Cumulative Antibiograms: Tamworth Hospital and Peel, 2016

Overview

Cumulative antibiograms summarise the collective susceptibility of specific bacterial isolates against various antibiotics. Online versions are available from https://aimed.net.au/antibiograms/ .

Infectious Disease consultancy advice on clinical and antimicrobial treatment is available at all hours from the on-call HNE Infectious Diseases Service (call 49213000 and page ID registrar or consultant). It is strongly recommended that advice is obtained for all patients with:

- *Staphylococcus aureus* bloodstream infection
- Infective spinal discitis or osteomyelitis at any site
- Infected joint replacements (early or late; suspected or proven)
- Bacterial meningitis (suspected or proven)
- Bacterial or culture negative endocarditis

An abridged **CEC Severe Sepsis First Dose Empirical Intravenous Antibiotic Guideline** and other antibiotic guidelines/resources are available on the HNE Quality Use of Medicines Smart phone enabled website www.hnequm.com and via the HNE Guidelines and CEC Sepsis pages at www.aimed.net.au, Pathology North's Antimicrobial Stewardship resource site.

For queries or production of other summary analyses of microbiology data, please contact the on-call Medical Microbiologist (tel. 49214000). HNE LHD 2015 epidemiological reports have been prepared for *Staphylococcus aureus* (MSSA and MRSA), vancomycin-resistant enterococci, *Streptococcus pneumoniae*, multi-resistant Gram negative species and *Clostridium difficile*. These reports are available on the Infection Prevention Service intranet page.

Data records

Element	Period
Urine isolates	January-December 2016
Non-urine isolates	January-December 2016

Antibiogram notes

- Analyses and this document was prepared by Mr Wayne Griffiths and Dr John Ferguson, Pathology North, March 2017
- Testing at this location was performed according to the Calibrated Dichotomous Susceptibility Testing (CDS) method over this period.
- The methods employed to construct the antibiogram are broadly based upon the Clinical and Laboratory Standards Institute (CLSI) M39-A3 document – *Analysis and presentation of cumulative antimicrobial susceptibility test data; approved guideline – Third Edition*. Published Feb 2009. The format was defined by the Australian Commission on Safety and Quality in Healthcare in 2013.
- Isolates cultured from all inpatients and outpatients attending HNE facilities served by Pathology North laboratories in this region. Comparative resistance rates between certain patient groups and institutions may differ significantly. Infection control screening isolates have not been included.
- Only the first isolate per patient per 365 day period has been included to prevent statistical bias from repeated sampling of multi-resistant isolates
- Note that not all antibiotics were tested against every isolate listed in each category. If this has happened, the number of isolates tested is shown below the percentage where this number is less than 90% of the total isolates. Where lesser numbers are tested, overall susceptibility may be falsely deflated as only more resistant isolates get tested against broader spectrum (restricted) antibiotics.
- Species with test data for less than 30 isolates have generally been excluded.

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Urinary isolate antibiogram

	Organism type	Isolates	% total	Unrestricted antibiotics: Ampicillin	Amoxycillin+ clavulanate	Cefazolin / cephalexin	Nitrofurantoin	Trimethoprim	Gentamicin (aminoglycoside)	Restricted antibiotics: Ceftriaxone	Norfloxacin
	All isolates	2,042	100%	Some miscellaneous/contaminant species excluded.							
Gram negative isolates	*Escherichia coli*	1,206	59%	65%	97%	96%	99%	83%	98%	n/a	97%
											849
	Klebsiella species	151	7%	R	97%	95%	n/a	89%	97%	n/a	97%
											105
	Enterobacter -like species*	104	5%	R	R	R	n/a	91%	98%	**	99%
											78
	Proteus mirabilis	77	4%	95%	100%	100%	R	94%	100%	n/a	100%
											44
	Pseudomonas aeruginosa	140	7%	R	R	R	R	R	99%	R	97%
											99
Gram positives	*Staphylococcus saphrophyticus*	35	2%	83%	S	S	100%	97%	n/a	S	n/a
	Streptococcus agalactiae (group B strep)	86	4%	100%	S	S	99%	n/a	R	S	n/a
	Enterococcus faecalis	243	12%	95%	S	R	97%	R	R	R	R

