Australian Government
Department of Health and Aged Care

Antimicrobial prescribing practice in Australian hospitals

Results of the 2020 Hospital National Antimicrobial Prescribing Survey

2020

NCAS National Centre for Antimicrobial Stewardship

HOSPITAL NAPS National Antimicrobial Prescribing Survey

Published by the Australian Government Department of Health and Aged Care

For issues regarding the content of the report:

Email: support@naps.org.au

Website: : https://www.naps.org.au/

ISBN: 978-1-76007-350-3

Preferred citation

> Royal Melbourne Hospital and the National Centre for Antimicrobial Stewardship. Antimicrobial prescribing practice in Australian hospitals. Results of the 2020 Hospital National Antimicrobial Prescribing Survey Canberra: Department of Health and Aged Care; 2023.

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Summary

Now in its eighth year, the Hospital National Antimicrobial Prescribing Survey (Hospital NAPS) continues to be a widely adopted and valued tool to assess the quality of antimicrobial prescribing across Australian hospitals. It is a key contributor to Australia's National Antimicrobial Resistance Strategy and the Antimicrobial Use and Resistance in Australia (AURA) program. Its focus on providing meaningful data for action with clear data visualisation for contributing hospitals has led to the continued high participation from all Australian hospitals, funding types, peer groups and remoteness classifications.

During 2020, 406 hospitals (284 public and 122 private) submitted data on 30,986 prescriptions to the Hospital NAPS database. Analyses are also presented of trends from 2015 to 2020.

Key findings of the 2020 Hospital NAPS

There have been long-term improvements in 3 key indicators of appropriateness of antimicrobial prescribing monitored by the Hospital NAPS:

- Documentation of indication increased to 84.6% in 2020 compared with 72.0% in 2015.
- Documentation of review or stop date increased to 52.0% in 2020 compared with 34.8% in 2015, the year this indicator was first reported. However, the level of documentation is still unacceptably low.
- There have been significant improvements in appropriateness across most public hospital peer groups over the past 7 years as their antimicrobial stewardship (AMS) programs mature and AMS principles become further embedded into routine practice.

Whilst these improvements are encouraging, concerning patterns regarding other aspects of antimicrobial prescribing appropriateness over time were seen:

- The proportion of surgical prophylaxis given for greater than 24 hours has essentially remained static since 2015 (27.0%). It was 26.6% in 2020. However, it should be noted that there are methodological limitations to the Hospital NAPS which impact the interpretation of this data.
- Compliance with the Therapeutic Guidelines or local guidelines declined from 72.1% in 2013 to 67.0% in 2020.
  - Rates of non-compliance with guidelines for specific indications continued to be high, particularly for chronic obstructive pulmonary disease (COPD), surgical prophylaxis, wound infections, diverticulitis and aspiration pneumonia.
  - There was inappropriate prescribing of broad-spectrum, high-use antimicrobials, particularly cefalexin, amoxicillin–clavulanic acid, and ceftriaxone.
  - Although the overall appropriateness of prescribing has essentially remained static since 2015, a deep dive into the data revealed that the quality of prescribing is improving across all public hospital peer groups. Conversely, appropriateness is decreasing across private hospital peer groups; however, this is likely due to increasing private hospital participation each year and the tendency that the prescribing quality is often lower in the first years of conducting the Hospital NAPS audit.

Implications for clinical practice

There are a number of opportunities for improvement of practice:

- Continued improvement of documentation of indication and review and stop dates is required to reach the best-practice target of greater than 95%. As hospitals continue to implement electronic medication management systems, this will help to further improve this metric into the future.
- There is a need for improved prescribing and guideline adherence in the areas of surgical prophylaxis (particularly with regard to extended duration of prophylaxis), respiratory tract infections such as COPD, aspiration pneumonia and community-acquired pneumonia, and surgical and non-surgical site wound infections. The 2019 update of the Therapeutic Guidelines expanded and clarified the recommendations in these areas, and future Hospital NAPS will be analysed to see whether there has been improvement in these areas.
- The 2020 update of the Antimicrobial Stewardship Clinical Care Standard had expanded indicators in the areas of documentation of indication and review or stop date, surgical prophylaxis, adverse drug reactions and antimicrobial review. The Hospital NAPS will be updated in the future to incorporate these indicators as data collection fields.

1. Introduction

A key objective of Australia's National Antimicrobial Resistance Strategy[1] is to ensure the judicious use of antimicrobials across all health sectors. One of the recommended activities is to encourage the adoption of antimicrobial stewardship (AMS) programs, with the aim of enhancing patient healthcare outcomes while reducing the emergence and spread of antimicrobial resistance.

The National Antimicrobial Prescribing Survey (NAPS) has been adopted as an important platform to support AMS programs in hospitals and residential aged care homes, and to provide data for the Antimicrobial Use and Resistance in Australia (AURA) Surveillance System.[2] The platform has undergone continuous improvement since 2013 and now comprises 4 modules: the Hospital NAPS, the Surgical NAPS, the Aged Care NAPS and the Quality Improvement NAPS. Despite the voluntary nature of the survey activities, participation has continued to increase across both public and private institutions. It is the only national audit survey platform globally that measures, reports and benchmarks the quality of use of antimicrobials across hospitals and aged care homes of all sizes and classifications. The methodology has been demonstrated to be both feasible and acceptable, and supports the collection of data on all antimicrobials, including topical agents, antivirals and antifungals.

The Hospital NAPS directly supports Australian health service organisations, states and territories and private health service provider organisations to develop and conduct AMS programs by:

- facilitating effective audit and review of antimicrobial use, including compliance with prescribing guidelines and prescribing appropriateness
- facilitating effective communication regarding antimicrobial use and identifying key targets for interventions
- supporting workforce education and training
- supporting the implementation of AMS practices across all hospitals – public, private, major city, regional and remote
- providing flexible and useful benchmarking within hospitals, across units and wards, and between hospitals and jurisdictions.

Participation in the Hospital NAPS assists health service organisations to demonstrate that they comply with the AMS requirements of the National Safety and Quality Health Service (NSQHS) Standards and the Antimicrobial Stewardship Clinical Care Standard.

The Australian Government Department of Health and Aged Care provides funding for the National Centre for Antimicrobial Stewardship (NCAS) to conduct the Hospital NAPS and contribute data to the AURA Surveillance System.[2] In 2020, the NAPS program transitioned from being overseen by the Australian Commission on Safety and Quality in Health Care (ACSQHC) to the Department of Health and Aged Care.

2. Methodology

2.1. Methods

The NAPS is a standardised auditing tool that health service organisations may use to assess the quality of their antimicrobial prescribing.

2.1.1. Timing

The Hospital NAPS module is open for data entry and reporting all year round, allowing hospitals to complete the survey whenever time and staffing levels permit.

The official national data collection period was 14 January to 14 December 2020.

All finalised data entered in 2020 have been included for analysis in this report.

2.1.2. Recruitment and eligibility

Using the NAPS registration database, individuals from more than 600 hospitals were invited via email to participate in the 2020 Hospital NAPS. Further promotion by the ACSQHC and NCAS occurred throughout the year via their websites, Twitter and the NAPS newsletter.

All hospitals offering overnight stays can participate in the Hospital NAPS. Facilities such as same-day services, sleep clinics and other private specialty clinics without overnight stay are ineligible.

2.1.3. Undertaking the survey

The Hospital NAPS is a web-based survey. Participants who register are granted access to the NAPS portal where they can submit their data. Data can be entered directly into the database or collected on a paper data collection form first (Appendix 2).

Participants are advised that the assessments of guideline compliance and appropriateness should ideally be performed by multidisciplinary teams. The membership of the auditing team was determined by each participating facility, depending on the staffing resources available, and could consist of any combination of infectious diseases physicians, clinical microbiologists, other interested physicians, pharmacists, infection prevention and control practitioners, or nurses. It was recommended that at least 2 members provide assessments whenever possible, as this facilitates discussion about more challenging assessments. Preferably, members providing assessments should have a sound clinical knowledge of antimicrobial prescribing and any local prescribing guidelines. If an on-site assessment team was not available, participants were encouraged to submit their data to other appropriately experienced clinicians available within their hospital network. The NAPS support team was also available to provide additional clinical advice for facilities without infectious diseases expertise.

2.1.4. Data collection methodology

Depending on the hospital size and the staffing resources available, participants could choose to conduct their survey using one of the following methodologies.

Option 1: Hospital-wide point prevalence survey (preferred)

This methodology required all inpatients to be assessed so that prevalence of antimicrobial use could be calculated. Data were collected on both the number of inpatients on antimicrobials (numerator) and the total number of inpatients (denominator). The data collection was recommended to be completed on a single calendar day. However, if this was not possible, wards could be surveyed on separate days provided that all patients were surveyed once only.

Option 2: Repeat point prevalence surveys (for smaller hospitals)

For small hospitals (those with fewer than 100 acute beds), Option 1 may not allow enough data to be collected to meaningfully reflect prescribing practices. Therefore, small hospitals could conduct repeat point prevalence surveys whereby a whole-hospital survey is conducted multiple times, with surveys at least one week apart, until at least 30 antimicrobial prescriptions have been collected. Auditors were advised that all inpatients should be included in the repeat surveys, including those who had been surveyed previously, as the appropriateness of their respective antimicrobial prescriptions could have changed over time.

Option 3: Random sampling point prevalence survey (for hospitals with ≥100 acute beds)
For large hospitals where a whole-hospital point prevalence survey could not be undertaken due to resource limitations, data could be collected from a random sample of inpatients provided the following guidelines were adhered to:

- A random sampling method should only be used in hospitals with ≥100 acute beds.
- The random sampling should include patients from all wards in the hospital.
- The proportion of patients sampled must be at least 50% of the inpatient population.
- The random sampling is based on inpatients, not antimicrobial prescriptions.

2.1.5. Support for auditors

Auditors were able to access the following online resources to promote accurate data collection and prescription assessment, as well as to assist with the reporting and feedback process:

- the Hospital NAPS user guide
- appropriateness definitions (Appendix 3)
- case examples
- an eLearning module
- reporting templates to help hospitals communicate survey results locally
- links to useful AMS-related presentations and posters.

The NAPS support team also provided direct support throughout the data collection period in the form of:

- webinar training sessions
- helpdesk support via phone and email
- a remote expert assessment service
- assistance with the assessment of guideline compliance and prescription appropriateness for hospitals without access to infectious diseases or AMS specialists.

2.1.6. eLearning module

The Hospital NAPS online eLearning program is available on the NAPS website at any time. The package provides users with information regarding setting up the survey, data collection, and assessments of compliance with guidelines and appropriateness.

Hospital NAPS participants needed to achieve a pass mark of 80% or more before they could finalise patient data and generate reports in 2020. The pass mark is kept high to promote consistency among auditors when performing their data collection and prescription assessments. Users who fail to pass the eLearning program within 3 attempts are encouraged to contact the NAPS support helpdesk to discuss any difficulties they may be experiencing.

2.2. Analyses

Hospitals that conducted whole-hospital audits, including single point prevalence surveys, repeat point prevalence surveys and randomised sample surveys, were included in the analyses. To avoid issues with systematic bias, all other Hospital NAPS survey methodologies, including directed surveys of selected antimicrobials, indications, specialties or wards, were excluded.

De-identified hospital data are analysed by funding type (public or private), state or territory, the Australian Bureau of Statistics remoteness[6] classifications and the Australian Institute of Health and Welfare (AIHW) peer group classifications[7]. Key performance indicators are analysed and reported for these categories.

The Hospital NAPS database is live, and participating hospitals are free to amend, add or remove their data at any time. For the delivery of the annual national reports, the database is accessed and analysed each year; therefore, previous years' data may have some small discrepancies in results compared with the previously published NAPS reports.

2.3. Considerations for data interpretation

The nature of the Hospital NAPS is such that only patients who are prescribed antimicrobials are included in the survey; therefore, patients who are not receiving any antimicrobials are excluded from the survey. It is important to understand that the survey does not describe the prescribing behaviour for an indication in the context of a whole patient population. Therefore, for indications where the usual recommended therapy is for no antimicrobial treatment, only patients who in fact are receiving antibiotic treatment are included; hence the reported results may appear worse than they actually are for a given indication.

For example, patients undergoing surgical procedures who are receiving no surgical antimicrobial prophylaxis (high rate of appropriateness) are excluded from the survey. Therefore, the surgical prophylaxis >24 hours metric, together with appropriateness and guideline compliance for this indication, may appear higher than if all patients undergoing a surgical procedure were included.

The Surgical NAPS module is specifically designed for assessing the quality of surgical antimicrobial prophylaxis and includes all patients undergoing a procedure, not just procedures where antimicrobial prophylaxis was administered. For more representative in-depth analysis, please refer to the 2020 Surgical NAPS report[8].

Sampling and selection bias

Participation in the Hospital NAPS is voluntary. The facilities that choose to participate do not represent a randomised sample; hence the results may not be representative of all Australian hospitals.

Comparison with previous surveys

In addition to the 2020 Hospital NAPS results, this report references elements of the 2015–2019 surveys. The ability to directly compare results from year to year is limited as a result of changes over time to the inclusion criteria, methodology and distribution of participating hospitals.

Data from 2013 and 2014 have been mostly removed from this report. The distribution of participating hospitals was substantially different in these early years when the hospital accreditation criteria for monitoring the quality of antimicrobial prescribing had not yet become widely enforced. Furthermore, the 2015 survey had several revisions to the data collection fields and methodology.

