



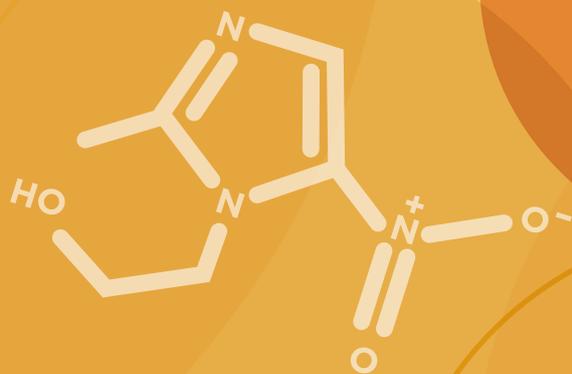
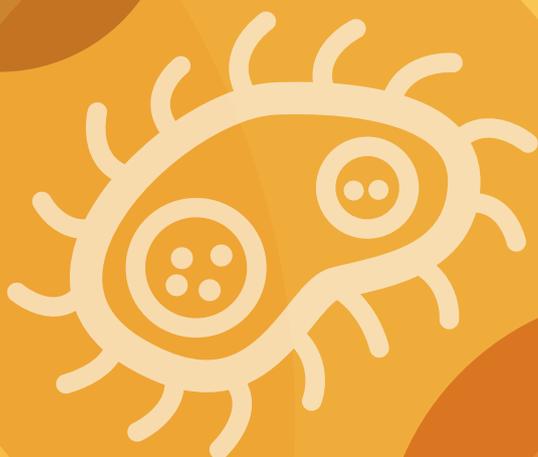
NCAS

National Centre for
Antimicrobial Stewardship

Antimicrobial prescribing practice in Australian hospitals

Results of the 2015 Hospital
National Antimicrobial
Prescribing Survey

December 2016



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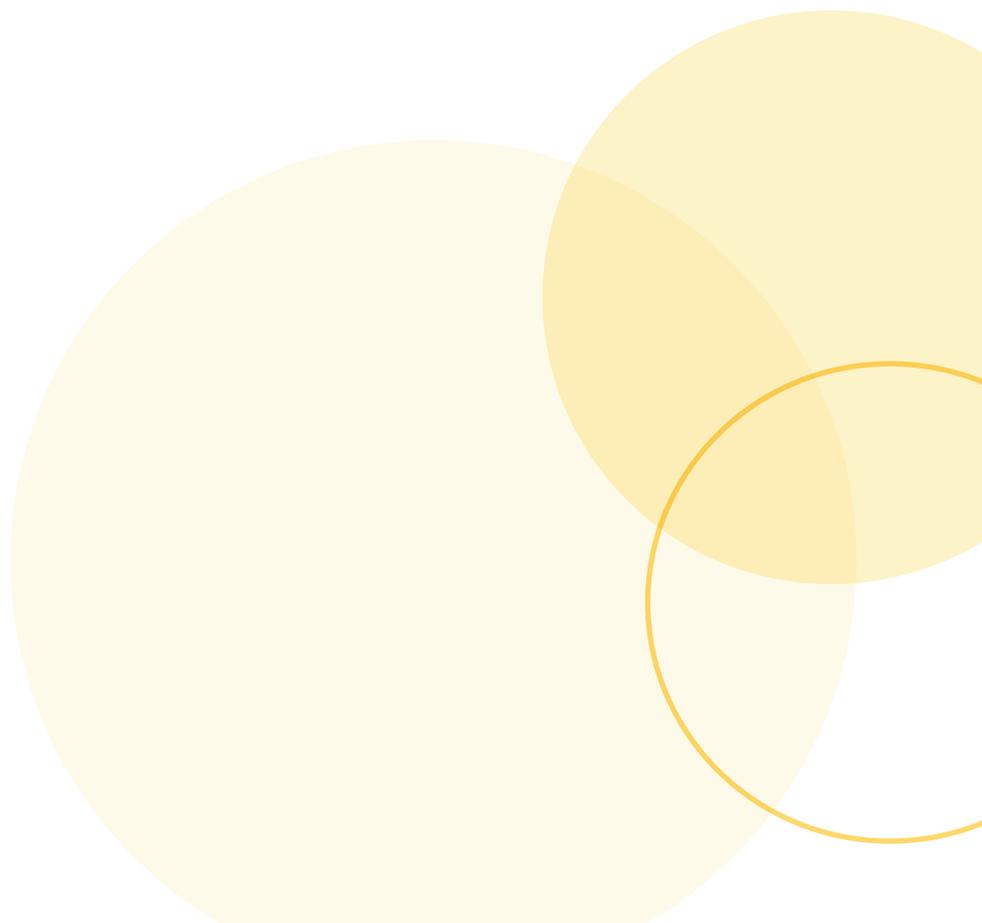
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Abbreviations

AMS	antimicrobial stewardship
COPD	chronic obstructive pulmonary disease
ICP	infection control practitioner
NAPS	National Antimicrobial Prescribing Survey
NCAS	National Centre for Antimicrobial Stewardship
PPS	point prevalence survey
PePS	period prevalence survey
sPPS	serial point prevalence survey

Executive summary

The National Antimicrobial Prescribing Survey (NAPS), which is conducted by the National Centre for Antimicrobial Stewardship (NCAS), is in its fourth year. NAPS has become an important tool for hospitals to support their local antimicrobial stewardship (AMS) programs, and to meet the requirements for accreditation against National Safety and Quality Health Service (NSQHS) Standard 3: Preventing and Controlling Healthcare Associated Infections. The NSQHS Standards were developed by the Australian Commission on Safety and Quality in Health Care (the Commission) to protect the public from harm, and to improve the quality of care provided by health service organisations through the implementation of quality assurance and quality improvement mechanisms.¹

NAPS is a component of the Antimicrobial Use and Resistance in Australia (AURA) Surveillance System, which the Commission established with funding provided by the Australian Government Department of Health. NAPS uniquely focuses on measuring the appropriateness of antimicrobial prescribing.

AURA and NAPS directly support a number of key objectives of Australia's first National Antimicrobial Resistance Strategy.² NAPS advances the appropriate and judicious use of antimicrobials by:

- facilitating effective audit and review of antimicrobial use, including compliance with prescribing guidelines and prescribing appropriateness
- facilitating effective communication about antimicrobial use and identifying key areas of concern

- supporting education and training of the workforce by informing local AMS programs
- providing flexible and useful benchmarking within hospitals across units and wards, and between hospitals and jurisdictions.

The uptake of the Hospital NAPS by Australian hospitals has continued to grow, with representation across all states and territories. In 2015, 83% of principal referral hospitals and 74% of large acute public hospitals participated in the survey. In the private hospitals, 50% of group A and 42% of group B hospitals participated. The greatest increases in participation occurred in inner and outer regional centres. Overall, there was a 13.3% increase in participation compared with the 2014 Hospital NAPS.

Each year, the Hospital NAPS is reviewed and modified to support the requirements of end users. For the 2015 survey, recommendations regarding survey methodology according to hospital size were included, together with documentation of review or stop date for antimicrobials as a new key indicator.

The 2015 data from 281 hospitals (213 public and 68 private) and 22 021 prescriptions shows similar results to the 2013 and 2014 Hospital NAPS. Analysis of all prescriptions showed that documentation of indication remained steady at 72.5%, noncompliance with guidelines was 23.3%, and inappropriateness of prescribing was 21.9%. The addition of 'review or stop date' as a new indicator revealed very low levels of documentation (35.5%), identifying this as an area for future improvement.

In 2015, there was a reduction in the proportion of surgical prophylaxis prescriptions continuing beyond 24 hours (27.4% in 2015, compared with 35.9% in 2014). However, it is unclear whether this is due to changes in the characteristics of participating hospitals or to real improvement across all facilities.

The most common indications for prescribing antimicrobials were surgical prophylaxis (15.5%), community-acquired pneumonia (10.5%), medical



1 Australian Commission on Safety and Quality in Health Care. National Safety and Quality Health Service Standards. Sydney: ACSQHC, 2012.

2 Commonwealth of Australia. Responding to the threat of antimicrobial resistance: Australia's first National Antimicrobial Resistance Strategy 2015–2019. Canberra: Commonwealth of Australia, 2015.

prophylaxis (7.6%), sepsis (5.7%) and urinary tract infection (5.0%). Some specific observations included high levels of prescribing for surgical prophylaxis, exacerbations of chronic obstructive pulmonary disease and asthma, and bronchitis.

The most common antimicrobials prescribed were cefazolin, ceftriaxone, metronidazole, amoxicillin-clavulanate and piperacillin-tazobactam. The appropriateness of prescribing for these five antimicrobials ranged from 65.1% to 77.6% in 2015, a slight increase from the 2014 Hospital NAPS scores of 63.1% to 76.9%. The high rates of inappropriate prescribing of cephalexin (39.2%) remain a concern. Most inappropriate use of cephalexin occurred in surgical prophylaxis, urinary tract infections and pneumonia.

Feedback on the 2015 Hospital NAPS was positive. Participants reported that yearly participation formed an integral part of their AMS programs, and that they appreciated the support and educational sessions provided by the NAPS team. Many participants also reported that their facility's NAPS results were presented to high-level AMS, medical advisory, and drug and therapeutic governance committees. NAPS results were used to design local education programs, support hospital accreditation and improve the standard of clinical care.

The professional breakdown of auditors included pharmacists (61.1%), nurses and infection control practitioners (19.9% combined), and doctors (13.3%). There was a substantial difference in auditor profession between public and private hospitals, with the majority of auditors in private hospitals being nurses and infection control practitioners (51.2%).

The NCAS and the Commission are committed to supporting strategies to enhance AMS in Australia. With support from the Commission, the NCAS has expanded NAPS audits to include residential aged-care facilities and multipurpose services, and surgical prophylaxis.

The results of the Aged Care NAPS pilot³ highlighted key areas for quality improvement, including prolonged durations of therapy, and poor documentation.

Findings from each NAPS module help to strengthen AMS programs by building competencies, increasing awareness of appropriate prescribing and guidelines, informing education and targeted quality improvement, and monitoring performance over time.

I loved this audit. I really appreciated the timeliness in which I could access expert opinion and felt supported in conducting the audit. Local medical officers appreciated the audit and feedback, which we turned into an education session. Very beneficial all round!

- regional hospital ICP



3 National Centre for Antimicrobial Stewardship, and Australian Commission on Safety and Quality in Health Care. Antimicrobial prescribing and infections in Australian residential aged care facilities: results of the 2015 Aged Care National Antimicrobial Prescribing Survey pilot. Sydney: ACSQHC, 2016.

Background

Antimicrobial resistance is a major public health concern, contributing to poor patient outcomes, morbidity, mortality and substantial costs to the healthcare system. The September 2016 United Nations declaration on antimicrobial resistance reinforces the World Health Organization's Global Action Plan on Antimicrobial Resistance. Australia, as a signatory to the United Nations declaration, is well placed to contribute effectively to the global response through implementation of its first National Antimicrobial Resistance Strategy 2015–2019.⁴ Surveillance programs such as the National Antimicrobial Prescribing Survey (NAPS) support improved understanding of the use of antimicrobial medicines in hospitals and raise awareness among health professionals about how to prevent antimicrobial-resistant infections.

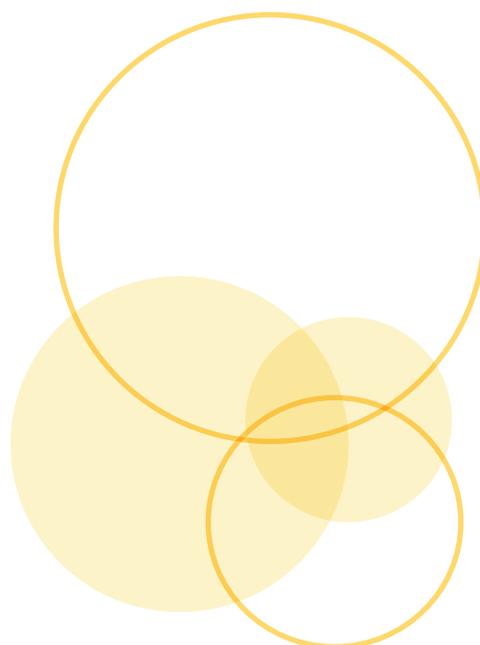
The development and implementation of NAPS has been an ongoing collaboration between the National Centre for Antimicrobial Stewardship (NCAS) and the Australian Commission on Safety and Quality in Health Care (the Commission). NAPS is developed and administered by the Guidance Group at Melbourne Health. The data derived from the Hospital NAPS and Aged Care NAPS modules has significantly contributed to the Commission's Antimicrobial Usage and Resistance in Australia (AURA) Surveillance System. The AURA Surveillance System plays a pivotal role in informing local, jurisdictional and national policy, and in the development of strategies to prevent and contain antimicrobial resistance in Australia.

