Clavulanate	Cefalexin	Nitrofurantoin	Trimethoprim	Sulfamethoxazole /Trimethoprim	Gentamicin	Ciprofloxacin	Vancomycin
Escherichia coli	126	%	58	87	87	98	71	59	96	58	-
		n	126	126	126	125	124	27*	113	12*	
Klebsiella pneumoniae	24*	%	R	100	96	52	92	^	100	^	-
		n		24*	24*	21*	24*	5*	19*	1*	
Pseudomonas aeruginosa	14*	%	R	R	R	^	R	R	90	82	-
		n				2*			10*	11*	
Enterococcus faecalis	11*	%	93	100	R	93	R	R	-	-	100
		n	14*	13*		14*					13*

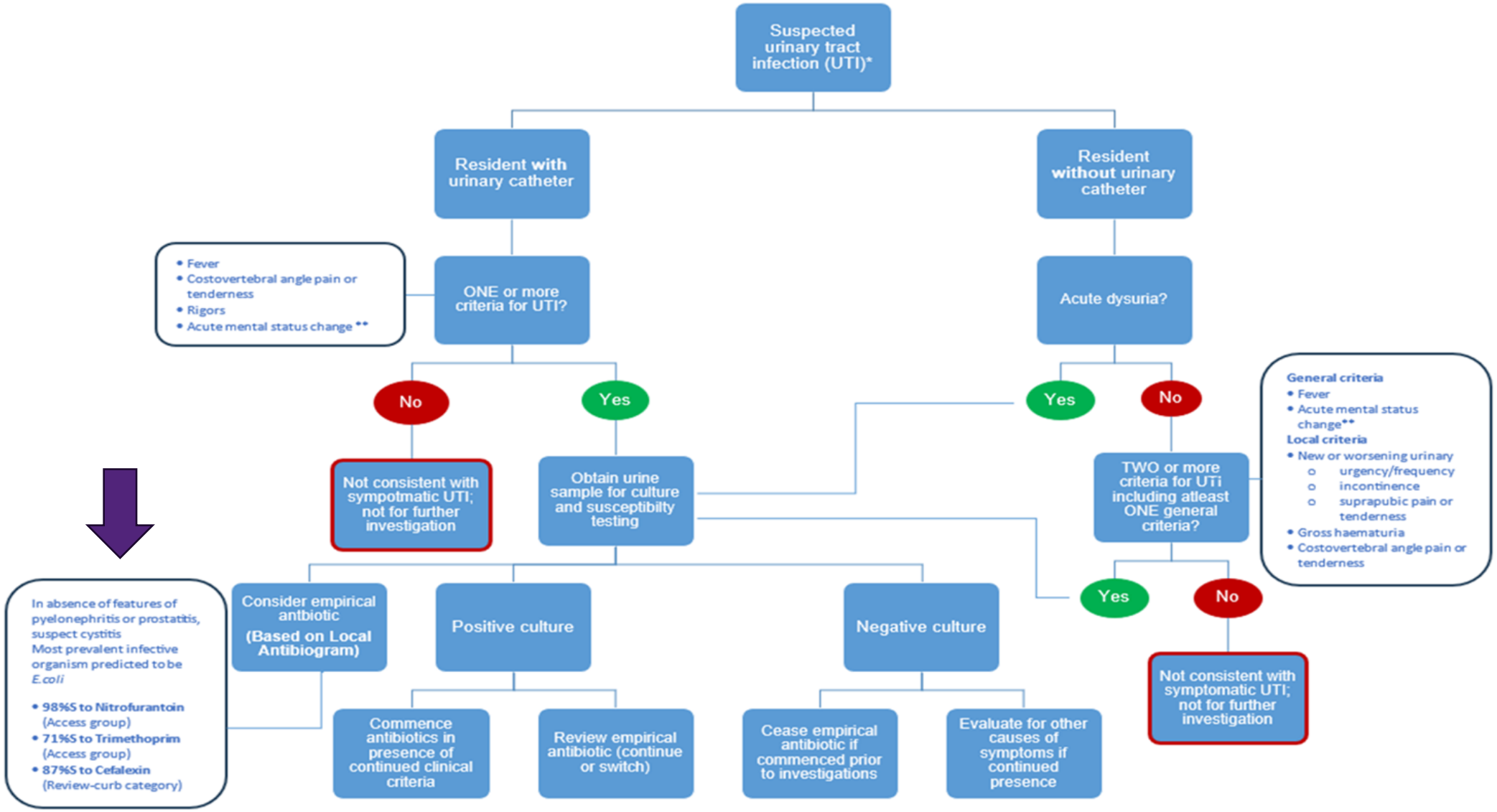
RACF: Residential aged care facility ; #%S for each organism/antibiotic combination generated by including first isolate of organism per 12-month period encountered in a given patient; *Indicates <30 isolates tested and potentially low accuracy of susceptibility rates; -Indicates the antimicrobial agent not tested, or is known to be clinically ineffective; R – intrinsic resistance; ^ results excluded due to insufficient isolates (<10); Antibiotics with light grey shading belong to Access category of Priority Antibacterial List; Antibiotics with dark grey shading belong to Review-Curb category of Priority Antibacterial List.