Table notes

n/a	Not available - not routinely tested in this laboratory or no testing standard available
93%	> 90% of isolates susceptible
S	Susceptible by extrapolation or intrinsically susceptible
75%	70-89% of isolates susceptible
45%	< 70% of isolates susceptible
R	Intrinsically resistant
*	*Enterobacter, Serratia, Citrobacter, Providencia, Morganella* species (excludes *C. diversus*)
**	Resistance may emerge during therapy and agent NOT recommended for these species.
	Refer to https://aimed.net.au/about/hne-guidelines/ for HNELHD restricted anti-infective indications

Combined urine isolate antibiograms (District wide)

Organism type	Ampicillin OR gentamicin susceptible	Cefazolin OR gentamicin susceptible
All unique Enterobacteriaceae (*E. coli, Klebsiella* and other species) isolates from urine (n=10189)	97%	98%

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Urinary isolate antibiogram: commentary

Please consult Therapeutic Guidelines: Antibiotic (TG:A) for recommended dosing and duration of therapy.

Infectious Syndrome	Therapeutic Guidelines (TG) empiric recommendations	Comments relating to the local cumulative antibiogram
Urosepsis (severe)	1. Ampicillin PLUS gentamicin OR (if non-immediate hypersensitivity to penicillin): 2. Gentamicin alone ***N.B.*** *Ceftriaxone ONLY for patients with absolute or relative C/I for gentamicin use*[1]*.*	Gentamicin retains activity against nearly all Gram negative uropathogens. It is usual to give just one dose in the setting of pyelonephritis or severe sepsis associated with urine source. Ampicillin provides optimal coverage for streptococci and enterococci that also cause UTI. Early oral switch based on tested susceptibility is indicated once a patient begins to respond to treatment (usually within 48hrs).
Urosepsis (outpatient therapy)	Trimethoprim OR Nitrofurantoin OR Amoxicillin+clavulanate OR Cephalexin ***N.B.*** *Norfloxacin ONLY if resistance to above is proven or infection with Pseudomonas confirmed.*	All of these agents retain good levels of activity against common Gram negative uropathogens such as *E. coli.* These agents are suitable for oral switch, provided that susceptibility to the specific agent is confirmed. ***N.B.*** *Trimethoprim can cause hyperkalaemia and is potentially dangerous in patients who are on an ACE inhibitor – see this cautionary posting - https://aimed.net.au/2014/11/27/cotrimoxazole-increases-risk-of-sudden-death-in-patients-receiving-renin-at-inhibitors/*
Notes	• **With few exceptions, urine cultures should NOT be collected from patients who don't have symptoms of infection.** • Presence of abnormal urinalysis, cloudy or smelly urine are NOT indications for culture *per se.* • Patients catheterised for more than 48 hours require a new catheter prior to sample collection or collection of an MSU following catheter removal. • **Always clearly specify the type of urine sample being submitted and the indication for collection** on the pathology request form. See also: http://www.cec.health.nsw.gov.au/__data/assets/pdf_file/0011/293726/UrineSpecimenCollectionDecisionSupportTool.pdf • Empirical use of norfloxacin or ceftriaxone is discouraged. Reserve these agents for directed therapy against pathogens resistant to first line agents. • For multi-resistant Gram negative urinary isolates, fosfomycin can be tested and is often susceptible. This drug is given orally and is effective in urinary tract infection. Please discuss with the Medical Microbiologist on-call if required (tel. 49214000). SAS approval is required for use.	

[1] **Aminoglycosides should *NOT* be used in patients with:**

- a history of vestibular or auditory toxicity caused by an aminoglycoside
- a history of serious hypersensitivity reaction to an aminoglycoside (rare)
- myasthenia gravis.

Unless the infection is life-threatening, aminoglycosides should generally be avoided in patients with:

- pre-existing significant auditory impairment (hearing loss or tinnitus)
- pre-existing vestibular condition (dizziness, vertigo or balance problems)
- a family history (first-degree relative) of auditory toxicity caused by an aminoglycoside
- chronic renal impairment (creatinine clearance less than 40 mL/min) or rapidly deteriorating renal function
- advanced age (eg 80 years or older), depending on calculated renal function.

