SURGICAL NAPS National Antimicrobial Prescribing Survey

NCAS National Centre for Antimicrobial Stewardship

GUIDANCE

# Surgical prophylaxis prescribing in Australian hospitals

Results of the 2017 and 2018 Surgical National Antimicrobial Prescribing Surveys

**Public Report** December 2019

The National Centre for Antimicrobial Stewardship
Published by Melbourne Health
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National Centre for Antimicrobial Stewardship. Surgical prophylaxis prescribing in Australian hospitals: results of the 2017 and 2018 Surgical National Antimicrobial Prescribing Surveys. Melbourne: Melbourne Health; 2019

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# Contents

# Abbreviations

| | |
|---|---|
| **ACSQHC** | Australian Commission on Safety and Quality in Health Care |
| **AURA** | Antimicrobial Use and Resistance in Australia |
| **NAPS** | National Antimicrobial Prescribing Survey |
| **NCAS** | National Centre for Antimicrobial Stewardship |
| **Surgical NAPS** | Surgical National Antimicrobial Prescribing Survey |

# Glossary

| | |
|---|---|
| **Adequate prescribing** | A prescription that is deemed adequate by the Surgical NAPS Appropriateness Assessment Guide; *see Appendix 5*. |
| **Appropriate prescribing** | A prescription that is deemed **appropriate** (optimal or adequate) by the Surgical NAPS Appropriateness Assessment Guide; *see Appendix 5*. |
| **Directed therapy** | There are microbiology culture and susceptibility results available to guide prophylaxis or treatment. |
| **Dose** | An individual antimicrobial dose administered either immediately prior to or during the surgical procedure. |
| **Elective surgery** | Surgery that can be booked in advance as a result of a specialist clinical assessment resulting in placement on an elective surgery waiting list. |
| **Emergency surgery** | Surgery to treat trauma or acute illness subsequent to an emergency presentation; *including unplanned surgery for admitted patients and unplanned surgery for patients already awaiting an elective surgery.* |
| **Existing antimicrobial therapy** | Any antimicrobial prescribed for treatment or prophylaxis in the **24 hours prior** (72 hours if on dialysis) to the procedure; *these are not analysed individually but are able to be considered when assessing the appropriateness of whether procedural antimicrobials were given or not given.* |
| **Inadequate prescribing** | A prescription that is deemed **inadequate** by the Surgical NAPS Appropriateness Assessment Guide; *see Appendix 5*. |
| **Inappropriate prescribing** | A prescription that is deemed **inappropriate** (suboptimal or inadequate) by the Surgical NAPS Appropriateness Assessment Guide; *see Appendix 5*. |
| **Initial dose** | The first dose of an antimicrobial administered either immediately prior to or during the surgical procedure for the purpose of prophylaxis. |
| **Local guidelines** | 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 facility's network.* |
| **Not assessable prescribing** | A prescription that is deemed **not assessable** by the Surgical NAPS Appropriateness Assessment Guide; *see Appendix 5*. |
| **Optimal prescribing** | A prescription that is deemed **optimal** by the Surgical NAPS Appropriateness Assessment Guide; *see Appendix 5*. |
| **Peer group**[1] | A hospital peer group supports comparisons that reflect the purpose, resources and role of each hospital and is defined by the type and nature of the services provided; based on data from a broad range of sources; intended to be multi–purpose and stable over time. |

| | |
|---|---|
| **Post–procedural antimicrobial prophylaxis** | All antimicrobials prescribed following, but directly relating to, the procedure for the purposes of prophylaxis; each prescription course of the antimicrobial is recorded and reported, including any inpatient or discharge scripts. |
| **Prescription** | Any antimicrobial prescribed as either a single dose or as a course following the surgical procedure. |
| **Procedural antimicrobial prophylaxis** | All antimicrobials prescribed following, but directly relating to, the procedure for the purposes of prophylaxis; *each **prescription** course of the antimicrobial is recorded and reported, including any inpatient or discharge scripts.* |
| **Procedure** | The procedure(s) performed during the surgical episode, as documented on the procedure form or in the medical record; *any procedure can be included, e.g. colonoscopies, radiological procedures, etc.* |
| **Procedure group** | The specialty group under which each procedure is classed for reporting; *see Appendix 1*. |
| **Prophylaxis** | An antimicrobial prescribed for the **prevention** of surgery–related infections. |
| **Remoteness classification**[2] | The Australian Standard Geographical Classification Remoteness Area was developed in 2001 by the Australian Bureau of Statistics as a statistical geography that allows quantitative comparisons based on remoteness of a point based on the physical road distance to the nearest Urban Centre. |
| **Repeat dose** | Any subsequent dose of an antimicrobial administered during the surgical procedure for the purpose of prophylaxis. |
| **Suboptimal prescribing** | A prescription that is deemed **suboptimal** by the Surgical NAPS Appropriateness Assessment Guide; *see Appendix 5*. |
| **Surgical episode** | Any individual procedure or set of multiple procedures performed together during the one session and the subsequent post–procedural care associated with the procedure(s). |
| **Therapeutic Guidelines**[3] | The paper version 15 of the *Therapeutic Guidelines; Antibiotic,* Antibiotic Expert Group. Version 15 (2014) or the eTG complete [digital]. Melbourne: Therapeutic Guidelines Limited https://www.tg.org.au/. |
| **Treatment** | An antimicrobial prescribed for the **treatment** of infection related to the procedure. |

# 1 Summary

# 1 Summary

The National Antimicrobial Prescribing Survey (NAPS) was initiated in 2011 and has assisted hundreds of Australian healthcare facilities in assessing their antimicrobial prescribing practices and in meeting requirements for hospital accreditation. The NAPS is an online tool, coordinated by a multi–disciplinary team at the National Centre for Antimicrobial Stewardship, and is delivered by the Guidance Group (Royal Melbourne Hospital). It provides valuable information on the utilisation of antimicrobials within Australia and since 2013 the Australian Commission on Safety and Quality in Health Care (ACSQHC) has provided a funding contribution for the development of the NAPS program for the Antimicrobial Use and Resistance in Australia (AURA) Surveillance System.

Since 2013, results from the Hospital NAPS have demonstrated that surgical prophylaxis accounts for 11–15% of all antimicrobial prescribing in Australian hospitals, of which approximately 40% annually is deemed inappropriate. In 2016 a dedicated Surgical NAPS was developed and implemented as an online auditing platform to further investigate the reasons for these higher rates of inappropriate prescribing.[4]

The Surgical NAPS provides a standardised tool that allows Australian healthcare facilities to audit and report antimicrobial use in incisional and non–incisional surgical procedures, and to investigate both procedural and post–procedural prescribing practices for surgical prophylaxis. It is designed to be a useful, practical and generalisable audit tool, providing some flexibility to fit the workflow of different facilities, and to suit a range of surveyors including pharmacists, nurses and medical practitioners. The Surgical NAPS development and ongoing support has been in part funded by the ACSQHC and the Australian Government Department of Health.

## 1.1 Surgical NAPS 2017

Data were submitted through the online data entry portal from 1 January to 31 December 2017. A total of 106 hospitals contributed data during this period and are included in this report. Public and private hospitals from every state and the Northern Territory provided data. A wide range of peer groups[1] and remoteness classifications[2] were represented. There were a total of 7,183 surgical episodes included in the analysis, with 6,921 (96.4%) having an incisional procedure.

When reviewed by procedure group, overall assessments of inappropriate antimicrobial prescribing were high. Inappropriateness ranged from 30.3% for gynaecological surgery through to 57.1% for cardiac surgery. An exception was gastrointestinal endoscopic procedures (3.8%) which had fewer elements of inappropriate antimicrobial prescribing.

Of the 7,183 surgical episodes audited, procedural prophylaxis was inappropriate in 34.0% of cases. This included surgical episodes where antimicrobials were administered either immediately prior to or during the surgical procedure, and episodes where no procedural antimicrobials were prescribed. The procedure groups with the most inappropriate prescribing overall were dentoalveolar surgery (50.8%), cardiac surgery (46.7%) and abdominal surgery (46.4%).

Further analysis of this procedural prophylaxis data revealed that there were 5,082 (70.8%) surgical episodes where antimicrobials were prescribed, and of these, 44.5% were considered inappropriate. In part, this is because 748 episodes (14.7%) did not require any antimicrobial. When antimicrobial doses were required and prescribed inappropriately (n=1,811) the most common reasons for inappropriateness were incorrect timing 44.6%, incorrect dosage 26.9% and spectrum too broad 13.7%. Additionally, there were 2,101 (29.2%) surgical episodes where no procedural antimicrobial was prescribed, and 88.9% of these were deemed to be appropriate.

For antimicrobial prophylaxis cefazolin is the mainstay antibiotic and 4,606 doses (76.5%) were recorded during the 2017 survey. Metronidazole and gentamicin were the next most commonly prescribed, with 383 (6.4%) and 287 (4.8%) doses respectively. The overall compliance with any guidelines for prescribing procedural antimicrobials was 59.6%.

For the post–procedural prescribing analysis, surgical episodes where antimicrobials were prescribed primarily for the treatment of infection, rather than for prophylaxis, were excluded, leaving 6,428 surgical episodes. From these, post–procedural prophylaxis was inappropriate in 19.3% of episodes. This included episodes where antimicrobials were prescribed specifically for prophylaxis and episodes where no antimicrobials were prescribed. The procedure groups with the most inappropriate post–procedural prescribing overall were thoracic surgery (44.9%), breast surgery (39.6%) and cardiac surgery (38.6%).

There were 2,075 surgical episodes (32.3%) that had at least one post–procedural antimicrobial prescribed for prophylaxis, of which 58.7% involved a prescription that was deemed inappropriate. Conversely, there were 4,085 surgical episodes (63.6%) where no post–procedural antimicrobials were prescribed, and 98.7% of these episodes were assessed as appropriate. The procedure groups with

the highest rate of inappropriateness when post–procedural prophylaxis was prescribed were breast surgery (95.3%), dentoalveolar surgery (88.7%) and gynaecological surgery (87.5%). Overall, compliance with any guidelines for prescribing post–procedural antimicrobials was 34.4%.

Of the 2,075 surgical episodes where a post–procedural antimicrobial was prescribed, 778 episodes (37.5%) did not require any antimicrobial according to guidelines. Of the 1,502 post–procedural prophylactic prescriptions where antimicrobials were required, 582 episodes (38.7%) were deemed inappropriate, with the most common reasons being incorrect duration (59.6%), incorrect dose or frequency (34.0%), and spectrum too broad (10.1%). The greatest number of post–procedural prophylactic prescriptions were for cefazolin 1,395 (58.1%). Cefalexin and chloramphenicol were the next most commonly prescribed with 299 (12.5%) and 139 (5.8%) prescriptions respectively.

There were a range of prescribing durations for the various surgical procedure groups, with median days of duration ranging from two to seven days. The procedure groups with the greatest median duration were ophthalmology (median 7 days, range 1–29 days), plastic and reconstructive surgery (median 6 days, range 1–21 days), head and neck surgery (6 days, range 1–23 days) and dentoalveolar surgery (6 days, range 2–9 days).

## 1.2 Surgical NAPS 2018

Data were submitted through the online data entry portal from 1 January to 31 December 2018. A total of 109 hospitals provided data during this period and are included in this report. Public and private hospitals from a wide range of peer groups[1] and remoteness classifications[2] contributed date. Every state, except Tasmania contributed data. There were a total of 5,637 surgical episodes included in the analysis, with 4,984 (88.4%) having an incisional procedure.

All procedure groups had high rates of overall inappropriate antimicrobial prescribing, apart from gastrointestinal endoscopic procedures (2.4%). For all other procedure groups, inappropriateness was slightly lower than the 2017 dataset, ranging from 22.6% for ophthalmology surgery through to 52.3% for dentoalveolar surgery.

Of the 5,637 surgical episodes audited, procedural prophylaxis (administered either immediately prior to or during the surgical procedure) was inappropriate in 28.7% of episodes. This included surgical episodes where no procedural antimicrobials were prescribed and episodes where procedural antimicrobials were prescribed. For the episodes where procedural antimicrobials were prescribed, the procedure groups with the most inappropriate procedural prescribing overall were dentoalveolar surgery (59.1%), head and neck surgery (58.6%), and gastrointestinal endoscopic procedures (53.3%).

There were 4,030 (71.5%) surgical episodes where procedural antimicrobials were prescribed, of these, 37.8% were considered inappropriate. There were 1,606 (28.5%) surgical episodes where there was no procedural antimicrobial prescribed, of these, 90.9% were deemed to be appropriate. Cefazolin was the most common antimicrobial prescribed with 3,800 doses (81.3%). Metronidazole and gentamicin were also given frequently, with 221 (4.7%) and 166 (3.6%) doses respectively.

The overall compliance with any guidelines for prescribing procedural antimicrobials was 65.1%. Of the 4, 030 surgical episodes where a procedural antimicrobial was prescribed, 485 episodes (12.0%) did not require any antimicrobial. Of the 1,212 doses where antimicrobials were required, the most common reasons for deeming the antimicrobial doses inappropriate were incorrect timing (51.2%), incorrect dosage (23.2%), and spectrum too broad (11.6%).

Surgical episodes where the prescribed antimicrobials were predominantly for the treatment of infection were excluded from the post–procedural prescribing analysis, leaving 5,106 surgical episodes. Of these, post–procedural prophylaxis was inappropriate in 22.5% of episodes. This included episodes where antimicrobials were prescribed specifically for prophylaxis and episodes where no antimicrobials were prescribed. The procedure groups with the most inappropriate post–procedural prescribing overall were breast surgery (42.0%), orthopaedic surgery (38.5%), and cardiac surgery (36.2%).

There were 1,728 episodes (33.8%) that had at least one post–procedural antimicrobial prescribed for prophylaxis, of which 62.1% episodes involved a prescription that was deemed inappropriate. There were 3,086 surgical episodes (60.4%) where no post–procedural antimicrobials were prescribed, and 95.9% of these episodes were assessed as appropriate. The procedure groups with the highest rate of inappropriateness when post–procedural prophylaxis was prescribed were dentoalveolar surgery (100%), gynaecological surgery (93.5%), and urological surgery (87.3%). Overall, compliance with any guidelines for prescribing post–procedural antimicrobials was 34.3%.

Of the 1,728 surgical episodes where a post–procedural antimicrobial was prescribed for prophylaxis 678 episodes (39.2%), according to guidelines, did not

require any antimicrobial. This was similar to our 2017 analysis. Of the 1,258 post–procedural prophylactic prescriptions where antimicrobials were required, 574 episodes (45.6%) were deemed inappropriate, with the most common reasons being incorrect duration (54.7%), incorrect dose or frequency (37.6%), and spectrum too broad (3.8%). In keeping with the 2017 dataset, the greatest number of post–procedural prophylactic prescriptions in 2018 were for cefazolin (n=1,106, 56.1%). Cefalexin and chloramphenicol were the next most commonly prescribed with 240 (12.2%) and 170 (8.6%) prescriptions respectively.

