AUSTRALIAN COMMISSION
ON SAFETY AND QUALITY IN HEALTH CARE

Priority Antibacterial List for Antimicrobial Resistance Containment

A stewardship resource for human health

April 2020

AURA
Antimicrobial Use and Resistance in Australia

Contents

Introduction

Antimicrobial use influences the development of antimicrobial resistance (AMR). AMR reduces the range of antimicrobials available to treat infections, and increases morbidity and mortality associated with infections caused by multidrug-resistant organisms. AMR is well established as a priority for action due to its serious and growing impact on human health. Consequently, surveillance of the volume of antimicrobial use and appropriateness of prescribing is essential to inform prevention and containment strategies for AMR.

The Antimicrobial Use and Resistance in Australia (AURA) Surveillance System provides data and information to support Australia's strategic response to one of the most significant challenges facing health care around the world: antimicrobial resistance (AMR). AURA was established in 2014 by the Australian Commission on Safety and Quality in Health Care (the Commission) to provide a nationally coordinated system for surveillance of AMR and antimicrobial use (AU) for human health. This work has been funded by the Australian Government Department of Health and, more recently, with contributions from the states and territories.

The AURA Surveillance System addresses the human health aspects of One Health objectives. In 2015, the Australian Government released Australia's first strategy on AMR, the National Antimicrobial Resistance Strategy 2015–2019[1], which outlined the framework to address AMR using a One Health approach. The implementation plan for the strategy was released in 2016.[2] The strategy aligns with the World Health Organization (WHO) Global Action Plan on Antimicrobial Resistance[3], which was also released in 2015 and endorsed at the United Nations General Assembly high-level meeting on AMR in 2016.[4]

The AURA Surveillance System collects data from hospital and community settings to provide a comprehensive national and regional picture of AU and AMR. The AURA National Coordination Unit (NCU) has led a process to progressively increase the breadth and volume of data collected for AU and AMR. Increases in geographic coverage have been achieved, with resistance data now available from the public sector in all states and the Australian Capital Territory, and from a number of private sector laboratories in Queensland. The AURA Surveillance System has also increased its coverage of hospitals and aged care homes providing data on AU and appropriateness of use, with a doubling of the number of hospitals and aged care homes participating in the National Antimicrobial Utilisation Surveillance Program (NAUSP), the National Antimicrobial Prescribing Survey (NAPS) and the Aged Care National Antimicrobial Prescribing Survey (AC NAPS) since 2014. These changes have resulted in increased representativeness of the data, which better supports the analysis of these data for trends over time.

Data from the AURA Surveillance System directly support the National Safety and Quality Health Service (NSQHS) Standards (second edition), and the work of clinicians, public and private sector hospitals, aged care homes and primary healthcare providers to prevent and control AMR to benefit patients and the community. The Preventing and Controlling Healthcare-Associated Infection Standard is one of eight NSQHS Standards. Since 2011, this Standard has required health service organisations to monitor patterns of AU and AMR, and use this information to guide antimicrobial stewardship (AMS), support infection prevention and control programs, and prevent and control AMR.

Surveillance of AU and AMR increases understanding of the burden of AMR in Australia, and the volume and appropriateness of AU. In conjunction with implementation of the NSQHS Standards and implementation of Australia's National Antimicrobial Resistance Strategy, AURA data inform and support national, state and territory, and local strategies to improve AU, prevent and contain AMR, and improve patient outcomes by providing Australia-specific data. These strategies include the development or revision of antimicrobial prescribing guidelines, and public health actions, such as education campaigns. The information can be used at a policy level to drive change, and by clinicians at a patient-care level to support more effective prescribing.

The NAUSP monitors the quantity of antimicrobial use in Australian hospitals. Participation in NAUSP can be provided as evidence that the requirements of the NSQHS Standards are met for accreditation. There is variability in the choice and proportion of use of antimicrobial agents between and within similar peer group hospitals in Australia, despite the existence of national antimicrobial prescribing guidelines.[5] This is likely due to combinations of local prescribing practices, maturity of local AMS programs or local antimicrobial resistance.

In 2017, antimicrobial usage in NAUSP contributor hospitals increased for the first time since 2010.[5] Whilst it has generally been the objective to reduce antimicrobial usage in the Australian hospital system, this needs to be considered at the local level as in some circumstances this may not represent appropriate use.[6] Currently, the appropriateness of antimicrobial use in Australian hospitals is monitored through the NAPS or local prescribing audits.[7,8] However, understanding the quantity of antimicrobial usage in terms of preferred or optimal prescribing choices is also important nationally, and locally.