In 2015, the Australian Government released Australia's first National Antimicrobial Resistance Strategy 2015–2019, which outlines a framework to address antimicrobial resistance using an integrated and coordinated One Health approach.⁵ NAPS supports achievement of the objectives of the national strategy through education and training of the healthcare workforce, and facilitating antimicrobial audit and review to enable implementation of antimicrobial stewardship (AMS)

practices that improve the appropriate and judicious use of antimicrobials.

NAPS delivers insights into the appropriateness of antimicrobial prescribing at both a local and national level. Since the launch of the web-based survey in 2013, NAPS has diversified and grown into a program that supports effective AMS across Australian hospital and aged-care settings. The data available from each NAPS module, especially the Hospital NAPS, has contributed to local, jurisdictional and national antimicrobial prescribing strategies to improve the quality of antimicrobial prescribing and care delivered to patients. To investigate prescribing practices for surgical prophylaxis, and the impact of compliance on surgical site infections and patient outcomes, the Surgical NAPS module pilot was launched in July 2016. As well, the development and successful implementation of the Aged Care NAPS in 2015 provided Australia with valuable insights into the appropriateness of antimicrobial prescribing in residential aged-care facilities and multipurpose facilities.

The Hospital NAPS is the flagship survey of the NCAS. Participation has grown from 32 pilot sites (30 public and 2 private) in 2011, when the survey was paper based, to 281 hospitals (213 public and 68 private) in 2015. This report focuses on the results of the 2015 Hospital NAPS.



- 4 Commonwealth of Australia. Responding to the threat of antimicrobial resistance: Australia's first National Antimicrobial Resistance Strategy 2015–2019. Canberra: Commonwealth of Australia, 2015.
- 5 'One Health' refers to a coordinated, collaborative, multidisciplinary and cross-sectoral approach to the development of health strategies for people, animals and the environment.

Methods

Timing

The 2015 Hospital NAPS was launched in September 2015, and data collection closed in February 2016.

Hospitals were encouraged to conduct their survey before Antibiotic Awareness Week in November 2015, so that results would be available for discussion and education.

Recruitment

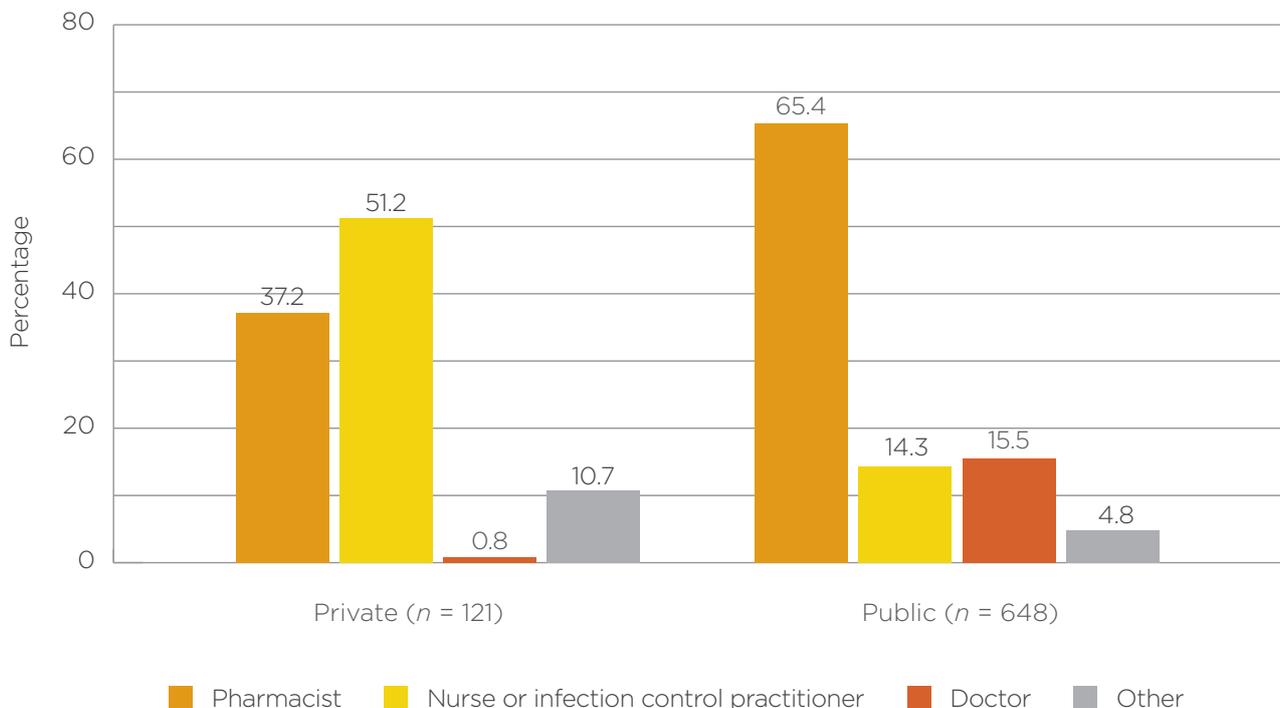
Approximately 900 individuals across 400 hospitals registered on the NAPS website were invited to participate in the 2015 Hospital NAPS. The Commission actively recruited hospitals, with a focus on increasing rural and remote representation. Further promotion occurred through tweets by the Commission and the NCAS throughout October and November 2015.

Auditors

The majority of auditors were pharmacists (61.1%), followed by nurses and infection control practitioners (ICPs; 19.9% combined), and doctors (13.3%). Similar to the 2014 Hospital NAPS, there was a substantial difference in auditor occupation between public and private hospitals (Figure 1). In private hospitals, nurses and ICPs comprised the majority of auditors (51.2%), and only one doctor was involved in the audit. In public hospitals, pharmacists were the leading auditors, followed by doctors, then nurses and ICPs.

Most auditors were pharmacists across all three remoteness classifications (regional, remote and very remote). A higher proportion of nurses and ICPs completed the Hospital NAPS in regional and remote hospitals than in metropolitan hospitals.

Figure 1 Occupation of auditors, by hospital funding type, 2015



Limitations in methodology

The results in this report should be interpreted in the context of the following limitations:

- **Sampling and selection bias:** The hospitals included were not a randomised sample because participation by healthcare facilities was voluntary. Hence, the results might not be representative of all Australian hospitals.
- **Comparison with previous surveys:** This report includes the results of the 2013, 2014 and 2015 Hospital NAPS. However, the ability to directly compare results with those from previous years is limited as a result of changes in inclusion criteria, methodology and distribution of participating hospitals. Additionally, a small number of hospitals used the 2014 methodology for the 2015 survey.
- **Patients may be counted multiple times:** For facilities that conducted a serial point prevalence survey, patients may be counted multiple times if they were still an inpatient on subsequent audit days. This may artificially inflate the prevalence of certain indications or antimicrobials that require longer durations of treatment.
- **Subjective nature of assessments:** Individual auditors at each participating facility were responsible for assessing the appropriateness of antimicrobial prescribing and compliance with guidelines. Remote expert assessments were conducted by the NAPS team on request. These assessments are not completely objective and involve some degree of interpretation.
- **Sample size:** Some indications for antimicrobials are uncommon; therefore, interpretation is difficult because of small numbers.

Modifications for the 2015 survey

Several modifications were made to the methods and data content of the 2015 survey. Users were notified of the changes through email, the NAPS website and online training sessions.

Revision of survey methodology

To improve the robustness of the 2015 Hospital NAPS data, to allow increased surveillance and benchmarking, revisions were made to the following areas of the NAPS methodology (see Table 1):

- Replacement of the period prevalence survey (PePS) with the serial point prevalence survey (sPPS). Feedback from 2013 and 2014 Hospital NAPS participants indicated the need for improved information about how to conduct a PePS, particularly about how to accurately report denominator information to estimate prevalence measures. The sPPS methodology allows hospitals to conduct repeated point prevalence surveys (PPSs) at regular intervals – for example, weekly or fortnightly – until they reach the minimum of 30 antimicrobial prescriptions. Since inpatients could be surveyed more than once using the PPS methodology, it was decided that only patients on the first audit day could be included in prevalence estimates.
- Provision of more detailed descriptions of how to conduct a randomised sample survey, including examples of randomisation strategies and suggestions for random number generator tools. This methodology was recommended for larger hospitals with more than 100 beds without the capacity to conduct a whole-hospital PPS.
- Provision of clearer instructions that directed surveys for targeted specialties, wards, antimicrobials or indications could not be included in national benchmarking. Instead, participants were provided with examples of how directed surveys could be used in conjunction with the results from the Hospital NAPS to more thoroughly investigate areas for improvement.

Table 1 Matrix in the NAPS user guide for study type, data use and recommended hospital size category

Study type	Data suitable for		
	Prevalence estimates	Appropriateness of prescribing	Recommended for
Point prevalence survey (preferred)	✓	✓	All hospitals if resources sufficient
Serial point prevalence survey	✓ (first day only)	✓ (if sufficient data collected, e.g. >30 prescriptions)	Smaller hospitals (e.g. <100 beds)
Random sampling point prevalence survey	✓ (if sampled appropriately across whole hospital)	✓	Only hospitals with ≥100 beds
Directed survey	X	✓	All hospitals, if required

Modifications to data set specifications

The data collection form for the 2015 Hospital NAPS is at Appendix 1.

The four major changes to the data collection form were as follows:

- **Review or stop date documented** was added as a key indicator, since this is now included in quality statement 6 of the Commission's Antimicrobial Stewardship Clinical Care Standard.⁶
- **Currently in ICU/NICU** (intensive care unit/neonatal intensive care unit) was added to enable better benchmarking and analysis of prescribing for ICU patients.
- **Renal replacement therapy** given within the previous 24 hours was added to prompt users to consider the effect of any renal replacement therapy (e.g. haemodialysis) when assessing dose appropriateness.
- **Indication does not require any antimicrobials** is a renaming of the previous 'antimicrobial not indicated' statement. The original intention of 'antimicrobial not indicated' was to cover situations where an antimicrobial was not required at all. Because some participants found this ambiguous, the statement was renamed to clarify its meaning.

Changes were also made to the online database, including:

- improvements to the reporting functionality, with new graphs and tables, and clearer rules about the displaying of benchmarking results
- changes to hospital peer group classifications to reflect the Australian Institute of Health and Welfare (AIHW) updated peer group classifications for private hospitals, released in 2015
- reducing the minimum number of hospitals required for benchmarking results to be displayed from seven to three; seven was considered too high, particularly for specialist hospitals or hospitals from smaller states and territories.

The 2014 AIHW Australian hospital peer group classification described in *Australian hospital statistics 2012–13*⁷ has been used for analysis of data submitted by public hospitals. The 2015 Australian hospital peer group classification described in *Australian hospital peer groups*⁸ has been used for analysis of data submitted by private hospitals.

The denominator for hospitals in each peer group is based on data supplied to the NCAS by the AIHW in January 2015.

6 Australian Commission on Safety and Quality in Health Care. Antimicrobial Stewardship Clinical Care Standard. Sydney: ACSQHC, 2014.

7 www.aihw.gov.au/WorkArea/DownloadAsset.aspx?id=60129547084
8 www.aihw.gov.au/WorkArea/DownloadAsset.aspx?id=60129553443

Support for auditors

The NAPS team provided email, telephone and online support to participating sites throughout the data collection period. Participants could attend a one-hour online training session, or a shortened refresher session for existing participants.

Expert assessments

An expert assessment service was provided by the NAPS team. Hospitals without access to infectious diseases specialists were offered assistance in the assessment of compliance and appropriateness. Other hospitals could request such assessment, if they felt it would improve the quality of the audit.

Development of templates to help hospitals communicate local survey results

A large number of regional, remote and private hospitals requested advice about the most effective method for presenting and sharing their 2015 Hospital NAPS results within their hospitals. A standardised reporting template and accompanying example report were developed as a guide, and additional links to useful presentations and posters were provided.

“
As a small private hospital with no infectious diseases medical staff, or access to any, to have NAPS staff able to review our hospital's data is a huge benefit and allows our results to have more credibility when reporting findings to visiting medical staff that admit to our hospital. – regional hospital ICP

Findings

Participation

A total of 300 hospitals submitted data during the data collection period. Because of methodological requirements for the 2015 survey, only hospitals that conducted whole-hospital audits (PPS, sPPS or randomised sample) were included in the analyses (Figure 2). Directed surveys and 'other' survey methodologies were excluded because of the potential for systematic bias.

Data submitted from 281 hospitals (213 public and 68 private) was therefore analysed and is presented in this report.

Overall, there has been an increase in participation each year since 2013 (Figure 3). The largest relative increase, of 64.2%, was seen between the 2013 survey (151 hospitals) and the 2014 survey (248 hospitals). A smaller relative increase, of 13.3%, was seen from 2014 to 2015.

State and Territory

All Australian states and territories were represented in the 2015 Hospital NAPS (Figure 4).