There were a range of prescribing durations for the various surgical procedure groups, with median days of duration ranging from two to nine days (an increase from the 2017 dataset). The procedure groups with the greatest median duration were ophthalmology (median 9 days, range 1–33 days), plastic and reconstructive surgery (median 6 days, range 1–21 days), head and neck surgery (6 days, range 1–35 days), dentoalveolar surgery (6 days, range 4–9 days) and breast surgery (6 days, range 1–13 days).

## 1.3 Implications

The second report into surgical prophylaxis antimicrobial prescribing in Australian hospitals (2017 and 2018 Surgical NAPS datasets) confirms the results of the 2016 Surgical NAPS pilot report[4] and the previous Hospital NAPS reports.[5,6,7,8,9] It has again identified the following priority areas for targeted quality improvement initiatives for antimicrobial surgical prophylaxis prescribing:

- Documentation of surgical incision time and administration time for antimicrobials
- Timing of procedural antimicrobial administration
- Compliance with guidelines for surgical antimicrobial prophylaxis
- Duration of therapy for post–procedural antimicrobials, when required
- Improved procedural prescribing, particularly for ceftriaxone, cefoxitin, cefalothin and chloramphenicol
- Improved post–procedural prescribing, particularly for dicloxacillin, trimethoprim and cefalexin and amoxicillin
- Improved procedural prescribing, particularly dentoalveolar, cardiac abdominal, and head and neck surgery
- Improved post–procedural prescribing for several indications, particularly dentoalveolar, gynaecological, urological, thoracic, breast and cardiac surgery.

# 2 Introduction

# 2 Introduction

The development and implementation of the National Antimicrobial Prescribing Survey (NAPS) has been an ongoing collaborative partnership between the National Centre for Antimicrobial Stewardship (NCAS), the Australian Commission on Safety and Quality in Health Care (ACSQHC) and the Australian Government Department of Health. The online NAPS database is developed and administered by the Guidance Group at Melbourne Health and provides valuable information on the utilisation of antimicrobials within Australia. Since 2013 the ACSQHC has provided a funding contribution for the development of the NAPS program for the Antimicrobial Use and Resistance in Australia (AURA) Surveillance System.[10]

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.[11] The NAPS program supports many of the core objectives of the national strategy through education and training of the healthcare workforce. The NAPS enables antimicrobial audit and review to assess the quality of antimicrobial prescribing and identify prescribing variation, and thereby supports antimicrobial stewardship programs to improve the appropriate and judicious use of antimicrobials.

Since 2013, when the Hospital NAPS was implemented as a national online auditing platform, the annual survey results have provided data on the appropriateness of antimicrobial prescribing in Australian hospitals. Surgical prophylaxis has consistently been shown to account for 11–15% of all antimicrobial prescribing in Australian hospitals, of which approximately 40% were deemed inappropriate due to one or more elements of the prescribing, such as incorrect drug choice, dosage or duration.[5,6,7,8,9]

There have been many studies supporting the use of appropriately administered surgical prophylaxis in reducing surgical site and other post–procedural infections.[12] Guidance for the appropriate use of surgical antimicrobial prophylaxis in Australia is available via the *Therapeutic Guidelines*[3] and their suggested principles of antimicrobial prescribing regarding surgical procedures are:

- Only prescribe prophylaxis if there is a clear need
- Appropriately timed prophylaxis is crucial to have effective plasma and tissue concentrations at the time of incision and for the duration of the surgical procedure
- Intravenous antimicrobial administration should be within 60 minutes of surgical incision; optimally 15 to 30 minutes before (30 to 120 minutes for vancomycin)
- A single dose of antibiotic is enough for most procedures, with a first–generation cephalosporin (e.g. cefazolin) being the preferred drug
- A repeat intraoperative dose may be needed for prolonged procedures or if the drug has a short half–life; e.g. cefazolin should be administered every 4 hours
- Post–procedural prophylaxis is only recommended in a few circumstances; e.g. some cardiac and vascular surgeries, lower limb amputation
- Prophylaxis should not be given for greater than 24 hours and extended prophylaxis is associated with an increased risk of adverse effects; e.g. infection with multi–drug resistant organisms or *Clostridioides difficile*
- The use of topical antimicrobials is not recommended for surgical prophylaxis.

Being a point prevalence survey (a survey that detects the total number of a specified condition, present in a defined population at a given point in time) the Hospital NAPS does not allow for detailed examination of surgical antimicrobial prescribing practices. In 2016 a dedicated Surgical National Antimicrobial Prescribing Survey (Surgical NAPS) was piloted as a national online auditing program to support comparisons and benchmarking of antimicrobials prescribed specifically for surgical prophylaxis. This pilot highlighted several areas of improvement for the prescribing of surgical antimicrobial prophylaxis, including:

- Documentation of incision time and administration time for antimicrobials
- Compliance with guidelines for surgical antimicrobial prophylaxis
- Timing of procedural antimicrobial administration
- Duration of therapy for post–procedural antimicrobials, when required.

The full results are available in the Surgical National Antimicrobial Prescribing Survey: Results of the 2016 pilot.[4]

The Surgical NAPS provides a standardised tool that allows Australian healthcare facilities to audit and report antimicrobial use in incisional and non–incisional surgical procedures, and to investigate procedural and post–procedural prescribing practices for surgical prophylaxis. It is designed to be a useful, practical and generalisable audit tool, providing some flexibility to fit the workflow of different facilities, and to suit a range of surveyors including pharmacists, nurses and medical practitioners.

Although user feedback from the 2016 Surgical NAPS pilot[4] highlighted some improvements for future surveys, resourcing limitations dictated that no major changes were implemented for the 2017 and 2018 Surgical NAPS. This report focuses on the results of the 2017 and 2018 Surgical NAPS and has confirmed the findings of previous Hospital and Surgical NAPS audits.

# 3 Methods

# 3 Methods

## 3.1 Timing

Data submitted through the online data entry portal from 1 January to 31 December 2017 were eligible for inclusion in the 2017 results (see section 6). Data submitted from 1 January to 31 December 2018 were included in the 2018 results section of this report (see section 7).

## 3.2 Survey methodology

### 3.2.1 Inclusion criteria

Any procedure type could be audited, including incisional or non–incisional procedures.

### 3.2.2 Data collection

Data were able to be collected on paper data collection forms then entered into the online portal (*see Appendix 4 for data fields*), or could be entered directly into the online portal.

### 3.2.3 Methodology

Auditors could choose a variety of methods to perform the survey, depending on the size of the facility and available resources.

**1) Retrospective audit** (this was the recommended methodology where possible)

This survey could be performed over any chosen timeframe, however a minimum of one week or 30 consecutive procedures or surgical episodes was recommended. Ideally, theatre lists were obtained for each day to capture all procedures during this timeframe. For those wanting to collect 30–day outcome follow–up data, it was recommended to perform retrospective chart and record review at least 30 days after the theatre list date.

**2) Prospective audit**

This survey can be performed over any chosen timeframe, however a minimum of one week or 30 consecutive procedures or surgical episodes was recommended. To capture all procedures during this timeframe, a theatre list was obtained for each day during the selected audit timeframe. Patients who underwent a procedure or surgical episode were followed prospectively for data collection purposes. This process began once the patient left the operation suite/theatre and continued until postoperative antimicrobials had been ceased, or at 30–day follow–up (if collecting 30–day outcome follow–up data).

**3) Other audit types**

Smaller, directed surveys are useful to examine the routine practice of a surgical specialty or for a particular procedure. This may be particularly relevant following a survey where an issue has been identified, such as over–prescription of an antimicrobial agent when compared to the national average, or when a specialty is not prescribing in accordance with guidelines.

## 3.3 Recruitment

The Surgical NAPS module was available to all users registered for the NAPS. All registered users of Hospital NAPS modules were notified, and it was also marketed on social media via Twitter by NCAS and the ACSQHC.

## 3.4 Auditor education and support

A data collection form (*see Appendix 4*), user guide, Surgical NAPS appropriateness assessment guideline (*see Appendix 5*) and worked case examples were made available to users through the resources page of the Surgical NAPS module. The NAPS support team provided telephone and email support during the survey period, as it does for all NAPS programs.

Three online videos were also developed and made available on the resources page. The videos covered utilising the resources and creating a survey, data entry and reporting functionality. A written guide to interpreting Surgical NAPS reports was also developed to assist users to understand their results, based on early feedback regarding the complex nature of the reports.

### 3.4.1 Expert assessments

An expert assessment service was provided by the NAPS support team. Hospitals without access to infectious diseases specialists were offered assistance with the assessment of guideline compliance and prescription appropriateness. All hospitals could request assessment support if they felt it would improve the quality of their audit.

### 3.4.2 Development of templates

A standardised reporting template and an example report were developed as a guide to help hospitals communicate local survey results. Links to useful presentations and posters were also provided.

# 4 Limitations

# 4 Limitations

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

### Sampling and selection bias

The hospitals that participated were not a randomised sample because participation was voluntary. Therefore, the results might not be representative of all Australian hospitals.

### Survey methodology was not defined

For the Surgical NAPS, each hospital could decide how they performed the survey and which patients, or surgical specialties, were audited. If directed surveys were performed, patient sampling may not have been random, and auditors may have targeted problem or higher volume surgical units.

### 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 support team on request. These assessments are not completely objective as they involve some degree of interpretation.

### Lack of data–field entry validation

To maintain strict timelines during the initial software development of the online survey, data validation or restrictions were not included for some fields. This allowed some data entry inconsistencies and the recording of incongruous results. Prior to compiling the 2017 and 2018 results some data cleaning was necessary, and the database will be redesigned in the future to incorporate validation processes.

### Misinterpretation of definitions

During the data analysis, potential inconsistencies were identified with how some facilities completed their survey, suggesting they may have misinterpreted some of the data–field definitions. Although it was recommended that all auditors read and comply with the methodology as set out in the user guide, this was not enforceable and there was no mandatory training prior to performing the survey.

The impact of some of the limitations was reduced by data exclusion and cleaning. A validation study performed on the 2016 data showed that there was a 6.7% rate of disagreement between hospital auditors and assessments conducted by the NAPS support team. This rate of discrepancy was deemed acceptable.

# 5

# Comparisons to the 2016 Surgical NAPS report

# 5 Comparisons to the 2016 Surgical NAPS report

It is important to acknowledge that the Surgical NAPS audit is more complex for contributors than the Hospital NAPS, and that it has been designed to provide longitudinal data on a patient's entire surgical episode. The complexity of the data collection increases the time taken to gather a complete dataset for each patient's surgical episode.

However, the detailed data that the Surgical NAPS provides means it is valuable for different surgical procedure groups as well as hospital antimicrobial stewardship program managers.

The Surgical NAPS has been developed with a flexible methodology, whereby auditors may choose various survey methodologies to collect meaningful data for their facility and within their available resources (*see 3 Methods*). As the Surgical NAPS data are not collected in a consistent manner across surveys, it is not designed to collect prevalence data on surgical antimicrobial prescribing (*see 4 Limitations*). Any overall data analysis should be undertaken with caution as this may be biased by the survey methodologies users have chosen to employ. Comparisons between survey data from different years should also be approached with care, as the dataset may comprise different proportions of surgical procedure groups, which have different requirements for surgical antimicrobial prescribing.

Data comparison between the 2016, 2017 and 2018 datasets has therefore not been provided in this report. Overall comparisons should be limited to within specific surgical procedure groups and a comparative analysis between the 2016 and 2017 datasets and the 2017 and 2018 datasets have been provided in *Appendix 2*.

# 6

# 2017 Surgical NAPS Results

# 6 2017 Surgical NAPS Results

The analysed results of the 2017 Surgical NAPS data are presented below.

## 6.1 Participating hospital demographics

In total, there were 106 hospitals that contributed data to the 2017 Surgical NAPS report, an increase of 39 from the 2016 pilot Surgical NAPS. Public and private hospitals from all states and the Northern Territory took part in the survey. A range of hospital peer groups[1] participated, and all remoteness classifications[2] were represented, (Tables 1, 2 and 3).

**Table 1 Number and percentage of participating public and private hospitals, by state and territory, Surgical NAPS 2017**

| State/Territory | Public (n) | Private (n) | Total (n) | Percentage (%) |
|---|---|---|---|---|
| Australian Capital Territory | 0 | 0 | 0 | – |
| New South Wales | 18 | 15 | 33 | 31.1 |
| Northern Territory | 1 | 0 | 1 | 0.9 |
| Queensland | 5 | 8 | 13 | 12.3 |
| South Australia | 2 | 8 | 10 | 9.4 |
| Tasmania | 0 | 1 | 1 | 0.9 |
| Victoria | 21 | 11 | 32 | 30.2 |
| Western Australia | 9 | 7 | 16 | 15.1 |
| Total | 56 | 50 | 106 | 100 |

Table 2 Number and percentage of participating public and private hospitals, by peer group classification,* Surgical NAPS 2017

| Peer group classification | Number (n) | Percentage (%) |
|---|---|---|
| Public hospitals | **56** | **52.8** |
| Principal referral hospitals | 13 | 12.3 |
| Public acute group A hospitals | 15 | 14.2 |
| Public acute group B hospitals | 8 | 7.5 |
| Public acute group C hospitals | 13 | 12.3 |
| Public acute group D hospitals | 1 | 0.9 |
| Women's hospitals | 2 | 1.9 |
| Children's hospitals | 2 | 1.9 |
| Other acute specialised hospitals | 1 | 0.9 |
| Other day procedure hospitals | 1 | 0.9 |
| Private hospitals | **50** | **47.2** |
| Private acute group A hospitals | 5 | 4.7 |
| Private acute group B hospitals | 11 | 10.4 |
| Private acute group C hospitals | 12 | 11.3 |
| Private acute group D hospitals | 16 | 15.1 |
| Mixed day procedure hospitals | 2 | 1.9 |
| Mixed sub–and non–acute hospitals | 1 | 0.9 |
| Other acute specialised hospitals | 3 | 2.8 |
| **Total** | **106** | **100** |

* Australian Institute of Health and Welfare 2015. Australian hospital peer groups. Health services series no. 66. Cat. no. HSE 170. AIHW; Canberra 2015