During 2019, the AURA NCU together with the AMS Advisory Committee considered the potential for an Australian Priority Antimicrobial List (PAL) to support containment of antimicrobial resistance in human health. An international guide developed by the WHO in 1977 in the form of the Essential Medicines List (EML)[9] was developed for similar purposes and has been adapted by a number of countries to aid in local AMS quality improvement processes. The WHO EML now forms the basis of an international benchmarking and surveillance program called Adopt Aware. In 2002, Australia developed the first Antibacterial Importance Ratings (AIR) list across human and animal health.[10] In 2007, the WHO adapted the AIR list to develop the Critically Important Antimicrobials for Human Medicine (CIA) list.[11]

Whilst the intention of the AIR was developed to support decision processes for antibacterial registration, the CIA list was formulated to aid in the development of risk mitigation strategies for the containment of AMR in humans due specifically to non-human use.[11] Neither was focussed on identifying agents that should be reserved in humans for AMR containment.[10] In order to support AMS efforts to contain AMR in human health, the EML was revised to include an extended assessment of antibacterial agents, and to support objective 4 of the WHO Global Action Plan on Antimicrobial Resistance to optimise the use of antimicrobial medicines in human and animal health.[3,12]

Some countries have subsequently adapted the revised WHO EML categories for local use. Public Health England used the EML to develop a framework to aid in describing antimicrobial prescribing as well as for national quality improvement schemes.[13]

A priority organism list was developed to support the AURA Surveillance System in relation to surveillance and reporting of AMR. The Commission's AMS Advisory Committee considered the EML and the AIR list and the potential value of a PAL for Australia. The Committee supported the development of a PAL to: complement the AIR list; support local, state and territory and national AMS programs; and address objective two of the National AMR Strategy: promoting the proper use of antimicrobials through effective stewardship practices.[1]

Antimicrobial stewardship (AMS) is a systematic approach to optimising antimicrobial use.[14] Antimicrobial resistance is only one consideration for the optimal use of antimicrobials; medication safety and cost are also important. It is possible to have a high performing AMS program that demonstrates both improved safety of use of antimicrobials and worsening rates of AMR or HAI. Ideally, AMS programs should focus on improving overall safety and quality of antimicrobial use, whilst also aiming to contain AMR and HAI. There are a range of resources that support the quality use of medicines that include considerations other than AMR.[15]

A successful intravenous to oral switch strategy that inadvertently leads to an increase in fluoroquinolone use and associated resistance, is an example of a safety improvement that may have unintended consequences for AMR. Another consideration for AMS implementation is an intervention that reduces usage of one antimicrobial at the expense of another. For example, a strategy to reduce aminoglycoside toxicity that inadvertently increases carbapenem use.

Purpose of the Priority Antibacterial List

The primary purpose of the PAL is to promote improved prescribing by reducing the total quantity of antibacterial use. The PAL can be used to describe reductions in a way that identifies preferred or quality use in terms of AMR and AMS. It was developed to support surveillance of antimicrobial usage at a national level. It may also be used for local AMS programs in both hospital and community settings.

The PAL is stratified according to preferred use categories for containment of AMR in human health in Australia. In general, the preferred use category includes antibacterials that are recommended as first-line treatment for infections where there is a low resistance potential. The categories also describe preferred antibacterial agents as a larger class for surveillance purposes.

Unlike the WHO EML, formulary procurement is not a focus of the PAL. However, the PAL may serve as a suitable framework at a hospital level for informing formulary restrictions for antimicrobials to contain AMR.

The Access, Review, Curb and Contain (ARCC) classification system

The Access, Review, Curb and Contain (ARCC) Classification System supports improvements in the safety and quality of antimicrobial use, whilst also containing the emergence of AMR and HAI.

The ARCC Classification System was developed based on concepts relevant to human therapeutic use of antimicrobials and development of AMR. The AIR, WHO EML and WHO CIA lists were developed and adapted in this context. The process to develop the Australian PAL is summarised below.

Antibacterials for inclusion

The PAL is specific to systemic antibacterials. All systemic antibacterials, including Special Access Scheme antibacterials, currently under surveillance by NAUSP were included (see Appendix).

Classification of the included antibacterials pertains only to their use as antibacterial agents, rather than their use for other infections such as for the treatment of mycobacterial, parasitic or fungal infections. Topical and inhaled antibacterials are excluded, but where there is an equivalent systemic antibacterial, non-systemic formulations have been considered similarly to their systemic formulation due to the potential for cross-resistance.

ARCC classification system

Two overarching categories were defined: the Access and Review groups. The Review group was further classified into two subgroups based on defined indications and resistance potential: the Curb and Contain groups.

The criteria considered for the classification were:

- Whether it is a recommended agent in *Therapeutic Guidelines: Antibiotic*[16], including as a first-line treatment for common infections that occur in the general population (excluding use in prophylaxis or as a first-line agent in the case of immediate or non-immediate hypersensitivity), and/or

- Expert review based on other considerations, such as risks in human health of AMR or HAIs or a need to reserve the agent for infections resistant to all other antimicrobials, and/or
- The inclusion of the agent in the WHO EML and the AIR list.