Peer group

Public hospitals

Approximately one in four public hospitals participated in the 2015 Hospital NAPS. There was representation from hospitals across all peer groups. Principal referral hospitals were well represented (82.8%), as were large acute (74.2%) and medium acute (62.2%) hospitals, and women's and children's hospitals (83.3%). Participation from small, very small and subacute hospitals was lower.

Details of participation of public and private hospitals according to their peer group can be found in Appendixes 2 and 3.

Figure 2 Number of participating hospitals (and contributing number of prescriptions) and reasons for exclusion from analysis, 2015

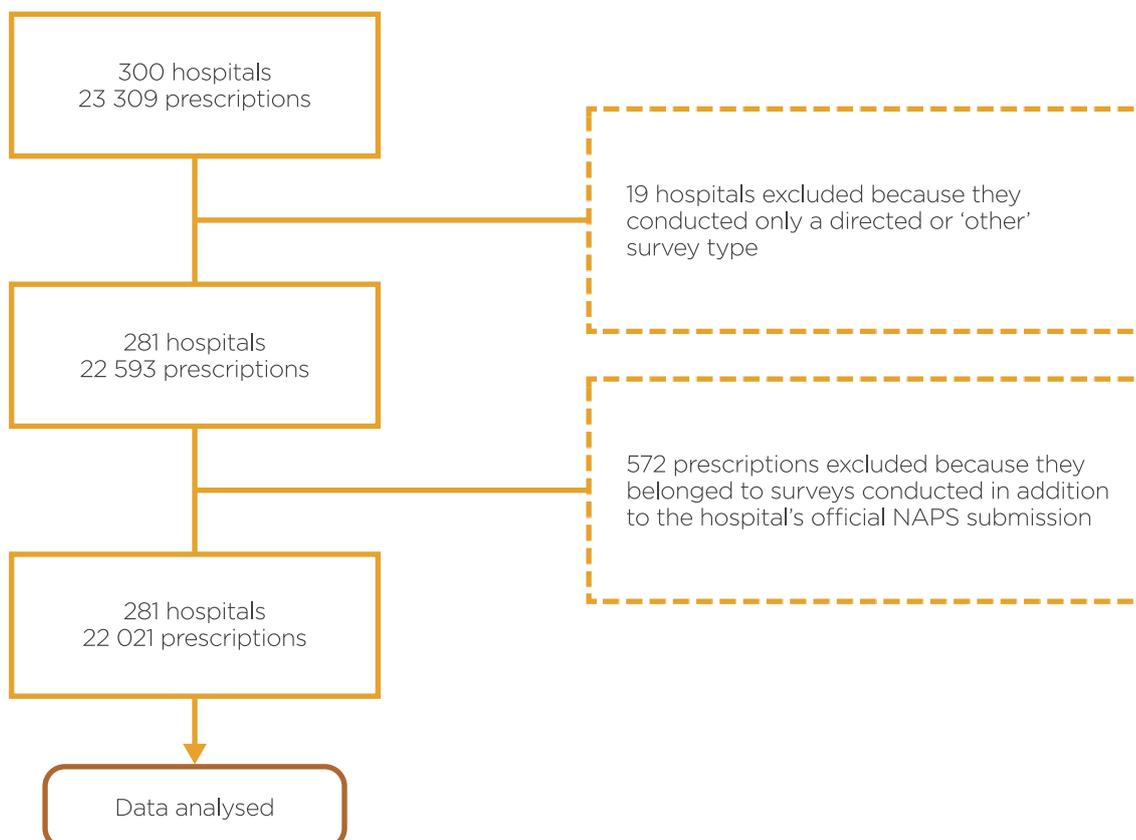


Figure 3 Number of participating hospitals, by funding type, 2013-15

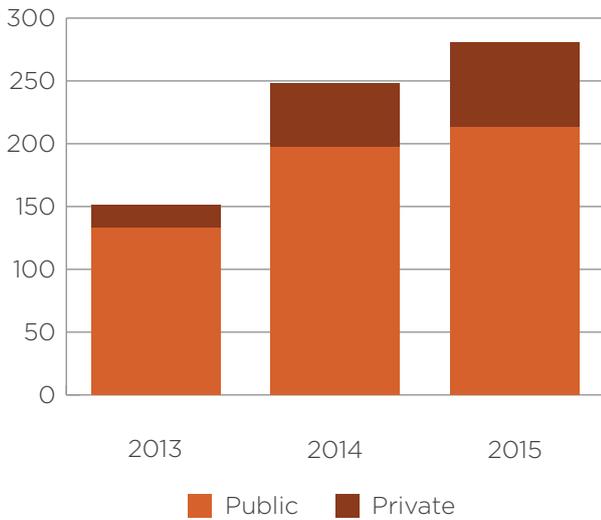
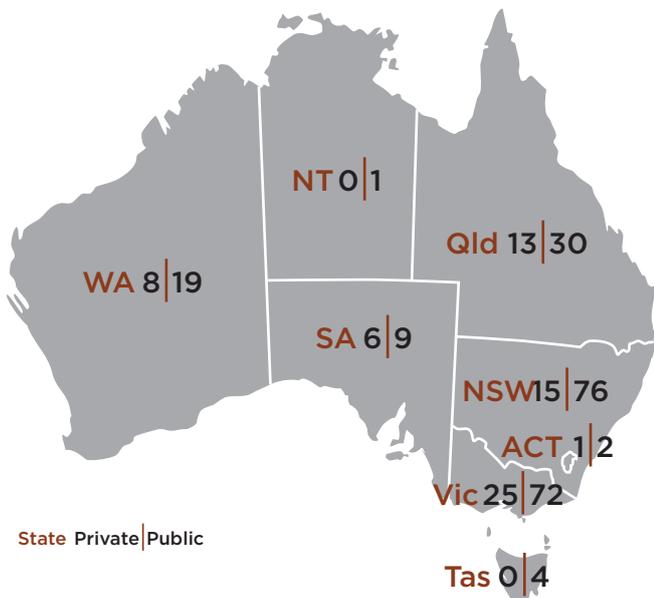


Figure 4 Number of private and public participating hospitals, by state or territory, 2015



Private hospitals

Overall, 13.2% of private hospitals participated in the survey, and 50% of private acute group A (large acute) hospitals participated. Lower rates of participation for private hospitals could be because approximately 50% of private hospitals are day procedure centres, and the Hospital NAPS is less relevant for these types of facilities.

Remoteness classification

Public hospitals

Participation by major city, inner and outer regional hospitals increased in the 2015 Hospital NAPS compared with 2014 (Table 2).

Figure 5 summarises changes in participation since 2013. The participation rate of major city public hospitals stabilised between 2014 and 2015. Participation by inner and outer regional hospitals continued to increase, and participation by remote and very remote hospitals remained small and relatively stable.

Private hospitals

Most participating private hospitals were in major city areas (Table 3); 13% of all major city private hospitals participated nationally. Participation rates were lower for inner and outer regional private hospitals. This information will be used in targeted recruitment to improve future participation rates and geographical representation.

Figure 5 Participation of public hospitals, as a percentage of the total number of public hospitals in each remoteness area, 2013-15

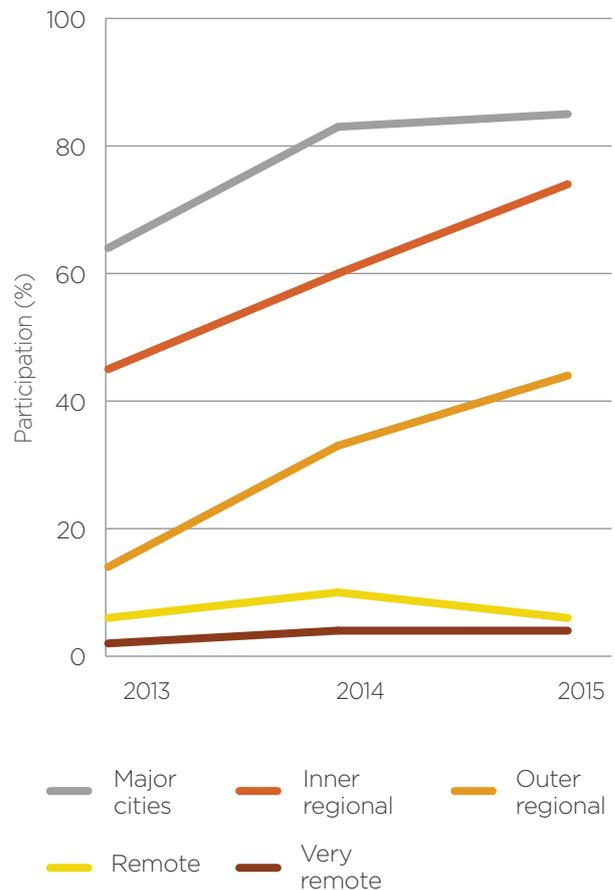


Table 2 Number of participating public hospitals, by remoteness classification, 2015

Remoteness classification	Number of participating hospitals	Total number nationally	Percentage of hospitals that participated	Percentage change from 2014
Major cities	85	176	47.8	+2.4
Inner regional	74	188	39.4	+23.3
Outer regional	44	227	19.4	+33.3
Remote	6	71	8.5	-40.0
Very remote	4	83	4.8	No change
Total	213	745	27.4	+12.1

Source: Australian Institute of Health and Welfare. Australian hospital statistics 2012–13. Canberra: AIHW, 2014.

Types of surveys performed and number of prescriptions

In total, 22 021 prescriptions were entered in the NAPS database for 14 389 patients for the 2015 Hospital NAPS.

More than 50% of the 22 021 antimicrobial prescriptions occurred in public principal referral and large acute hospitals. The full breakdown of the numbers of prescriptions entered according to hospital peer group is in Appendix 4.

Most hospitals conducted a whole-hospital PPS, followed by an sPPS and a randomised sample. A small number of hospitals used the previous PePS survey methodology, because local resourcing constraints meant that they were not able to wait to conduct their surveys until after the 2015 Hospital NAPS had been officially launched. Since PePS was a previously acceptable methodology, results for these hospitals have been included in the 2015 analyses.

Although half of all participating hospitals conducted a PPS, this methodology accounted for three-quarters of all prescriptions, indicating that hospitals that conducted a PPS had large patient numbers. In contrast, one-third of participating hospitals conducted a serial PPS, accounting for 15.5% of total prescriptions; these tended to be smaller facilities (Table 4).

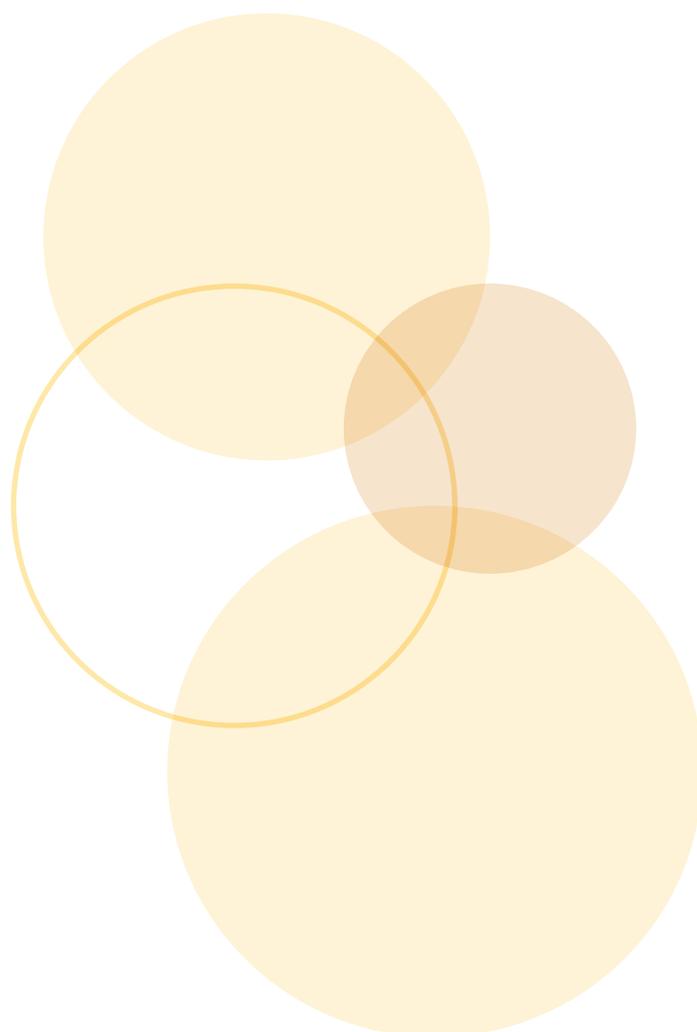


Table 3 Number of participating private hospitals, by remoteness classification, 2015

Remoteness classification	Number of participating hospitals	Total number nationally	Percentage of hospitals that participated
Major city	55	422	13.0
Inner regional	9	74	12.2
Outer regional	4	19	21.1
Total	68	515	13.2

Note: Before 2015, remoteness data was only available from the Australian Institute of Health and Welfare for public hospitals, not private hospitals. Hence, a comparison between 2014 and 2015 is not possible.