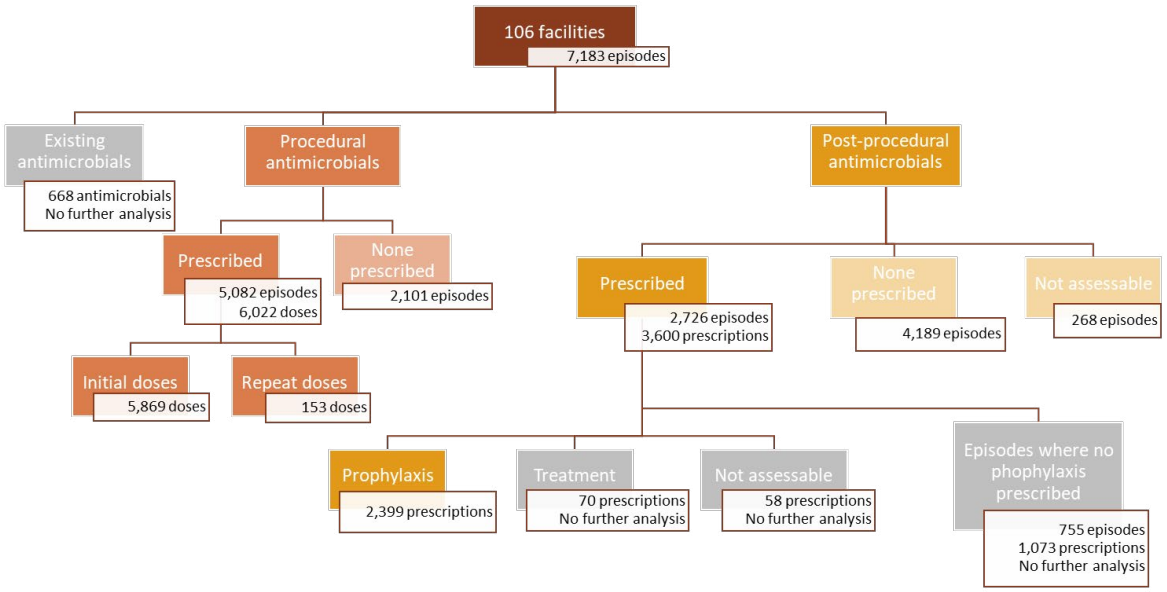
Table 3 Number and percentage of participating public and private hospitals, by remoteness classification,* Surgical NAPS 2017

| Remoteness classification | Public (n) | Private (n) | Total (n) | Percentage (%) |
|---|---|---|---|---|
| Major cities | 32 | 39 | 71 | 67.0 |
| Inner regional | 17 | 10 | 27 | 25.5 |
| Outer regional | 6 | 1 | 7 | 6.6 |
| Remote | 1 | 0 | 1 | 0.9 |
| Very remote | 0 | 0 | 0 | – |
| **Total** | **56** | **50** | **106** | **100** |

* Australian Bureau of Statistics. 1270.0.55.005 – Australian Statistical Geography Standard (ASGS): Volume 5 – Remoteness Structure, July 2016. AMS; Canberra 2018

Figure 1 shows the breakdown of the workflow for data analysis of the 2017 Surgical NAPS results and may be useful for reference throughout the report.

**Figure 1 Workflow diagram for the analysis of data, Surgical NAPS 2017**




## LEGEND

**Episode** – an individual procedure or set of multiple procedures performed together during the one surgical session and the subsequent post–procedural care associated with the procedure(s)

**Dose** – an individual antimicrobial dose administered either immediately prior to or during the surgical procedure

**Prescription** – any antimicrobial prescribed as either a single dose or as a course following the surgical procedure

**Existing antimicrobial** – an antimicrobial prescribed for treatment or prophylaxis in the 24 hours prior (72 hours if on dialysis) to the procedure, used to determine the appropriateness of whether procedural antimicrobials were given or not given

**Procedural antimicrobial** – an antimicrobial administered either immediately prior to or during the surgical procedure for the purpose of prophylaxis; each initial and repeat dose of the antimicrobial administered is recorded individually

**Post–procedural antimicrobial** – an antimicrobial prescribed following, but directly relating to, the procedure; each prescription of the antimicrobial is recorded, including any inpatient or discharge scripts

**Initial dose** – the first dose of an antimicrobial administered either immediately prior to or during the surgical procedure for the purpose of prophylaxis

**Repeat dose** – any subsequent dose of an antimicrobial administered during the surgical procedure for the purpose of prophylaxis

**Prophylaxis** – an antimicrobial prescribed for the prevention of surgical related infection

**Treatment** – an antimicrobial prescribed for the treatment of infection related to the procedure

**Episodes where no prophylaxis prescribed** – any episode where all prescribed antimicrobials are recorded as for 'treatment' and/or 'not assessable'

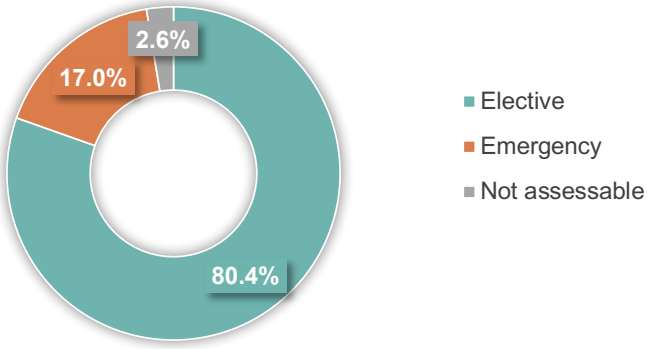
## 6.2 Overall findings

A total of 7,183 surgical episodes were included in the 2017 Surgical NAPS analysis. Characteristics of those episodes include the following:

- 3,803 (52.9%) for females, 3,341 (46.5%) for males and 39 (0.5%) for other
- 6,834 (95.1%) were initial surgeries, and 349 (4.9%) were subsequent surgeries
- 407 (5.7%) were trauma related
- 2,041 (28.4%) were for insertion or removal of prosthetic material
- 39 (0.5%) had excessive blood loss documented
- 5,776 (80.4%) were elective procedures and 1,220 (17.0%) were emergency procedures, (Figure 2)
- 6,921 (96.4%) had an incisional procedure, and of those 4,756 (68.7%) had a documented incision time, (Figure 3).

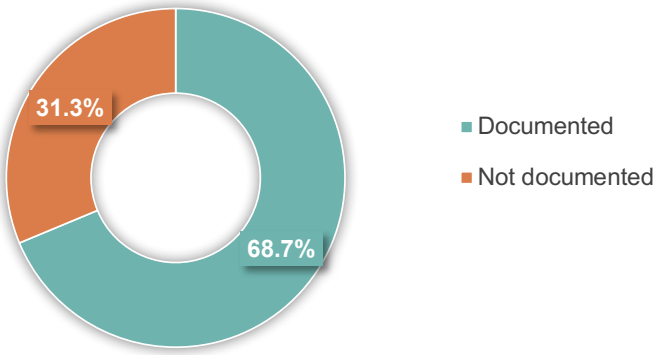
Further analyses of some of the risk factors are available in *Appendix 3*.

**Figure 2** **Percentage of elective and emergency surgical procedures, Surgical NAPS contributor hospitals, 2017***




* n = 7,183 surgical episodes

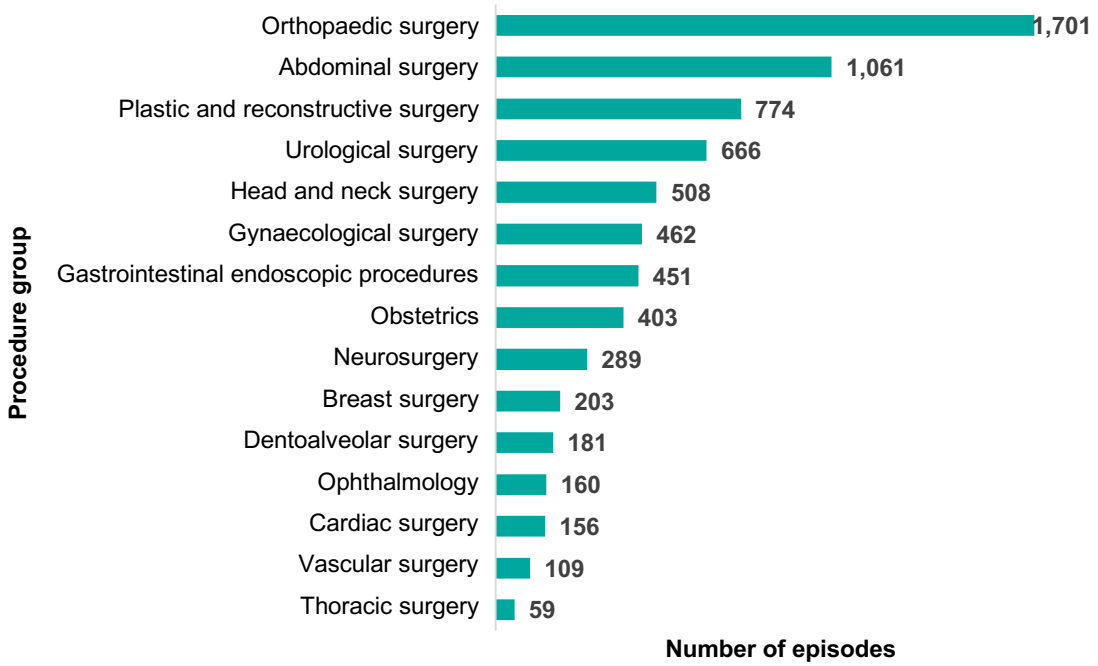
**Figure 3** **Percentage of surgical episodes with an incision time documented, Surgical NAPS contributor hospitals, 2017***




* n = 6,921 surgical episodes involving an incisional procedure

Each hospital could choose how to perform the Surgical NAPS audit. Audits may have been conducted as prevalence surveys (consecutive or random patients), directed surveys or other types of audits. As data were not collected on the type of audits performed, it is not possible to determine the prevalence of the surgical procedures or antimicrobials prescribed. The number of surgical episodes per procedure group included in the 2017 Surgical NAPS analysis are shown in Figure 4.

**Figure 4** **Number of surgical episodes for each surgical procedure group, Surgical NAPS contributor hospitals, 2017***




**Note:** where there were multiple procedures per surgical episode, only the primary procedure group was included

* n = 7,183 surgical episodes

Table 4 outlines the number and percentage of hospitals that contributed data to each procedure group. It is important to note that hospitals may routinely perform only certain surgical procedures or may have audited select surgical procedure groups. Each procedure group had a minimum of sixteen hospitals contributing to the data. The percentages of hospitals contributing to the procedure groups ranged from 15.1% for thoracic surgery to 75.5% for plastic and reconstructive surgery.

**Table 4** Number and percentage of participating hospitals by funding type contributing to each surgical procedure group, Surgical NAPS 2017*

| Procedure group | Public hospitals | Private hospitals | Contributing hospitals | |
|---|---|---|---|---|
| | (n) | (n) | (n) | (%) |
| Plastic and reconstructive surgery | 44 | 36 | 80 | 75.5 |
| Abdominal surgery | 48 | 30 | 78 | 73.6 |
| Orthopaedic surgery | 34 | 42 | 76 | 71.7 |
| Urological surgery | 39 | 26 | 65 | 61.3 |
| Head and neck surgery | 35 | 25 | 60 | 56.6 |
| Gynaecological surgery | 40 | 16 | 56 | 52.8 |
| Obstetrics | 30 | 19 | 49 | 46.2 |
| Gastrointestinal endoscopic procedures | 26 | 21 | 47 | 44.3 |
| Breast surgery | 22 | 18 | 40 | 37.7 |
| Neurosurgery | 23 | 16 | 39 | 36.8 |
| Dentoalveolar surgery | 15 | 19 | 34 | 32.1 |
| Vascular surgery | 24 | 8 | 32 | 30.2 |
| Cardiac surgery | 13 | 8 | 21 | 19.8 |
| Ophthalmology | 11 | 8 | 19 | 17.9 |
| Thoracic surgery | 11 | 5 | 16 | 15.1 |

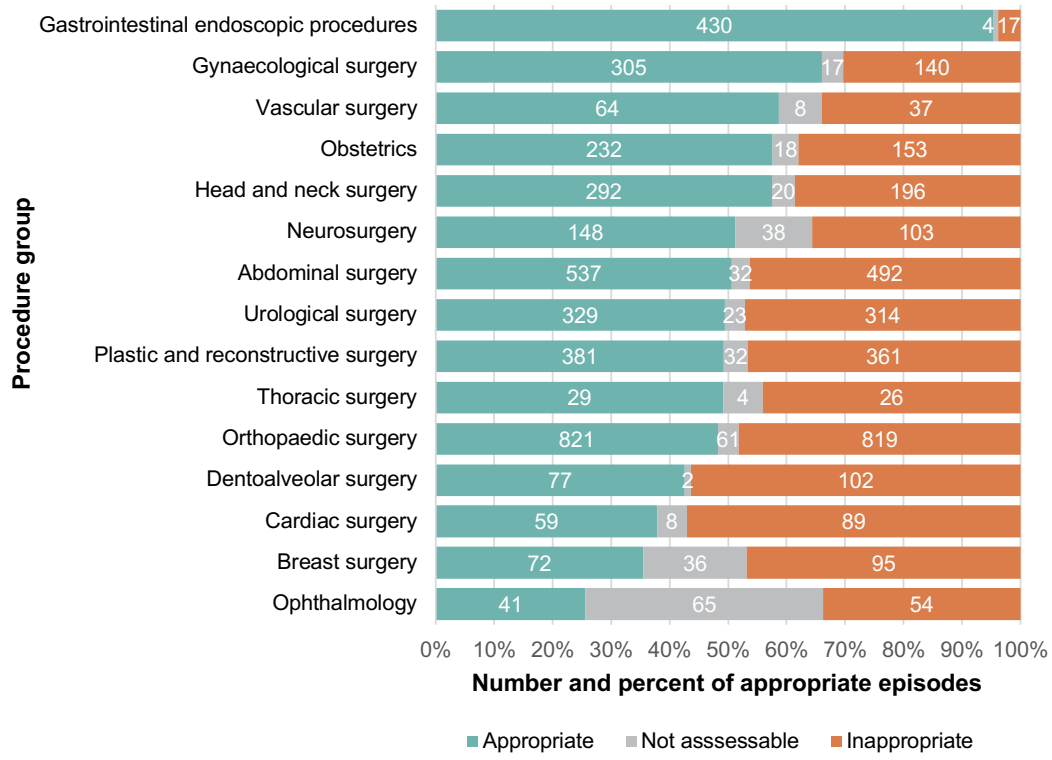
* n = 106 hospitals

The overall appropriateness of prescribing (procedural plus post–procedural) for each surgical group is shown in Figure 5. For reporting purposes, 'optimal' and 'adequate' are deemed to be appropriate, while 'suboptimal' and 'inadequate' are deemed to be inappropriate, (*see Appendix 5*).