Patients may be counted multiple times

In facilities that chose Option 2, certain patients may have been counted multiple times if they were still an inpatient on a subsequent audit day. This may artificially inflate the prevalence of some indications that require longer durations of treatment, or the antimicrobials that are used to treat these conditions.

Subjective nature of assessments

The NAPS has a mandatory eLearning module, detailed user guides, standardised appropriateness definitions and remote expert support to assist facilities to conduct their assessments.

Nevertheless, individual auditors at each facility are ultimately responsible for assessing antimicrobial prescribing appropriateness and compliance with guidelines, and there is some degree of interpretation involved.

Use of alternative audit tools

Depending on local AMS issues, casemix and resources, hospitals may have chosen to use other audit tools, such as the Surgical NAPS or Quality Improvement NAPS. This may have impacted on the number of hospitals that chose to participate in the 2020 Hospital NAPS.

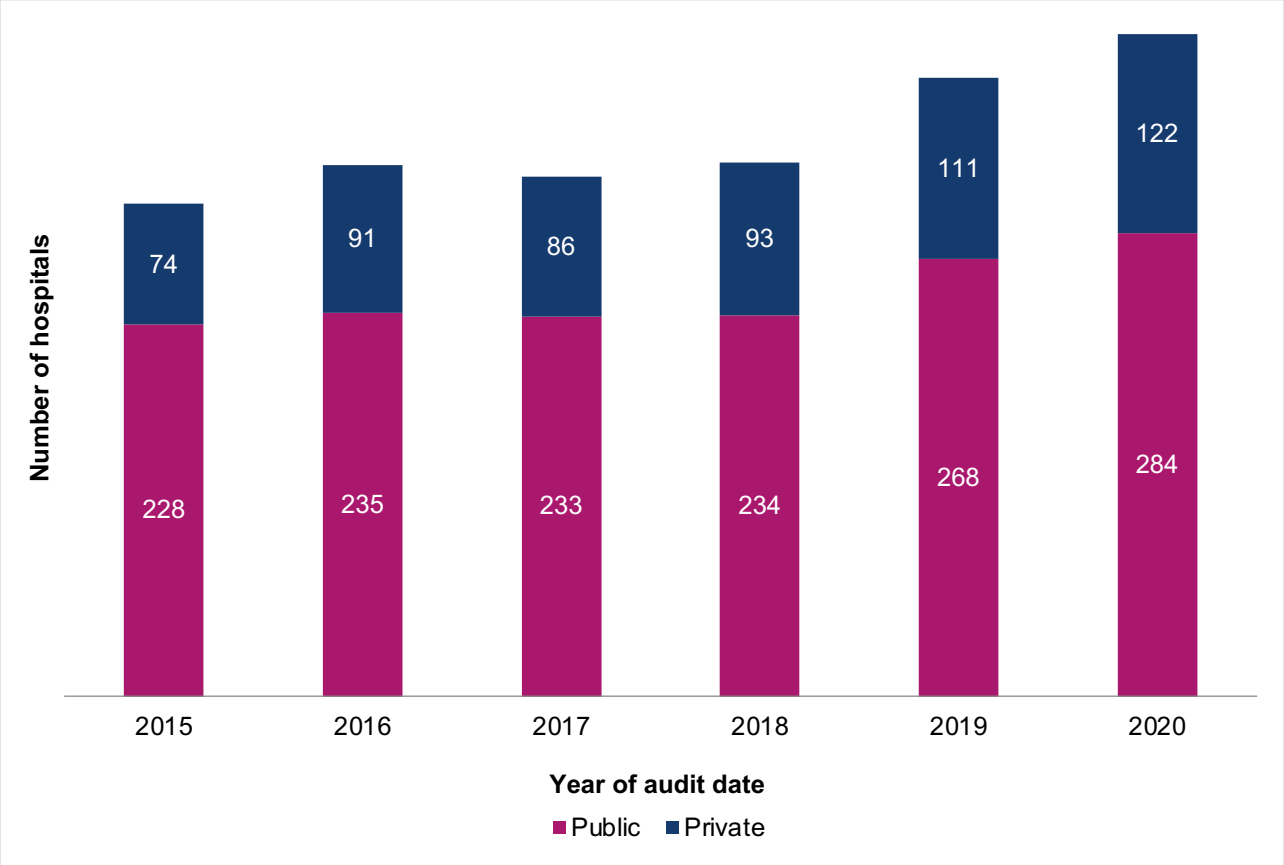
3. Key results

3.1. Participation

This report analyses the data submitted by 406 hospitals (284 public and 122 private) that met the Hospital NAPS inclusion criteria. An additional 27 hospitals participated in the survey in 2020, compared with 2019 (Figure 1).

Data from 21,290 patients were submitted during the 2020 national data collection period, generating 30,986 prescriptions for analysis. The overall prevalence of antimicrobial prescribing (i.e. the percentage of hospital inpatients receiving an antimicrobial on the audit day) among contributor hospitals was 37.4%.

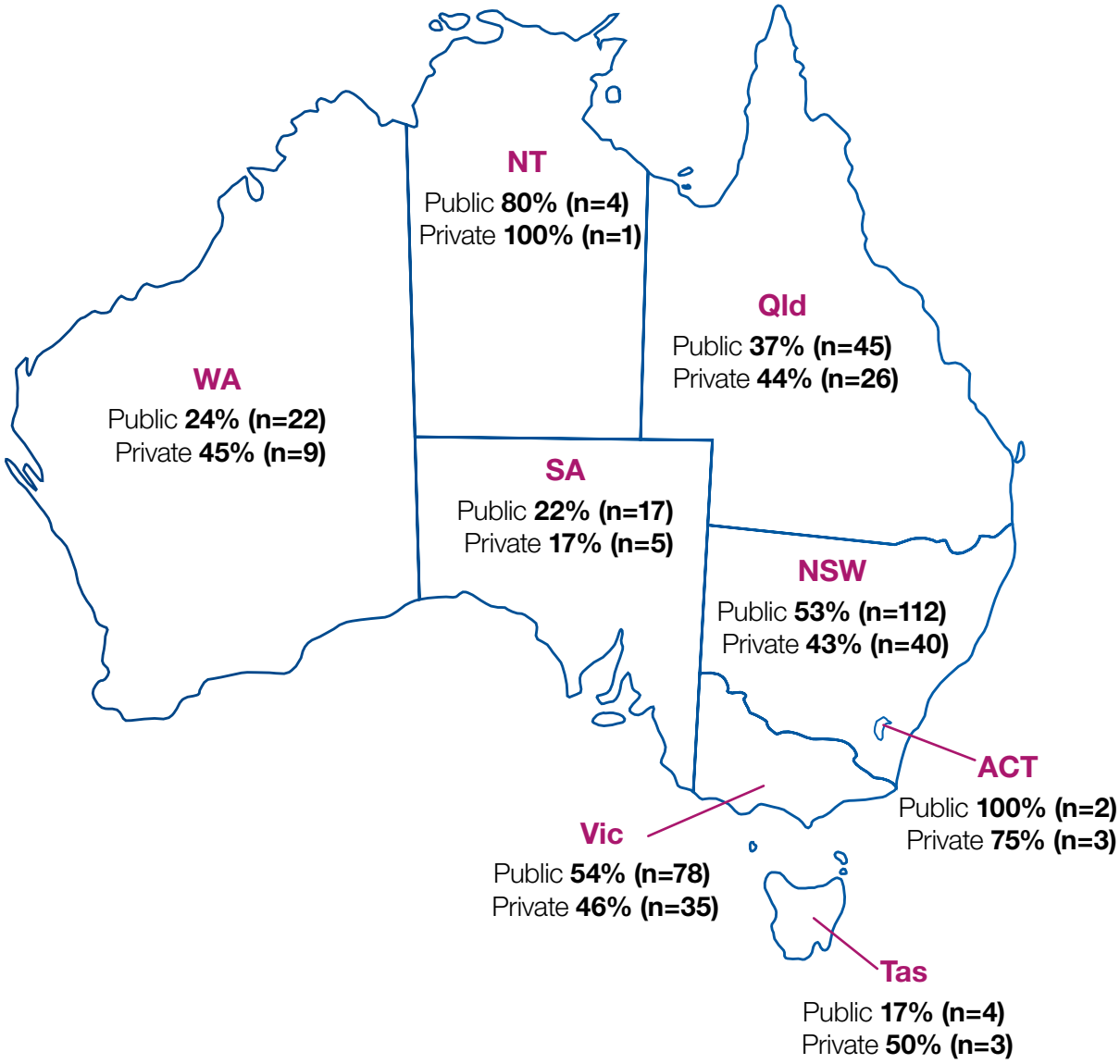
Figure 1: Number of public and private hospitals that contributed to the Hospital NAPS, 2015–2020



Forty-two per cent of all eligible public and private hospitals participated in the survey, and all Australian states and territories were represented (Figure 2). There were increases in participation for all hospital peer groups from 2015 to 2020 (Appendix 1: Figure 1A). The full analysis of hospital participation by funding type, state and territory, peer group and remoteness classification can be found in Appendix 1: Tables 1A and 1B. See Appendix 1: Table 1C for the breakdown of participation by number and percentage of prescriptions.

This is the first year in which the representative participation of private hospitals (42.4%, 122 of 288 private hospitals) exceeded that of public hospitals (41.9%, 284 of 678 public hospitals). This may be due to a combination of factors: antimicrobial stewardship becoming more embedded into the quality programs of private hospitals, and the reduction in elective surgery from the temporary shutdown in 2020 related to the coronavirus-19 (COVID-19) pandemic, thereby freeing up staffing resources in private hospitals to participate.

Figure 2: Percentage of public and private hospitals that contributed to the Hospital NAPS by state and territory, 2020*

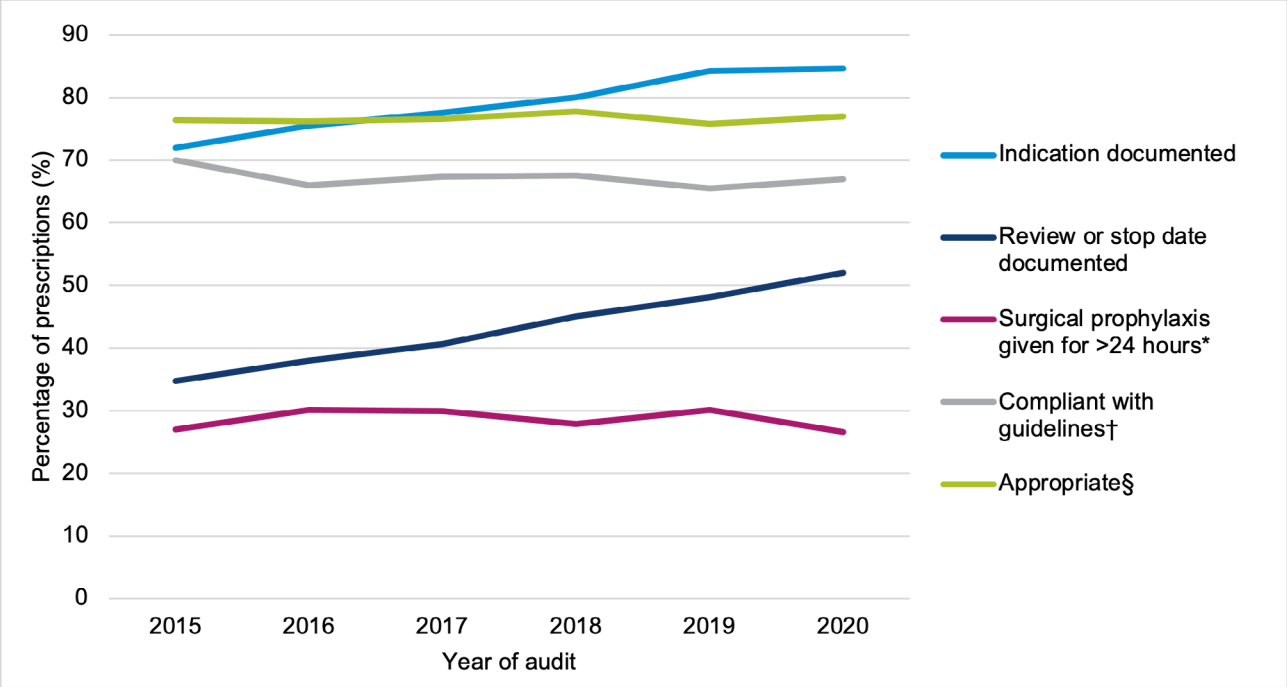


* Refer to Appendix 1: Table 1A for the total number of hospitals in each jurisdiction.

3.2. Key performance indicators

The 5 key indicators described below have been collected consistently.

Figure 3: Hospital NAPS key indicators, for assessable prescriptions, 2015–2020



* Where surgical prophylaxis was selected as the indication (n=4,662 in 2020).

† Prescriptions for which compliance was assessable (n=24,816 in 2020). Excludes prescriptions for which guidelines were not available, as well as prescriptions that were 'directed therapy' or 'not assessable'. Refer to Appendix 3 for definitions.

§ Prescriptions for which appropriateness was assessable (n=29,740 in 2020). Excludes prescriptions deemed to be 'not assessable'. Refer to Appendix 3 for definitions.

See Appendix 1: Tables 1C and 1D for the breakdown of Hospital NAPS key indicators by funding type, state and territory, peer group and remoteness classification.