Source: Australian Institute of Health and Welfare. Australian hospital statistics 2012–13. Canberra: AIHW, 2014.

Table 4 Survey methodologies performed by participating hospitals, 2015

Methodology	Hospitals		Prescriptions	
	Number	Percentage	Number	Percentage
Hospital-wide point prevalence survey	154	54.8	16 382	74.4
Randomised sample	24	8.5	1 631	7.4
Serial point prevalence survey	96	34.2	3 409	15.5
Period prevalence survey	7	2.5	599	2.7
Total	281	100.0	22 021	100.0

Key indicators

The prevalence of antimicrobial use (i.e. the percentage of hospital inpatients receiving an antimicrobial on the Hospital NAPS audit day) is estimated to be 40.5%, based on data submitted from hospitals that conducted a PPS, an sPPS (only data from the first audit day are used) or a randomised survey.

Table 5 summarises the key indicators from the 2015 Hospital NAPS compared with the 2014 Hospital NAPS. In relation to compliance, 55.9% of prescriptions overall were compliant with guidelines. However, of those prescriptions where compliance was able to be assessed, 70.6% were compliant with guidelines.

In relation to appropriateness, 73.2% of all prescriptions were appropriate. Of those prescriptions where appropriateness was able to be assessed, 77.0% were appropriate.

Based on aggregate data, the results for most key indicators have remained stable across 2013, 2014 and 2015.

A more detailed breakdown of these results by state, peer group, remoteness and funding type can be found in Tables 6 and 7.

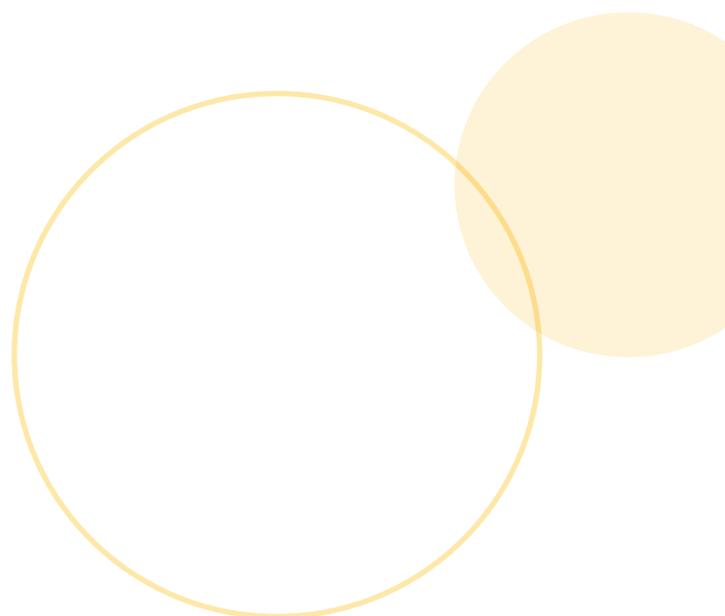


Table 5 Results for key Hospital NAPS indicators, 2013–15

Key indicator	Percentage of total prescriptions			Percentage change from 2014 to 2015		
	2013	2014	2015	Absolute change ^a	Relative change ^b	
Indication documented in medical notes (best practice >95%)	70.9	74.0	72.5	-1.5	-2.0	
Review or stop date documented (best practice >95%)	na	na	35.5	na	na	
Surgical prophylaxis given for >24 hours (best practice <5%) ^c	41.8	35.9	27.4	-8.5	-24.0	
Compliance with guidelines	Compliant with <i>Therapeutic Guidelines: Antibiotic</i> or local guidelines ^d	59.7 (72.2)	56.2 (73.7)	55.9 (70.6)	-0.3	-1.0
	Noncompliant ^d	23.0 (27.8)	24.3 (26.3)	23.3 (29.4)	-1.0	-4.0
	Directed therapy	na	10.4	12.4	2.0	19.0
	No guideline available	11.0	4.6	3.8	-0.8	-17.0
	Not assessable	6.3	4.5	4.7	0.2	4.0
Appropriateness	Appropriate (optimal and adequate) ^e	70.8 (75.6)	72.3 (75.9)	73.2 (77.0)	0.9	1.0
	Inappropriate (suboptimal and inadequate) ^e	22.9 (24.4)	23.0 (24.1)	21.9 (23.0)	-1.1	-5.0
	Not assessable	6.3	4.7	5.0	0.3	6.0

na = not applicable

a Figures represent the change between 2014 and 2015 (2015 percentage minus 2014 percentage).

b Figures represent the percentage change between 2014 and 2015 expressed as a percentage of the 2014 base year.

c Where surgical prophylaxis was selected as the indication (3404 prescriptions in 2015).

d Figures in brackets refer to prescriptions for which compliance was assessable (17 429 prescriptions in 2015). The denominator excludes antimicrobial prescriptions marked as 'directed therapy', 'not available' or 'not assessable'.

e Figures in brackets refer to prescriptions for which appropriateness was assessable (20 929 prescriptions in 2015). The denominator excludes antimicrobial prescriptions marked 'not assessable'.

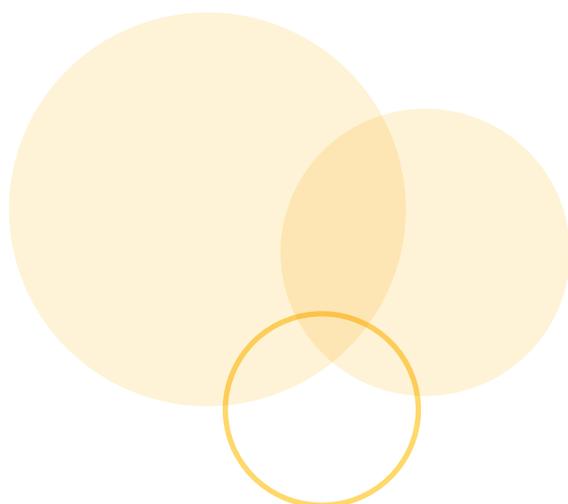


Table 6 Results for key indicators, by state or territory, remoteness, peer group and funding type, 2015

Key indicator		Number of hospitals	Number of prescriptions	Indication documented (%) ^a	Review or stop date documented (%) ^b	Surgical prophylaxis >24 hours (%) ^c
State or territory	NSW & ACT	94	7 539	75.7	33.7	36.6
	Qld & NT	44	3 078	69.0	31.1	35.3
	SA	15	1 654	77.6	36.4	24.1
	Tas	4	538	75.7	25.3	43.8
	Vic	97	6 740	70.3	39.0	19.9
	WA	27	2 472	68.8	37.4	21.7
Remoteness	Major cities	140	4 228	72.0	37.2	26.8
	Inner regional	83	15 300	73.8	32.2	26.1
	Outer regional	48	2 094	71.6	32.7	42.3
	Remote	6	255	80.8	25.7	No data
	Very remote	4	144	78.5	11.1	No data
Peer group (public hospitals only)	PR	24	6 483	75.6	32.2	39.2
	L	46	5 093	76.4	29.7	37.3
	M	28	1 428	79.7	35.6	23.2
	S	84	2 898	77.5	31.6	16.8
	VS	5	23	na ^d	na ^d	na ^d
	W	10	1 215	76.8	35.1	43.5
	N	13	291	74.9	45.7	na ^d
Ps, O	3	209	82.8	52.2	na ^d	
Funding type	Public	213	17 640	76.6	32.3	35.6
	Private	68	4 381	55.9	48.5	21.6
Combined national result		281	22 021	72.5	35.5	27.4

L = large acute hospitals; M = medium acute hospitals; N = mixed subacute and nonacute hospitals, and public rehabilitation hospitals; na = not applicable; O = other acute specialised hospitals and unpeered hospitals; PR = principal referral hospitals; Ps = psychiatric hospitals; S = small acute hospitals, including those with surgery and/or obstetrics; VS = very small hospitals; W = women's hospitals, children's hospitals, and women's and children's hospitals

a Percentage of prescriptions where an indication was documented.

b Percentage of prescriptions with a review or stop date documented.

c Where surgical prophylaxis was selected as the indication (3404 prescriptions).

d Results are not displayed if there are fewer than 30 prescriptions.

Table 7 Results for key indicators of compliance with guidelines and appropriateness, by state or territory, remoteness, peer group and funding type for all prescriptions (n = 22 021), 2015

Key indicator	Compliance with guidelines (%)						Appropriateness (%)		
	Compliant	Noncompliant	Directed therapy	Not available	Not assessable	Not assessable	Appropriate	Inappropriate	Not assessable
State or territory									
NSW & ACT	53.0	25.5	12.7	4.5	4.3	70.9	24.5	4.6	
Qld & NT	51.7	26.4	14.8	1.9	5.3	72.6	22.8	4.6	
SA	61.0	18.4	13.6	4.6	2.4	78.0	19.2	2.8	
Tas	56.3	22.1	11.2	5.0	5.4	73.8	21.8	4.5	
Vic	58.4	21.7	11.1	3.2	5.6	73.4	20.2	6.4	
WA	59.6	20.2	11.7	4.3	4.1	76.5	19.2	4.3	
Remoteness									
Major cities	56.1	21.5	13.4	4.5	4.5	73.6	21.7	4.8	
Inner regional	57.4	27.6	8.4	2.1	4.6	72.7	22.3	5.0	
Outer regional	50.8	26.7	14.3	2.2	5.9	70.8	22.9	6.3	
Remote	69.0	18.0	3.5	2.0	7.5	75.3	17.3	7.5	
Very remote	45.8	38.2	13.2	0.7	2.1	68.8	29.2	2.1	
Peer group (public hospitals only)									
PR	55.5	17.7	17.0	5.7	4.1	77.5	18.6	4.0	
L	51.9	27.4	11.7	4.3	4.9	70.7	24.3	5.0	
M	58.3	23.5	11.1	1.8	5.3	76.3	19.1	4.6	
S	59.0	27.5	7.2	1.6	4.7	72.5	22.0	5.5	
VS ^a	na	na	na	na	na	na	na	na	
W	66.7	13.0	11.1	6.6	2.6	82.9	15.6	1.6	
N	56.0	11.0	24.7	4.5	3.8	84.9	7.9	7.2	
Ps, O	70.3	17.2	8.1	1.0	3.4	73.7	22.5	3.8	
Funding type									
Public	56.2	22.1	12.3	4.3	4.4	75.0	20.5	4.5	
Private	54.7	27.7	10.1	1.6	5.8	65.6	27.4	7.0	
Combined national result	55.9	23.3	12.4	3.8	4.7	73.2	21.9	5.0	

L = large acute hospitals; M = medium acute hospitals; N = mixed subacute and nonacute hospitals, and public rehabilitation hospitals; na = not applicable; O = other acute specialised hospitals and unperpet hospitals; PR = principal referral hospitals; Ps = psychiatric hospitals; S = small acute hospitals, including those with surgery and/or obstetrics; VS = very small hospitals; W = women's hospitals, children's hospitals, and women's and children's hospitals
^a Results are not displayed if there are fewer than 30 prescriptions.

Documentation of indication

In the 2015 Hospital NAPS, documentation of indication improved for treatment indications (78.3% – 13 259 of 16 919) than prophylaxis indications (52.9% – 2161 of 3899). Documentation of indication was also better in public hospitals (76.6% – 13 509 of 17 640) than in private hospitals (55.9% – 2447 of 4381). However, all results remain below the best-practice target of more than 95%.

These differences were also observed in the results of the 2014 Hospital NAPS.

Documentation of review or stop date

Documentation of a review or stop date was included as a new key indicator for the 2015 Hospital NAPS. Currently, there is no known best-practice target for review or stop date documentation. However, the Antimicrobial Stewardship Clinical Care Standard⁹ recommends that all prescriptions have the intended duration and review plan documented in the patient's health record. Therefore, the decision was made to apply the best-practice target of more than 95%, for consistency with other benchmarks for appropriateness of antimicrobial prescribing. The results for this indicator were poor, with only about one-third (35.5%) of all prescriptions containing a review or stop date. This highlights documentation as a key area for future improvement across all hospital peer groups.

“By including all types of antimicrobial use, we are able to identify some areas that are not well captured by usual surveillance ... (this) allows us to show areas of practice that are not well covered by Therapeutic Guidelines, but are relevant at our institution. This tells us where a local guideline might be useful.” – metropolitan hospital pharmacist



9 Australian Commission on Safety and Quality in Health Care. Antimicrobial Stewardship Clinical Care Standard. Sydney: ACSQHC, 2014.

Surgical prophylaxis for more than 24 hours

Results from the 2015 Hospital NAPS showed that the proportion of surgical prophylaxis prescriptions extending for more than 24 hours declined to 27.4% in 2015, down from 35.9% in 2014 and 41.8% in 2013.

Figure 6 illustrates the gradual improvement in this indicator for both public and private hospitals since 2013. It is unclear whether this improvement is due to the increased number of participating hospitals, variations in casemix between public and private hospitals, or real improvement. The results for both hospital types fell well short of the best-practice target of less than 5%.