Each surgical episode was given an overall assessment of inappropriate if any single aspect of the procedural or post–procedural prescribing was deemed inappropriate by the surveyor. This included allergy or microbiology mismatch; incorrect antimicrobial timing, dose, route, frequency or duration; if the antimicrobial spectrum was too broad or too narrow; or if the procedure did not require any antimicrobials.

When reviewed by procedure group, overall assessments of inappropriate antimicrobial prescribing were high. Inappropriateness ranged from 30.3% for gynaecological surgery through to 57.1% for cardiac surgery. An exception was gastrointestinal endoscopic procedures (3.8%) which had fewer elements of inappropriate antimicrobial prescribing.

Figure 5 Total number and percentage of episodes by appropriateness of prescribing for each surgical procedure group, Surgical NAPS contributor hospitals, 2017*




**Note:** for ophthalmology there was a high percentage of 'not assessable' episodes (n = 65; 40.6%), this was over representation of one hospital that deemed all its 59 ophthalmology procedures as 'not assessable'.

* n = 7,183 surgical episodes, including all episodes where antimicrobials were prescribed as well as those episodes where none were prescribed.

## 6.3 **Procedural prophylaxis**

Procedural antimicrobial prophylaxis was defined as any antimicrobial administered either immediately prior to or during the procedure for purposes of prophylaxis. Throughout this report, for procedural antimicrobials, each **dose** of the antimicrobial administered is recorded and reported individually. Although any existing antimicrobials were not analysed individually, these were able to be considered when assessing the appropriateness of whether procedural antimicrobials were given or not given.

Overall, of the 7,183 surgical episodes audited, procedural prophylaxis was inappropriate in 2,443 episodes (34.0%), (Table 5). This included surgical episodes where no procedural antimicrobials were prescribed and episodes where procedural antimicrobials were prescribed. The procedure groups with the most inappropriate prescribing overall were dentoalveolar surgery 50.8% (95 doses), cardiac surgery 46.7% (114 doses) and abdominal surgery 46.4% (602 doses), as shown in Figure 6.

There were 5,082 surgical episodes (70.8%) where procedural antimicrobials were prescribed and of these, 2,259 episodes (44.5%) were considered inappropriate. There were 2,101 surgical episodes (29.2%) where there was no procedural antimicrobial prescribed. Of these, 1,868 (88.9%) were deemed to be appropriate and 206 (2.9%) required procedural antimicrobials that had not been prescribed.

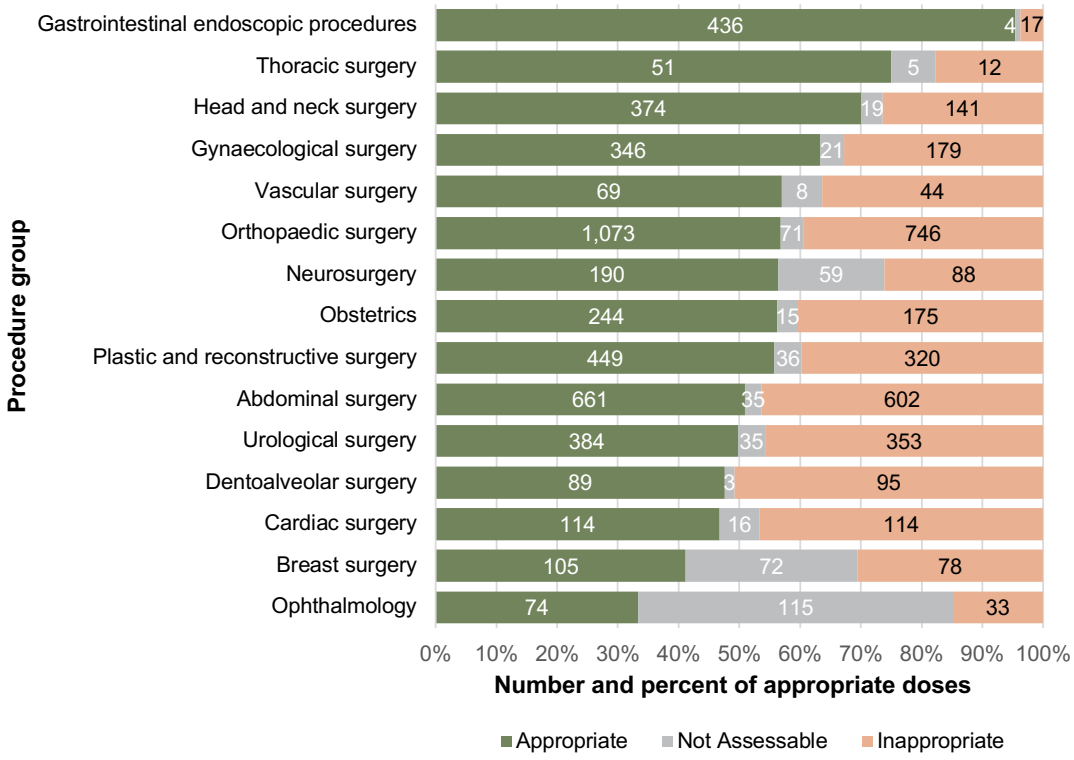
A total of 6,022 individual antimicrobial doses were given for procedural prophylaxis; 153 (2.6%) of these were repeat doses. Of all procedural antimicrobial doses 41.7% (2,512 doses) were assessed as inappropriate for at least one reason, and there were 46 episodes where repeat doses were required but not given. There were 764 doses prescribed (12.7%) where, according to guidelines, no antimicrobial was required.

Table 5 **Appropriateness of the procedural prescribing of antimicrobials for surgical episodes and antimicrobial doses, Surgical NAPS contributor hospitals, 2017***

| | Total | Appropriate | | Inappropriate | | Not assessable | |
|---|---|---|---|---|---|---|---|
| | (n) | (n) | (%) | (n) | (%) | (n) | (%) |
| **Surgical episodes** | **7,183** | **4,405** | **61.3** | **2,443** | **34.0** | **335** | **4.7** |
| Antimicrobial prescribed | 5,082 | 2,537 | 49.9 | 2,259 | 44.5 | 286 | 5.6 |
| No antimicrobial prescribed | 2,101 | 1,868 | 88.9 | 184 | 8.8 | 49 | 2.3 |
| Antimicrobial not prescribed when required | 206 | 37 | 18.0 | 167 | 81.1 | 2 | 1.0 |
| **Antimicrobial doses** | **6,022** | **3,145** | **52.2** | **2,512** | **41.7** | **365** | **6.1** |
| Initial dose | 5,869 | 3,039 | 51.8 | 2,471 | 42.1 | 359 | 6.1 |
| Repeat dose | 153 | 106 | 69.3 | 41 | 26.8 | 6 | 3.9 |
| Repeat dose not given when required | 46 | – | – | 44 | 95.7 | 2 | 4.3 |
| Antimicrobial prescribed when not required | 764 | 35 | 4.6 | 701 | 91.8 | 28 | 3.7 |

* The overall appropriateness of prescribing for a surgical episode was determined by taking the lowest ranked assessment of the individual doses, including all episodes where antimicrobials were prescribed as well as when none were prescribed. 'Optimal' and 'adequate' are deemed as being appropriate, 'suboptimal' and 'inadequate' are deemed as being inappropriate.

Figure 6 **Total number and percentage of procedural antimicrobial doses by appropriateness for each procedure group, Surgical NAPS contributor hospitals, 2017***

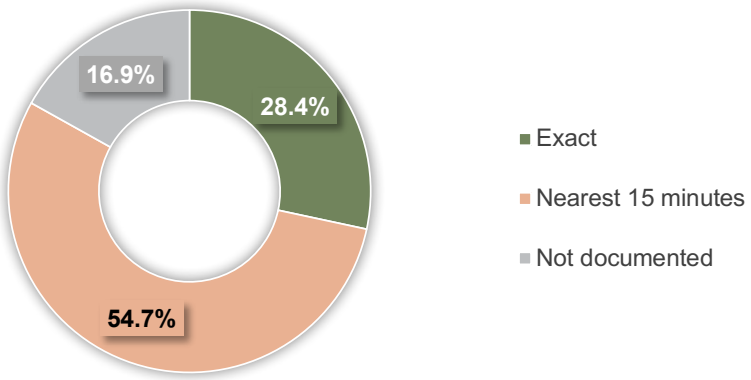



**Note:** for ophthalmology there was a high percentage of 'not assessable' doses (n = 115; 51.8%). This was over representation of one hospital that deemed 110 of its 111 ophthalmology procedural doses as 'not assessable'.

* n = 8,123 including each dose prescribed and when no antimicrobial was prescribed

Of the 6,022 procedural antimicrobial doses prescribed, 5,004 (83.1%) had a documented administration time; of these 1,708 (28.4%) were recorded to the exact minute and 3,296 (54.7%) to the nearest 15 minutes, (Figure 7). It is important to have a time of incision documented, as the interval between antimicrobial administration time and first incision is a key principle of appropriate surgical antimicrobial prophylaxis prescribing.[9] The optimal time for prophylactic antimicrobial administration is within the 60 minutes prior to first incision, although data suggests administration 15 to 30 minutes before first incision may be optimal. Due to its long infusion time, vancomycin should ideally be started 30 to 120 minutes before first incision. Without a documented incision time, and antimicrobial administration time, it is difficult to determine the appropriateness of the surgical antimicrobial prophylaxis timing.

Figure 7 Percentage of procedural antimicrobial doses for which an administration time was documented, Surgical NAPS contributor hospitals, 2017*




* n = 6,022 doses of procedural antimicrobial prophylaxis

There was minimal difference between public and private hospitals in appropriateness of procedural prescribing of antimicrobials, with 40.4% and 43.3% inappropriateness respectively, (Table 6).

Table 6 Appropriateness of antimicrobial prescribing for surgical episodes, by funding type, Surgical NAPS contributor hospitals, 2017

| Funding type | Surgical episodes | At least one antimicrobial prescribed | | Total doses | Inappropriate | |
|---|---|---|---|---|---|---|
| | (n) | (n) | (%) | (n) | (n) | (%) |
| Public hospitals | 4,073 | 2,744 | 67.4 | 3,246 | 1,311 | 40.4 |
| Private hospitals | 3,110 | 2,338 | 75.2 | 2,776 | 1,201 | 43.3 |
| **Total** | **7,183** | **5,082** | **70.8** | **6,022** | **2,512** | **41.7** |

The surgical procedure groups that had the highest rate of antimicrobials prescribed procedurally were: breast surgery, 182 antimicrobials prescribed out of 203 surgical episodes (89.7%); orthopaedic surgery 1,521 out of 1,701 episodes (89.4%); and ophthalmology 142 out of 160 episodes (88.8%). The procedure groups with the highest rate of inappropriateness of antimicrobial prescribing, when an antimicrobial was prescribed, were: dentoalveolar surgery 92 out of 128 prescriptions (71.9%); gastrointestinal endoscopic procedures 14 out of 24 prescriptions (58.3%); and plastic and reconstructive surgery 275 out of 499 prescriptions (55.1%), as shown in Table 7.

Table 7 Percentage of surgical episodes prescribed an antimicrobial, number of doses prescribed and inappropriateness of procedural prescribing by procedure group, Surgical NAPS contributor hospitals, 2017

| Procedure group | Surgical episodes | At least one antimicrobial prescribed | | Total doses | Inappropriate | |
|---|---|---|---|---|---|---|
| | (n) | (n) | (%) | (n) | (n) | (%) |
| Orthopaedic surgery | 1,701 | 1,521 | 89.4 | 1,701 | 625 | 36.7 |
| Abdominal surgery | 1,061 | 863 | 81.3 | 1,095 | 485 | 44.3 |
| Plastic and reconstructive surgery | 774 | 472 | 61.0 | 499 | 275 | 55.1 |
| Urological surgery | 666 | 453 | 68.0 | 557 | 304 | 54.6 |
| Head and neck surgery | 508 | 236 | 46.5 | 258 | 130 | 50.4 |
| Gynaecological surgery | 462 | 277 | 60.0 | 358 | 150 | 41.9 |
| Gastrointestinal endoscopic procedures | 451 | 18 | 4.0 | 24 | 14 | 58.3 |
| Obstetrics | 403 | 322 | 79.9 | 352 | 149 | 42.3 |
| Neurosurgery | 289 | 226 | 78.2 | 269 | 71 | 26.4 |
| Breast surgery | 203 | 182 | 89.7 | 232 | 75 | 32.3 |
| Dentoalveolar surgery | 181 | 122 | 67.4 | 128 | 92 | 71.9 |
| Ophthalmology | 160 | 142 | 88.8 | 204 | 24 | 11.8 |
| Cardiac surgery | 156 | 126 | 80.8 | 204 | 72 | 35.3 |
| Vascular surgery | 109 | 83 | 76.1 | 94 | 36 | 38.3 |
| Thoracic surgery | 59 | 39 | 66.1 | 47 | 10 | 21.3 |
| **Total** | **7,183** | **5,082** | **70.8** | **6,022** | **2,512** | **41.7** |

Of the 6,022 procedural antimicrobial doses that were administered, the most common routes of administration were:

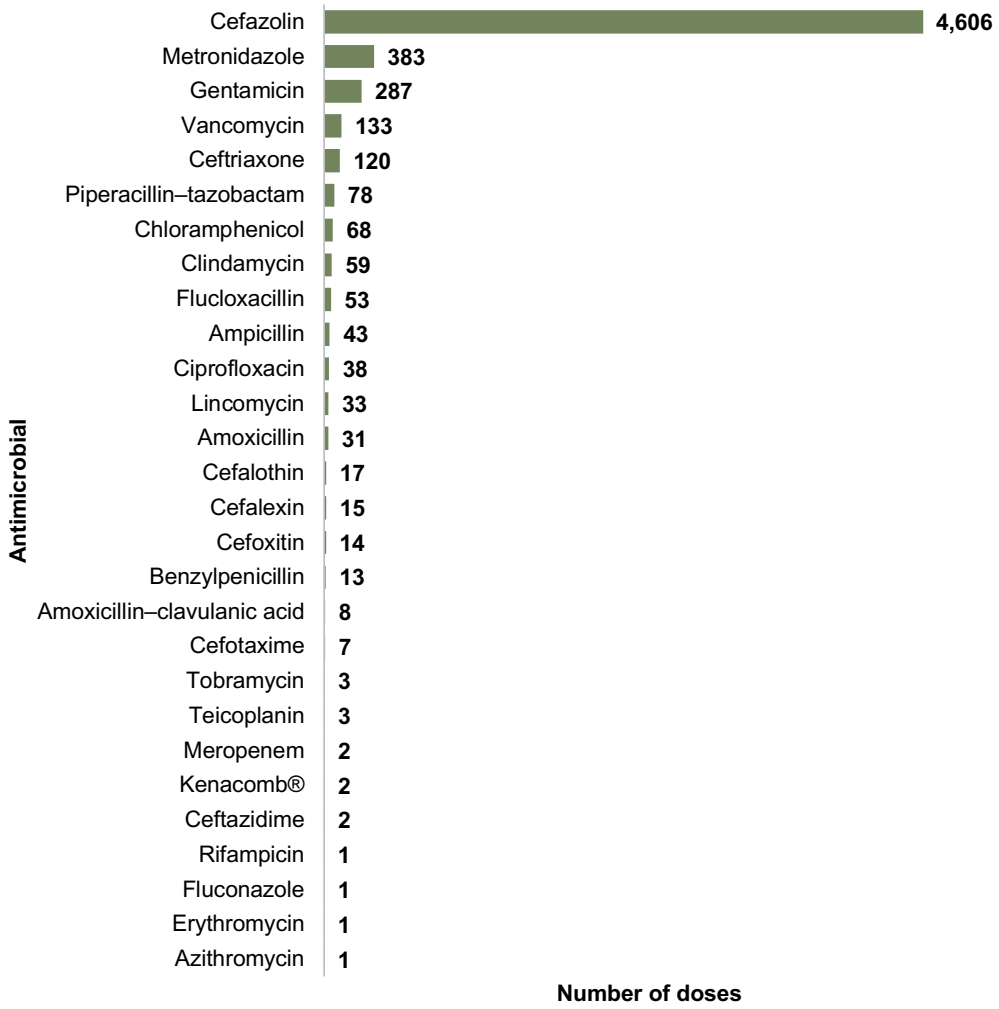
- Intravenous 94.1% (5,664)
- Ocular 3.1% (188)
- Topical 2.1% (127).