Appendix 1: Table 1E shows the changes over time for the different guideline compliance and appropriateness categories for Hospital NAPS prescriptions.

3.2.1. Documentation of indication

There was consistent improvement over time in documentation of the reason for the antimicrobial prescription (Figure 3); the rate was 84.6% in 2020. Among private hospitals, the indication documentation rate was 70.3%. In public hospitals, the rate was 88.9%, which is approaching the best-practice target of 95% that has been adopted by NCAS for the Hospital NAPS (Appendix 1: Table 1C).

3.2.2. Documentation of review or stop date

Figure 3 shows consistent improvement in documentation of the antimicrobial review or stop date, from 34.8% in 2015 to 52.0% in 2020; private hospitals (57.6%) performed better than public hospitals (50.3%) (Appendix 1: Table 1C).

3.2.3. Surgical prophylaxis greater than 24 hours

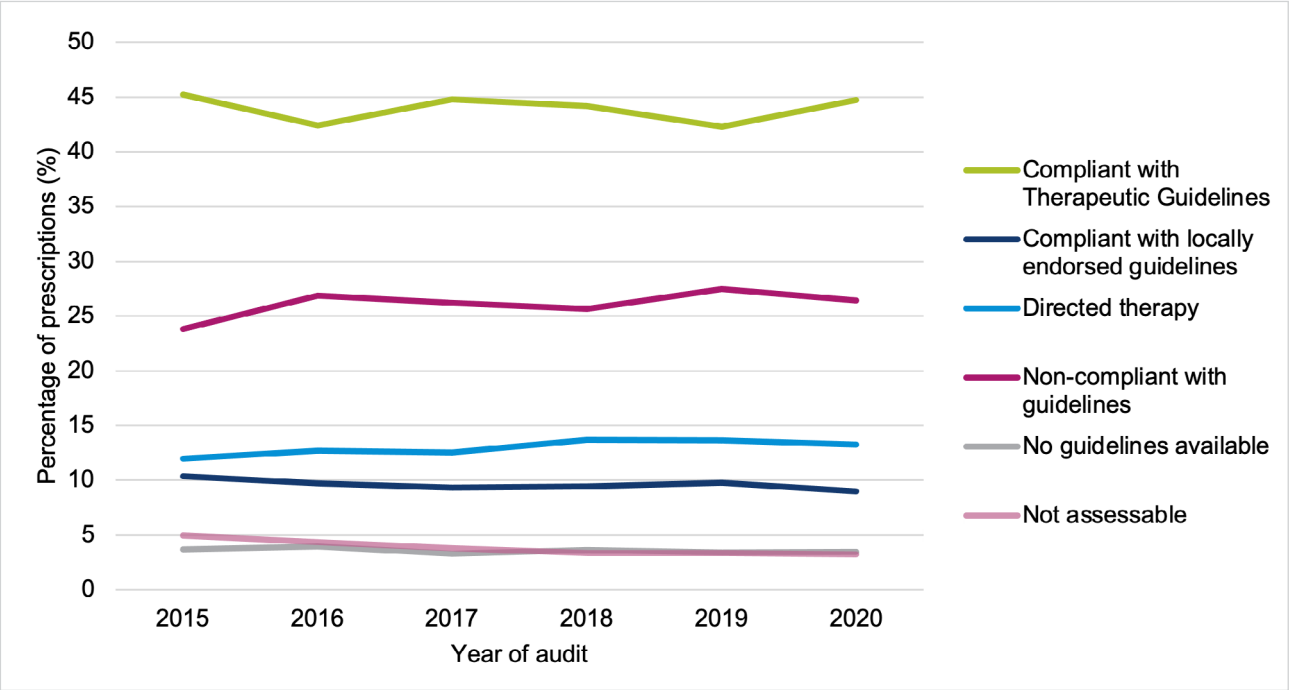
Approximately one-quarter (26.6%) of surgical antimicrobial prophylaxis prescriptions had a duration of greater than 24 hours. This figure has remained relatively static over the last 6 years (Figure 3).

Note that despite the methodological considerations (described in Section 2.3) of the Hospital NAPS only auditing prescribed antimicrobials, this figure is in fact very similar to the results of the 2020 Surgical NAPS, where 26.1% of procedures had antimicrobial prophylaxis that continued beyond 24 hours. Further in-depth analyses of the types and durations of post-operative surgical prophylaxis procedures can be found in the 2020 Surgical NAPS report.[8]

3.3. Compliance with guidelines

Compliance with the Therapeutic Guidelines increased from 42.3% in 2019 to 44.7% in 2020 (Figure 4). This may be explained by the substantial update to the antimicrobial content of the Therapeutic Guidelines in 2019[3]. This update provided recommendations on more conditions; hence auditors may have been more likely to find guidelines for their audited patients' conditions. The percentage of prescriptions assessed as directed therapy or compliant with local guidelines has effectively remained the same from 2015 to 2020 (Figure 4), and has not been influenced by the release of different versions of the Therapeutic Guidelines.

Figure 4: Compliance with guidelines for all prescriptions, 2015–2020

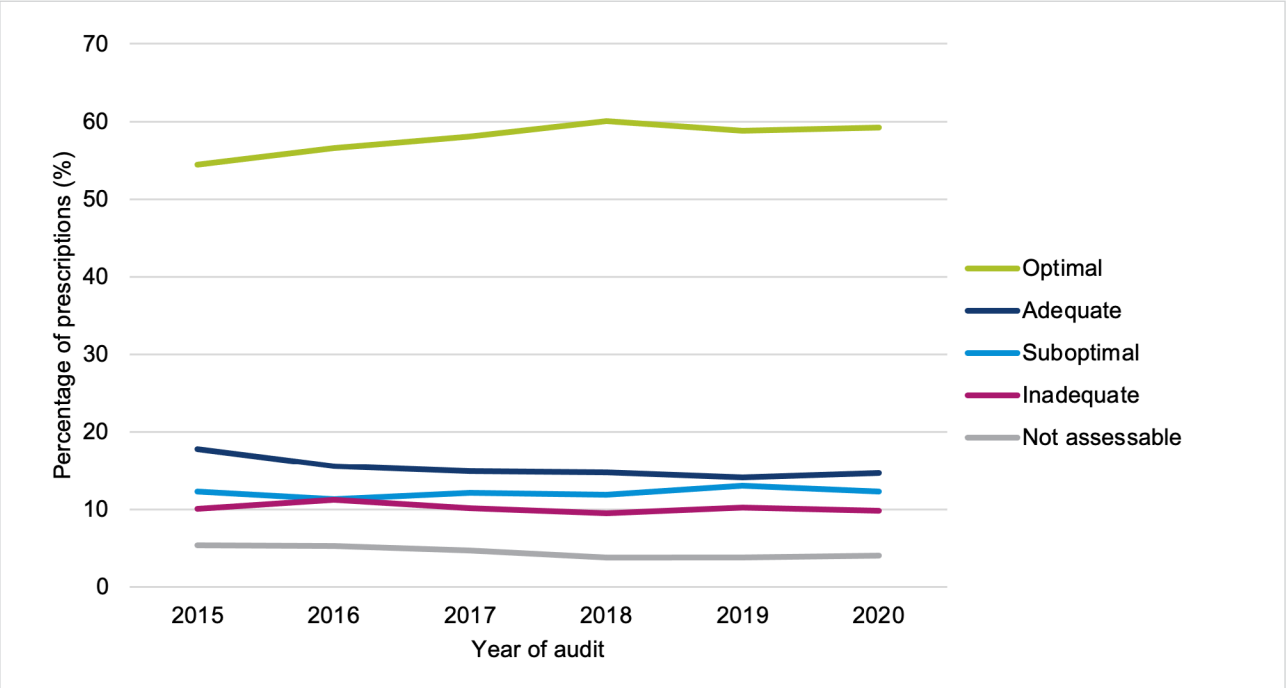


3.4. Appropriateness

Reflecting on the improvement in compliance with the Therapeutic Guidelines since 2019 (Figure 4), the number of prescriptions assessed as inappropriate (suboptimal and inadequate – refer to Appendix 3) decreased from 23.3% in 2019 to 22.0% in 2020 (Figure 5). The percentage of prescriptions considered to be inadequate in private hospitals was 16.1%, double that in public hospitals (7.9%). A significantly higher number of prescriptions were assessed as optimal in public hospitals (61.3%) compared to private hospitals (52.3%).

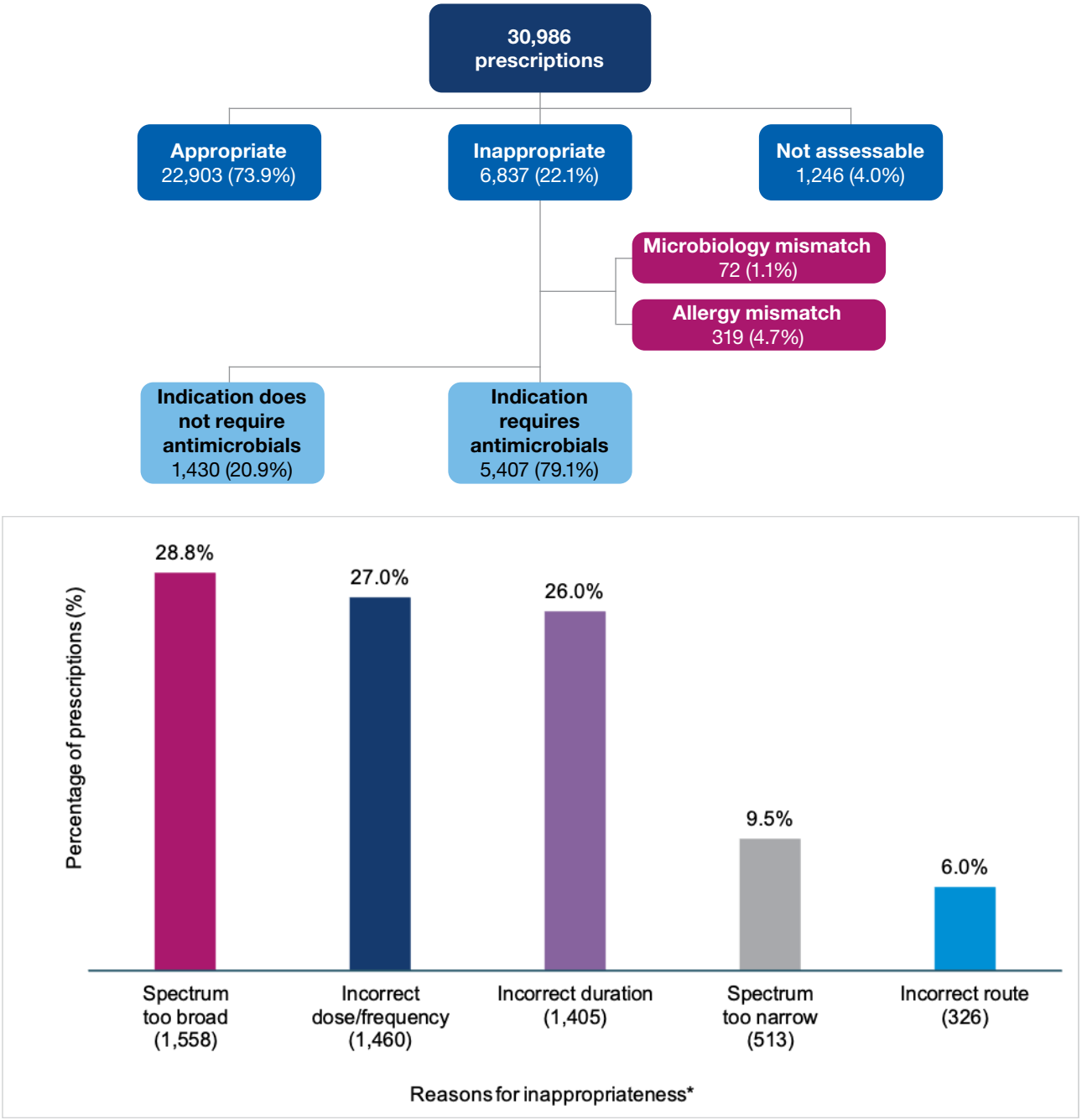
Although the overall appropriateness of prescribing has essentially remained static since 2015, a more in-depth analysis of the data revealed that the quality of prescribing is improving for most of the peer groups. This is discussed further in Section 4.1.

Figure 5: Appropriateness for all prescriptions, 2015–2020



3.4.1. Reasons for inappropriateness

Figure 6: Reasons for inappropriateness for all prescriptions, 2020



* Each prescription is assessed against each quality indicator and thus can be represented in more than one category.

Of the 30,986 prescriptions entered in 2020, 6,837 (22.1%) were assessed as inappropriate (suboptimal and inadequate) by the auditors. Out of those, 72 (1.1%) were identified as having an allergy mismatch and 319 (4.7%) as having a microbiology mismatch. These low rates are consistent with findings in the previous years.