Compliance with guidelines

About one-quarter of prescriptions did not comply with guidelines (*Therapeutic Guidelines: Antibiotic* or local guidelines); this has remained fairly consistent since 2013. There appeared to be a slightly lower rate of noncompliance in public hospitals (22.1%) than in private hospitals (27.7%), and in major city hospitals (21.5%) than in regional (inner regional – 27.6%; outer regional – 26.7%) and very remote hospitals (38.2%). Noncompliance appeared to be lowest in remote hospitals (18.0%).

Public hospitals (4.3%) had a higher rate of prescriptions for which no guidelines were available than private hospitals (1.6%), possibly reflecting the greater complexity of patient casemix seen in public hospitals.

Appropriateness

About one in five antimicrobial prescriptions was deemed to be inappropriate from the 2015 Hospital NAPS. A greater proportion of private hospital prescriptions (27.4%) was assessed as being inappropriate than public hospital prescriptions (20.5%). Across all peer groups, appropriateness was highest for principal referral, medium acute, subacute, women's, children's, and women's and children's hospitals.

Interestingly, despite the reduction in the proportion of surgical prophylaxis prescriptions prescribed for longer than 24 hours, the rate of inappropriateness for surgical prophylaxis prescriptions has remained fairly steady across the three years (41.6% in 2013, 40.0% in 2014 and 40.5% in 2015). This indicates that there may be other reasons, not

yet identified, contributing to this sustained level of inappropriateness.

Most commonly prescribed antimicrobials

For both public and private hospitals, the five most commonly prescribed antimicrobials were consistent with findings from the 2013 and 2014 Hospital NAPS: (1) cefazolin, (2) ceftriaxone, (3) metronidazole, (4) amoxicillin–clavulanate and (5) piperacillin–tazobactam. Figure 7 shows the 20 most commonly prescribed antimicrobials from 2013 to 2015.

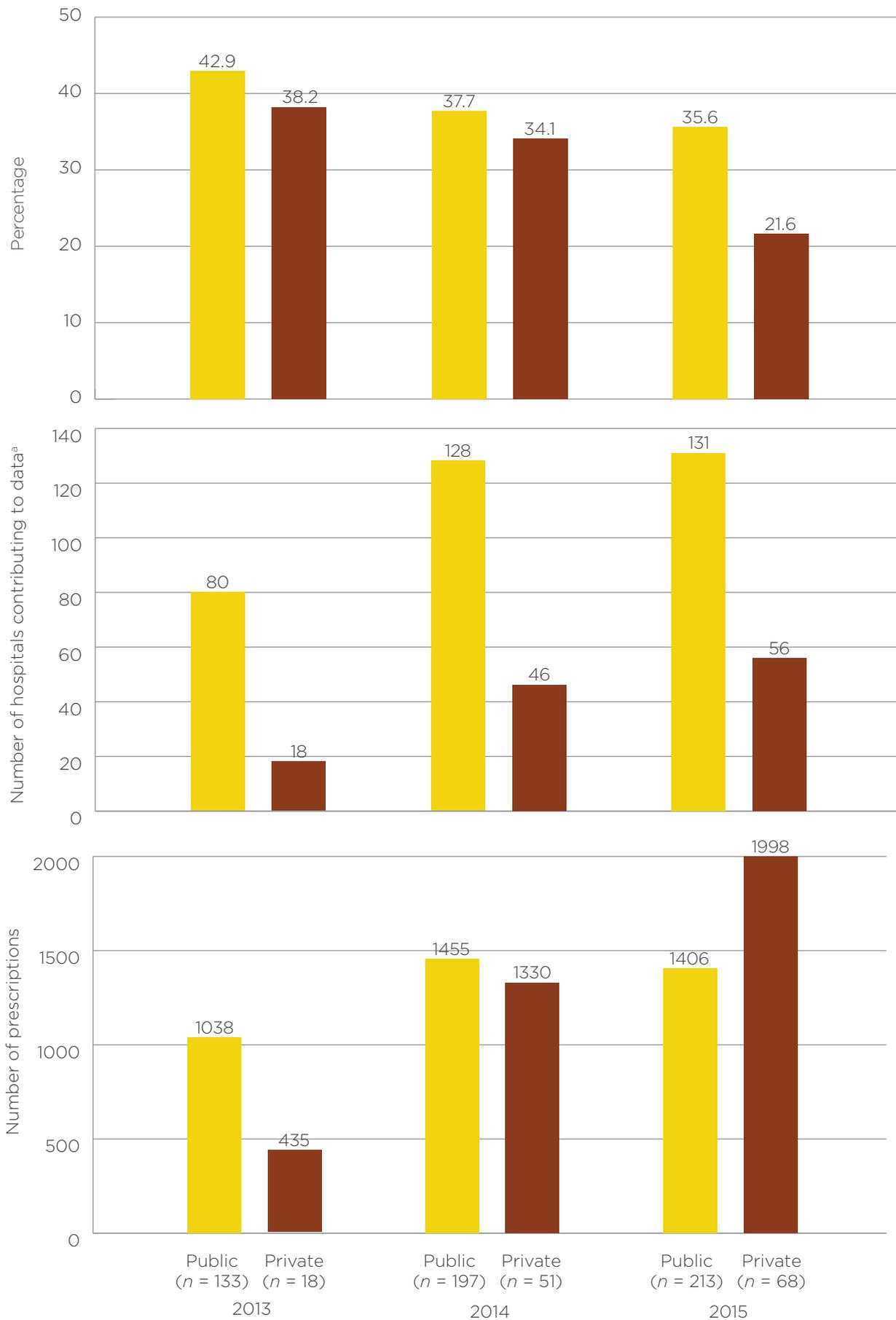
In private hospitals, cefazolin accounted for the largest proportion of antimicrobial prescriptions (33.1%), followed by ceftriaxone (6.8%), cephalexin (6.5%), piperacillin–tazobactam (5.0%) and metronidazole (4.8%). In public hospitals, ceftriaxone was the most commonly prescribed antimicrobial (9.5%), followed by cefazolin (8.7%), metronidazole (6.9%), amoxicillin–clavulanate (6.9%) and piperacillin–tazobactam (6.6%).

In major city hospitals, and inner and outer regional hospitals, ceftriaxone and cefazolin were consistently the top two antimicrobials prescribed. Flucloxacillin featured more prominently in very remote and remote hospitals; it was the most common antimicrobial in very remote hospitals (20.8%) and the second most common antimicrobial in remote hospitals (6.5%, after ceftriaxone). A possible explanation is that remote and very remote hospitals tend to see lower acuity patients, so that narrower spectrum antimicrobials are more commonly used.

Appropriateness for the 20 most commonly prescribed antimicrobials

Approximately two-thirds of cefazolin, ceftriaxone, metronidazole and amoxicillin–clavulanate prescriptions were assessed to be appropriate (Figure 8). Most of the inappropriate cefazolin prescriptions (82.2%) were for surgical prophylaxis, for which the most common reasons for inappropriate prescribing were incorrect duration and incorrect dose. Of the five most commonly prescribed antimicrobials, a higher proportion of prescriptions for piperacillin–tazobactam were appropriate (77.6%).

Figure 6 Surgical prophylaxis given for >24 hours, by hospital funding type, 2013-15



^a Number of hospitals that had at least one antimicrobial prescribed for surgical prophylaxis

Note: Results are shown as a percentage of all surgical prophylaxis prescriptions. The number of contributing hospitals is given in brackets.

Figure 7 The 20 most commonly prescribed antimicrobials as a percentage of all antimicrobials prescribed in Australian hospitals, 2013-15

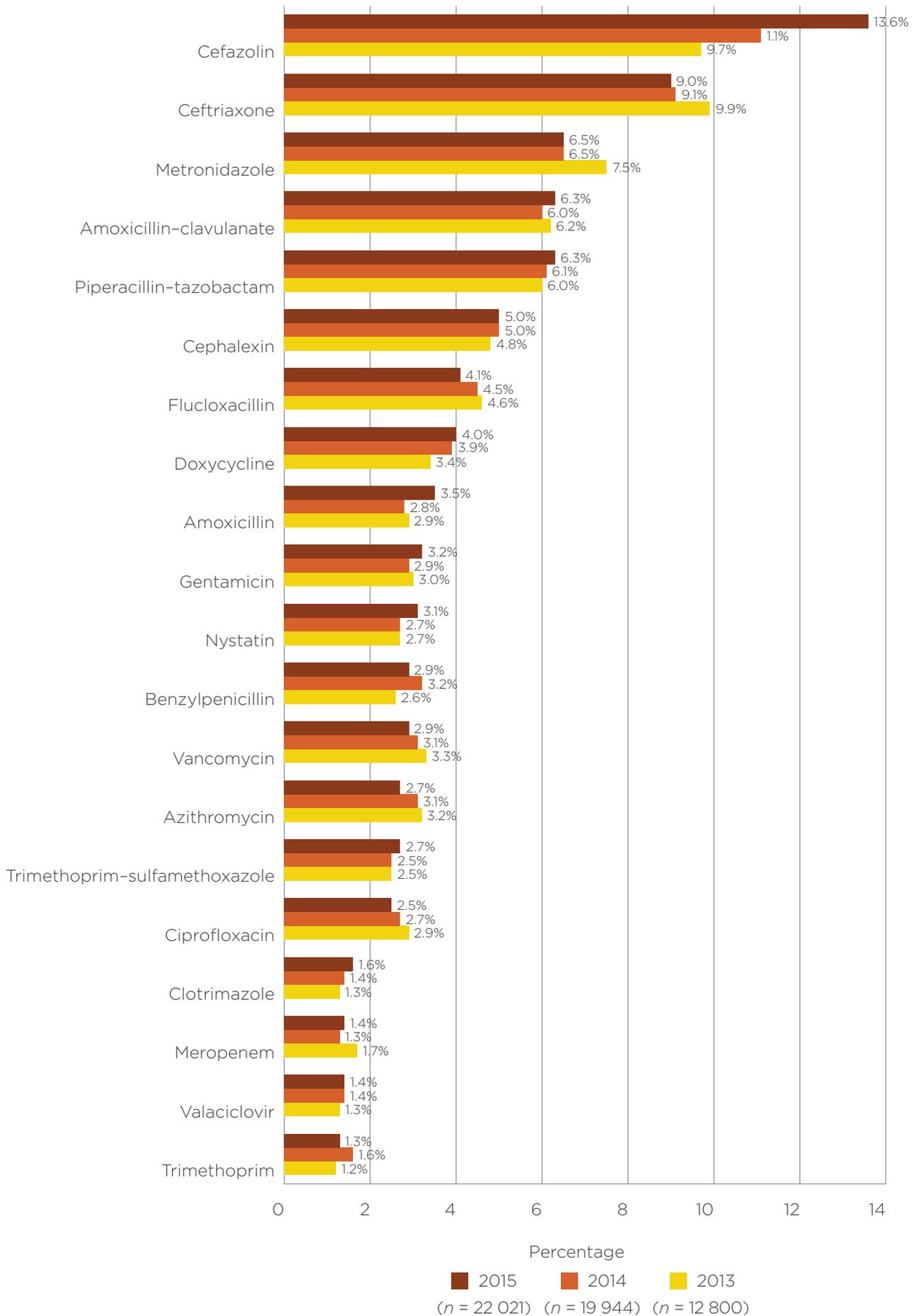
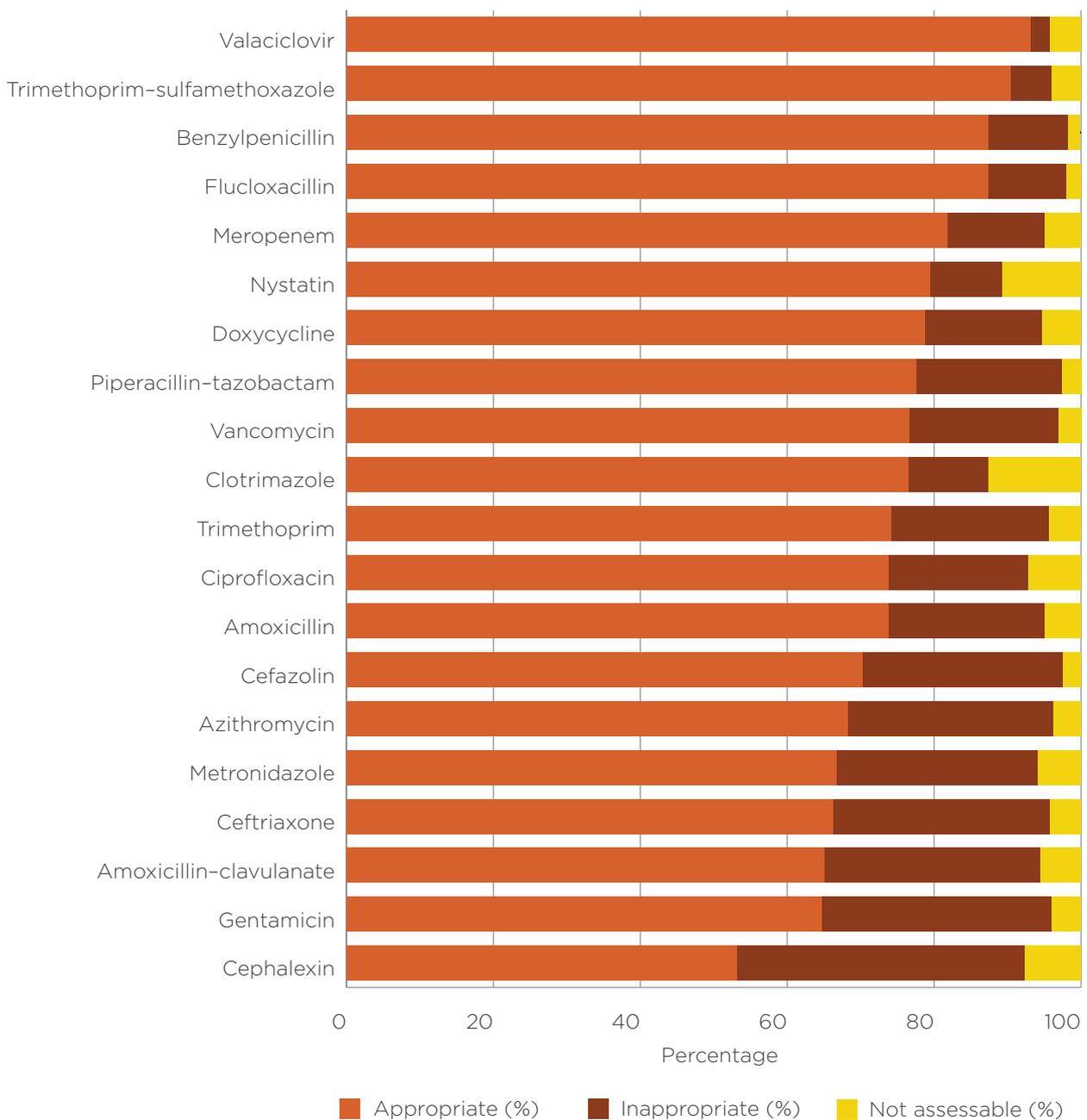