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Non-urinary isolate antibiogram

	Organism type	# strains	% total	Routinely reported antibiotics: Ampicillin	Amoxycillin + clavulanate	Cefazolin / cephalexin	Fludoxacillin/ dicloxacillin	Erythromycin/ clindamycin	Tetracycline	Trimethoprim+ +S'methoxazole	Gentamicin (aminoglycoside)	Restricted or second line antibiotics: Ceftriaxone	Piperacillin + tazobactam	Ceftazidime	Meropenem (carbapenem)	Ciprofloxacin	Vancomycin
	All isolates	2,280	100%	Some miscellaneous/contaminant species excluded.													
Gram negative isolates	*Escherichia coli*	224	10%	62%	88%	87%	R	R	n/a	88%	98%	94%	94%	n/a	100%	94%	R
																145	
	Klebsiella species	48	2%	R	94%	71%	R	R	n/a	97%	97%	94%	90%	n/a	100%	98%	R
																60	
	Enterobacter-like species*	62	3%	R	R	R	R	R	R	98%	98%	**	n/a	n/a	100%	99%	R
																132	
	Pseudomonas aeruginosa	236	10%	R	R	R	R	R	R	R	98%	R	n/a	97%	96%	95%	R
																231	
	Haemophilus influenzae	127	6%	69%	89%	n/a	R	R	n/a	66%	S	97%	S	S	S	S	R
Gram positive isolates	*Staphylococcus aureus-* ALL	1,166					85%										
	Methicillin-susc. S. aureus	990	43%	21%	S	S	100%	88%	98%	99%	n/a	-	S	-	S	-	100%
	Methicillin-resistant S. aureus	191	8%	R	R	R	R	73%	95%	96%	n/a	R	R	R	R	-	100%
	Streptococcus pyogenes (group A strep)	168	7%	100%	S	S	S	100%	n/a	n/a	R	S	S	-	S	-	S
	Streptococcus agalactiae (group B strep)	110	5%	100%	S	S	S	86%	n/a	n/a	R	S	S	-	S	-	S
	Streptococcus dysgalactiae (group C or G strep)	45	2%	100%	S	S	S	93%	n/a	n/a	R	S	S	-	S	-	S
	Streptococcus pneumoniae	79	3%	100%	S	-	-	89%	n/a	n/a	R	S	S	-	S	-	S
				***													

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Additional table notes (see also above)

***	Based on oxacillin susceptibility- almost all oxacillin resistant *Streptococcus pneumoniae* isolates ARE susceptible to benzylpenicillin/amoxicillin used to treat non-meningeal infection

Non-urinary isolate antibiogram commentary

Please consult Therapeutic Guidelines: Antibiotic (TG:A) for recommended dosing and duration of therapy.

Infectious Syndrome	Therapeutic Guidelines (TG) empiric recommendations	Comments relating to the local cumulative antibiogram
Sepsis, undiagnosed focus	1. Flucloxacillin PLUS gentamicin[b] PLUS vancomycin[c] until blood culture results are finalised. OR (if non-immediate hypersensitivity to penicillin) 2. Cefazolin PLUS gentamicin PLUS vancomycin	Most Gram negatives remain highly susceptible to gentamicin which remains the most rapidly bactericidal agent. In 2016, 11% of Hunter New England community presentations with bacteraemia due to *Staphylococcus aureus* infection were MRSA (see below). Pathology North is usually able to provide a rapid PCR test to confirm MRSA presence. **In the absence of microbiology results, empiric therapy should ADD in IV vancomycin.** ***N.B.*** *HNELHD Staphylococcus aureus bloodstream infection management guideline for essential care elements.* For current CEC Severe Sepsis first dose antibiotic recommendations, see https://aimed.net.au/severe-sepsis-guidelines-cec-nsw/ Or consult http://hnequm.com .
Skin / soft tissue infection	1. Di/flucloxacillin OR (if non-immediate hypersensitivity to penicillin) 2. Cephalexin or clindamycin as oral alternatives For severe disease consider addition of vancomycin for MRSA coverage, while culture results awaited.	**Incision and drainage of an uncomplicated < 5 cm boil without cellulitis is sufficient treatment[d].** Culture for MRSA is advised from open skin infections when relevant. For advice on management of recurrent staphylococcal skin infection, refer to the HNE HealthPathways resource or https://aimed.net.au/2017/03/14/patient-advice-recurrent-staphylococcal-infection/ . Non-severe skin infections due to MRSA require an alternative antibiotic - doxycycline or trimethoprim+sulphamethoxazole are usually appropriate.
Additional MRSA isolate susceptibilities (n= 189)	Rifampicin 99% Fusidic acid 98%	Combination oral therapy with rifampicin is often used for significant MRSA bone or joint infection. Such treatments should be only prescribed if recommended by the Infectious Diseases Service. It is important that drug supplies are provided via the hospital pharmacy as private scripts for rifampicin are expensive. Rifampicin monotherapy must be avoided.