Common infections were defined as common at a population level. For example, although febrile neutropenia or septic shock from melioidosis are not uncommon prescribing indications in certain settings, their management is limited to a very small number of clinicians and settings. On a population basis, these types of infections are relatively uncommon in Australia. In contrast, the treatment of skin and soft tissue infection related to methicillin-resistant *Staphylococcus aureus* is very common in many parts of Australia, and so this was considered common.

Agents recommended as first-line for allergy are not considered first-line for common infections within this classification system. This approach was taken to promote improvement in optimal practice with respect to allergy de-labelling and its benefits of narrower, more appropriate antibacterial use.

The exclusion of agents only recommended as first-line for prophylaxis, as opposed to treatment, was to promote non-antibacterial approaches to infection reduction where possible. Additional benefits of this approach are that agents used primarily for prophylaxis can be actively monitored to mitigate potential increases due to non-prophylactic use.

Access group

The criteria for Access category inclusion are set out in Table 1. In general, agents recommended as first-line treatment for common infections with a low AMR or HAI potential are assigned to the Access group (Table 2). Agents that are not recommended as first-line treatment for common infections, but have a low resistance potential, were also included. Where clear stratification was not possible based on the above criteria, classification was based on expert opinion.

Review group

The Review group comprises the remaining agents not included in the Access group. They include agents under surveillance in NAUSP that have moderate to high AMR or HAI potential (Table 2), regardless of the recommendations for their use for treatment of infections.

To signify the difference between agents recommended as first-line treatments for a broad range of bacterial infections in the general population, despite high AMR and/or HAI potential, the group was further categorised into the Curb and Contain categories.

Curb category

The Curb category includes therapies recommended as first-line agents for common bacterial infections, despite a high AMR potential. This category also includes agents not recommended for first-line treatment, but with moderate AMR or HAI potential.

Contain category

The Contain category includes agents with high AMR or HAI potential that are not recommended as first-line agents for common bacterial infections.

The inclusion of agents in the Contain category, as opposed to the Curb category, was also considered where the agents are only recommended for a discrete number of indications for special populations, but are also important agents for the treatment of multidrug-resistant infections, or are ‘last-line antibiotics’ based on expert opinion.

Table 1: ARCC classification for first line recommended agents

Criteria		First-line treatment for common infections *	
		Yes	**No**
Final Risk Review	**Low**	Access	Access
	Medium	Review: Curb	Review: Curb
	High	Review: Curb	Review: Contain

*Excludes first-line recommended treatments for allergy and agents used for prophylaxis

Priority Antibacterial List

Table 2: Priority Antibacterial List based on the ARCC classification

Access	Review	
	Curb	Contain
amoxicillin	amoxicillin–clavulanic acid	amikacin
ampicillin	azithromycin	aztreonam
benzathine benzylpenicillin	cefaclor	cefepime
benzylpenicillin	cefalexin	ceftaroline
chloramphenicol	cefalothin	ceftazidime
dicloxacillin	cefazolin	ceftazidime–avibactam
doxycycline	cefotaxime	ceftolozane–tazobactam
flucloxacillin	cefoxitin	colistin
gentamicin	ceftriaxone	daptomycin
metronidazole	cefuroxime	doripenem
minocycline	clarithromycin	ertapenem
nitrofurantoin	ciprofloxacin	fosfomycin
phenoxymethylpenicillin	clindamycin	imipenem–cilastatin
procaine benzylpenicillin	erythromycin	linezolid
streptomycin	fidaxomicin	meropenem
sulfamethoxazole–trimethoprim	lincomycin	moxifloxacin
tetracycline	norfloxacin	pivmecillinam
tinidazole	piperacillin–tazobactam	polymixin B
tobramycin	rifampicin	pristinamycin
trimethoprim	rifaximin	tigecycline
	roxithromycin	
	sodium fusidate	
	spiramycin	
	teicoplanin	
	vancomycin	

Options for use of Priority Antibacterial List

States, territories and health service organisations may choose to use the PAL as surveillance tool or to support AMS quality improvement activities. Examples of options for a use are described in Table 3.

Table 3: Options for use of the Priority Antibacterial List

Setting	Surveillance	Local formulary management and guideline development	Restricted antimicrobial categorisation	Quality improvement	Clinical care
National	Yes	N/A	N/A	Yes	N/A
State or Territory	Yes	Yes	Yes	Yes	N/A
Health service	Yes	Yes	Yes	Yes	Yes
Facility or ward	Yes	Yes	Yes	Yes	Yes
Primary Health Network	Yes	Yes	Yes	Yes	Yes

N/A = Not applicable

Surveillance

The PAL can be used for the surveillance of antibacterial use in any healthcare setting. One of the features of the PAL is stratification based on first-line therapies recommended in guidelines and low AMR-promoting features. This means that proportional increases in usage of antibacterials in the Access category over time may represent improved compliance with guidelines or better choice of narrower-spectrum antibacterials for directed therapies that are less likely to promote AMR.