Figure 8 Appropriateness of prescribing for the top 20 most commonly prescribed antimicrobials in hospitals, 2015



In keeping with previous years' surveys, the narrow-spectrum antimicrobials tended to be well prescribed, with flucloxacillin, doxycycline and benzylpenicillin all having high rates of appropriateness. This indicates that, when narrow-spectrum agents are prescribed, they are suitable for the infection that they treat. Similarly, antimicrobials commonly used for medical prophylaxis (nystatin, trimethoprim-sulfamethoxazole and valaciclovir) were also well prescribed, because use of these agents for this purpose tends to be well defined in protocols for haematology, oncology and transplant patients.

Poorly prescribed antimicrobials

Consistent with the 2013 and 2014 Hospital NAPS results, cephalexin continued to be poorly prescribed, with approximately 40% of prescriptions being inappropriate. The most commonly cited reasons for inappropriate prescribing were the indication not requiring any antimicrobials (29.5%), incorrect duration (25.1%), incorrect dose or frequency (15.7%), and spectrum too narrow (13.6%).

Table 8 lists the indications associated with reasons for inappropriate prescribing of cephalexin. Incorrect dosage, incorrect duration and lack of need for cephalexin for the indication were commonly seen for surgical prophylaxis and urinary tract infection indications. Additionally, it appeared that many prescribers did not recognise cephalexin's inadequate cover for respiratory pathogens in community- and hospital-acquired pneumonia.

Gentamicin was poorly prescribed, with 31.2% of prescriptions being inappropriate – prescribing appeared to be poorer in private hospitals (58.5% inappropriate) than in public hospitals (20.2%). The most common reason for inappropriateness was incorrect dose (45.9%), followed by spectrum too broad (16.7%) and the indication not requiring any antimicrobials (16.2%).

Table 9 shows that surgical prophylaxis was the main indication for the gentamicin prescriptions deemed to have incorrect dosage.

Most common indications

The five most common indications were similar to those found in the 2014 Hospital NAPS (Figure 9). There has been a slight increase in the proportion of surgical prophylaxis prescriptions; this may be due to more private hospitals participating in the 2015 Hospital NAPS, since they are more likely to perform a higher volume of surgical procedures.

In public hospitals, community-acquired pneumonia (9.4%), medical prophylaxis (6.9%) and surgical prophylaxis (6.4%) were the most common indications for prescribing antimicrobials. In private hospitals, surgical prophylaxis was the most common indication (9.1%), followed by urinary tract infection (1.1%) and community-acquired pneumonia (1.1%).

Table 8 Common reasons for inappropriate prescribing of cephalexin, and associated common indications, in hospitals, 2015

Reason for inappropriateness	Number of prescriptions ^a	Common indications ^b
Indication did not require any antimicrobials	104	Surgical prophylaxis (62%), urinary tract infection (14%)
Incorrect duration	103	Surgical prophylaxis (64%), urinary tract infection (14%)
Incorrect dose or frequency	67	Surgical prophylaxis (28%), urinary tract infection (28%), cystitis (9%), cellulitis (7%)
Spectrum too narrow	56	Community-acquired pneumonia (25%), hospital-acquired pneumonia (9%), urinary tract infection (9%)

a There were 434 cephalexin prescriptions that were marked as inappropriate. For these, this table shows the most common reasons for inappropriateness and their associated numbers.

b Percentages are rounded to the nearest whole number. tract infection (1.1%) and community-acquired pneumonia (1.1%).

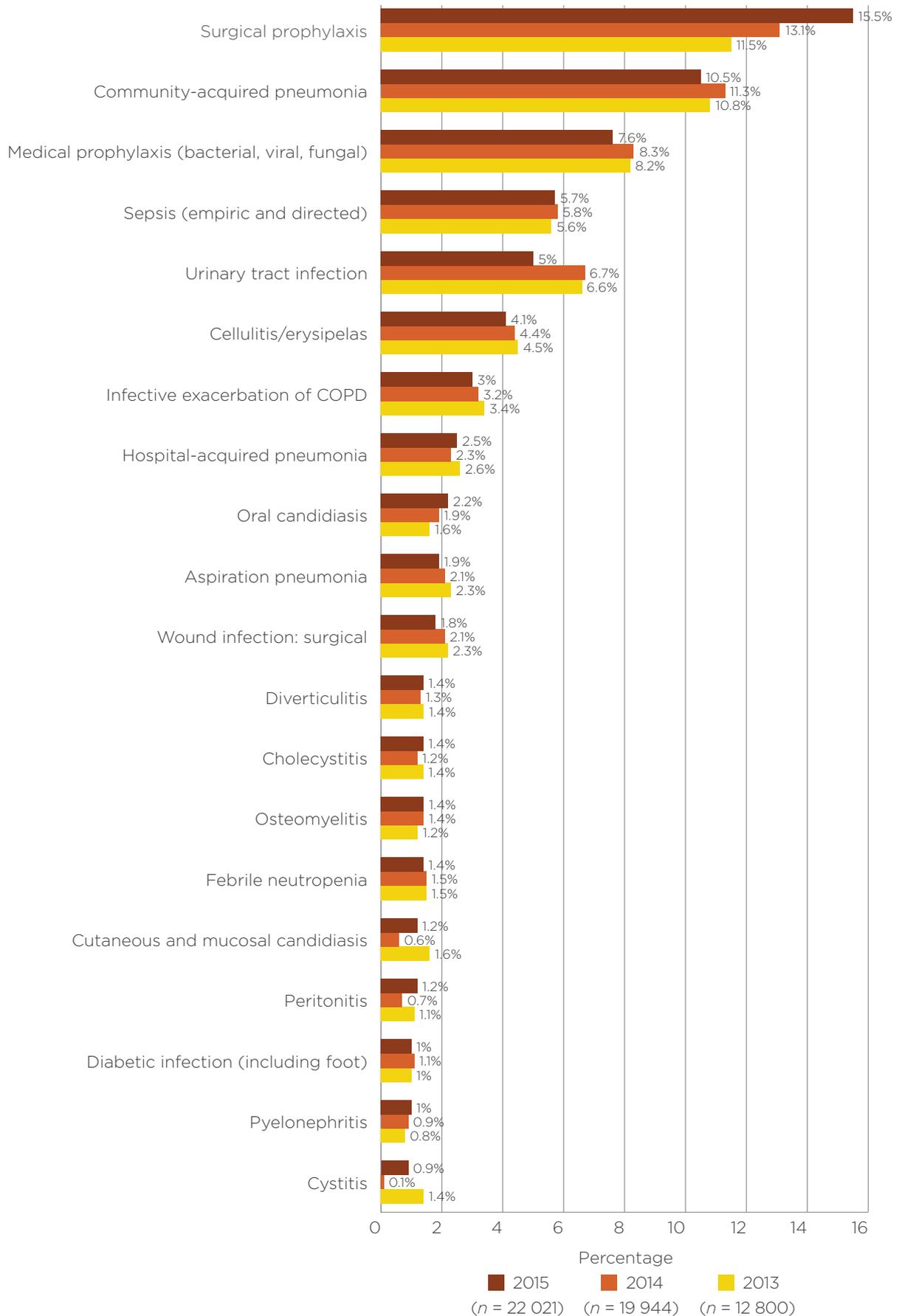
Table 9 Common reasons for inappropriate prescribing of gentamicin, and associated common indications, in hospitals, 2015

Reason for inappropriateness	Number of prescriptions ^a	Common indications ^b
Incorrect dose or frequency	97	Surgical prophylaxis (70%), sepsis (11%)
Spectrum too broad	30	Surgical prophylaxis (30%), urinary tract infection (20%)

a There were 222 gentamicin prescriptions that were marked as inappropriate. For these, this table shows the most common reasons for inappropriateness and their associated numbers.

b Percentages are rounded to the nearest whole number.

Figure 9 The 20 most common indications for prescribing antimicrobials in public and private hospitals, 2013-15



COPD = chronic obstructive pulmonary disease

Appropriateness of prescribing for the 20 most common indications

Of the 20 most common indications, surgical prophylaxis, infective exacerbation of chronic obstructive pulmonary disease (COPD) and cholecystitis were the conditions for which there were the highest proportions of inappropriate prescribing (Figure 10). In contrast, many of the other 20 indications had high rates of appropriateness, particularly medical prophylaxis, oral candidiasis and osteomyelitis.

Prophylaxis

Prophylaxis indications featured strongly in the 20 most common indications, with a combination of medical and surgical prophylaxis accounting for almost one-quarter (23.1%) of all antimicrobial prescriptions. Medical prophylaxis was well prescribed, with less than 10% of prescriptions deemed to be inappropriate; this is likely to reflect the use of protocols for medical prophylaxis for haematology, oncology and transplant patients.

In contrast, prescribing for surgical prophylaxis remains poor and does not appear to have improved from previous Hospital NAPS results. Approximately two in every five prescriptions for surgical prophylaxis were deemed to be inappropriate. The most commonly identified reasons for inappropriateness were incorrect duration (29.9%), incorrect dose (27.6%) and the procedure not requiring antimicrobials (22.0%).

Indications for which prescribing was most commonly assessed as inappropriate

Approximately one in five (21.9%) prescriptions were inappropriate. Of these, 53.8% were suboptimal and 46.2% inadequate (for definitions, refer to Appendix 5). The most common reasons for inappropriateness were spectrum too broad, indication not requiring any antimicrobials and incorrect dose (Table 10).

Table 11 shows the 20 indications for which prescribing was most commonly assessed to be inappropriate; surgical prophylaxis and respiratory tract exacerbations feature prominently in this list.

Respiratory tract infections

High rates of inappropriateness of prescribing were observed for a number of respiratory tract

infections. Rates of inappropriateness for infective exacerbation of COPD remained steady compared with 2014 (34.3% in 2015; 36.8% in 2014). They showed only a small decline for community-acquired pneumonia (24.4% in 2015; 25.0% in 2014). Rates of inappropriateness declined for bronchitis and exacerbations of asthma compared with 2014, but the numbers were low.

The most common reasons for inappropriate prescribing for these three conditions were spectrum too broad (49.8%) and the indication not requiring antimicrobials (15.5%).