[b] For empiric dosage recommendations for aminoglycosides - see Therapeutic Guidelines: Antibiotic, Edition 15, 2014.

[c] For empiric dosage recommendations for vancomycin- see Therapeutic Guidelines: Antibiotic, Edition 15, 2014.

[d] Nathwani et al. Guidelines for UK practice for the diagnosis and management of methicillin-resistant *Staphylococcus aureus* (MRSA) infections presenting in the community. J Antimic Chemo (2008) 61, 976–994, recommendation 9A.

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Infectious Syndrome	Therapeutic Guidelines (TG) empiric recommendations	Comments relating to the local cumulative antibiogram
Intra-abdominal infections **(e.g. secondary peritonitis from ruptured viscus)**	1. Ampicillin PLUS gentamicin PLUS metronidazole OR 2. Piperacillin+tazobactam OR (if non-immediate hypersensitivity to penicillin), 3. Ceftriaxone PLUS metronidazole	Early surgical management to attain source control is paramount and underpins short-course antibiotic therapy[e]. Most Gram negatives remained susceptible to gentamicin. A majority of enterococci are susceptible to ampicillin; all are resistant to ceftriaxone. However enterococci are seldom primary pathogens in this site. Healthcare-associated VRE is increasingly prevalent (see Signal analyses above). Susceptibility of Gram negatives to piperacillin+tazobactam was high. This agent is also active against *Enterococcus faecalis*. In 2017, IV amoxicillin+clavulanate becomes available and may be a suitable replacement for piperacillin+tazobactam in certain situations.
Community-acquired pneumonia (mild-usually outpatient managed cases)	1. Amoxicillin OR (if non-immediate hypersensitivity to penicillin or suspected atypical cause), 2. Doxycycline	***N.B. Assess severity in all cases – see CORB score below.*** ***Streptococcus pneumoniae* isolates retains excellent susceptibility to penicillin** . Whilst susceptibility to second-line agents such as azithromycin (see erythromycin result-82%) and doxycycline (85%) is reasonable, isolates of *Streptococcus pneumoniae* and other species that are non-susceptible to these agents have high level resistance- select an alternative agent. Nearly all *H. influenzae* were susceptible to doxycycline which is a first line treatment in acute on chronic COPD. Gentamicin also provides adequate empirical cover for *Haemophilus influenzae* although testing is not done routinely. ***N.B. Severe pneumonia- ensure that appropriate microbiology is collected PRIOR to antibiotics,*** including blood cultures (2 sets), testing for legionella (urinary antigen and PCR of sputum), respiratory viruses (PCR assay – nose and throat specimen) and serum for *Mycoplasma pneumoniae* IgM. **HNELHD Adult Community Acquired Pneumonia Guidelines** via https://aimed.net.au/about/hne-guidelines/ . Current CEC Severe Sepsis first dose antibiotic recommendations, see https://aimed.net.au/severe-sepsis-guidelines-cec-nsw/ include recommendations for children with severe pneumonia.
Community-acquired pneumonia (moderate)	1. Benzylpenicillin PLUS Doxycycline OR (if non-immediate hypersensitivity to penicillin), 2. Ceftriaxone PLUS Doxycycline	
Community-acquired pneumonia (severe as shown by presence of >= two CORB[f] criteria)	1. Benzylpenicillin PLUS Gentamicin PLUS Azithromycin OR (if non-immediate hypersensitivity to penicillin), 2. Ceftriaxone PLUS Azithromycin	

[e] See this randomised trial: Sawyer et al. Trial of Short-Course Antimicrobial Therapy for Intraabdominal Infection. N Engl J Med 2015; 372:1996-2005.

[f] **CORB**- recommended pneumonia severity classification: 4 criteria: **C**onfusion (acute), **O**xygen saturation 90% or less, **R**espiratory rate > 30 breaths per minute, **B**lood pressure < 90 mm Hg (systolic) or < 60 mm Hg (diastolic)

Cumulative Antibiograms: Tamworth Hospital and Peel Sector,

Signal resistances

1. **Vancomycin-resistant Enterococcus (VRE) , Tamworth Hospital & Peel Sector**

Species	Unique patient isolates (VSE/VRE)	Percent VRE	VRE genotypes
Enterococcus faecium	91	81%	41% *vanA*, 59% *vanB* (based on 22 genotypes)
Enterococcus faecalis	219	1%	*vanB*

HNELHD wide, two linezolid resistant isolates of *vanA E. faecium* were detected (both Calvary Mater).