The additional information regarding antibacterial use by ARCC category may also be used to make comparisons with total antimicrobial use, particularly where the volume of total use has been stable over a long period.

Local formulary management

Local formulary management should always be based on local needs, because of the diversity of infectious disease epidemiology and AMR patterns. However, the PAL may assist with formulary choices for alternative agents for specific conditions based on their ARCC category.

The PAL could also be used to assist with development of local treatment guidelines, where there may be multiple options for antibacterial agents.

Monitoring use of restricted antibacterials

In the hospital system, restriction of antibacterials is often overseen by AMS programs. As for formulary management, restriction of antibacterials should always be based on local needs, because of the diversity of infectious disease epidemiology and AMR patterns. The balance

between restriction and availability will also require consideration of treatment options for critical infections and conditions such as sepsis.

Authority Required listing on antibacterials on the PBS, and limitations on repeats, are mechanisms for restricting community prescribing.

The PAL may assist with annual review of state and territory and health service organisation antibacterial restriction programs.

Quality improvement

The PAL stratifies antibacterials into three categories; for quality improvement purposes, it is important to monitor total usage for each category in addition to class or individual antibacterial use.

Review of each of these aspects of usage, using the PAL, can assist with the design of quality improvement initiatives to target an individual agent or a class of antibacterials, as well assessment of these initiatives.

Clinical care

In general, the PAL Access category agents are narrower spectrum, and may be preferred for directed therapy. The PAL may serve as a reference tool for clinicians, particularly when they are required to select from multiple antibacterial options for directed therapy in response to a microbiological report.

Education strategies that promote optimal prescribing could use the PAL to support clinician decisions regarding antibacterial options in the absence of AMS or infectious diseases specialist advice.

Selective reporting guidelines, issued by the Royal College of Pathologists of Australasia for pathology laboratories, already accommodate therapeutic prescribing guidelines for antibacterials. The PAL is an additional tool that could be used to support local laboratory decisions on selective reporting or antimicrobial susceptibility testing to further promote use of Access category antibacterials where relevant.

Appendix

The following is a list of all agents currently under surveillance by NAUSP. Only systemic antibacterials have been included in the antibacterial list.

Table A1: Antibacterial agents under NAUSP surveillance, as at June 2019.[17]

ANTIMICROBIAL SUBGROUP *(ATC pharmacological subgroup & chemical subgroup where relevant)*	**AGENTS WITHIN CLASS** *(ATC chemical substance)*	**WHO defined daily dose** *(DDD)*	**Route**
Antibacterials for systemic use (J01)			
Aminoglycosides antibacterials (J01G)			
1. Streptomycins (J01GA)	streptomycin (J01GA01)	1	P
2. Other aminoglycosides (J01GB)	amikacin (J01GB06)	1	P
	amikacin (J01GB06)	1	Inh
	gentamicin (J01GB03)	0.24	P
	neomycin (J01GB05)	1	O
	tobramycin (J01GB01)	0.24	P
	tobramycin (J01GB01)	0.3	Inh (sol)
	tobramycin (J01GB01)	0.112	Inh (pwd)
Amphenicols (J01B)			
1. Amphenicols (J01BA)	chloramphenicol (J01BA01)	3	O,P
Beta-lactam antibacterials, penicillins (J01C)			
1. Penicillins with extended spectrum (J01CA)	amoxicillin (J01CA04)	1.5	O
	amoxicillin (J01CA04)	3	P
	ampicillin (J01CA01)	6	P
	pivmecillinam (J01CA08)	0.6	O
2. Beta–lactamase sensitive penicillins (J01CE)	benzathine benzylpenicillin (J01CE08)	3.6	P
	benzylpenicillin (J01CE01)	3.6	P
	phenoxymethylpenicillin (J01CE02)	2	O
	procaine benzylpenicillin (J01CE09)	0.6	P
3. Beta-lactamase resistant penicillins (J01CF)	dicloxacillin (J01CF01)	2	O,P
	flucloxacillin (J01CF05)	2	O,P
4. Combinations of penicillins, including beta-lactamase inhibitors (J01CR)	amoxicillin/clavulanate (J01CR02)	1.5	O
	amoxicillin/clavulanate (J01CR02)	3.0	P
	piperacillin/tazobactam (J01CR05)	14	P
	ticarcillin/clavulanate (J01CR03)	15	P