Of the 127 doses that were administered topically, only eight (6.3%) were deemed appropriate and of the 30 doses that were administered orally, only five (16.7%) were deemed appropriate.

The most common antimicrobials prescribed procedurally are shown in Figure 8. Cefazolin was the most common

antimicrobial prescribed with 4,606 doses (76.5%), and metronidazole and gentamicin were the next most commonly prescribed, with 383 (6.4%) and 287 (4.8%) doses respectively.

**Figure 8** **Number of antimicrobial doses given for procedural prophylaxis, by antimicrobial, Surgical NAPS contributor hospitals, 2017***




* n = 6,022 procedural antimicrobial doses

Table 8 shows the inappropriateness of antimicrobial doses that were prescribed for procedural prophylaxis in Surgical NAPS contributor hospitals. Some of the notable findings of inappropriate prescribing – albeit for antimicrobials for which a relatively small number of doses were prescribed overall – were for ceftriaxone (120 doses, of which 85.8% were deemed inappropriate), cefoxitin (14 doses of which 85.7% were deemed inappropriate) and cefalothin (17 doses of which 76.5% were deemed inappropriate).

Table 8 Number of doses, percentage and inappropriateness of antimicrobials prescribed for procedural prophylaxis, Surgical NAPS contributor hospitals, 2017*

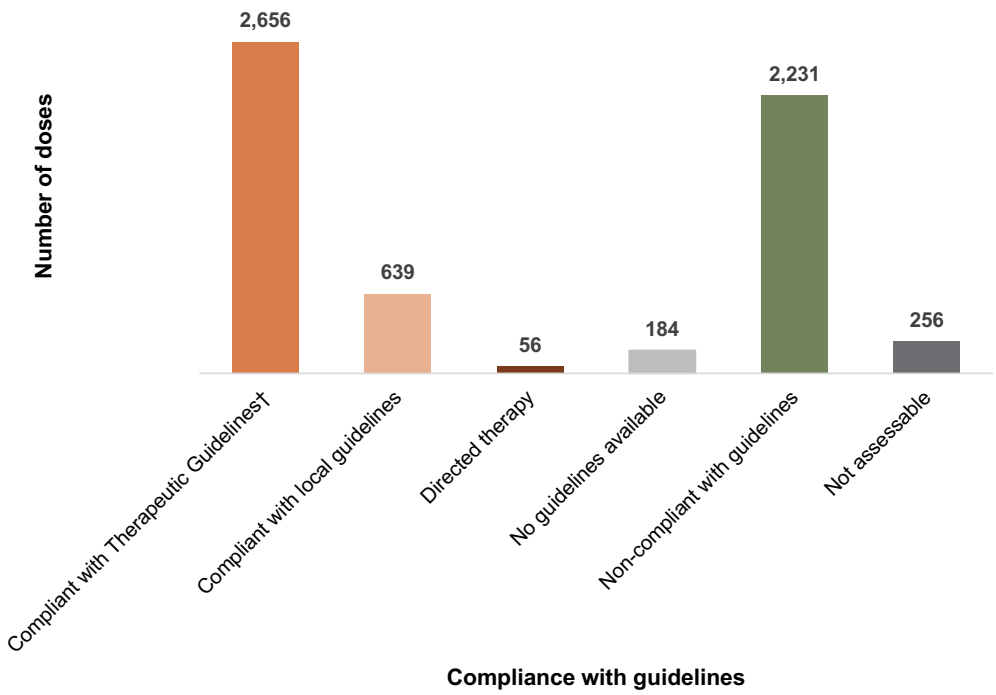
| Antimicrobial | Total doses prescribed | | Inappropriate | |
|---|---|---|---|---|
| | (n) | (%) | (n) | (%) |
| Cefazolin | 4,606 | 76.5 | 1,723 | 37.4 |
| Metronidazole | 383 | 6.4 | 171 | 44.6 |
| Gentamicin | 287 | 4.8 | 185 | 64.5 |
| Vancomycin | 133 | 2.2 | 73 | 54.9 |
| Ceftriaxone | 120 | 2.0 | 103 | 85.8 |
| Piperacillin–tazobactam | 78 | 1.3 | 43 | 55.1 |
| Chloramphenicol | 68 | 1.1 | 7 | 10.3 |
| Clindamycin | 59 | 1.0 | 28 | 47.5 |
| Flucloxacillin | 53 | 0.9 | 35 | 66.0 |
| Ampicillin | 43 | 0.7 | 32 | 74.4 |
| Ciprofloxacin | 38 | 0.6 | 22 | 57.9 |
| Lincomycin | 33 | 0.5 | 19 | 57.6 |
| Amoxicillin | 31 | 0.5 | 23 | 74.2 |
| Cefalothin | 17 | 0.3 | 13 | 76.5 |
| Cefalexin | 15 | 0.2 | 10 | 66.7 |
| Cefoxitin | 14 | 0.2 | 12 | 85.7 |
| Benzylpenicillin | 13 | 0.2 | 1 | 7.7 |
| Amoxicillin–clavulanic acid | 8 | 0.1 | 0 | – |
| Cefotaxime | 7 | 0.1 | 5 | – |
| Teicoplanin | 3 | 0.0 | 0 | – |
| Tobramycin | 3 | 0.0 | 2 | – |
| Ceftazidime | 2 | 0.0 | 2 | – |
| Kenacomb® | 2 | 0.0 | 0 | – |
| Meropenem | 2 | 0.0 | 0 | – |
| Azithromycin | 1 | 0.0 | 0 | – |
| Erythromycin | 1 | 0.0 | 1 | – |
| Fluconazole | 1 | 0.0 | 1 | – |
| Rifampicin | 1 | 0.0 | 1 | – |
| **Total** | **6,022** | **100** | **2,512** | **41.7** |

* Percentages are not shown for antimicrobials where n <10

Where procedural antimicrobials were prescribed, 2,656 doses (44.1%) were compliant with the *Therapeutic Guidelines*,[3] 639 doses (10.6%) were compliant with local guidelines and 2,231 doses (37.0%) were non–compliant with any guidelines, (Figure 9). The number of procedural antimicrobials being prescribed for directed therapy, or when there were no guidelines available or when compliance was not assessable, were very low. When these were excluded, the overall compliance with any guidelines for prescribing procedural antimicrobials was 59.6%, (Figure 10). The appropriateness of prescribed procedural antimicrobials was deemed optimal for 2,903 doses (48.2%) and inadequate for 1,323 doses (22.0%), (Figure 11).

Where no procedural antimicrobials were prescribed, the compliance was high with 1,494 (71.1%) being compliant with the *Therapeutic Guidelines*[3] and 311 (14.8%) being compliant with local guidelines. The appropriateness was also high with 1,836 (87.4%) deemed optimal.

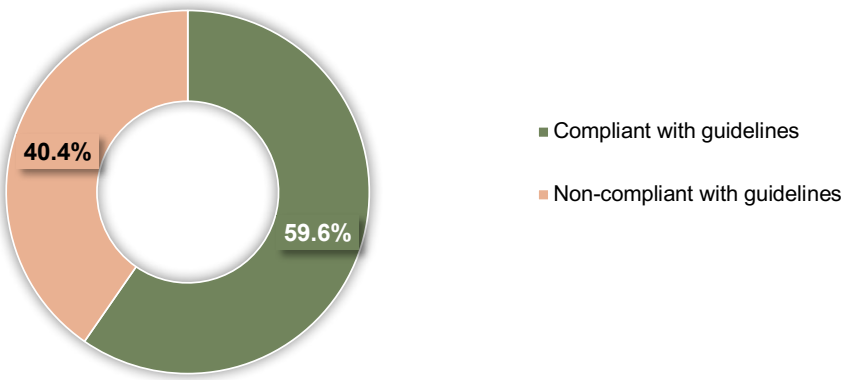
**Figure 9** **Number of procedural antimicrobial doses and compliance with guidelines for antimicrobial doses, Surgical NAPS contributor hospitals, 2017***




* n = 6,022 procedural antimicrobial doses

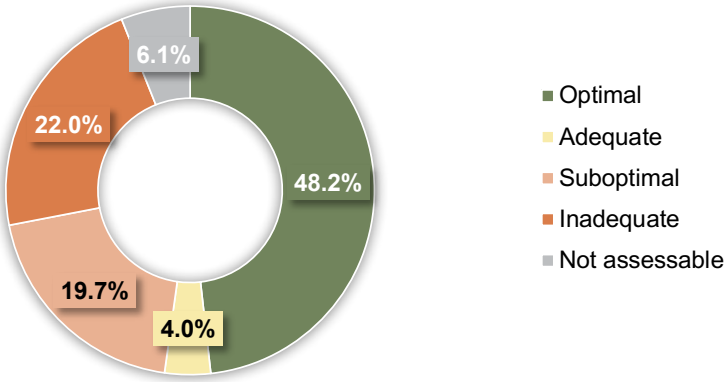
† Antibiotic Expert Group. Therapeutic Guidelines: Antibiotic. Version 15. Melbourne: Therapeutic Guidelines Limited; 2014. https://www.tg.org.au/

Figure 10 Percentage compliance with guidelines, by prescribed procedural antimicrobial dose, when guidelines are available, Surgical NAPS contributor hospitals, 2017*




* n = 5,526 includes prescribed procedural antimicrobial doses, excluding any assessed as directed therapy, no guidelines available or not assessable

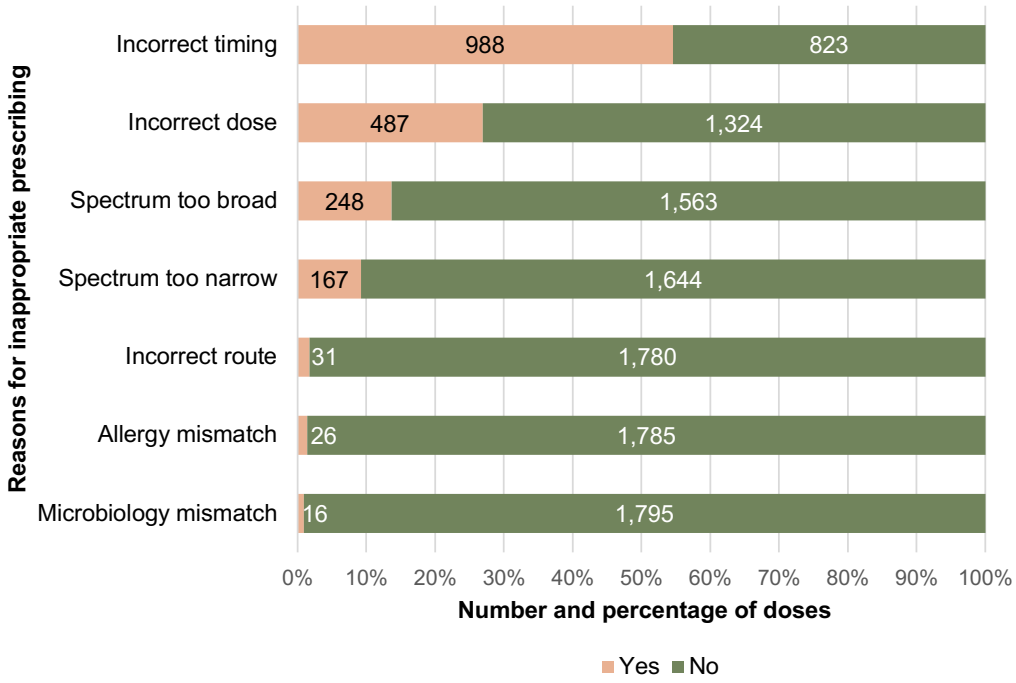
Figure 11 Percentage appropriateness of prescribed procedural antimicrobial doses, Surgical NAPS contributor hospitals, 2017*




* n = 6,022 procedural antimicrobial doses

Of the 5,285 procedural doses where, as per guidelines, antimicrobials were required, 1,811 doses (34.3%) were deemed inappropriate, with the most common reasons being incorrect timing 54.6% (988 doses), incorrect dosage 26.9% (487 doses), and spectrum too broad 13.7% (248 doses), as shown in Figure 12.

Figure 12 Reasons for inappropriateness, by number and percentage of required procedural antimicrobial doses, Surgical NAPS contributor hospitals, 2017*




* n = 1,811 required procedural antimicrobial doses deemed inappropriate

## 6.4 Post–procedural prophylaxis

Post–procedural antimicrobial prophylaxis was defined as any antimicrobial given immediately following the surgical procedure for the purpose of surgical prophylaxis. Throughout this report, for post–procedural antimicrobials, each **prescription course** of the antimicrobial is recorded and reported, including any inpatient or discharge scripts. Of the 7,183 surgical episodes, there were 755 episodes where all antimicrobials prescribed were for treatment of infection or were not assessable, these episodes were excluded from the post–procedural analysis leaving a total of 6,428 episodes for analysis.