Table 10 Most common reasons for inappropriate prescribing of antimicrobials in hospitals, as a percentage of all inappropriately prescribed antimicrobials, 2015^a

Reason	Yes (%)	No (%)	Not specified (%)
Indication does not require antimicrobials	19.6	54.4	26.0
Spectrum too narrow	8.1	61.3	30.6
Spectrum too broad	25.2	48.8	26.0
Incorrect duration	17.8	54.1	28.0
Incorrect dose	19.5	55.2	25.2
Incorrect route	4.8	63.9	31.4

^a n = 4823

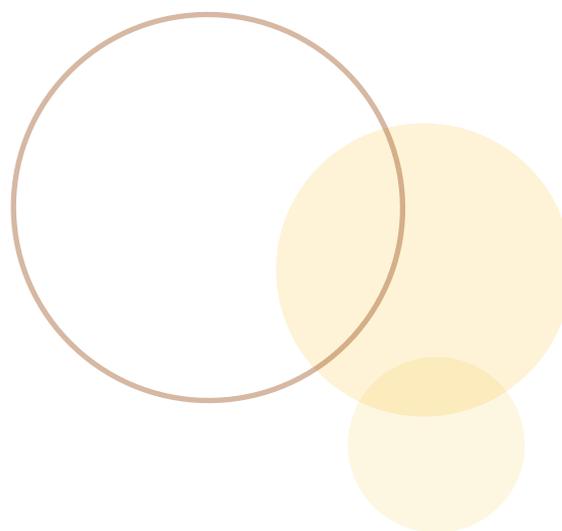
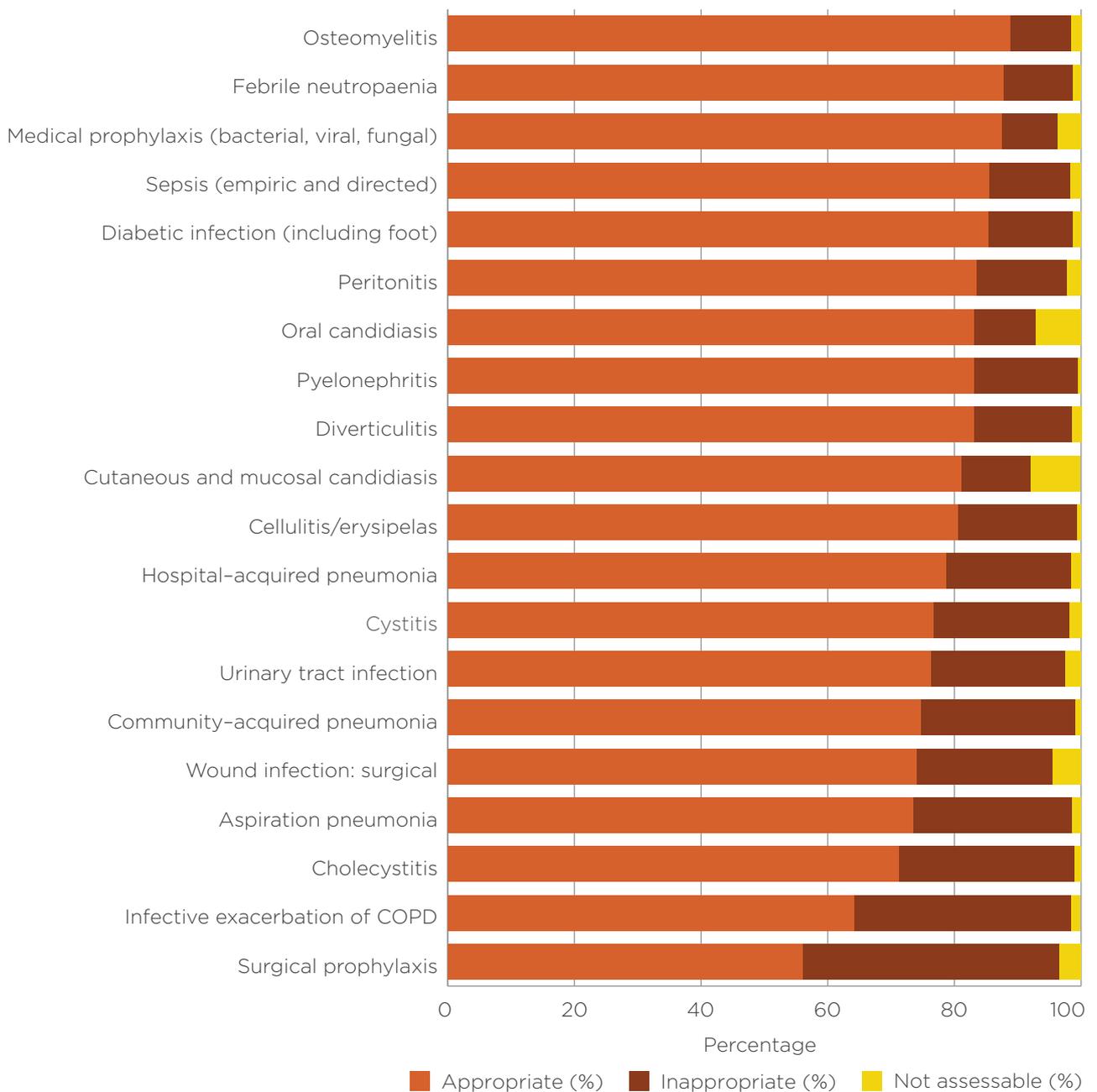


Figure 10 Appropriateness of antimicrobial prescribing in hospitals for the 20 most common indications, 2015



COPD = chronic obstructive pulmonary disease

Table 11 The 20 indications for which antimicrobials were most commonly prescribed inappropriately in hospitals, 2015^a

Indication	Number of prescriptions	Appropriate (%)	Inappropriate (%)	Not assessable (%)
Bronchitis	68	57	41	2
Surgical prophylaxis	3404	56.0	40.5	3.5
Infective exacerbation of asthma	75	60	37	3
Infective exacerbation of COPD	661	64.1	34.3	1.5
Fever/pyrexia of unknown origin	152	59	31	10
Pancreatitis	42	67	29	5
Abscess (includes quinsy)	35	71	29	0
Tonsillitis	39	67	28	5
Cholecystitis	309	71	28	1
Trauma (includes wound)	187	70	28	3
Colitis	36	64	28	8
Bronchiectasis	123	72	26	2
Aspiration pneumonia	408	74	25	2
Catheter-associated infection	69	70	25	6
Community-acquired pneumonia	2315	74.6	24.4	1.0
Premature rupture of membranes	30	77	23	0
Empyema	66	74	23	3
Abscess/boils/folliculitis	118	78	22	0
Wound infection: surgical	404	74	22	5
Cystitis	205	77	22	2

COPD = chronic obstructive pulmonary disease

^a Percentages have been rounded to the nearest whole number for indications where there were fewer than 500 prescriptions.

Compliance with guidelines for the 20 most common indications

Overall, 23.3% of prescriptions were deemed to be noncompliant with guidelines; of these, 29.0% were deemed to be appropriate. An example is where the antimicrobial dose or frequency does not fall within the recommended guidelines, but the antimicrobial is still determined to be a reasonable alternative (and therefore appropriate).

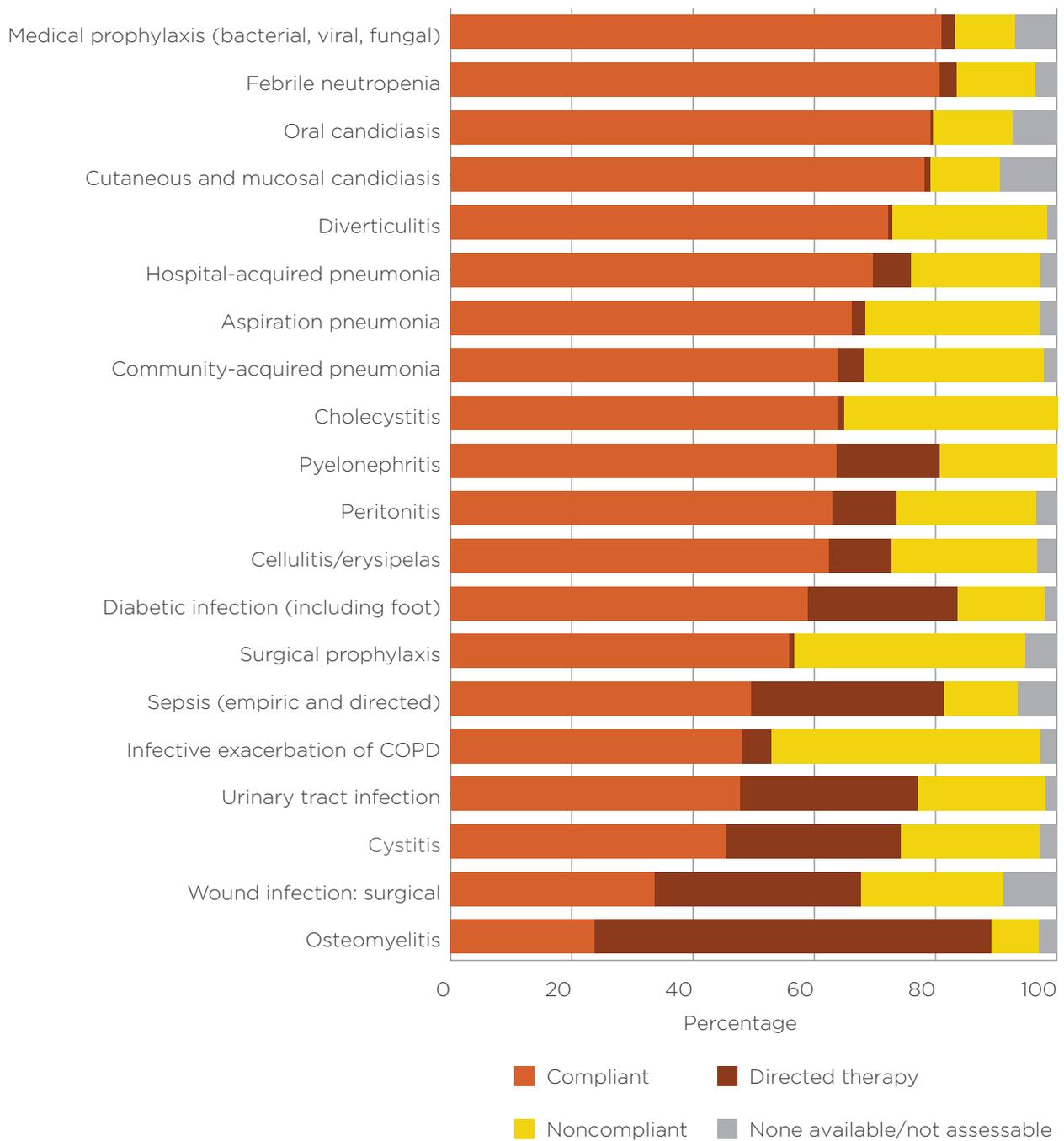
The most common reasons for noncompliance were spectrum too broad (26.4%), and incorrect dose or frequency (22.0%).

Figure 11 shows the level of compliance for the 20 most common indications. Indications with high levels of noncompliance were similar to those with

high levels of inappropriateness – namely, surgical prophylaxis, infective exacerbation of COPD and cholecystitis.

For some indications, a large proportion of prescriptions were directed therapy – that is, their use was guided by the availability of microbiology results. This was especially prominent for osteomyelitis treatment, surgical wound infections, sepsis and urinary tract infections.

Figure 11 Percentage of antimicrobial prescriptions compliant with guidelines for the 20 most common indications, 2015



COPD = chronic obstructive pulmonary disease

Feedback

All respondents indicated their willingness to participate again in the Hospital NAPS.

Most facilities (66.4%) required one to three surveyors to conduct the 2015 Hospital NAPS; 29.0% required four to 10 surveyors, and 4.7% required more than 10 surveyors.

Overall, 46.1% of hospitals completed the 2015 Hospital NAPS within one week, and one-third of hospitals required one month or longer. The length of time required to complete the survey was markedly longer for regional, rural and remote facilities than for metropolitan facilities; this is likely to be due to hospital size and the availability of staff to conduct the survey.

Most respondents (76.0%) indicated that they were able to assess compliance and appropriateness using clinical staff from within their hospital. A small proportion (5.8%) required assistance from staff outside their hospital, and 18.3% required assistance from the NAPS team. The proportion of hospitals that required assistance from the NAPS team was substantially higher in rural and remote hospitals (41.4%) than in regional (16.7%) and metropolitan (4.4%) hospitals. Assistance was also required more for nurses and ICPs (35.7%) than for pharmacists (5.3%).

Of the 19 respondents who requested expert assessments from the NAPS team, all were satisfied with the service they received, and 17 indicated that their level of understanding had either 'greatly improved' or 'somewhat improved'; 11 indicated that they would require substantial ongoing support from the NAPS team for future participation. Comments from these 19 respondents reinforced that remote expert assessments and telephone or online support increased surveyors' confidence in conducting the Hospital NAPS. The assistance also improved the credibility of their results when they were reported to medical staff.

Local use of NAPS results

Many respondents indicated that their NAPS results were used as a basis for staff education, and were reported to AMS, medication advisory, and drug and therapeutics committees.

The reporting functionality, especially the ability to benchmark against hospitals in similar peer groups, has been highly valued by participants as a mechanism for providing feedback, and for monitoring improvement and appropriateness over time. Participants also commented that the results from the Hospital NAPS were used to promote the effectiveness of local AMS programs and included in business cases for acquisition of resources.