Macrolides, lincosamides and streptogramins (J01F)			
1. Macrolides (J01FA)	azithromycin (J01FA10) azithromycin (J01FA10) clarithromycin (J01FA09) erythromycin (J01FA01) erythromycin ethylsuccinate (J01FA01) roxithromycin (J01FA06) spiramycin[a] (J01FA02)	0.3 0.5 0.5 1 2 0.3 3	O P O O,P O O O
2. Lincosamides (J01FF)	clindamycin (J01FF01) clindamycin (J01FF01) lincomycin (J01FF02)	1.2 1.8 1.8	O P P
3. Streptogramins (J01FG)	Pristinamycin (J01FG01)	2	O
Other antibacterials (J01X)			
1. Glycopeptide antibacterials (J01XA)	teicoplanin (J01XA02) vancomycin (J01XA01)	0.4 2	P P
2. Polymyxins (J01XB)	colistin (J01XB01) colistin (J01XB01) polymyxin B (J01XB02)	9MU 3MU 0.15	P I n h P
3. Steroid antibacterials (J01XC)	fusidic acid (sodium fusidate) (J01XC01)	1.5	O,P
4. Imidazole derivatives (J01XD)	metronidazole (J01XD01)	1.5	P
5. Nitrofuran derivatives (J01XE)	nitrofurantoin (J01XE01)	0.2	O
6. Other antibacterials (J01XX)	daptomycin (J01XX09) fosfomycin (J01XX01) fosfomycin[a] (J01XX01) linezolid (J01XX08) methenamine (J01XX05)	0.28 3 8 1.2 2	P O P O,P O
Other beta-lactam antibacterials (J01D)			
1. First-generation cephalosporins (J01DB)	cefalexin (J01DB01) cefalotin (J01DB03) cefazolin (J01DB04)	2 4 3	O P P
2. Second-generation cephalosporins (J01DC)	cefaclor (J01DC04) cefoxitin (J01DC01) cefuroxime (J01DC02)	1 6 0.5	O P O
3. Third-generation cephalosporins (J01DD)	cefotaxime (J01DD01) ceftazidime (J01DD02) ceftazidime/avibactam(J01DD52) ceftriaxone (J01DD04)	4 4 6 2	P P P P

4. Fourth-generation cephalosporins (J01DE)	cefepime (J01DE01)	4	P
5. Monobactams (J01DF)	aztreonam (J01DF01)	4	P
6. Carbapenems (J01DH)	ertapenem (J01DH03) imipenem / cilastatin (J01DH51) meropenem (J01DH02)	1 2 3	P P P
7. Other cephalosporins and penems (J01DI)	ceftaroline (J01DI02) ceftolozane/tazobactam (J01DI54)	1.2 3	P P
Quinolone antibacterials (J01M)			
1. Fluoroquinolones (J01MA)	ciprofloxacin (J01MA02) ciprofloxacin (J01MA02) moxifloxacin (J01MA14) norfloxacin (J01MA06)	1 0.8 0.4 0.8	O O P O
Sulfonamides and trimethoprim (J01E)			
1. Trimethoprim and derivatives (J01EA)	trimethoprim (J01EA01)	0.4	O
2. Combinations of sulphonamides and trimethoprim, including derivatives (J01EE)	sulfamethoxazole and trimethoprim (J01EE01)	1.92	O,P
Tetracyclines (J01A)			
1. Tetracyclines (J01AA)	doxycyline (J01AA02) minocycline (J01AA08) tetracycline[a] (J01AA07) tigecycline (J01AA12)	0.1 0.2 1 0.1	O, P O O, P P
Antimycotics for systemic use (J02)			
Antimycotics for systemic use (J02A)			
1. Antibiotics (J02AA)	amphotericin B[a] (J02AA01) liposomal amphotericin B (J02AA01) amphotericin B lipid complex (J02AA01)	0.035 0.2 0.35	P P P
2. Imidazole derivatives (J02AB)	ketoconazole (J02AB02)	0.2	O
3. Triazole derivatives (J02AC)	fluconazole (J02AC01) itraconazole (J02AC02) itraconazole MR (J02AC02) isavuconazole (J02AC05) posaconazole (J02AC04) voriconazole (J02AC03)	0.2 0.2 0.1 0.2 0.3 0.4	O,P O,P O (MR) O,P O,P O,P