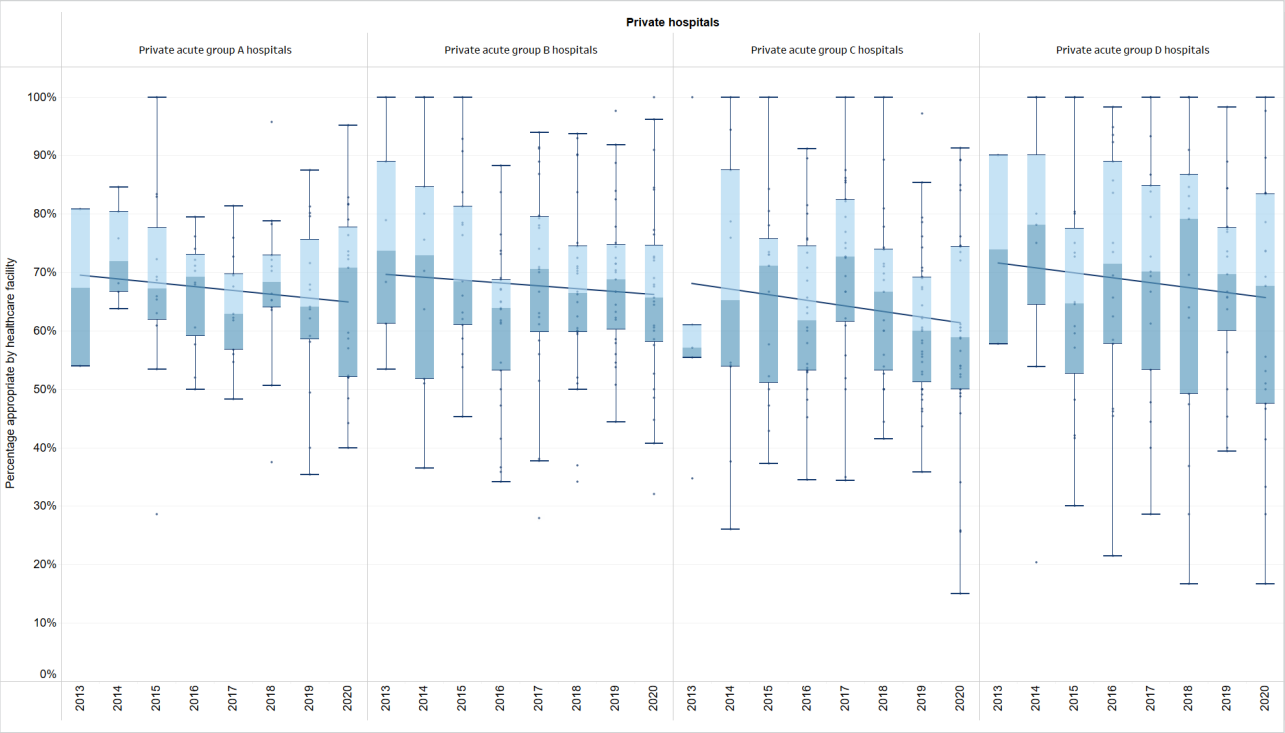
Of the 6,837 (22.1%) inappropriate prescriptions in the database, 1,430 (20.9%) were prescribed for patients whose conditions did not require antimicrobial therapy. The remaining reasons for inappropriateness are shown in Figure 6. Similar to previous years' results, the main reasons for inappropriateness were 'spectrum too broad', 'incorrect dose or frequency' and 'incorrect duration'.

3.4.2. Appropriateness of prescribing peer group analysis

Figure 7: Appropriateness of antimicrobial prescribing across public healthcare facilities (AIHW), 2013–2020

The overall appropriateness of prescribing has essentially remained consistent over the years. However, the appropriateness of prescribing for the individual peer groups in the public sector shows a clear trend of improvement across the groups (Figure 7). The trend of improvement is more subtle in principal referral hospitals, which could be attributed to a combination of factors. Referral hospitals are more likely to have longer histories of established AMS services. In contrast, smaller and regional hospitals are likely to have introduced AMS services after this was mandated in the NSQHS Standards in more recent years, particularly in 2017, when the NSQHS criteria were significantly expanded to include the need for hospitals to incorporate the key elements of the Antimicrobial Stewardship Clinical Care Standard.[4,5] Included in these key elements are many of the NAPS key indicators, such as documentation of indication, compliance with guidelines, review of prescription, and monitoring of surgical antibiotic prophylaxis. In addition, principal referral hospitals are more likely to have well-embedded local guidelines for antimicrobial prescribing, as well as on-site infectious disease specialist services to aid in the management of complicated cases.

Figure 8: Appropriateness of antimicrobial prescribing by private healthcare facilities (AIHW), 2013–2020



The appropriateness of prescribing for the peer groups in the private sector appears to be decreasing over the years (Figure 8). However, it is important to understand this result in the context of the changing mix of participating private hospitals. The private hospitals performing the survey in the earlier years consisted of larger, well-established hospitals with existing AMS services. Over the years, smaller hospitals in the process of establishing AMS services joining the survey may have negatively impacted on the overall appropriateness of prescribing. Once prescribing issues are identified in the NAPS, it may take some time for hospitals to implement initiatives to improve prescribing. The NAPS team will continue to provide support to these hospitals when requested and we will continue to track the trajectory of participating hospitals over time.

Antimicrobial prescribing in private hospitals is heavily influenced by surgical prophylaxis, which is the most common indication. The results of the 2020 Surgical NAPS have shown that 54.3% of all surgical episodes had appropriate surgical antimicrobial prophylaxis administered.[8] As more hospital sites come on board, the trend will become more accurate and representative, although the ranges may remain very wide. Some private hospitals have also chosen to perform the Surgical NAPS instead of the Hospital NAPS, as it provides more detailed information about where improvement efforts need to be directed.

3.4.3. Appropriateness of antimicrobials on the Priority Antibacterial List

The Priority Antibacterial List for Antimicrobial Resistance Containment (the Priority Antibacterial List)[9] was developed by the ACSQHC to support local and national antimicrobial usage surveillance. Antibiotics are categorised into 3 categories: Access, Curb and Contain (Appendix 5)[9].

The appropriateness of antibiotics grouped according to these categories is shown in Figure 9, with a more detailed breakdown of the individual Curb antimicrobials shown in Figure 10.

Figure 9: Appropriateness of prescribing for antibiotics on the Priority Antibacterial List, 2020

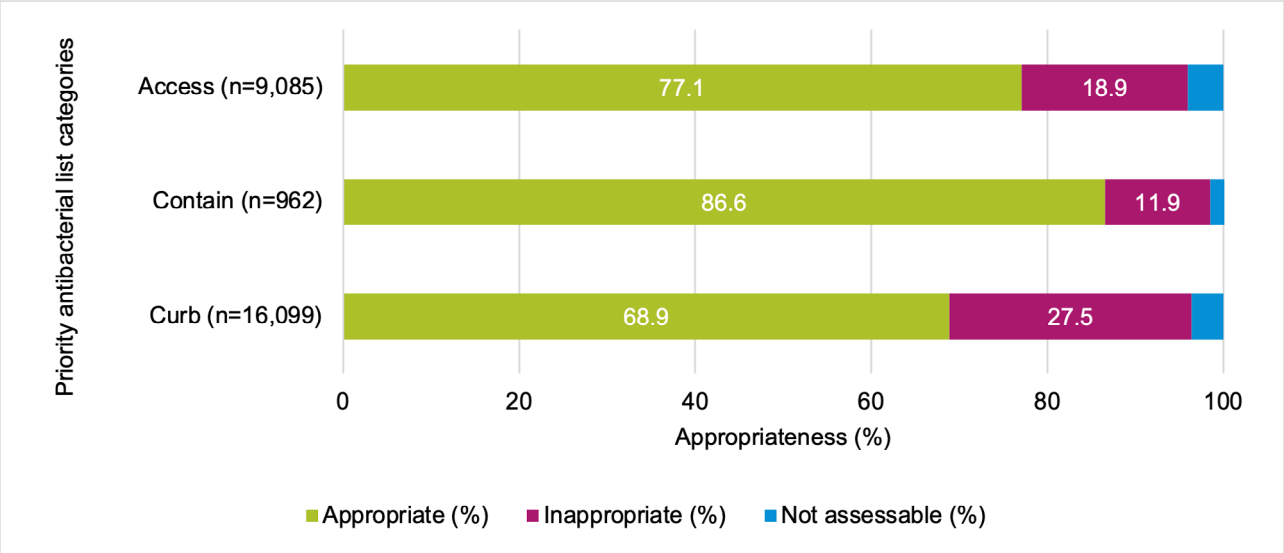
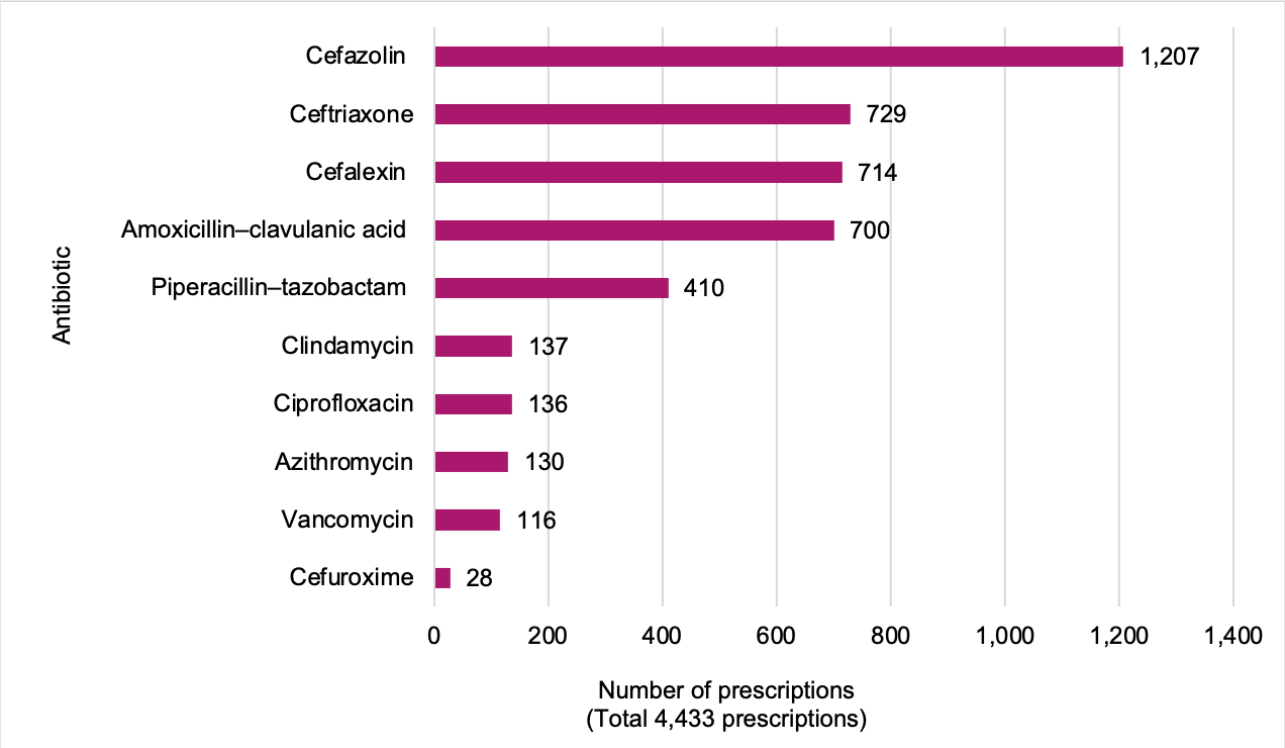


Figure 10: Number of inappropriate prescriptions of Curb antibiotics on the Priority Antibacterial List*, 2020



* Only antibiotics with more than 25 inappropriate prescriptions are shown.