Overall, of these 6,428 surgical episodes, post–procedural prophylaxis was inappropriate in 1,239 surgical episodes (19.3%), as shown in Table 9. This included episodes where antimicrobials were prescribed specifically for prophylaxis and episodes where no antimicrobials were prescribed. Antimicrobials that were prescribed only for the treatment of infection were excluded. The procedure groups with the most inappropriate prescribing overall were thoracic surgery (49 of which 44.9% were inappropriate), breast surgery (207 of which 39.6% were inappropriate) and cardiac surgery (166 of which 38.6% were inappropriate), as shown in Figure 13.

There were 4,085 surgical episodes (63.6%) where no post–procedural antimicrobials were prescribed, and 4,032 (98.7%) of these episodes were assessed as appropriate. There were 104 surgical episodes (1.6%) where antimicrobials were required but not prescribed. The remaining 2,075 surgical episodes (32.3%) had at least one post–procedural antimicrobial prescribed for prophylaxis, of which 1,218 episodes (58.7%) involved a prescription with an element that was deemed inappropriate. There were 778 episodes (12.1%) where an antimicrobial was prescribed when not required and a further 268 surgical episodes (4.2%) were unable to be assessed as to whether post–procedural antimicrobials had been prescribed.

Of the 2,399 antimicrobials (66.6%) prescribed for prophylaxis, (Table 9), 1,475 (61.5%) had at least one prescription element that was deemed inappropriate. There were 897 antimicrobials (37.4%) prescribed for prophylaxis which, according to guidelines, were not required and 847 (94.4%) were deemed inappropriate.

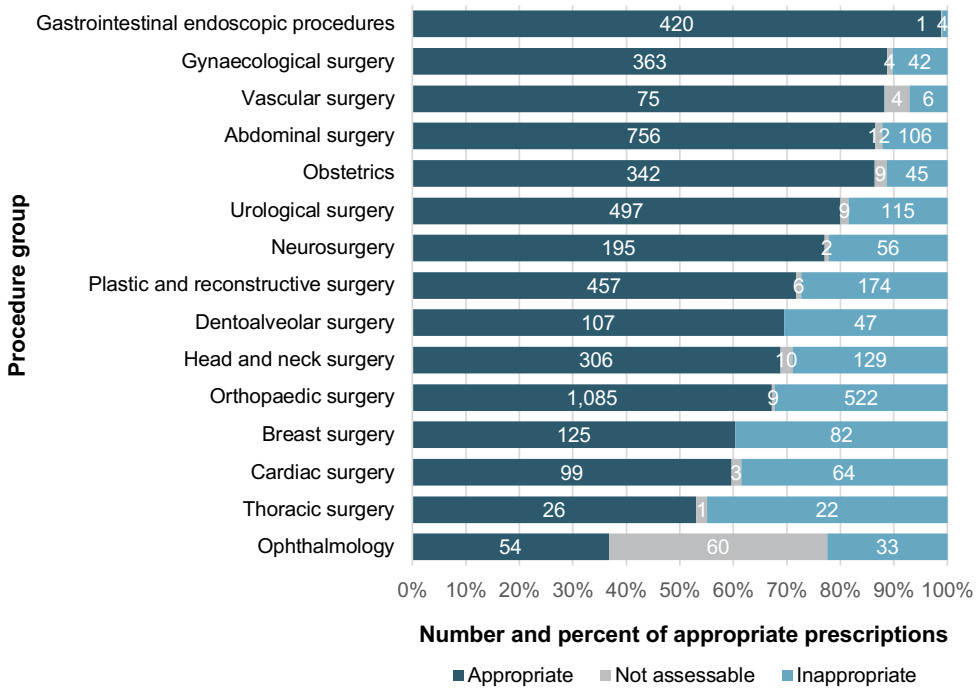
Table 9 Appropriateness of post–procedural prophylactic prescribing of antimicrobials for surgical episodes and antimicrobial prescriptions*, Surgical NAPS contributor hospitals, 2017#

| Post–procedural prophylaxis | Total | Appropriate | | Inappropriate | | Not assessable | |
|---|---|---|---|---|---|---|---|
| | (n) | (n) | (%) | (n) | (%) | (n) | (%) |
| **Surgical episodes** | **6,428** | **4,796** | **74.6** | **1,239** | **19.3** | **393** | **6.1** |
| Antimicrobial prescribed | 2,075 | 764 | 36.8 | 1,218 | 58.7 | 93 | 4.5 |
| Antimicrobial prescribed when not required | 778 | 44 | 5.7 | 728 | 93.6 | 6 | 0.8 |
| No antimicrobial prescribed | 4,085 | 4,032 | 98.7 | 21 | 0.5 | 32 | 0.8 |
| Antimicrobial not prescribed when required | 104 | 88 | 84.6 | 15 | 14.4 | 1 | 1.0 |
| Not assessable | 268 | – | – | – | – | 268 | 100 |
| **Antimicrobial prescriptions** | **2,527** | **870** | **34.4** | **1,549** | **61.3** | **108** | **4.3** |
| Prophylaxis | 2,399 | 822 | 34.3 | 1,475 | 61.5 | 102 | 4.3 |
| Prophylaxis prescribed when not required | 897 | 44 | 4.9 | 847 | 94.4 | 6 | 0.7 |
| Treatment | 70 | 31 | 44.3 | 35 | 50.0 | 4 | 5.7 |
| Not assessable | 58 | 17 | 29.3 | 39 | 67.2 | 2 | 3.5 |

* The overall appropriateness of prescribing for a surgical episode was determined by taking the lowest ranked assessment of the individual post–procedural prescriptions

# 755 surgical episodes had only post–procedural antimicrobials prescribed for treatment of infection or were not assessable and were excluded from the analysis

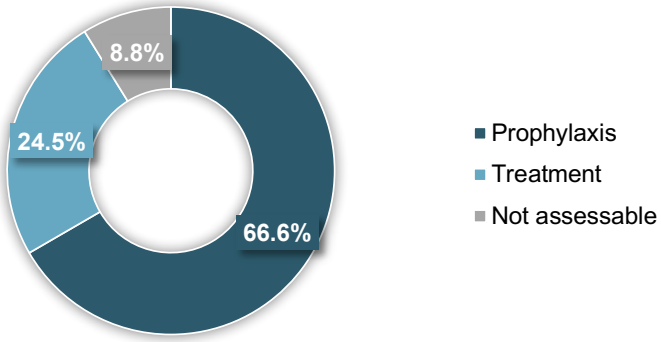
Figure 13 Number of post–procedural prophylactic antimicrobial prescriptions by percentage appropriateness for each surgical procedure group, Surgical NAPS contributor hospitals, 2017*




**Note:** for ophthalmology there was a high percentage of 'not assessable' prescriptions (n = 60; 37.5%), this was over–representation of one hospital that deemed 57 of its 59 ophthalmology post–procedural prescriptions as 'not assessable'

* n = 6,484 including each prophylaxis prescription course, and episodes when no antimicrobial was prescribed

Figure 14 Percentage of indications for prescribing post–procedural antimicrobials, Surgical NAPS contributor hospitals, 2017*




* n = 3,600 post–procedural antimicrobial prescriptions

There was minimal difference between public and private hospitals in post–procedural prescribing of antimicrobials, with 60.9% (756 antimicrobials) and 62.1% (719 antimicrobials) deemed inappropriate respectively. There was a lower rate of antimicrobial prescribing in public hospitals, with 29.2% of surgical episodes (1,027 episodes) having at least one antimicrobial prescribed post–procedurally compared with 36.0% (1,048 episodes) at private hospitals, (Table 10).

Table 10 **Post–procedural prophylactic prescribing of antimicrobials for surgical episodes, by funding type, Surgical NAPS contributor hospitals, 2017***

| Funding type | Surgical episodes | At least one prophylactic antimicrobial prescribed | | Total doses | Inappropriate | |
|---|---|---|---|---|---|---|
| | (n) | (n) | (%) | (n) | (n) | (%) |
| Public hospitals | 3,515 | 1,027 | 29.2 | 1,241 | 756 | 60.9 |
| Private hospitals | 2,913 | 1,048 | 36.0 | 1,158 | 719 | 62.1 |
| **Total** | **6,428*** | **2,075** | **32.3** | **2,399** | **1,475** | **61.5** |

* 755 surgical episodes had post–procedural antimicrobials prescribed for treatment of infection only and were excluded from the analysis

The surgical procedure groups that had the highest rate of prophylactic antimicrobials prescribed post–procedurally were ophthalmology 78.5% (124 antimicrobials), cardiac surgery 70.1% (108 antimicrobials) and orthopaedic surgery 63.3% (1,008 antimicrobials). The procedure groups with the highest rate of inappropriateness when post–procedural prophylaxis was prescribed were breast surgery (86 antimicrobials of which 95.3% were inappropriate), dentoalveolar surgery (53 antimicrobials of which 88.7% were inappropriate) and gynaecological surgery (48 antimicrobials of which 87.5% were inappropriate), (Table 11).

**Table 11** Post–procedural prophylactic prescribing of antimicrobials for surgical episodes, by procedure group and percentage inappropriate, Surgical NAPS contributor hospitals, 2017*

| Procedure group | Surgical episodes | At least one antimicrobial prescribed | | Total doses | Inappropriate | |
|---|---|---|---|---|---|---|
| | (n) | (n) | (%) | (n) | (n) | (%) |
| Orthopaedic surgery | 1,593 | 1,008 | 63.3 | 1,102 | 520 | 47.2 |
| Abdominal surgery | 875 | 112 | 12.8 | 154 | 98 | 63.6 |
| Plastic and reconstructive surgery | 637 | 189 | 29.7 | 224 | 173 | 77.2 |
| Urological surgery | 600 | 104 | 17.3 | 137 | 114 | 83.2 |
| Head and neck surgery | 456 | 136 | 29.8 | 150 | 123 | 82.0 |
| Gastrointestinal endoscopic procedures | 437 | 3 | 0.7 | 3 | 3 | – |
| Gynaecological surgery | 413 | 26 | 6.3 | 48 | 42 | 87.5 |
| Obstetrics | 370 | 35 | 9.5 | 65 | 43 | 66.2 |
| Neurosurgery | 258 | 80 | 31.0 | 89 | 56 | 62.9 |
| Breast surgery | 187 | 61 | 32.6 | 86 | 82 | 95.3 |
| Ophthalmology | 158 | 124 | 78.5 | 124 | 33 | 26.6 |
| Dentoalveolar surgery | 155 | 51 | 32.9 | 53 | 47 | 88.7 |
| Cardiac surgery | 154 | 108 | 70.1 | 123 | 64 | 52.0 |
| Vascular surgery | 87 | 8 | 9.2 | 9 | 6 | – |
| Thoracic surgery | 48 | 30 | 62.5 | 32 | 22 | 68.8 |
| **Total** | **6,428** | **2,075** | **12.8** | **2,399** | **1,426** | **59.4** |

* Percentages are not shown for antimicrobials where n <10

Of the 2,399 antimicrobial prescriptions for post–procedural prophylaxis only, the most common routes of administration were:

- Intravenous 68.4% (1,642 antimicrobials)
- Oral 22.6% (543 antimicrobials)
- Ocular 5.0% (120 antimicrobials).

Of the 543 antimicrobials that were administered orally, only 70 prescriptions (12.9%) were deemed appropriate and only 22 of the 94 topical prescriptions (23.4%) were deemed appropriate.

Where post–procedural antimicrobials were prescribed for prophylaxis, 608 prescriptions (25.3%) were compliant with the *Therapeutic Guidelines*,[3] 185 (7.7%) were compliant with local guidelines and 1,541 (64.2%) were non–compliant with any guidelines, (Figure 15). There were low rates of post–procedural antimicrobials being prescribed for directed therapy, where there were no guidelines available or where compliance was not assessable. When these were excluded, the overall compliance with any guidelines for prescribing post–procedural antimicrobials was 34.4%, (Figure 16). The appropriateness of prescribed post–procedural antimicrobials was deemed optimal for 718 prescriptions (29.9%) and inadequate for 1,181 (49.2%), Figure 17.

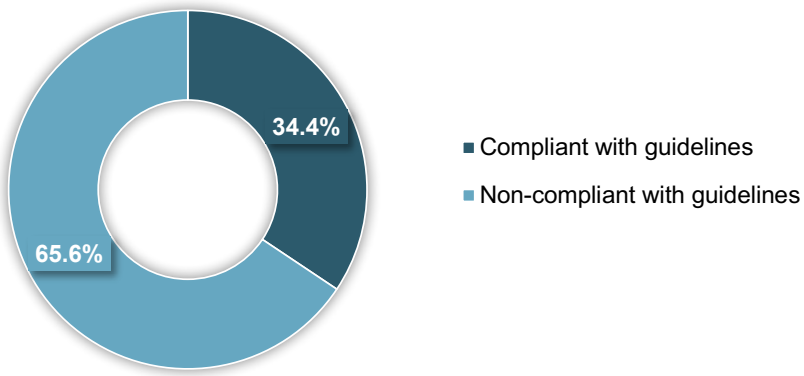
Of the 4,189 episodes where no post–procedural antimicrobials were prescribed, the compliance and appropriateness were very high –89.0% (3,727 episodes) were compliant with the *Therapeutic Guidelines*[3] and 8.9% (371 episodes) were compliant with local guidelines, with 97.7% of these surgical episodes being deemed optimal.