4. Other antimycotics for systemic use (J02AX)	flucytosine (J02AX01) anidulafungin (J02AX06) caspofungin (J02AX04) micafungin (J02AX05)	10 0.1 0.05 0.1	O[a],P P P P
Antimycobacterials (J04)			
Drugs for treatment of tuberculosis (J04A)			
1. Antibiotics (J04AB)	rifampicin (J04AB02)	0.6	O,P
Antivirals for systemic use (J05)			
Direct acting antivirals (J05A)			
1. Nucleosides and nucleotides, excluding reverse transcriptase inhibitors (J05AB)	aciclovir (J05AB01) cidofovir (J05AB12) famciclovir (J05AB09) ganciclovir (J05AB06) valaciclovir (J05AB11) valganciclovir (J05AB14)	4.0 0.025 0.75 3.0 0.5 3.0	O P O O P O
2. Phosphonic acid derivatives (J05AD)	foscarnet (J05AD01)	0.9	O
3. Protease inhibitors (J05AE)	atazanavir (J05AE08) darunavir (J05AE10) fosamprenavir (J05AE07) indinavir (J05AE02) ritonavir (J05AE03) saquinavir (J05AE01) tipranivir (J05AE09)	6.5 0.3 1.2 1.4 2.4 1.2 1.8	O O O O O O O
4. Nucleoside and nucleotide reverse transcriptase inhibitors (J05AF)	abacavir (J05AF06) adefovir (J05AF08) didanosine (J05AF02) emtricitabine (J05AF09) entecavir (J05AF10) lamivudine (J05AF05) stavudine (J05AF04) tenofovir disoproxil (J05AF07) zidovudine (J05AF01)	1.0 0.6 0.01 0.4 0.2 0.0005 0.3 0.08 0.245 0.6	O O O O O O O O P O O
5. Non-nucleoside reverse transcriptase inhibitors (J05AG)	efavirenz(J05AG03) etravirine (J05AG04) nevirapine (J05AG01) rilpivirine (J05AG05)	0.6 0.4 0.4 0.025	O I
6. Neuraminidase inhibitors (J05AH)	oseltamivir (J05AH02) zanamivir (J05AH01)	0.15 0.02	O I
7. Antivirals for treatment of HCV infection (J05AP)	daclatasvir (J05AP07) ribavirin (J05AP01) ribavirin (J05AP01) sofosbuvir (J05AP08)	0.06 6 1 0.4	O O O
8. Antivirals for treatment of HIV infections, combinations (J05AR)	lopinavir and ritonavir (J05AR10) raltegravir (J05AX08)	0.8	O O P

9. Other antivirals (J05AX)	dolutegravir (J05AX12) enfuvirtide (J05AX07) maraviroc (J05AX09)	0.8 0.05 0.18 0.6	O

Sensory Organs (S)

ANTIMICROBIAL SUBGROUP (ATC pharmacological subgroup & chemical subgroup where relevant)	**AGENTS WITHIN CLASS** *(ATC chemical substance)*	**WHO defined daily dose (DDD)**	**Route**
Ophthalmologicals (S01)			
Anti-infectives (S01A)			
1. Antibiotics* (S01AA)	amikacin (S01AA21) azithromycin (S01AA26) benzylpenicillin (S01AA14) cefuroxime (S01AA27) chloramphenicol (S01AA01)	N/A N/A N/A N/A N/A	T T T T T
2. Antivirals (S01AD) 3. Fluroquinolones (S01AE) 4. Other anti-infectives (S01AX)	framycetin (S01AA07) gentamicin (S01AA11) natamycin (S01AA10) tetracycline (S01AA09) tobramycin (S01AA12) aciclovir (S01AD03) ganciclovir (S01AD09) trifluridine (S01AD02) ciprofloxacin (S01AE03) ofloxacin (S01AE01) propamidine (S01AX15)	N/A N/A N/A N/A N/A N/A N/A N/A N/A N/A	T T T T T T T T T T
Antiinflammatory agents and anti-infectives in combination (S01C)			
1. Corticosteroids and anti-infectives in combination (S01CA)	hydrocortisone and anti-infectives (S01CA03)	N/A	T
Otologicals (S02)			
Anti-infectives (S02A)			
1. Anti-infectives (S02AA)	acetic acid (S02AA10) chloramphenicol (S02AA01) ciprofloxacin (S02AA15)	N/A N/A N/A	T T T

Corticosteroids and anti-infectives in combination (S02C)			
1. Corticosteroids and anti-infectives in combination (S02CA)	dexamethasone and anti-infectives (S02CA06) flumetasone and anti-infectives (S02CA02) triamicinolone and anti-infectives (S02CA04)	N/A N/A N/A	T T T

* Other extemporaneously prepared antibiotic eye drops (e.g. cefazolin) are also collected by NAUSP

Dermatologicals (D)

ANTIMICROBIAL SUBGROUP (ATC pharmacological subgroup & chemical subgroup where relevant)	**AGENTS WITHIN CLASS** *(ATC chemical substance)*	**WHO defined daily dose (DDD)**	**Route**
Antifungals for dermatological use (D01)			
Antifungals for topical use (D01A)			
1. Antibiotics (D01AA)	nystatin (D01AA01)	N/A	T
2. Imidazole and triazole derivatives (D01AC)	bifonazole (D01AC10) bifonazole, combinations (D01AC60) clotrimazole (D01AC01) econazole (D01AC03) imidazoles/triazoles in combinations with corticosteroids (D01AC20) ketoconazole (D01AC08) miconazole (D01AC02) miconazole, combinations (D01AC52)	N/A N/A N/A N/A N/A N/A N/A N/A N/A	T T T T T T T T T
3. Other antifungals for topical use (D01AE)	amorolfine (D01AE16) ciclopirox (D01E14) selenium sulphide (D01E13) terbinafine (D01AE15) tolnaftate (D01AE18)	N/A N/A N/A N/A N/A	T T T T T
Antifungals for systemic use (D01B)			
1. Antifungals for systemic use (D01BA)	griseofulvin (D01BA01) terbinafine (D01BA02)	0.5 0.25	O O