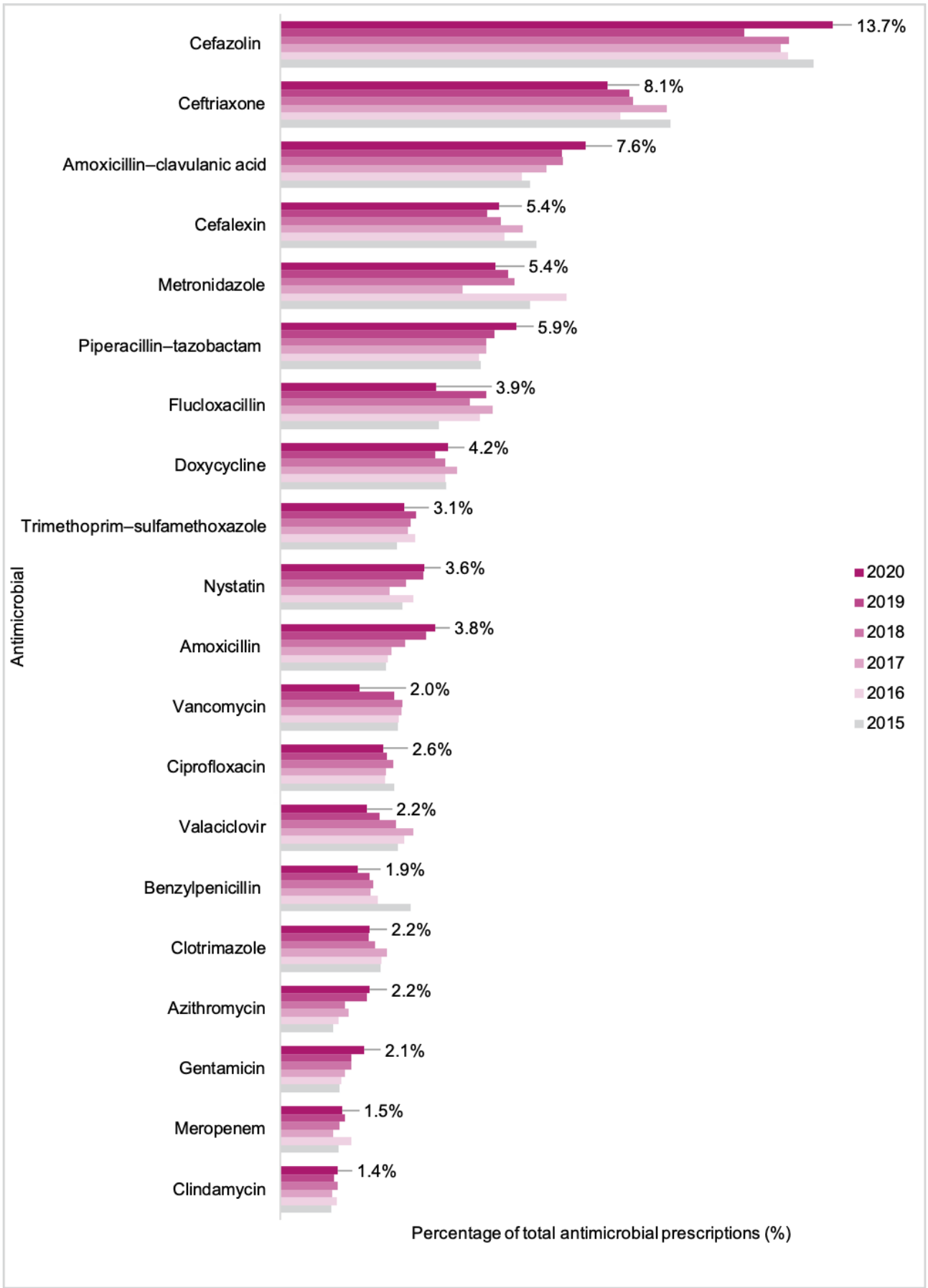
A significantly higher proportion of antibiotic prescribing in the Curb category was assessed to be inappropriate (27.5%) compared to antibiotics in the Contain (11.9%) and Access (18.9%) groups (Figure 9). Antimicrobials in the Access category are often used as first-line therapy according to guidelines. Antimicrobials in the Contain category are often prescribed by, or used as per advice from, specified infectious disease services, resulting in the high proportion of prescriptions being assessed as appropriate.

In contrast, antimicrobials in the Curb category are commonly used for indications that are often assessed as inappropriate – for example, cefazolin in surgical prophylaxis and ceftriaxone in treating respiratory illnesses including COPD. Of the Curb antimicrobials, cefazolin, ceftriaxone, cefalexin, amoxicillin–clavulanic acid, and piperacillin–tazobactam make up 84.8% of all the inappropriate doses. Therefore, targeting these antimicrobials, perhaps through a combination of restrictive policies and educational initiatives, will significantly impact on the appropriateness of antimicrobial prescribing nationally.

3.5. Most commonly prescribed antimicrobials

Figure 11 shows the 20 most common antimicrobials prescribed by NAPS contributor hospitals in 2020. Cefazolin continues to be the most frequently prescribed antimicrobial. There is a visible reduction in ceftriaxone use in 2020. This is potentially due to the reduction in antimicrobials being used to treat respiratory illnesses, which is discussed further in Section 3.6.

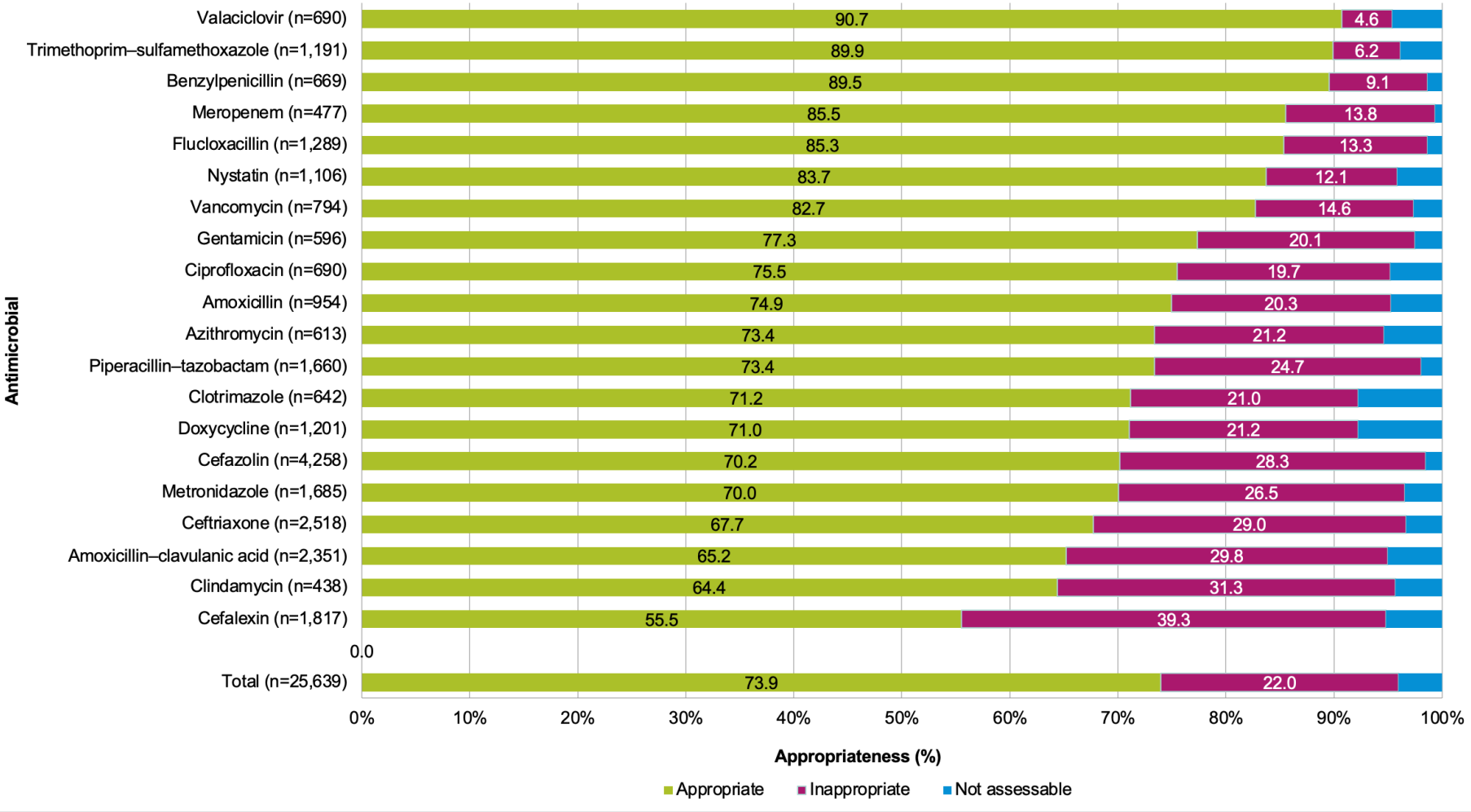
Figure 11: The 20 most common antimicrobials prescribed by Hospital NAPS contributor hospitals, 2015–2020



3.5.1. Appropriateness of the most commonly prescribed antimicrobials

The top 5 most commonly prescribed antimicrobials (cefazolin, ceftriaxone, amoxicillin–clavulanic acid, cefalexin and metronidazole) also had amongst the highest rates of inappropriateness (Figure 12). These results are relatively consistent compared with the 2019 results. Combined, these 5 agents account for approximately 40% of all antimicrobials surveyed, yet they had rates of inappropriateness ranging between 28.3% and 39.3%. The most inappropriately prescribed antimicrobial continues to be cefalexin (39.3% in 2020; 41.5% in 2019).

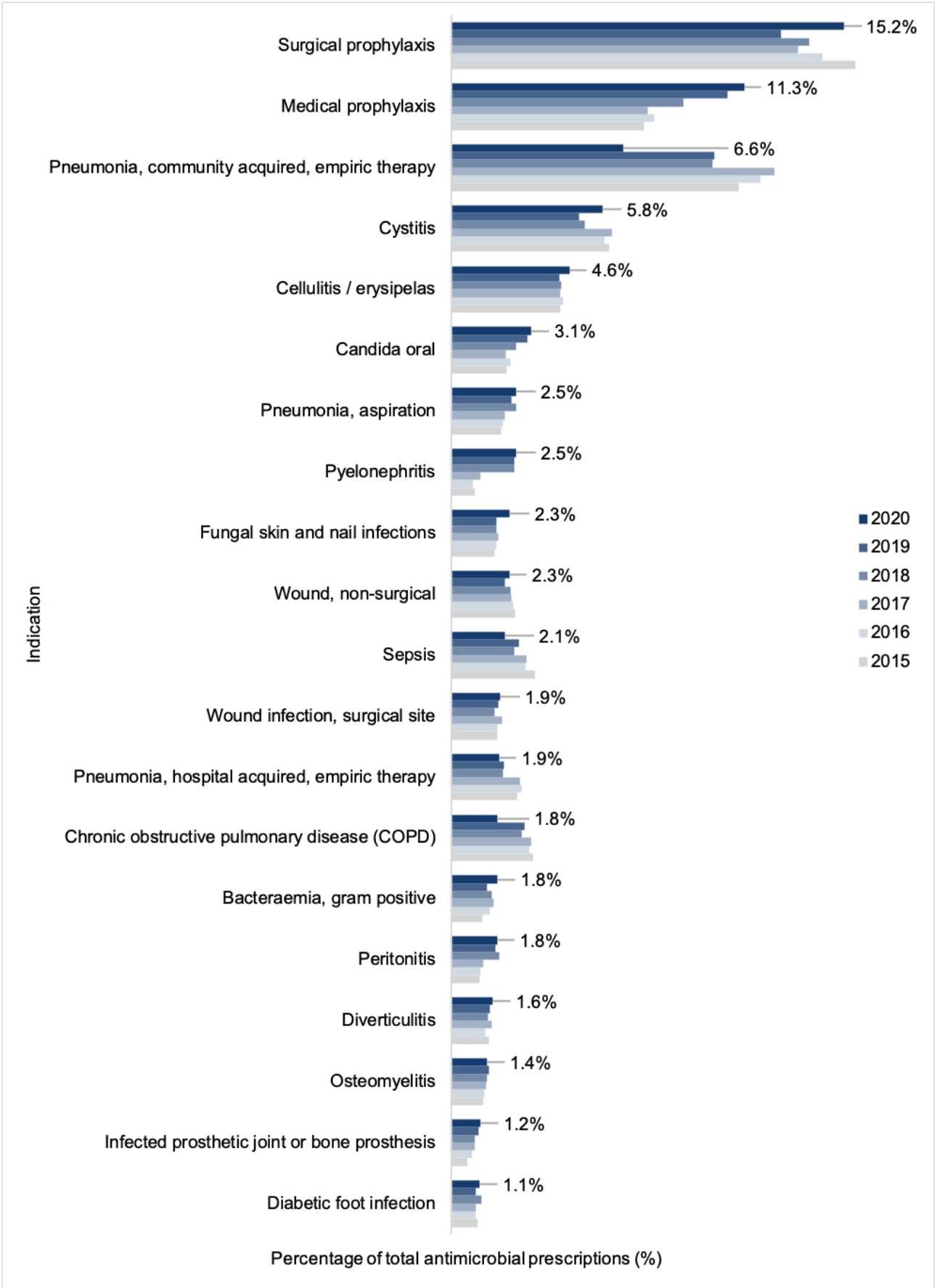
Figure 12: Appropriateness of the 20 most commonly prescribed antimicrobials in Hospital NAPS contributor hospitals, 2020



3.6. Most common indications for antimicrobial prescribing

There have been some noticeable shifts in the proportions of indications compared with the 2019 survey. The percentage of antimicrobials prescribed for community-acquired pneumonia has reduced noticeably, from 10.6% in 2019 to 6.6% in 2020. The proportion of antimicrobial prescriptions for COPD also reduced, from 2.8% in 2019 to 1.8% in 2020. It is likely that, rather than these changes being due to a reduction in the proportion of patients with respiratory illnesses being prescribed antimicrobial therapy, they are in fact a reflection of a lower number of patients with these conditions in hospital. The impact of COVID-19 related lockdowns and restrictions would have reduced the transmission of respiratory-related illnesses and the associated burden on the healthcare system, and hence reduced the number of patients presenting to hospital with these illnesses.