**Figure 15** **Number of prescriptions for post–procedural antimicrobial prophylaxis that complied with guidelines, Surgical NAPS contributor hospitals, 2017***


* n = 2,399 prescriptions for post–procedural prophylaxis

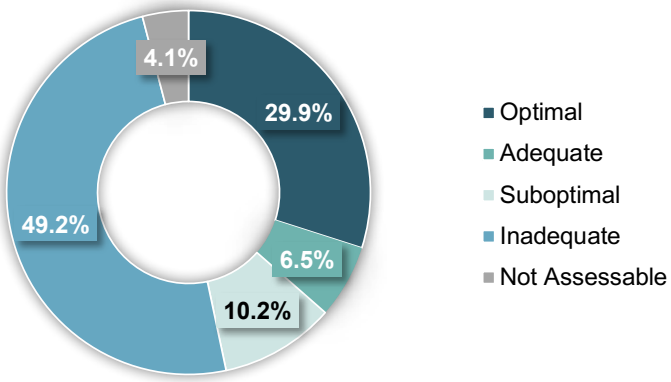
† Antibiotic Expert Group. Therapeutic Guidelines: Antibiotic. Version 15. Melbourne: Therapeutic Guidelines Limited; 2014. https://www.tg.org.au/

Figure 16 Percentage compliance with guidelines of post–procedural antimicrobial prophylaxis prescriptions, where guidelines were available, Surgical NAPS contributor hospitals, 2017*




* n = 2,307, includes prescribed prophylactic post–procedural antimicrobials; excluding any assessed as directed therapy, no guidelines available or not assessable

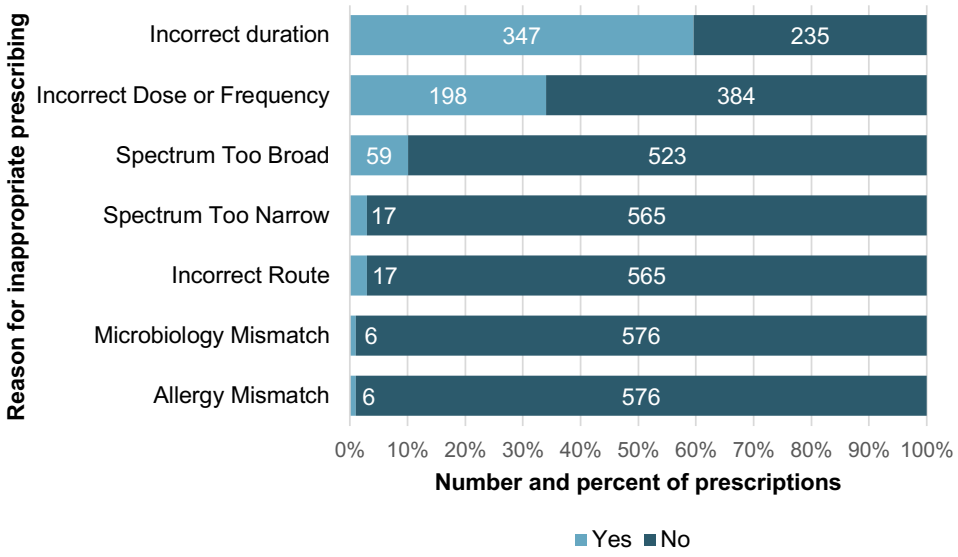
Figure 17 Percentage appropriateness of post–procedural antimicrobial prophylaxis prescriptions, Surgical NAPS contributor hospitals, 2017*




* n = 2,399 prescriptions for post–procedural prophylaxis

Of the 1,502 post–procedural prophylactic prescriptions where antimicrobials were required, 582 episodes (38.7%) were deemed inappropriate, with the most common reasons being incorrect duration 347 (59.6%), incorrect dose or frequency 198 (34.0%) and spectrum too broad 59 (10.1%), as shown in Figure 18.

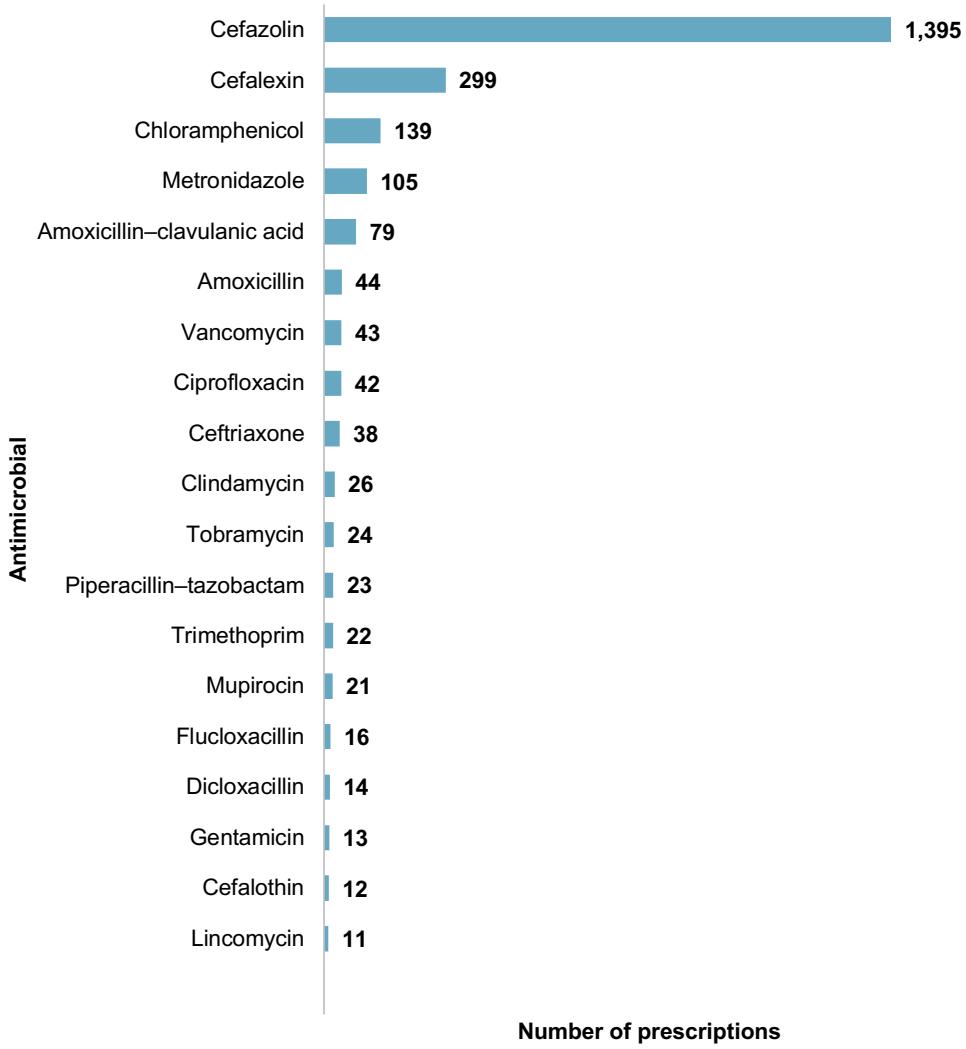
Figure 18 **Reasons for inappropriateness, number and percentage of post–procedural antimicrobial prescriptions for prophylaxis, Surgical NAPS contributor hospitals, 2017***




* n = 582, prescriptions where post–procedural antimicrobial prophylaxis was required and deemed inappropriate

The most common post–procedural antimicrobials prescribed are displayed in Figure 19. The greatest number of prescriptions were for cefazolin 58.1% (1,395 antimicrobials), cefalexin and chloramphenicol were the next most commonly prescribed with 12.5% (299 antimicrobials) and 5.8% (139 antimicrobials) respectively.

Figure 19 Number of antimicrobials prescribed for post–procedural prophylaxis, Surgical NAPS contributor hospitals, 2017*




* n = 2,399 prescriptions for post–procedural prophylaxis

## 6.5 Duration of prophylaxis

As the administration time was not recorded for many of the antimicrobials prescribed, the duration of post–procedural prophylaxis was based on the calendar days of prescribing and reflects days of antimicrobial therapy rather than exact durations of therapy. Antimicrobial use beyond 48 hours was therefore used as a marker for prolonged post–procedural prescribing for this report, with results displayed being an under–representation of the true rate of prescribing for greater than 48 hours, due to using days of therapy.

There was a large difference in the duration of post–procedural surgical prophylaxis prescribed between public or private hospitals, with 37.9% (470 antimicrobials) prescribed in public hospitals and 27.6% (320 antimicrobials) prescribed in private hospitals having greater than 48 hours of surgical prophylaxis prescribed, (Table 12). There was also a greater range in the duration of prescriptions for public hospitals (1–71 days), there was no difference in the median length of prescribing of two days. On average, 32.9% of total post–procedural prophylactic antimicrobial prescribing was for greater than 48 hours.

**Table 12 Duration of post–procedural prophylaxis by funding type, Surgical NAPS contributor hospitals, 2017**

| Funding type | Antimicrobial prescriptions (n) | Duration range (days) | Duration median (days) | Duration > 48 hours (n) | (%) |
|---|---|---|---|---|---|
| Public hospitals | 1,241 | 1–71 | 2 | 470 | 37.9 |
| Private hospitals | 1,158 | 1–29 | 2 | 320 | 27.6 |
| **Total** | **2,399** | **1–71** | **2** | **790** | **32.9** |

There was a range of prescribing durations for the various surgical procedure groups, with median days of duration ranging from 2–7 days, (Table 13). The procedure groups with the greatest median duration were ophthalmology (median 7 days, range 1–29 days), plastic and reconstructive surgery (median 6 days, range 1–21 days), head and neck surgery (median 6 days, range 1–23 days) and dentoalveolar surgery (median 6 days, range 2–9 days).

Table 13 Duration of post–procedural prophylaxis, number of prescriptions by procedure group and percentage greater than 48 hours, Surgical NAPS contributor hospitals, 2017

| Procedure group | Antimicrobial prescriptions (n) | Duration range (days) | Duration median (days) | Duration > 48 hrs (n) | (%) |
|---|---|---|---|---|---|
| Orthopaedic surgery | 1,102 | 1–16 | 2 | 85 | 7.7 |
| Plastic and reconstructive surgery | 224 | 1–21 | 6 | 155 | 69.2 |
| Abdominal surgery | 154 | 1–15 | 3 | 56 | 36.4 |
| Head and neck surgery | 150 | 1–23 | 6 | 120 | 80.0 |
| Urological surgery | 137 | 1–15 | 4 | 69 | 50.4 |
| Ophthalmology | 124 | 1–29 | 7 | 120 | 96.8 |
| Cardiac surgery | 123 | 1–37 | 2 | 14 | 11.4 |
| Neurosurgery | 89 | 1–8 | 2 | 28 | 31.5 |
| Breast surgery | 86 | 1–71 | 5 | 54 | 62.8 |
| Obstetrics | 65 | 1–29 | 2 | 15 | 23.1 |
| Dentoalveolar surgery | 53 | 2–9 | 6 | 52 | 98.1 |
| Gynaecological surgery | 48 | 1–11 | 2 | 12 | 25.0 |
| Thoracic surgery | 32 | 1–5 | 2 | 5 | 15.6 |
| Vascular surgery | 9 | 1–12 | 3 | 4 | 44.4 |
| Gastrointestinal endoscopic procedures | 3 | 1–4 | 2 | 1 | 33.3 |
| **Total** | **2,399** | **1–71** | **2** | **790** | **32.9** |

The route of administration also had an impact on duration of therapy. There was a median of two days of therapy for intravenously administered antimicrobials compared to seven days of therapy for antimicrobials administered via the ocular and enteral routes. There were also prolonged durations for oral and topical administration, which both had a median of six days of therapy, (Table 14).

**Table 14** Duration of post–procedural prophylaxis by route of administration, Surgical NAPS contributor hospitals, 2017*

| Route of administration | Antimicrobial prescriptions (n) | Duration range (days) | Duration median (days) | Duration > 48 hours (n) | (%) |
|---|---|---|---|---|---|
| Intravenous | 1,642 | 1–18 | 2 | 115 | 7.0 |
| Oral | 541 | 1–71 | 6 | 475 | 87.8 |
| Ocular | 120 | 1–29 | 7 | 116 | 96.7 |
| Topical | 94 | 1–37 | 6 | 82 | 87.2 |
| Enteral | 2 | 5–8 | 7 | 2 | – |
| **Total** | **2,399** | **1–71** | **2** | **790** | **32.9** |

* Percentages are not shown for antimicrobials where n <10

Table 15 shows the antimicrobials that were prescribed for post–procedural surgical prophylaxis. Of these, the antimicrobials with the greatest duration were tobramycin (median 19 days, range 8–29 days), Kenacomb® (median 14 days, range 14–23 days) and phenoxymethylpenicillin (median 13 days, range 11–15 days). Of note, cefalexin had the longest duration of therapy for prophylaxis with 71 days recorded. There were high rates of inappropriateness for many of the antimicrobials prescribed, antimicrobials of note with high rates of inappropriateness were dicloxacillin 92.9% (13 prescriptions), trimethoprim 90.9% (20 prescriptions) and amoxicillin 88.6% (39 prescriptions).

Table 15 Number of prescriptions, duration of post–procedural surgical prophylaxis and percentage inappropriate, by antimicrobial, Surgical NAPS contributor hospitals, 2017*

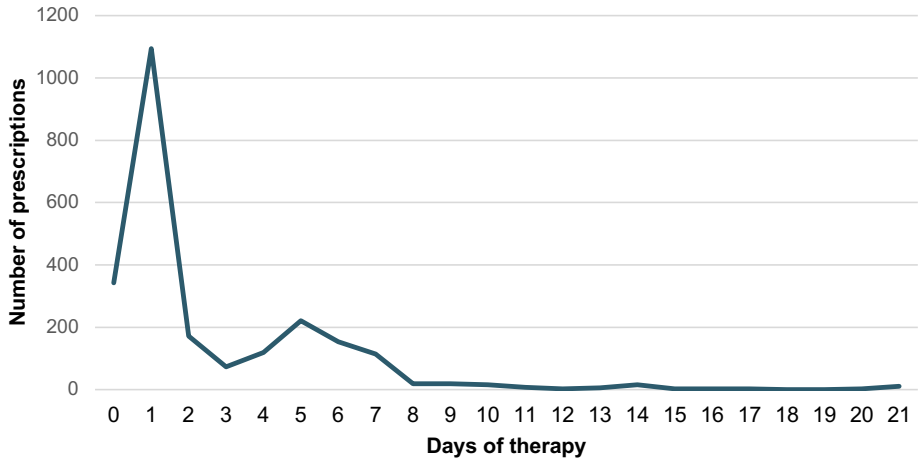
| Antimicrobial | Prescriptions | Range | Median | Duration > 48 hours | | Inappropriate | |
|---|---|---|---|---|---|---|---|
| | (n) | (days) | (days) | (n) | (%) | (n) | (%) |
| Cefazolin | 1,395 | 1–18 | 2 | 76 | 5.4 | 693 | 49.7 |
| Cefalexin | 299 | 1–71 | 6 | 271 | 90.6 | 264 | 88.3 |
| Chloramphenicol | 139 | 1–29 | 7 | 133 | 95.7 | 49 | 35.3 |
| Metronidazole | 105 | 1–29 | 2 | 35 | 33.3 | 81 | 77.1 |
| Amoxicillin–clavulanic acid | 79 | 1–15 | 6 | 65 | 82.3 | 55 | 69.6 |
| Amoxicillin | 44 | 2–16 | 7 | 40 | 90.9 | 39 | 88.6 |
| Vancomycin | 43 | 1–6 | 1 | 2 | 4.7 | 29 | 67.4 |
| Ciprofloxacin | 42 | 1–15 | 5 | 33 | 78.6 | 35 | 83.3 |
| Ceftriaxone | 38 | 1–8 | 2 | 9 | 23.7 | 29 | 76.3 |
| Clindamycin | 26 | 1–9 | 4 | 14 | 53.8 | 20 | 76.9 |
| Tobramycin | 24 | 8–29 | 19 | 24 | 100 | 17 | 70.8 |
| Piperacillin–tazobactam | 23 | 1–17 | 2 | 6 | 26.1 | 12 | 52.2 |
| Trimethoprim | 22 | 2–12 | 7 | 19 | 86.4 | 20 | 90.9 |
| Mupirocin | 21 | 1–37 | 5 | 14 | 66.7 | 6 | 28.6 |
| Flucloxacillin | 16 | 1–8 | 4 | 9 | 56.3 | 14 | 87.5 |
| Dicloxacillin | 14 | 6–8 | 7 | 14 | 100 | 13 | 92.9 |
| Gentamicin | 13 | 1–5 | 1 | 1 | 7.7 | 9 | 69.2 |
| Cefalothin | 12 | 2–5 | 2 | 3 | 25.0 | 8 | 66.7 |
| Lincomycin | 11 | 1–2 | 2 | 0 | 0.0 | 7 | 63.6 |
| Cefaclor | 7 | 3–11 | 7 | 6 | 85.7 | 6 | – |
| Roxithromycin | 4 | 5–11 | 6 | 4 | 100 | 4 | – |
| Kenacomb® | 3 | 14–23 | 14 | 3 | 100 | 3 | – |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Trimethoprim–sulfamethoxazole | 3 | 2–6 | 6 | 2 | 66.7 | 3 | – |
| Ampicillin | 2 | 1–2 | 2 | 0 | 0.0 | 2 | – |
| Benzylpenicillin | 2 | 1–5 | 3 | 1 | 50.0 | 2 | – |
| Meropenem | 2 | 2–3 | 3 | 0 | 0.0 | 0 | – |
| Nitrofurantoin | 2 | 8–11 | 10 | 2 | 100 | 2 | – |
| Phenoxymethylpenicillin | 2 | 11–15 | 13 | 2 | 100 | 1 | – |
| Cefotaxime | 1 | 5–5 | 5 | 1 | 100 | 0 | – |
| Cefoxitin | 1 | 2–2 | 2 | 0 | 0.0 | 1 | – |
| Erythromycin | 1 | 7 | 7 | 1 | 100 | 1 | – |
| Fluconazole | 1 | 1 | 1 | 0 | 0.0 | 0 | – |
| Norfloxacin | 1 | 3 | 3 | 0 | 0.0 | 1 | – |
| Sulfamethoxazole | 1 | 1 | 1 | 0 | 0.0 | 0 | – |
| **Total** | **2,399** | **1–71** | **2** | **790** | **32.9** | **1,426** | **59.4** |