2. **Methicillin-resistant *Staphylococcus aureus* (MRSA)**
Across Peel Sector, 15% of non-urinary isolates of *Staphylococcus aureus* were MRSA (see above antibiogram).

3. **Vancomycin-intermediate and resistant Staphylococcus aureus (VISA, VRSA)**
Across HNELHD, no VISA or VRSA isolates were detected in 2016.

4. **Carbapenemase-producing Enterobacteriaceae[g] (CPE) , *Acinetobacter baumannii, Pseudomonas aeruginosa***
Across Peel Sector, four unique patient isolates of meropenem-resistant Enterobacteriaceae obtained in 2016 from sputum (1), urine (1) and screen (1) specimens. Two isolates submitted for carbapenemase gene detection – one was positive for IMP, OXA-23 genes and the other had no detectable CP genes.

Across HNELHD, one isolate of meropenem-resistant *Acinetobacter baumannii* detected that carried the *OXA-23* carbapenemase and the 16s rRNA methylase gene *armA* (a newly reported mechanism of resistance that is associated with pan-resistance to aminoglycosides).

Across HNELHD, four isolates of carbapenemase-producing *Pseudomonas aeruginosa* of *GES* carbapenemase genotype were detected at John Hunter(2), Belmont(1) and Calvary Mater (1) Hospitals. (A majority of meropenem resistance in *Pseudomonas* is due to other mechanisms).

5. **Extended-spectrum betalactamase producing Enterobacteriaceae (genotypically confirmed)**
Across Peel Sector, one unique patient isolate was confirmed to contain the ESBL CTX-M1 gene. No isolates with plasmid *AMPc* genes were detected (a minority of the 16 isolates phenotypically detected were sent for genotyping). ESBLs are associated with ceftriaxone or ceftazidime resistance (see ceftriaxone susceptibility figures in the antibiogram).

6. ***Streptococcus pneumoniae* with reduced penicillin susceptibility (MIC > 0.06mg/L)**
Data not available due to Calibrated Dichotomous Susceptibility Testing (CDS) method in use over this period.

[g] Enterobacteriaceae include *E.coli* and *Klebsiella, Proteus, Enterobacter, Serratia* and other Gram negative coliform species.

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Sentinel bloodstream events (HNELHD-wide)

1. **Gram negative aerobic pathogens**
   No meropenem-resistant Gram negative bloodstream events recorded in 2016.

2. **Healthcare-associated *Staphylococcus aureus* bloodstream infection with percent MRSA by region and year, HNELHD, 2015-2016**

Year and region	MRSA	MSSA	Total	% MRSA
2015	**9**	**67**	**76**	**12%**
GNC	6	45	51	12%
Hunter	2	6	8	25%
LMNC		5	5	0%
Peel		6	6	0%
Tablelands	1	5	6	17%
2016	**10**	**63**	**73**	**14%**
GNC	8	40	48	17%
Hunter		5	5	0%
LMNC	2	6	8	25%
Mehi		1	1	0%
Peel		5	5	0%
Tablelands		6	6	0%
Total	**19**	**130**	**149**	**13%**

3. **Community-acquired *Staphylococcus aureus* bloodstream infection and percent MRSA by region & ATSI status, HNELHD, 2015-16**

Location and ATSI Status	MRSA	MSSA	Total	% MRSA
GNC	**21**	**163**	**184**	11%
Aboriginal but not Torres Strait Islander Origin	2	7	9	22%
Neither	19	156	175	11%
Hunter	**9**	**71**	**80**	11%
Aboriginal but not Torres Strait Islander Origin	1	3	4	25%
Neither	8	66	74	11%
Torres Strait Islander Origin		2	2	0%
LMNC	**3**	**44**	**47**	6%
Aboriginal but not Torres Strait Islander Origin		3	3	0%
Neither	3	41	44	7%
Mehi	**2**	**7**	**9**	22%
Aboriginal but not Torres Strait Islander Origin	2	1	3	67%
Neither		6	6	0%
Peel	**3**	**41**	**44**	7%
Aboriginal but not Torres Strait Islander Origin	1	6	7	14%
Neither	2	35	37	5%
Tablelands	**4**	**31**	**35**	11%
Aboriginal but not Torres Strait Islander Origin	3	3	6	50%
Neither	1	28	29	3%
Total	**42**	**357**	**399**	**11%**