Figure 13: The 20 most common indications for antimicrobial prescribing in Hospital NAPS contributors, 2015–2020

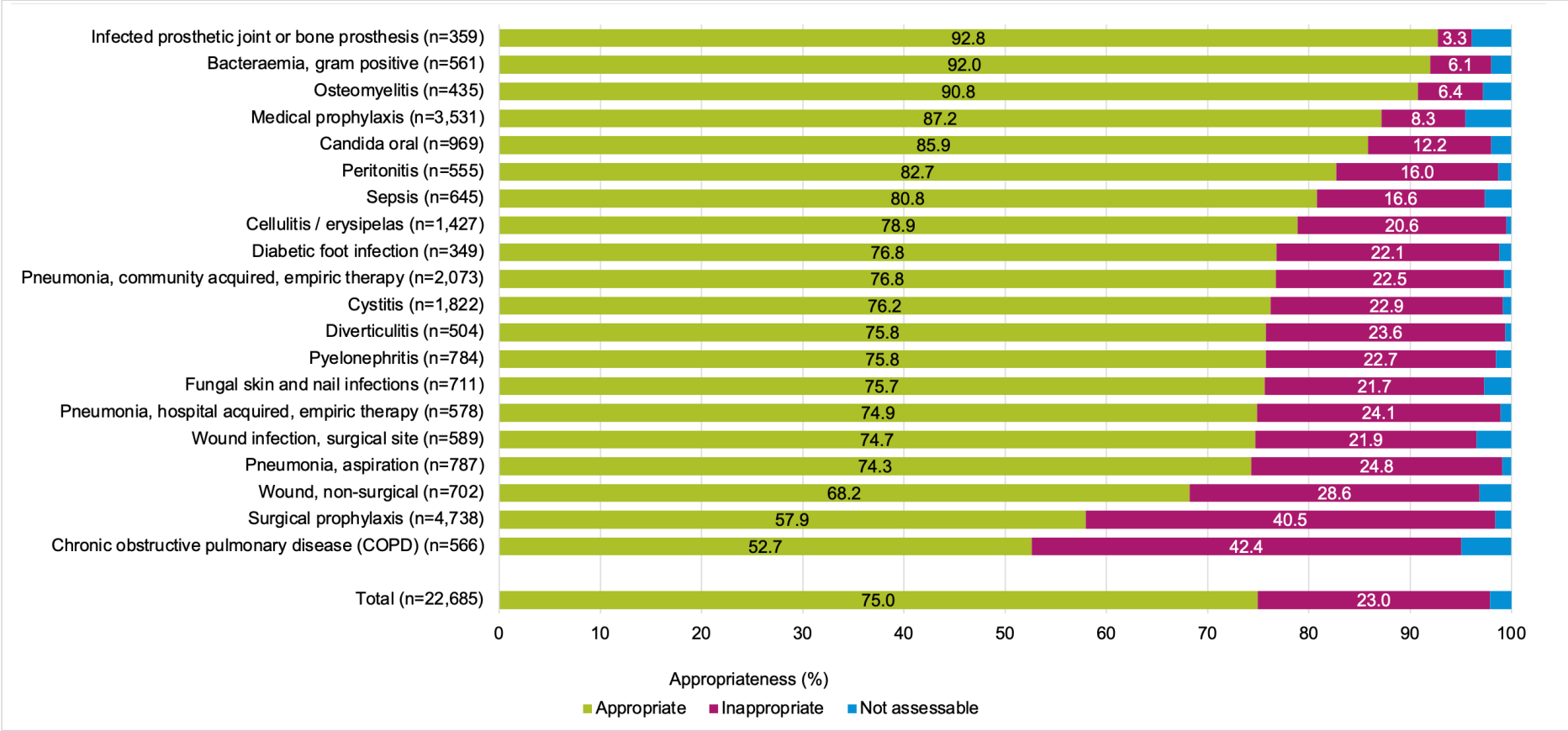


Appropriateness of prescribing for the 20 most common indications

Of the 20 most common indications in 2020, the 3 indications with the most inappropriate prescribing continue to be COPD, surgical prophylaxis and non-surgical wound infection (Figure 14); this distribution has remained unchanged for several years. Interestingly, very few surgical prophylaxis prescriptions were deemed to be not assessable (possibly due to the heavily protocolised nature of this indication), yet there were still very high rates of inappropriate prescribing.

In contrast, other indications with clear prescribing protocols such as febrile neutropenia and medical prophylaxis had very high rates of appropriate prescribing. Bacteraemia (both gram positive and gram negative) and osteomyelitis also had high rates of appropriate prescribing, likely due to the specialised infectious diseases oversight required for the management of these patients.

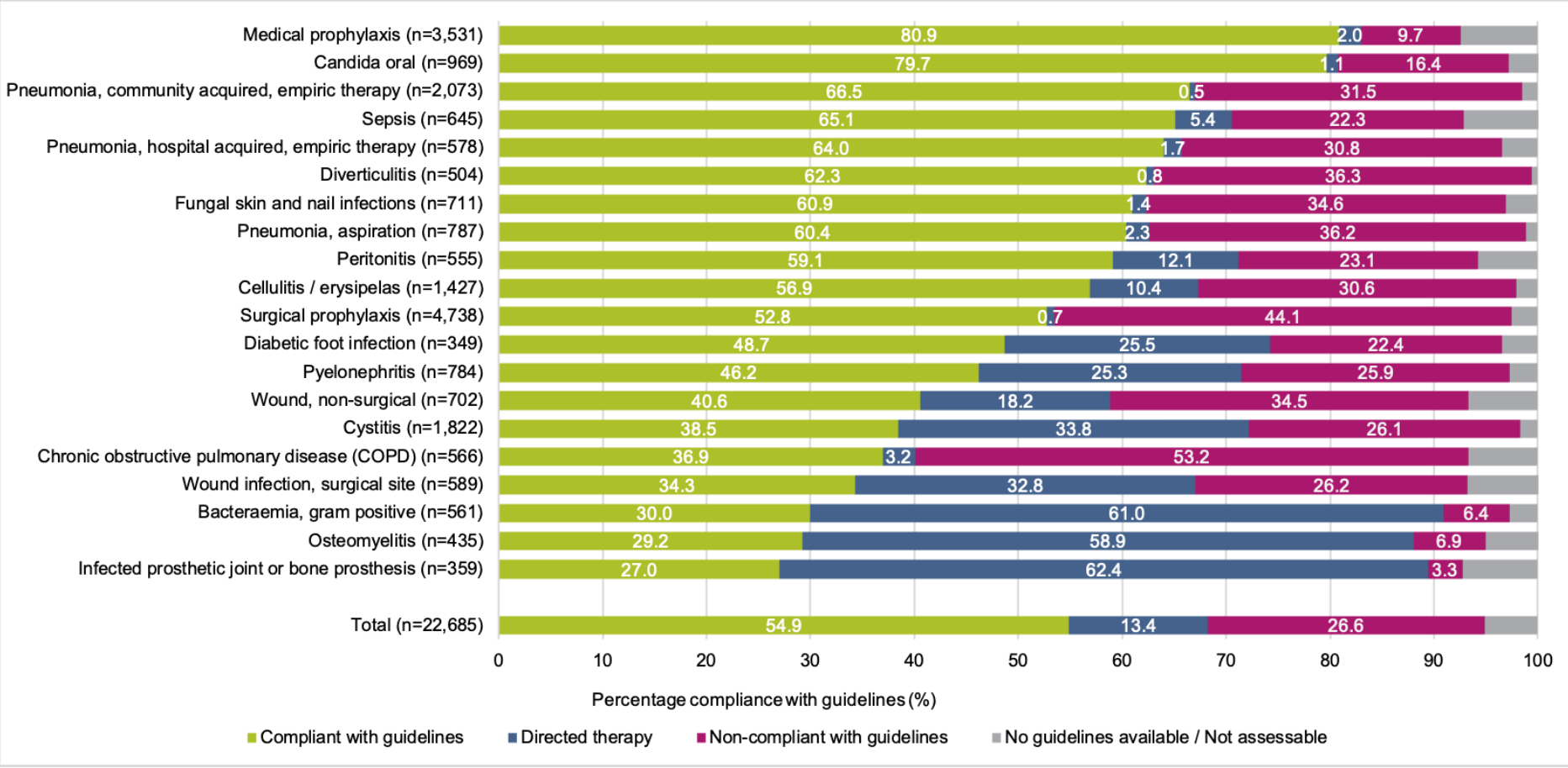
Figure 14: Appropriateness of prescribing for the 20 most common indications in the Hospital NAPS contributors, 2020*



* Excludes prescriptions where the indication for prescribing was unknown (n=671).

3.6.1. Compliance with guidelines for the 20 most common indications

Figure 15: Compliance with guidelines for the 20 indications most commonly requiring antimicrobials in Hospital NAPS contributors, 2020



* Excludes prescriptions where the indication for prescribing was unknown (n=676).

For the top 20 most common indications, the average rate of non-compliance (compliance with neither the Therapeutic Guidelines nor locally endorsed guidelines) was 26.6%. Indications that were frequently evaluated as being non-compliant with guidelines were COPD, wound infections (both surgical and non-surgical) and surgical prophylaxis. Not surprisingly, these indications were also associated with high rates of inappropriateness (Figure 14). These findings have remained consistent across many years of NAPS surveys despite the existence of clear national guidelines and a substantial revision to the antimicrobial recommendations in the Therapeutic Guidelines in 2019. This suggests there is still considerable work to be done in supporting and educating prescribers in good antimicrobial prescribing. It is also possible that the impact of COVID-19 meant that many hospital stewardship services did not have the resources to implement education initiatives on the new guidelines for the relevant medical teams.

In contrast, those conditions where prescribing is often guided by microbiology and susceptibility results, such as bacteraemia and osteomyelitis, had high rates of being categorised as directed therapy and had correspondingly high levels of appropriateness. Similarly, other indications with well-implemented protocols and guidelines, such as medical prophylaxis and febrile neutropenia, were also more likely to be assessed as appropriate.

3.7. Impact of COVID-19 on 2020 Hospital NAPS

The global pandemic of COVID-19, caused by the novel severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), significantly impacted on human health and the daily life of people across the world. Although there has been limited community transmission in Australia compared to other parts of the world, COVID-19 significantly impacted on the Australian healthcare system both directly and indirectly in 2020.

From March 2020, lockdown and physical distance measures were implemented across all states and territories in Australia. These measures, in conjunction with mask wearing and improved hand hygiene, likely affected the transmission of a variety of communicable respiratory illnesses. It is possible that this reduced the number of patients presenting to healthcare facilities with respiratory infections such as influenza and community-acquired pneumonia. For example, the proportion of antimicrobials prescribed for community-acquired pneumonia in 2020 was 8.9%, which is considerably lower than previous years' results of between 13% and 15%.

The strain on the healthcare workforce caused by COVID-19 is likely to have impacted on the resources available to conduct the Hospital NAPS and also to implement AMS quality initiatives. The extent of this impact over the 2020 data collection period is unknown, although the overall number of facilities participating in the Hospital NAPS increased compared to 2019 (Figure 1). Victoria was the hardest hit state. It entered a prolonged period of lockdown from July to October 2020, with Melbourne having substantial restrictions in place for 112 days. This likely explains why there were 5 fewer Victorian public hospitals participating in the Hospital NAPS during 2020 compared to 2019.

There was only one patient included in the 2020 Hospital NAPS data who was treated for SARS-CoV-2. This is likely attributable to the fact that facilities were unable to conduct quality improvement surveys such as NAPS during the peak of COVID-19 due to resource constraints.

4. Implications for clinical practice

4.1. Documentation

Accurate documentation of an antimicrobial's indication and review or stop date is a vital AMS measure to ensure that all clinicians accessing the patient's record have a clear understanding of why the antimicrobial has been prescribed and when it should be reassessed or ceased. Encouragingly, there was continued improvement in these 2 key performance indicators. Whilst there is still some work to be done before the best-practice target of 95% documentation is reached, these improvements are nonetheless to be celebrated. They demonstrate the positive impact of having nationally endorsed AMS standards and criteria as well as the NAPS program itself.

Additionally, the continued adoption of electronic medication management systems across many Australian hospitals will help to improve documentation into the future. These systems can be configured to require clinicians to document the indication and a review or stop date at the point of prescribing. NCAS is continuing to work with health service providers to explore ways in which the unique indications list currently utilised in the NAPS can be embedded into these systems to support standardised documentation and reporting.

4.2. Indications with poorer prescribing

Higher rates of guideline non-compliance and inappropriateness were observed for:

- respiratory tract infections, particularly COPD, aspiration pneumonia and community-acquired pneumonia
- wound infections, both surgical and non-surgical site infections
- surgical prophylaxis.

These clinical areas have been consistently identified in all previous years' NAPS reports. The newly revised antimicrobial guidelines in the Therapeutic Guidelines released in 2019 had considerably expanded recommendations in these areas. Nonetheless, it takes time for new guidelines to disseminate through hospitals and for practice change to occur. It is possible that, due to the COVID-19 pandemic's impact on hospital staffing, hospitals may not have had the resources required to implement quality initiatives based on these recommendations. We will await the results of future surveys to further analyse these trends.

Furthermore, NCAS will continue to collaborate with specific medical colleges and other key stakeholders to improve awareness and prescribing in these areas.

4.3. Updated clinical care standards

The new version of the Antimicrobial Stewardship Clinical Care Standard (CCS)[10] was released in mid-2020 with expanded indicators in several of the problem areas identified in previous NAPS: documentation of indication and review or stop date, surgical prophylaxis measures such as guideline compliance, dosage and prolonged therapy, adverse drug reactions, and antimicrobial review at 48 hours. Since this occurred in the middle of the Hospital NAPS data collection period, the changes are unlikely to have had any impact on the survey results; however, this will further help to embed many of the NAPS core elements into hospitals' AMS programs.

Given that the CCS is now a key requirement in hospital accreditation standards, the NAPS will be updated to explicitly incorporate the CCS indicators as part of the survey data-collection fields.

5. Conclusion

Participation in the Hospital NAPS across public and private hospitals continued to increase in 2020 despite the significant challenges arising from the COVID-19 pandemic. The results showed some encouraging improvements in several key indicators, as well as ongoing themes of poor prescribing in areas such as respiratory tract infections, wound infections and surgical prophylaxis. Additionally, higher inappropriateness was observed for frequently prescribed antimicrobials such as cefalexin, amoxicillin–clavulanic acid, and ceftriaxone.