Pooled data antibiogram – Skin/soft tissue isolates

Organism			Pooled Metropolitan Brisbane RACF antibiogram 1 January 2022 – 31 December 2022 Cumulative Antimicrobial Susceptibility Test Data – Skin/Soft tissue Antibiogram										
			PERCENTAGE (%) SUSCEPTIBLE#										
	No. isolates		Amoxicillin/ Clavulanate	Penicillin	Flucloxacillin	Dicloxacillin	Cefalexin	Sulfamethoxazole/ Trimethoprim	Erythromycin	Tetracycline	Ciprofloxacin	Vancomycin	Clindamycin
Staphylococcus aureus	73	%	73	16	74	73	73	100	93	99	67	100	93
		n	73	64	72	63	63	73	72	73	18*	21*	73

RACF: Residential aged care facility ; #%S for each organism/antibiotic combination generated by including first isolate of organism per 12-month period encountered in a given patient; *Indicates <30 isolates tested and potentially low accuracy of susceptibility rates; Antibiotics with light grey shading belong to Access category of Priority Antibacterial List; Antibiotics with dark grey shading belong to Review-Curb category of Priority Antibacterial List.

Diagnostic and treatment algorithm – suspected UTI



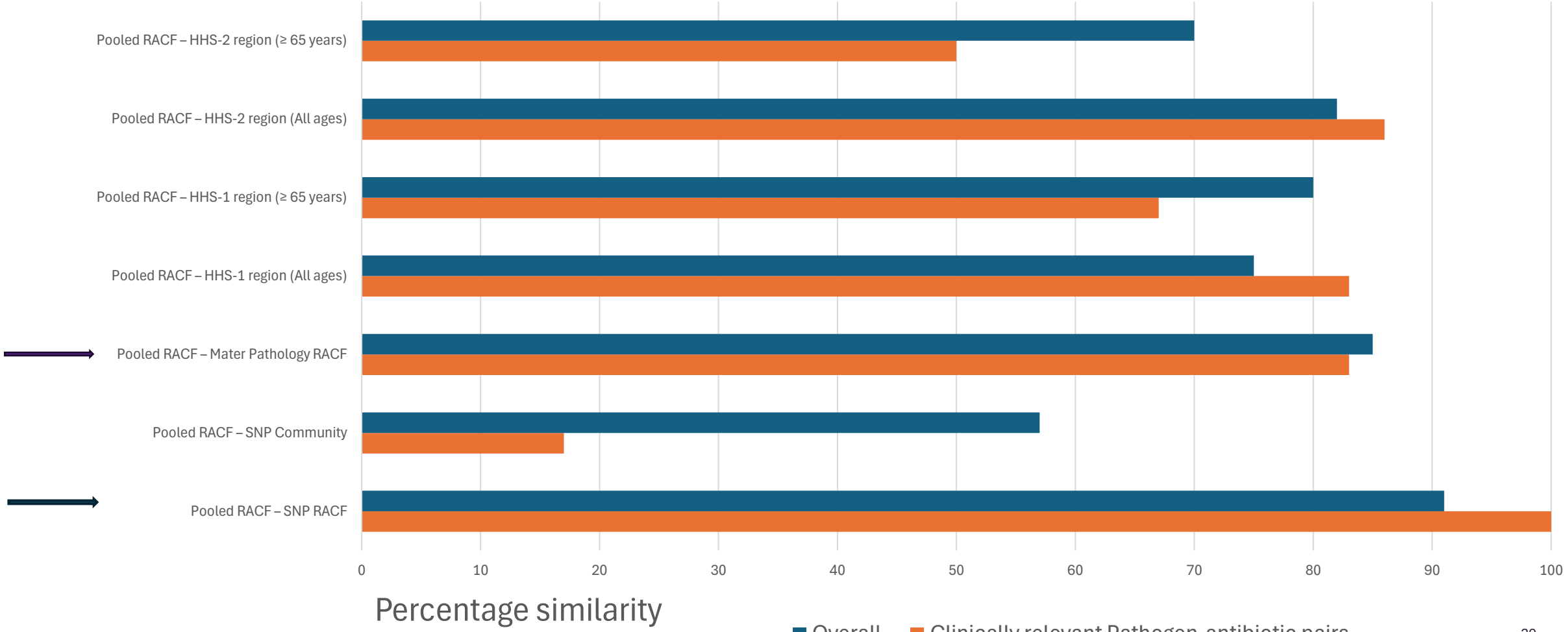
Antibiograms

- RACF-specific antibiograms = Time, labour and cost intensive
- Potential missing data
- Multiple private pathology providers service RACFs

→ Utilise alternatively available data to approximate resistance patterns for RACFs

Utilising alternative resistance data

Comparison of Pooled data antibiograms with alternately available resistance data for 2022



Summary of findings

- Knowledge of local resistance patterns, provided by antibiograms, may improve antibiotic appropriateness by optimising empirical prescribing
- Insufficient data to produce annual antibiograms for RACFs
- Pragmatic solutions explored which are effective:
  - ✓ Extend antibiogram time-period to 3 years
  - ✓ Pool susceptibility data from geographically united RACFs
  - ✓ Engage private pathology providers

References

1. Naghavi M, Vollset SE, Ikuta KS, Swetschinski LR, Gray AP, Wool EE, Aguilar GR, Mestrovic T, Smith G, Han C, Hsu RL. Global burden of bacterial antimicrobial resistance 1990–2021: a systematic analysis with forecasts to 2050. The Lancet. 2024 Sep 28;404(10459):1199-226.
2. Australian Commission on Safety and Quality in Health Care. AURA 2023: fifth Australian report on antimicrobial use and resistance in human health. . Sydney: ACSQHC; 2023.
3. Australian Commission on Safety and Quality in Health Care. Antimicrobial use in the community: 2023. Sydney; ACSQHC, 2024.
4. National Centre for Antimicrobial Stewardship and Australian Commission on Safety and Quality in Health Care. (2023) 2022 Aged Care National Antimicrobial Prescribing Survey Report.
5. Khatri D, Burrows J. Assessment and management of urinary tract infections in aged care facilities. Australasian Journal on Ageing. 2021;40(1):58-65.
6. Furuno JP, Comer AC, Johnson JK, Rosenberg JH, Moore SL, MacKenzie TD, et al. Using antibiograms to improve antibiotic prescribing in skilled nursing facilities. Infect Control Hosp Epidemiol. 2014;35 Suppl 3:S56-61.
7. Australian Commission on Safety and Quality in Health Care. (2021) Australian Stewardship in Australian Health Care: Chapter 16 Antimicrobial stewardship in community and residential aged care.
8. CLSI, Analysis and Presentation of Cumulative Antimicrobial Susceptibility Test Data, in CLSI guideline M39. 2022, Clinical and Laboratory Standards Institute: USA.
9. Australian Commission on Safety and Quality in Health Care. (2021) What is an antibiogram?

Thank you