Clinically, results from the Hospital NAPS assist local facilities to identify areas of poor prescribing (such as prescribing for surgical prophylaxis and respiratory tract conditions, and poor recognition of penicillin allergies), as well as areas of practice that are not covered by guidelines or protocols.

“
We conduct a ‘pharmacy’ session with local GP VMOs [visiting medical officers] every two months ... They found this very worthwhile, and the discussion that ensued was a terrific learning opportunity for the younger GPs present, and certainly I got to see things from the VMO’s perspective also.

– rural hospital

Conclusion

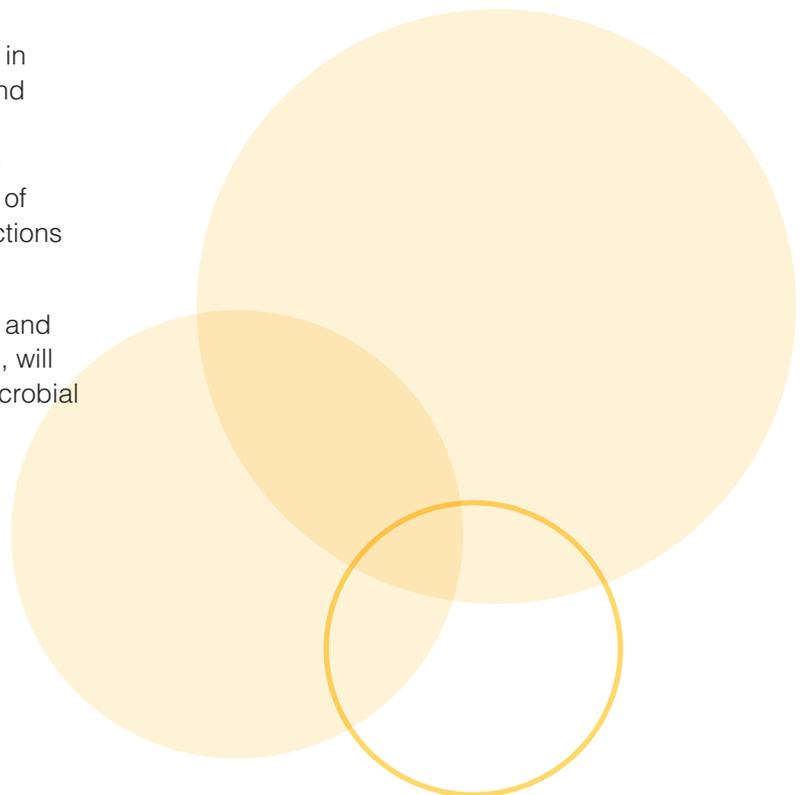
The collaboration between the Commission and the NCAS has resulted in NAPS diversifying and growing into a program that supports the challenges of AMS across Australian healthcare and aged-care settings. The consistent increase in the number and representation of participating hospitals since 2013 indicates that NAPS is able to meet the varying needs of the workforce across different geographical locations, levels of expertise and access to specialists. NAPS results have identified target areas for improvement, and helped to embed AMS across the hospital and aged-care sectors.

The Commission and the NCAS will promote continued increased participation in NAPS to ensure increasing representativeness of data across the range of Australian hospitals.

The 2015 Hospital NAPS confirmed many of the findings from the 2013 and 2014 surveys. It continued to highlight the need for improved prescribing and targeted education with regard to:

- prescribing for surgical prophylaxis, particularly in the area of prolonged duration of therapy and incorrect dosing
- prescribing for exacerbations of COPD, where the antimicrobials prescribed were either too broad in spectrum or not required
- the need for increased documentation in medical notes, particularly of review and stop dates
- high rates of inappropriate prescribing of cephalexin, particularly in the areas of surgical prophylaxis, urinary tract infections and pneumonia.

The NCAS, together with the Commission and other AURA Surveillance System partners, will continue to work to further improve antimicrobial prescribing in Australian hospitals.



Appendix 1 Hospital NAPS data collection form

Audit date: / / Patient identification number: Date of birth / age: / / Gender: M / F / O Specialty: currently in ICU / NICU Ward: Weight kg: eGFR / CrCl ml/min:

Antimicrobials							Compliance with guidelines																	
For NICU patients							*Select Therapeutic Guidelines if local guidelines are the same																	
Birth weight kg		Gestational age weeks																						
Start date	Antimicrobial	Route	Dose	Freq	Indication documented	Specify documented or presumed indication	Review / stop date documented	Therapeutic Guidelines	Local guidelines*	Non-compliant	Directed therapy	None available	Not assessable	Surgical prophylaxis > 24 hrs	Allergy mismatch	Microbiology mismatch	Incorrect route	Incorrect dose / frequency	Incorrect duration	Spectrum too broad	Spectrum too narrow	Indication does not require any antimicrobials	If restricted: approval given	Appropriateness (1-5)
/ /																								
/ /																								
/ /																								
/ /																								

(1 - optimal, 2 - adequate, 3 - suboptimal, 4 - inadequate, 5 - not assessable)

Allergies and adverse drug reactions to antimicrobials
 nil known not documented present; specify drug and nature

Surgical procedure performed
 If prophylaxis given within the previous 24 hours; include in audit

Microbiology not collected / not assessable
 collected; provide any relevant results

Clinical notes or comments
 Renal replacement therapy given within the previous 24 hours; eg. dialysis

Appendix 2 Participating public hospitals, by peer group, 2015

Public hospital peer group ^a	Number of participating hospitals	Total number nationally ^b	Percentage of hospitals that participated
PR: principal referral hospitals	24	29	82.8
L: large acute hospitals	46	62	74.2
M: medium acute hospitals	28	45	62.2
S1: small acute hospitals with surgery and/or obstetrics	60	143	42.0
S2: small acute hospitals – other	24	191	12.6
VS: very small hospitals	5	135	3.7
W1: women's hospitals	4	5	80.0
W2: women's and children's hospitals	1	1	100.0
W3: children's hospitals	5	6	83.3
N1: mixed subacute and nonacute hospitals	9	26	34.6
N2: rehabilitation hospitals	4	13	30.8
Ps: psychiatric hospitals	1	21	4.8
O3: other acute specialised hospitals	1	3	33.3
O5: unpeered hospitals	1	12	8.3
Total	213	778	27.4

a There was no participation from O1 (early parenting centres), O2 (drug and alcohol hospitals), O4 (other day procedure facilities) and OT (outpatient facilities). These categories are not displayed, but are still included in the total.

b Source: Australian Institute of Health and Welfare. Australian hospital statistics 2012–13. Canberra: AIHW, 2014. Available at: www.aihw.gov.au/publication-detail/?id=60129546922

Definitions of public hospital peer groups used for this analysis can be found in *Australian hospital statistics 2012–13*.¹⁰



10 www.aihw.gov.au/WorkArea/DownloadAsset.aspx?id=60129547084

Appendix 3 Participating private hospitals, by peer group, 2015

Private hospital peer group ^a	Number of participating hospitals	Total number nationally ^b	Percentage of hospitals that participated
Private acute group A hospitals	11	22	50.0
Private acute group B hospitals	15	36	41.7
Private acute group C hospitals	15	49	30.6
Private acute group D hospitals	17	70	24.3
Other acute specialised hospitals	3	16	18.8
Private acute psychiatric hospitals	1	29	3.4
Private rehabilitation hospitals	5	23	21.7
Mixed day procedure hospitals	1	57	1.8
Total	68	515	13.2

a There was no participation from the following types of facilities: dialysis clinics, drug and alcohol hospitals, endoscopy centres, eye surgery centres, fertility clinics, haematology and oncology clinics, hyperbaric health centres, mixed subacute and nonacute hospitals, oral and maxillofacial surgery centres, other women's and children's hospitals, plastic and reconstructive surgery centres, reproductive health centres, sleep centres, unpeered hospitals, very small hospitals, and women's hospitals. These categories are not displayed, but are still included in the total.

b Source: Australian Institute of Health and Welfare. Australian hospital peer groups. Canberra: AIHW, 2014. Available at: www.aihw.gov.au/WorkArea/DownloadAsset.aspx?id=60129553443

Definitions of private hospital peer groups used for this analysis can be found in *Australian hospital peer groups*.¹¹

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11 www.aihw.gov.au/WorkArea/DownloadAsset.aspx?id=60129553443

Appendix 4 Numbers of prescriptions, by hospital peer group, 2015

Funding type	Peer group	Number of prescriptions	Percentage of total prescriptions
Public	Principal referral hospitals	6 483	29.4
	Large acute hospitals	5 093	23.1
	Medium acute hospitals	1 428	6.5
	Small acute hospitals – other	471	2.1
	Small acute hospitals with surgery and/or obstetrics	2 427	11.0
	Very small hospitals	23	0.1
	Children's hospitals	799	3.6
	Women's hospitals	301	1.4
	Women's and children's hospitals	115	0.5
	Other acute specialised hospitals	96	0.4
	Subacute and nonacute hospitals	213	1.0
	Unpeered hospitals	82	0.4
	Public rehabilitation hospitals	78	0.4
	Psychiatric hospitals	31	0.1
Private	Private acute group A hospitals	1 433	6.5
	Private acute group B hospitals	953	4.3
	Private acute group C hospitals	1 099	5.0
	Private acute group D hospitals	623	2.8
	Private acute psychiatric hospitals	34	0.2
	Other acute specialised hospitals	67	0.3
	Private rehabilitation hospitals	121	0.5
	Mixed day procedure hospitals	51	0.2
Total		22 021	100.0

Appendix 5 Hospital NAPS definitions of appropriateness

Appropriateness	If endorsed guidelines are present	If endorsed guidelines are absent
Appropriate	1 Optimal' Antimicrobial prescription follows either the Therapeutic Guidelines ² or endorsed local guidelines <i>optimally</i> , including antimicrobial choice, dosage, route and duration ³ , (including for surgical prophylaxis)	The antimicrobial prescription has been reviewed and endorsed by a clinician with expert antimicrobial prescribing knowledge. ⁴ OR The prescribed antimicrobial will cover the likely causative OR cultured pathogens and there is not a narrower spectrum or more appropriate antimicrobial choice, dosage, route or duration ³ available, (including for surgical prophylaxis)
	2 Adequate Antimicrobial prescription does not optimally follow the Therapeutic Guidelines ² or endorsed local guidelines, including antimicrobial choice, dosage, route or duration ³ , however, is a reasonable alternative choice for the likely causative or cultured pathogens OR For surgical prophylaxis, as above and duration ³ is less than 24 hours	Antimicrobial prescription including antimicrobial choice, dosage, route and duration ³ is not the most optimal, however, is a reasonable alternative choice for the likely causative or cultured pathogens OR For surgical prophylaxis, as above and duration ³ is less than 24 hours
Inappropriate	3 Suboptimal Antimicrobial prescription including antimicrobial choice, dosage, route and duration ³ , is an unreasonable choice for the likely causative or cultured pathogens, including: <ul style="list-style-type: none"> spectrum excessively broad or an unnecessary overlap in spectrum of activity failure to appropriately de-escalate with microbiological results OR There may be a mild or non-life-threatening allergy mismatch	Antimicrobial prescription including antimicrobial choice, dosage, route and duration ³ , is an unreasonable choice for the likely causative or cultured pathogens OR Antimicrobial prescription including antimicrobial choice, dosage, route or duration ³ is unlikely to treat the likely causative or cultured pathogens
	4 Inadequate An antimicrobial is not indicated for the documented or presumed indication OR There may be a severe or possibly life-threatening allergy mismatch, or the potential risk of toxicity due to drug interaction OR For surgical prophylaxis, the duration ³ is greater than 24 hours (except where guidelines endorse this) The indication is not documented and unable to be determined from the notes	An antimicrobial is not indicated for the documented or presumed indication OR There may be a severe or possibly life-threatening allergy mismatch, or the potential risk of toxicity due to drug interaction OR For surgical prophylaxis, the duration ³ is greater than 24 hours (except where guidelines endorse this) The indication is not documented and unable to be determined from the notes
5 Not assessable The notes are not comprehensive enough to assess appropriateness OR The patient is too complex, due to multiple co-morbidities, allergies or microbiology results, etc.	The notes are not comprehensive enough to assess appropriateness OR The patient is too complex, due to multiple co-morbidities, allergies or microbiology results, etc.	

¹ Taking into account acceptable changes due to the patient's age, weight, renal function or other prescribed medications, if this information is available

² Antibiotic Expert Group. Therapeutic Guidelines: Antibiotic, Version 15 (2014). <http://online.tg.org.au/rp/>

³ Duration should only be assessed if the guidelines state a recommended duration and the antimicrobial has already been dispensed for longer than this, or if there is a clear planned 'end date' documented

⁴ Examples include infectious diseases physician or registrar, clinical microbiologist or registrar, or specialist pharmacist