Whilst overall appropriateness of prescribing has remained steady for several years, in-depth analysis of the peer groups shows that, encouragingly, appropriateness is improving across most public hospital peer groups as their antimicrobial stewardship programs mature and become embedded into hospital practice. Whilst appropriateness remains lower in private hospitals, this is anticipated to increase as more private hospitals participate in the NAPS.

There have been some recent substantial expansions in national guidelines and quality standards, particularly expanded antimicrobial recommendations in the Therapeutic Guidelines and expanded indicators in the Antimicrobial Stewardship CCS. Many of these updates directly address problem areas identified in previous NAPS. It is possible that the COVID-19 pandemic has impacted on hospitals' ability to embed these changes, so we will await the results of future surveys to determine longer term impact.

Appendix 1: Results

Figure 1A: Public and private hospital participation in Hospital NAPS by peer group classification, 2015–2020

* This category includes public children's hospitals, women's hospitals, and women's and children's hospitals.

† This category includes public rehabilitation and geriatric evaluation and management hospitals, psychiatric hospitals and unpeered hospitals.

§ This category includes private rehabilitation hospitals, acute psychiatric hospitals and other acute specialised hospitals

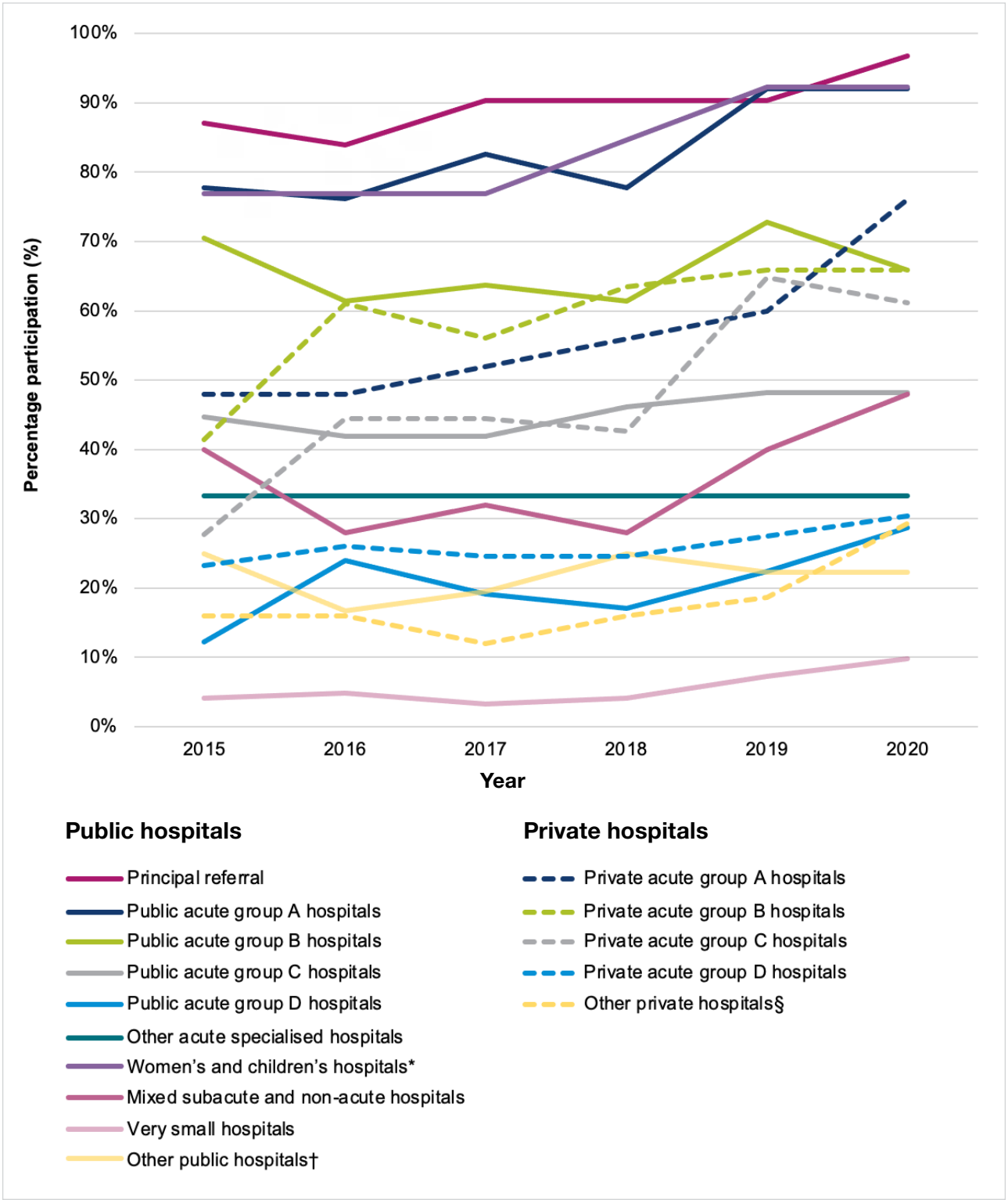


Table 1A: Public and private hospitals that contributed to Hospital NAPS by state, territory and remoteness area, 2020

		Funding type	Number of participating hospitals	Number of hospitals in reporting group*	Participation	Number of participating hospitals	Number of hospitals in reporting group*	Total participating hospitals
			No.	No.	%	No.	No.	%
State or territory	NSW	Public	112	213	53	152	306	49.7
		Private	40	93	43			
	Vic	Public	78	144	54	113	220	51.4
		Private	35	76	46			
	Qld	Public	45	122	37	71	181	39.2
		Private	26	59	44			
	SA	Public	17	77	22	22	106	20.8
		Private	5	29	17			
	WA	Public	22	92	24	31	112	27.7
		Private	9	20	45			
	Tas	Public	4	23	17	7	29	24.1
		Private	3	6	50			
	NT	Public	4	5	80	5	6	83.3
		Private	1	1	100			
	ACT	Public	2	2	100	5	6	83.3
		Private	3	4	75			
Remoteness	Major cities	Public	112	170	66	207	389	53.2
		Private	95	219	43			
	Inner regional	Public	94	190	49	114	244	46.7
		Private	20	54	37			
	Outer regional	Public	61	208	29	68	224	30.4
		Private	7	16	44			
	Remote	Public	14	60	23	14	60	23.3
		Private	na^	na^	na^			
	Very remote	Public	3	50	6	3	50	6.0
		Private	na^	na^	na^			
Total		**Public**	**284**	**678**	**42**	**406**	**966**	**42.0**
		Private	**122**	**288**	**42**			

* Numbers represent all eligible hospitals in the AIHW reporting groups for public and private, states and territories, and remoteness classifications[7]

^ na = not applicable.

Table 1B: Public and private hospitals that contributed to the Hospital NAPS by peer group, 2020

		Number of participating hospitals	Number of hospitals in reporting group^	Participation
		No.	No.	%
Public hospital peer groups*	Principal referral	30	31	97
	Public acute group A hospitals	58	63	92
	Public acute group B hospitals	29	44	66
	Public acute group C hospitals	68	141	48
	Public acute group D hospitals	54	188	29
	Other acute specialised hospitals	1	3	33
	Children's hospitals	6	6	100
	Women's and children's hospitals	6	7	86
	Mixed subacute and non-acute hospitals	12	25	48
	Rehabilitation and GEM hospitals†	6	13	46
	Very small hospitals	12	123	10
	Psychiatric hospitals	1	23	4
	Unpeered	1	9	11
Private hospital peer groups§	Private acute group A hospitals	19	25	76
	Private acute group B hospitals	27	41	66
	Private acute group C hospitals	33	54	61
	Private acute group D hospitals	21	69	30
	Other acute specialised hospitals	5	18	28
	Private rehabilitation hospitals	12	25	48
	Private acute psychiatric hospitals	3	30	10
	Women's hospitals	1	2	50
	Haematology and oncology clinics	1	10	10
TOTAL		**406**	**950**	**43**

^ * Numbers represent all eligible hospitals in the AIHW reporting groups for public and private, states and territories, and remoteness classifications.

* Excludes early parenting centres, same-day hospitals and outpatient hospitals.

† GEM = geriatric evaluation and management.

§ Excludes ineligible private hospitals.

Table 1C: Hospital NAPS key indicator results, by state and territory, remoteness area and AIHW peer group, 2020

		Key indicators						
		Number of hospitals	Percentage of all hospitals	Number of prescriptions	Percentage of all prescriptions	Indication documented	Review or stop date documented	Surgical prophylaxis >24 hours
		No.	%	No.	%	%	%	%*
State or territory	ACT	5	1.2	549	1.8	89.6	51.7	43.0
	NSW	152	37.4	10,516	34.3	86.4	54.3	31.7
	NT	5	1.2	475	1.5	93.9	47.6	53.8
	Qld	71	17.5	5,557	18.1	82.7	46.0	20.8
	SA	22	5.4	2,315	7.6	81.5	54.9	14.6
	Tas	7	1.7	727	2.4	81.2	48.3	18.4
	Vic	113	27.8	7,775	25.4	84.4	54.6	29.3
	WA	31	7.6	2,740	8.9	83.1	47.0	21.2
Remoteness	Major cities	207	51.0	22,062	71.2	84.5	55.6	24.1
	Inner regional	114	28.1	5,772	18.6	84.8	44.9	27.1
	Outer regional	68	16.7	2,606	8.4	83.7	38.4	23.3
	Remote	14	3.4	477	1.5	90.4	47.2	41.7
	Very remote	3	0.7	69	0.2	81.2	30.4	100.0
Public hospital peer group	Principal referral	30	7.4	9,162	29.6	90.6	51.5	27.2
	Public acute group A hospitals	58	14.3	6,760	21.8	87.6	50.3	25.7
	Public acute group B hospitals	29	7.1	1,685	5.4	90.4	47.7	29.0
	Public acute group C hospitals	68	16.7	2,863	9.2	84.2	44.1	24.7
	Public acute group D hospitals	54	13.3	978	3.2	88.4	33.3	57.1
	Other acute specialised hospitals	1	0.2	119	0.4	90.8	32.8	87.5
	Children's hospitals	6	1.5	951	3.1	88.4	61.6	28.0
	Women's and children's hospitals	6	1.5	310	1.0	95.9	58.3	25.3
	Mixed subacute and non-acute hospitals	12	3.0	370	1.2	89.5	72.4	33.3
	Rehabilitation and GEM hospitals†	6	1.5	182	0.6	92.3	49.5	100.0
	Very small hospitals	12	3.0	78	0.3	91.0	73.1	na
	Psychiatric hospitals	1	0.2	210	0.7	92.9	70.5	na
	Unpeered	1	0.2	69	0.2	76.8	62.3	75.0

Private hospital peer group	Private acute group A hospitals	19	4.7	2,581	8.3	73.4	53.6	27.9
	Private acute group B hospitals	27	6.7	1,715	5.5	62.4	52.4	29.4
	Private acute group C hospitals	33	8.1	1,354	4.4	69.9	58.5	25.6
	Private acute group D hospitals	21	5.2	796	2.6	69.1	74.4	19.6
	Other acute specialised hospitals	5	1.2	196	0.6	91.3	79.6	19.4
	Private rehabilitation hospitals	12	3.0	399	1.3	74.2	58.1	75.0
	Private acute psychiatric hospitals	3	0.7	72	0.2	84.7	62.5	100.0
	Women's hospitals§	1	–	–	–	–	–	–
	Haematology and oncology clinics§	1	–	–	–	–	–	–
Funding type	Public	284	70.0	23,837	76.9	88.9	50.3	27.1
	Private	122	30.0	7,149	23.1	70.3	57.6	26.3
Combined national result		**406**	**100**	**30,986**	**100**	**84.6**	**52.0**	**26.6**

* Where surgical prophylaxis was selected as the indication (n=4,662 in 2020).

† GEM = geriatric evaluation and management.