Antibiotics and chemotherapeutics for dermatological use (D06)			
Antibiotics for topical use (D06A)			
1. Other antibiotics for topical use (D06AX)	fusidic acid (D06AX01) neomycin (D06AX04) mupirocin (D01AX09)	N/A N/A N/A	T T T
Chemotherapeutics for topical use (D06B)			
1. Sulfonamides (D06BA)	mafenide (D06BA03) silver sulfadiazine (D06BA01) sulfathiazole (D06BA02)	N/A N/A N/A	T T T
2. Antivirals (D06BB)	 aciclovir (D06BB03) idoxuridine (D06BB01)	N/A N/A N/A	T T T
3. Other chemotherapeutics (D06BX)	penciclovir (D06BB06) metronidazole (D06BX01)	N/A	T
Anti-acne preparations (D10)			
Anti-acne preparations for topical use (D10A)			
1. Anti-infectives for treatment of acne (D10AF)	clindamycin (D10AF01) erythromycin (D10AF02)	N/A N/A	T T

Alimentary tract and metabolism (A)

ANTIMICROBIAL SUBGROUP (ATC pharmacological subgroup & chemical subgroup where relevant)	**AGENTS WITHIN CLASS** *(ATC chemical substance)*	**WHO defined daily dose (DDD)**	**Route**
Stomatological preparations (A01)			
Stomatological preparations (A01A)			
1. Anti-infectives and antiseptics for local oral treatment (A01AB)	amphotericin B (A01AB04) miconazole (A01AB09)	0.04 0.2	O O
Drugs for acid related disorders (A02)			
Drugs for peptic ulcer and gastro-oesophageal reflux disease (GORD) (A02B)			
1. Combinations for eradication of Helicobacter pylori (A02BD)	esomeprazole, amoxicillin and clarithromycin (A02BD06)	N/A	O

Antidiarrheals, intestinal anti-inflammatory/anti-infective agents (A07)			
Intestinal anti-infectives (A07A)			
1. Antibiotics (A07AA)	fidaxomicin (A07AA12) nystatin (A07AA02) rifaximin (A07AA11) vancomycin (A07AA09)	0.4 1.5 MU 0.6 2	O O O O

Antiparasitics products, insecticides and repellents (P)

ANTIMICROBIAL SUBGROUP (ATC pharmacological subgroup & chemical subgroup where relevant)	**AGENTS WITHIN CLASS** *(ATC chemical substance)*	**WHO defined daily dose (DDD)**	**Route**
Ectoparasiticides, including scabicides, insectisides and repellents (P)			
Ectoparasiticides, including scabicides (P03A)			
1. Pyrethines, including synthetic compounds (P03AC)	bioallethrin, combinations (P03AC52) permethrin (P03AC04) pyrethrum, combinations (P03AC51)	N/A N/A N/A	T T T
2. Other ectoparasiticides, including scabicides (P03AX)	benzyl alcohol (P03AX06) benzyl benzoate (P03AX01) crotamition (N/A) dimeticone (P03AX05) isopropyl myristate (N/A) malathion (P03AX03)	N/A N/A N/A N/A N/A N/A	T T T T T T
Agents against amoebiasis and other protozoal diseases (P01A)			
1. Nitroimidazole derivatives (P01AB)	metronidazole (P01AB01) tinidazole (P01AB02)	2 2	O, R O
2. Other agents against amoebiasis and other protozoal diseases (P01AX)	atovaquone (P01AX06) nitazoxanide (P01AX11)	2.25 1	O O

Genito-urinary system and sex hormones (G)

ANTIMICROBIAL SUBGROUP (ATC pharmacological subgroup & chemical subgroup where relevant)	**AGENTS WITHIN CLASS** *(ATC chemical substance)*	**WHO defined daily dose (DDD)**	**Route**
Gynecological anti-infectives and antiseptics (G01)			
Anti-infectives and antiseptics excluding combinations with corticosteroids (G01A)			
1. Antibiotics (G01AA)	clindamycin	0.1	V
	(G01AA10) nystatin (G01AA01)	0.1 MU	V
2. Imidazole derivatives (G01AF)		0.1	V
	clotrimazole (G01AF02)	0.5	V
	metronidazole (G01AF01)	0.1	V
	miconazole (G01AF04)		