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

Table 1D: Compliance with guidelines and prescription appropriateness in Hospital NAPS contributors, by state and territory, remoteness area and AIHW peer group, 2020

		Compliance with guidelines§ (%)					Appropriateness (%)		
		Compliant	Non-compliant	Directed therapy	Not available	Not assessable	Appropriate	Inappropriate	Not assessable
State or territory	ACT	49.0	22.0	12.6	10.6	5.8	71.6	23.9	4.6
	NSW	52.8	28.0	13.7	2.4	3.2	71.9	24.2	3.9
	NT	57.5	24.4	12.0	5.3	0.8	78.1	18.9	2.9
	Qld	56.3	23.9	13.7	2.9	3.1	75.6	20.5	3.9
	SA	57.1	24.1	12.7	2.6	3.5	77.7	18.1	4.1
	Tas	51.7	21.5	14.2	8.7	4.0	74.3	19.5	6.2
	Vic	53.5	27.6	11.2	4.2	3.5	73.2	22.3	4.5
	WA	50.4	26.4	16.8	4.3	2.2	76.7	20.5	2.8
Remoteness	Major cities	53.2	25.3	14.2	3.9	3.4	74.3	21.7	4.0
	Inner regional	55.8	29.5	9.6	2.3	2.8	72.9	23.2	3.9
	Outer regional	54.5	26.7	13.5	2.4	3.0	73.9	21.8	4.4
	Remote	48.0	32.1	12.2	4.0	3.8	71.9	24.9	3.1
	Very remote	34.8	60.9	4.3	na	na	50.7	49.3	0.0
	Principal referral	53.6	21.7	17.7	4.5	2.6	78.2	18.8	3.1
Public hospital peer group	Public acute group A hospitals	53.2	26.4	13.9	4.1	2.4	76.0	21.2	2.8
	Public acute group B hospitals	49.2	33.2	11.3	3.3	3.0	70.1	26.1	3.8
	Public acute group C hospitals	56.5	30.0	9.3	0.9	3.3	73.0	23.1	3.9
	Public acute group D hospitals	51.6	37.0	8.1	0.8	2.5	67.6	28.9	3.5
	Other acute specialised hospitals	72.3	10.9	12.6	1.7	2.5	84.9	12.6	2.5
	Children's hospitals	64.6	12.2	12.6	8.3	2.3	84.4	13.4	2.2
	Women's and children's hospitals	76.1	11.2	6.1	5.6	1.0	84.9	13.4	1.7
	Mixed subacute and non-acute hospitals	48.4	20.3	19.2	4.9	7.3	80.0	10.0	10.0
	Rehabilitation and GEM* hospitals	54.9	25.3	11.0	4.4	4.4	74.2	19.2	6.6
	Very small hospitals	65.4	17.9	16.7	0.0	0.0	82.1	17.9	0.0
	Psychiatric hospitals	61.0	28.6	4.3	0.0	6.2	78.1	15.2	6.7
	Unpeered hospitals	40.6	36.2	18.8	1.4	2.9	69.6	27.5	2.9

Private Hospital peer group	Private acute group A hospitals	49.9	33.6	10.6	2.1	3.8	66.3	29.0	4.8
	Private acute group B hospitals	52.0	28.3	10.3	3.1	6.3	66.1	25.2	8.7
	Private acute group C hospitals	44.8	39.4	8.4	2.0	5.3	59.5	34.6	5.9
	Private acute group D hospitals	63.6	25.1	5.2	1.6	4.5	68.3	23.9	7.8
	Other acute specialised hospitals	68.4	18.4	8.7	2.6	2.0	80.6	17.3	2.0
	Private rehabilitation hospitals	42.6	27.3	22.1	1.8	6.3	70.4	20.3	9.3
	Private acute psychiatric hospitals	69.4	5.6	4.2	0.0	20.8	70.8	11.1	18.1
	Women's hospitals†	–	–	–	–	–	–	–	–
	Haematology and oncology clinics†	–	–	–	–	–	–	–	–
Funding type	Public	54.4	24.9	14.2	3.8	2.7	76.3	20.4	3.3
	Private	51.5	31.3	10.0	2.2	5.0	65.9	27.5	6.6
Combined national result		**53.7**	**26.4**	**13.2**	**3.4**	**3.2**	**73.9**	**22.1**	**4.0**

* GEM = geriatric evaluation and management.

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

§ Compliance with guidelines: aggregate of 'Compliant with Therapeutic Guidelines' and 'Compliant with locally endorsed guidelines'.

Table 1E: Hospital NAPS compliance with guidelines and prescription appropriateness, for all prescriptions, 2013–2020

Key indicator		Percentage of total prescriptions (%)							
		2013	2014	2015	2016	2017	2018	2019	2020
Compliance with guidelines	Compliant with Therapeutic Guidelines	44.5	44.2	45.2	42.4	44.8	44.2	42.3	44.7
	Compliant with local guidelines	14.1	12.6	10.4	9.7	9.3	9.4	9.8	9.0
	Non-compliant	22.7	23.9	23.8	26.9	26.2	25.7	27.5	26.4
	Directed therapy	na	9.5	12.0	12.7	12.5	13.7	13.7	13.2
	No guideline available	12.0	5.3	3.7	4.0	3.3	3.6	3.4	3.4
	Not assessable	6.6	4.5	4.9	4.4	3.8	3.4	3.4	3.2
Appropriateness	Optimal	54.0	55.2	54.5	56.6	58.1	60.0	58.8	59.2
	Adequate	16.9	16.9	17.8	15.6	14.9	14.8	14.1	14.7
	Suboptimal	15.0	12.7	12.3	11.3	12.2	11.9	13.0	12.2
	Inadequate	7.7	10.5	10.0	11.2	10.2	9.5	10.3	9.8
	Not assessable	6.6	4.7	5.4	5.3	4.7	3.8	3.8	4.0

Appendix 2: Data collection form

HOSPITAL NAPS National Antimicrobial Prescribing Survey

GUIDANCE | NCAS

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

Antimicrobials

Only record the antimicrobials as prescribed at 8:00 am on the day of the audit and any surgical prophylaxis or stat doses in the previous 24 hours

For NICU patients: Birth weight *kg* | Gestational age *weeks*

Start date	Antimicrobial	Route	Dose	Freq	Prescriber code#	Indication documented	Specify documented or presumed indication	Review / stop date documented	Guideline compliance (1-6)	Surgical prophylaxis > 24 hrs	Allergy mismatch	Microbiology mismatch	Indication does not require any antimicrobials	Incorrect route	Incorrect dose / frequency	Incorrect duration	Spectrum too broad	Spectrum too narrow	If restricted: approval given	Appropriateness (1 - 5)
/ /																				
/ /																				
/ /																				
/ /																				
/ /																				

#Maximum of 6 characters, of which there must be at least 2 numbers

Adverse drug reactions (including allergy) to antimicrobial

❒ Nil known ❒ Present ❒ Not documented

If present, specify drugs or classes and nature of allergies

Were appropriate microbiology samples collected?

❒ Yes ❒ Partially* ❒ Not applicable ❒ No ❒ Not assessable

Record the specimen type, organism, and susceptibilities if relevant

*If more than one indication or microbiological sample is required

Guideline compliance

1. Compliant with Therapeutic Guidelines
2. Compliant with locally endorsed guidelines*
3. Non-compliant with guidelines
4. Directed therapy
5. No guidelines available
6. Not assessable

*Select **Therapeutic Guidelines** if local guidelines are the same

Clinical notes or comments

❒ Renal replacement therapy given within previous 24hrs (*e.g., dialysis*)

Surgical procedure if performed

If prophylaxis given within previous 24 hrs; *include in audit*

Appropriateness

*please refer to the **appropriateness definitions** in the resources tab or in the user guide*

1. Optimal
2. Adequate
3. Suboptimal
4. Inadequate
5. Not assessable

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Appendix 3: Appropriateness definitions

Hospital NAPS appropriateness definitions

			If endorsed guidelines are present	If endorsed guidelines are absent
Appropriate	1	Optimal[1]	Antimicrobial prescription follows either the Therapeutic Guidelines[2] or endorsed local guidelines *optimally*, including antimicrobial choice, dosage, route and duration[3]	The antimicrobial prescription has been reviewed and endorsed by an infectious diseases clinician or a clinical microbiologist **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
	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	There may be a mild or non-life-threatening allergy mismatch **OR** Antimicrobial prescription including antimicrobial choice, dosage, route and duration[3], is an ***unreasonable*** choice for the likely causative or cultured pathogens, including: • spectrum excessively broad, unnecessary overlap in spectrum of activity, dosage excessively high or duration excessively long • failure to appropriately de-escalate with microbiological results	
	4	Inadequate	Antimicrobial prescription including antimicrobial choice, dosage, route or duration[3] is ***unlikely*** to treat the likely causative or cultured pathogens **OR** The documented or presumed indication does not require ***any*** antimicrobial treatment **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 local guidelines endorse this)	
	5	Not assessable	The indication is not documented and unable to be determined from the notes **OR** 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 weight, allergy status, renal or hepatic function, or relevant drug interactions (if this information is available)

[2] Antibiotic Expert Group. Therapeutic Guidelines: Antibiotic. Version 16 (2019), or online version

[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

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Appendix 4: Compliance with guidelines assessment criteria

Compliance with guidelines *(only choose one of the following five criteria)*

Compliant with Therapeutic Guidelines[1]	• The prescription complies with the current Therapeutic Guidelines[1], including: ○ *route, dose, frequency* **AND** ○ *takes into account acceptable alterations due to age, weight, renal function, allergies, other prescribed medications etc.*
Compliant with locally endorsed guidelines[2]	• The prescription complies with an officially endorsed local guideline, including: ○ *route, dose, frequency* **AND** ○ *takes into account acceptable alterations due to age, weight, renal function, allergies, other prescribed medications etc.* • This does not include individual, departmental, or historical guidelines that do not have executive or drug and therapeutic committee approval • If the local guidelines are based exactly on the Therapeutic Guidelines[1], then choose the '*Therapeutic Guidelines*' in preference to '*Local guidelines*'
Non-compliant with guidelines	• There is non-compliance with both Therapeutic Guidelines[1] and local guidelines. **UNLESS** *the prescription takes into account acceptable alterations due to age, weight, renal function, allergies, other prescribed medications etc.*
Directed therapy	• The prescription has changed from empiric to directed therapy with microbiology culture or susceptibility results available
No guidelines available	• There are no guidelines available for the documented or presumed indication
Not assessable	• The medical records are not comprehensive enough to determine a documented or presumed indication **OR** • It is difficult to assess if there is compliance

1. Antibiotic Expert Group. Therapeutic Guidelines: Antibiotic. Version 16 (2019). Melbourne http://online.tg.org.au/ip/
2. Local guidelines must be authorised and readily available on wards or on the hospital intranet. They cannot be a web link to international guidelines or other non-approved sites. Exceptions include paediatric and neonatal guidelines from an Australian children's hospital and links to other official guidelines within a hospital's network.

Appendix 5: Access, Review, Curb and Contain (ARCC) classification system

Figure 5A: ARCC classification for first-line recommended agents[9]

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

Figure 5B: Priority Antibacterial List[9] based on ARCC classification

Access	Review	
	Curb	**Contain**
amoxicillin	amoxicillin–clavulanic acid	amikacin
ampicillin	azithromycin	aztreonam
benzathine benzylpenicillin	cefaclor	cefepime
benzylpenicilli	cefalexin	ceftaroline
chloramphenicol	cefalotin	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	polymyxin b
tobramycin	rifampicin	pristinamycin
trimethoprim	rifaximin	tigecycline
	roxithromycin	
	sodium fusidate	
	spiramycin	
	teicoplanin	
	vancomycin	

Appendix 6: List of abbreviations

Abbreviation	Definition
ACSQHC	Australian Commission on Safety and Quality in Health Care
AIHW	Australian Institute of Health and Welfare
AMS	antimicrobial stewardship
ARCC	Access, Review, Curb and Contain
AURA	Antimicrobial Use and Resistance in Australia
CCS	Clinical Care Standard
COPD	Chronic Obstructive Pulmonary Disease
COVID-19	coronavirus-19
GEM	geriatric evaluation and management
NAPS	National Antimicrobial Prescribing Survey
NCAS	National Centre for Antimicrobial Stewardship
NSQHS	National Safety and Quality Health Service
SARS-CoV-2	severe acute respiratory syndrome coronavirus 2

References

1. Australian Government Department of Health, Australian Government Department of Agriculture. Australia's National Antimicrobial Resistance Strategy: 2020 and Beyond. Canberra; 2020.
2. Australian Commission on Safety and Quality in Health Care. Antimicrobial Use and Resistance in Australia Surveillance System. Available from: https://www.safetyandquality.gov.au/our-work/antimicrobial-resistance/antimicrobial-use-and-resistance-australia-surveillance-system. [Cited 2022 May 9].
3. eTG Complete [Internet]. Australia. Therapeutic Guidelines Limited; 2022. Available from: https://tgldcdp.tg.org.au/etgcomplete. [Cited 2022 May 9].
4. Australian Commission on Safety and Quality in Health Care. National Safety and Quality Health Service Standards. 2nd ed. Sydney: ACSQHC; 2017
5. Australian Commission on Safety and Quality in Health Care. Antimicrobial Stewardship Clinical Care Standard. Sydney: ACSQHC; 2014.
6. Australian Bureau of Statistics. Australian Statistical Geography Standard (ASGS): Volume 5 – remoteness structure July 2016 [Internet]. ABS; 2016. Available from: https://www.abs.gov.au/AUSSTATS/abs@.nsf/allprimarymainfeatures/D964E42C5DF5B6D4CA257B03000D7ECB?opendocument. [Cited 2020 September 11].
7. Australian Institute of Health and Welfare. Hospitals at a glance 2017–18. Canberra: AIHW; 2019. Available from: https://www.aihw.gov.au/reports/hospitals/hospitals-at-a-glance-2017-18.
8. Australian Government Department of Health and Aged Care. Surgical prophylaxis prescribing in Australian hospitals: Results of the 2020 Surgical National Antimicrobial Prescribing Survey. In press 2023.
9. Australian Commission on Safety and Quality in Health Care. Priority Antibacterial List for Antimicrobial Resistance Containment: A stewardship resource for human health. ACSQHC; 2020. Available from: https://www.safetyandquality.gov.au/sites/default/files/2020-04/priority_antibacterial_list_for_amr_containment_-_mar_2020.pdf. [Last accessed May 2022].
10. Australian Commission on Safety and Quality in Health Care. Antimicrobial Stewardship Clinical Care Standard. Sydney: ACSQHC; 2020.

All information in this publication is correct as at January 2023

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DT0002451 January 2023