Glossary

antibacterial agent	A specific agent with activity against bacteria
AIR	Antimicrobial Importance Rating
antibacterial	Chemical substances that inhibit the growth of, or destroy, bacteria
antimicrobial	Chemical substances that inhibit the growth of, or destroy, bacteria, fungi, viruses or parasites
AMS	antimicrobial stewardship
AMR	antimicrobial resistance
ARCC	Access, Review, Curb, Contain
AURA	Antimicrobial Use and Resistance in Australia
Category	Refers specifically to the ARCC categories
CIA	Critically Important Antimicrobial
Class	A specific class of antibacterial, for example, anti-staphylococcal penicillins (refer to the Antimicrobial Importance Rating classes)
Directed treatment	Treatment for an infection where the pathogen has been identified. Generally this will include the performance of antimicrobial susceptibility testing for the pathogen identified or laboratory recommendations for therapies that constitute reliable treatment such as metronidazole for anaerobic infections.
EML	Essential Medicines List
HAI	Healthcare-associated infection
NAPS	National Antimicrobial Prescribing Survey
NAUSP	National Antimicrobial Utilisation Surveillance Program
PAL	Priority Antibacterial List
WHO	World Health Organization

References

1. Australian Government Department of Health. Responding to the threat of antimicrobial resistance: Australia's First National Antimicrobial Resistance Strategy 2015–2019. Canberra: Australian Government; 2015. https://www.amr.gov.au/resources/national-amr-strategy
2. Australian Government Department of Health AGDoAaWR. Implementation plan: Australia's first National Antimicrobial Resistance Strategy 2015–2019. Canberra: Australian Government Department of Health; 2016.
3. World Health Organization. Global action plan on antimicrobial resistance. Geneva: WHO; 2015. https://www.who.int/antimicrobial-resistance/publications/global-action-plan/en/
4. United Nations. Political declaration of the high-level meeting of the General Assembly on antimicrobial resistance. New York: United Nations General Assembly; 2016.
5. Australian Commission on Safety and Quality in Health Care. AURA 2019: third Australian report on antimicrobial use and resistance in human health. Sydney: ACSQHC; 2019. https://www.safetyandquality.gov.au/sites/default/files/2019-06/AURA-2019-Report.pdf
6. Australian Commission on Safety and Quality in Health Care. AURA 2017: Second Australian report on antimicrobial use and resistance in human health. Sydney: ACSQHC; 2017. https://www.safetyandquality.gov.au/sites/default/files/2019-05/aura-2017-second-australian-report-on-antimicrobial-use-and-resistance-in-human-health.pdf
7. National Antimicrobial Prescribing Survey. National Antimicrobial Prescribing Survey 2019. Available from: https://www.naps.org.au/Default.aspx.
8. Australian Commission on Safety and Quality in Health Care. Hospital Antimicrobial Use Sydney: ACSQHC; 2019. Available from: https://www.safetyandquality.gov.au/our-work/antimicrobial-resistance/antimicrobial-use-and-resistance-australia-surveillance-system-aura/hospital-antimicrobial-use.
9. World Health Organization. WHO Model Lists of Essential Medicines 2019. Available from: https://www.who.int/medicines/publications/essentialmedicines/en/.
10. Australian Government Department of Health. Importance Ratings and Summary of Antibacterial Uses in Human and Animal Health in Australia. Office of Health Protection. Canberra. 2018.
11. World Health Organization. Critically Important Antimicrobials for Human Medicine: Categorization for the Development of Risk Management Strategies to contain Antimicrobial Resistance due to Non-Human Antimicrobial Use. Switzerland; 2007. https://apps.who.int/iris/bitstream/handle/10665/43765/9789241595742_eng.pdf?sequence=1
12. World Health Organization. Executive Summary: The Selection and Use of Essential Medicines. Geneva: WHO; 2017. https://www.who.int/medicines/publications/essentialmedicines/EML_2017_ExecutiveSummary.pdf
13. Budd E, Sharland M, Hand K, Howard P, Wilson P, Wilcox M.H, et al. Adaptation of the WHO essential medicines list for national antibiotic stewardship policy. Madrid, Spain: ECCMID; 2018. https://www.escmid.org/escmid_publications/escmid_elibrary/material/?mid=63572
14. Australian Commission on Safety and Quality in Health Care. Antimicrobial Stewardship in Australian Health Care 2018. Sydney: ACSQHC; 2018. https://www.safetyandquality.gov.au/our-work/antimicrobial-stewardship/antimicrobial-stewardship-australian-health-care-2018
15. Australian Commission on Safety and Quality in Health Care. National Quality Use of Medicines Indicators for Australian Hospitals: Indicator Summary. Sydney: ACSQHC; 2014. https://www.safetyandquality.gov.au/sites/default/files/migrated/SAQ186_National_QUM_Indicators_Summary_clientPRINT-D14-39599.pdf
16. Antibiotic Expert Groups. Theapeutic Guidelines: Antibiotic. Melbourne: Therapeutic Guidelines Limited; 2019.

17. Government of South Australia. Antimicrobial agents included in NAUSP reporting. SA Health; 2019.

AUSTRALIAN COMMISSION
ON SAFETY AND QUALITY IN HEALTH CARE

Level 5, 255 Elizabeth Street, Sydney NSW 2000
GPO Box 5480, Sydney NSW 2001

PHONE: (02) 9126 3600
FAX: (02) 9126 3613

@ACSQHC
safetyandquality.gov.au/