* Percentages are not shown for antimicrobials where n <10

When prescribing post–procedural prophylaxis, there is a propensity to prescribe for defined periods of time. This is evident in Figure 20, where the peaks correspond to the number of prescriptions prescribed for one, five, seven, 14 and 21 days of therapy. These traditional treatment durations of greater than 24 hours are commonly used for antimicrobials, although they are not based on any formal evidence, have not been proven to be necessary for prophylaxis for any conditions, and are not recommended by any national guidelines.

**Figure 20** **Prescription duration, days of post–procedural prophylaxis up to 21 days, Surgical NAPS contributor hospitals, 2017***




* n = 2,399 prescriptions for post–procedural prophylaxis

## 6.6 30–day outcomes

The collection of 30–day patient outcome data can be difficult, as patients may not present to the hospital that performed the surgical procedure either for follow–up appointments or if complications occur. With this in mind, data collection was optional for the 30–day outcome measures.

Thirty–nine (36.8%) facilities opted to collect these data; 2,912 (40.5%) surgical episodes were captured.

Outcome data relating to those episodes were as follows:

- 102 (3.5%) surgical site infections, 53.9% of which had an element of prescribing deemed inappropriate
  - 68 superficial (66.7%)
  - 16 deep incisional (15.7%)
  - 10 prosthetic (9.8%)
  - 8 organ space (7.8%)
- One (0.03%) *Clostridioides difficile* infection
- 33 (1.1%) multi–drug resistant organism infections, 54.5% of which had an element of prescribing deemed inappropriate
- 13 (0.4%) unplanned intensive care unit admissions, 63.5% of which had an element of prescribing deemed inappropriate
- 127 (4.4%) unplanned hospital readmissions, 48.0% of which had an element of prescribing deemed inappropriate
- 7 (0.2%) deaths
- 184 (6.3%) other morbidities, 52.7% of which had an element of prescribing deemed inappropriate. The most common of these were pneumonia and urinary tract infections, both with 11 events (6.0%). Sepsis, acute kidney injury, adverse drug reaction and deep vein thrombosis all had three events each (1.6%).

7

# 2018 Surgical NAPS Results

# 7 2018 Surgical NAPS Results

The analysed results of the 2018 Surgical NAPS data are presented below.

## 7.1 Participating hospital demographics

In total, there were 109 hospitals that contributed to the 2018 Surgical NAPS dataset, an increase of 3 from the 2017 Surgical NAPS reported in section 6. Public hospitals from all states, except Tasmania, took part in the survey. Comparatively, private hospitals also lacked representation from Tasmania and the Northern Territory. A range of hospital peer groups[1] participated, and all remoteness classifications[2] were represented, (Tables 16, 17 and 18).

**Table 16** **Number and percentage of participating public and private hospitals, by state and territory, Surgical NAPS 2018**

| State/Territory | Public (n) | Private (n) | Total (n) | Percentage (%) |
|---|---|---|---|---|
| Australian Capital Territory | 2 | 1 | 3 | 2.8 |
| New South Wales | 18 | 19 | 37 | 33.9 |
| Northern Territory | 1 | 0 | 1 | 0.9 |
| Queensland | 4 | 6 | 10 | 9.2 |
| South Australia | 1 | 6 | 7 | 6.4 |
| Tasmania | 0 | 0 | 0 | – |
| Victoria | 20 | 8 | 28 | 25.7 |
| Western Australia | 17 | 6 | 23 | 21.1 |
| **Total** | **63** | **46** | **109** | **100** |

Table 17 Number and percentage of participating public and private hospitals, by peer group classification,* Surgical NAPS 2018

| Peer group classification | Number (n) | Percentage (%) |
|---|---|---|
| **Public hospitals** | **63** | **57.8** |
| Principal referral hospitals | 12 | 11.0 |
| Public acute group A hospitals | 20 | 18.3 |
| Public acute group B hospitals | 6 | 5.5 |
| Public acute group C hospitals | 21 | 19.3 |
| Public acute group D hospitals | 2 | 1.8 |
| Women's hospitals | 1 | 0.9 |
| Children's hospitals | 0 | 0.0 |
| Other acute specialised hospitals | 1 | 0.9 |
| **Private hospitals** | **46** | **42.2** |
| Private acute group A hospitals | 4 | 3.7 |
| Private acute group B hospitals | 9 | 8.3 |
| Private acute group C hospitals | 15 | 13.8 |
| Private acute group D hospitals | 11 | 10.1 |
| Mixed day procedure hospitals | 2 | 1.8 |
| Other acute specialised hospitals | 1 | 0.9 |
| Eye surgery centres | 4 | 3.7 |
| **Total** | **109** | **100** |

* Australian Institute of Health and Welfare 2015. Australian hospital peer groups. Health services series no. 66. Cat. no. HSE 170. AIHW; Canberra 2015

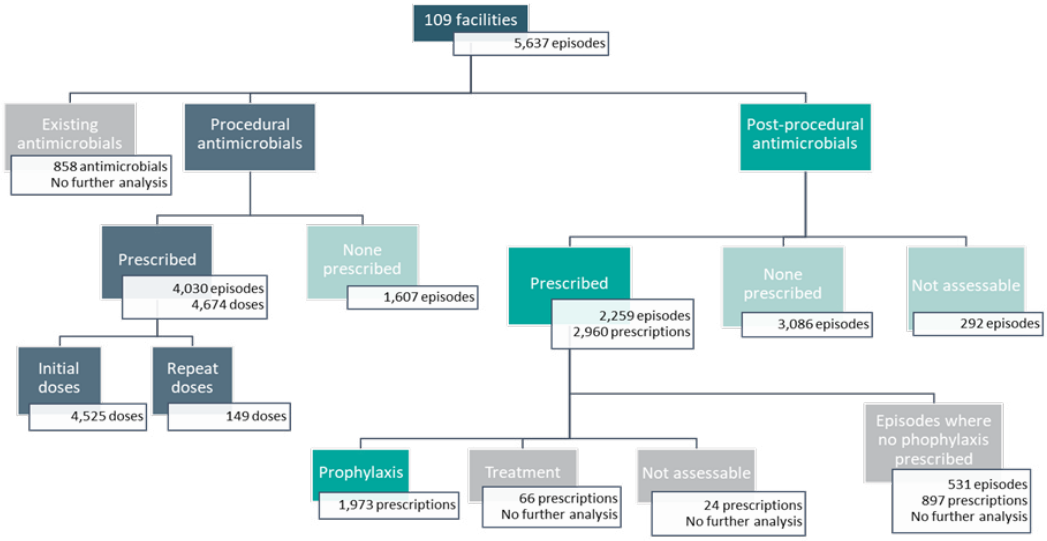
Table 18 Number and percentage of participating public and private hospitals, by remoteness classification,* Surgical NAPS 2018

| Remoteness classification | Public (n) | Private (n) | Total (n) | Percentage (%) |
|---|---|---|---|---|
| Major cities | 24 | 36 | 60 | 55.0 |
| Inner regional | 29 | 9 | 38 | 34.9 |
| Outer regional | 6 | 1 | 7 | 6.4 |
| Remote | 4 | 0 | 4 | 3.7 |
| Very remote | 0 | 0 | 0 | – |
| **Total** | **63** | **46** | **109** | **100** |

* Australian Bureau of Statistics. 1270.0.55.005 – Australian Statistical Geography Standard (ASGS): Volume 5 – Remoteness Structure, July 2016. AMS; Canberra 2018

Figure 21 shows the breakdown of the workflow for data analysis of the 2018 Surgical NAPS survey results and may be useful for reference throughout the report.

**Figure 21** **Workflow diagram for the analysis of data, Surgical NAPS 2018**




## Legend

**Episode** – an individual procedure or set of multiple procedures performed together during the one surgical session and the subsequent post–procedural care associated with the procedure(s)

**Dose** – an individual antimicrobial dose administered either immediately prior to or during the surgical procedure

**Prescription** – any antimicrobial prescribed as either a single dose or as a course following the surgical procedure

**Existing antimicrobial** – an antimicrobial prescribed for treatment or prophylaxis in the 24 hours prior (72 hours if on dialysis) to the procedure, used to determine the appropriateness of whether procedural antimicrobials were given or not given

**Procedural antimicrobial** – an antimicrobial administered either immediately prior to or during the surgical procedure for the purpose of prophylaxis; each initial and repeat dose of the antimicrobial administered is recorded individually

**Post–procedural antimicrobial** – an antimicrobial prescribed following, but directly relating to, the procedure; each prescription of the antimicrobial is recorded, including any inpatient or discharge scripts

**Initial dose** – the first dose of an antimicrobial administered either immediately prior to or during the surgical procedure for the purpose of prophylaxis

**Repeat dose** – any subsequent dose of an antimicrobial administered during the surgical procedure for the purpose of prophylaxis

**Prophylaxis** – an antimicrobial prescribed for the prevention of surgical related infection

**Treatment** – an antimicrobial prescribed for the treatment of infection related to the procedure

**Episodes where no prophylaxis prescribed** – any episode where all prescribed antimicrobials are recorded as for 'treatment' and/or 'not assessable'

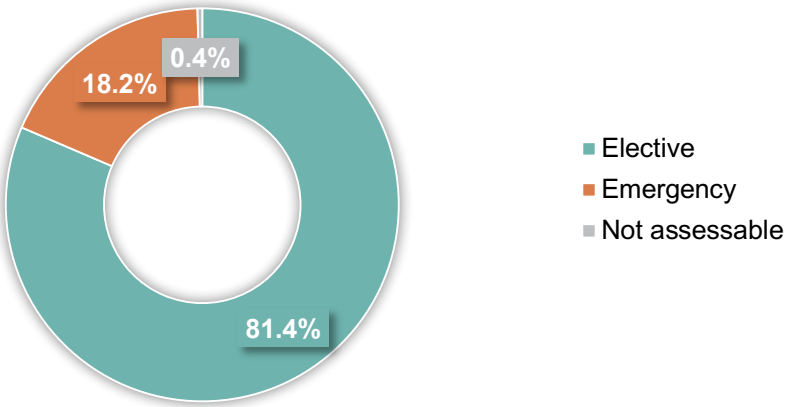
## 7.2 Overall findings

A total of 5,637 surgical episodes were included in the 2018 Surgical NAPS analysis.

Characteristics of those episodes include the following:

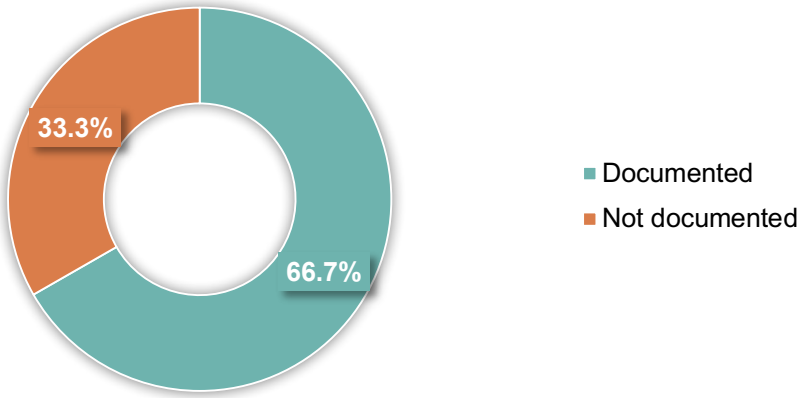
- 2,928 (51.9%) for females, 2,706 (48.0%) for males and 3 (0.05%) for other
- 5,410 (96.0%) were initial surgeries, and 227 (4.0%) were subsequent surgeries
- 404 (7.2%) were trauma related
- 1,659 (29.4%) were for insertion or removal of prosthetic material
- 35 (0.6%) had excessive blood loss documented
- 4,591 (81.4%) were elective procedures and 1,024 (18.2%) were emergency procedures, (Figure 22)
- 4,984 (88.4%) had an incisional procedure, and of those 3,325 (68.7%) had a documented incision time, (Figure 23).

**Figure 22** Percentage of elective and emergency surgical procedures, Surgical NAPS contributor hospitals, 2018*




* n = 5,637 surgical episodes

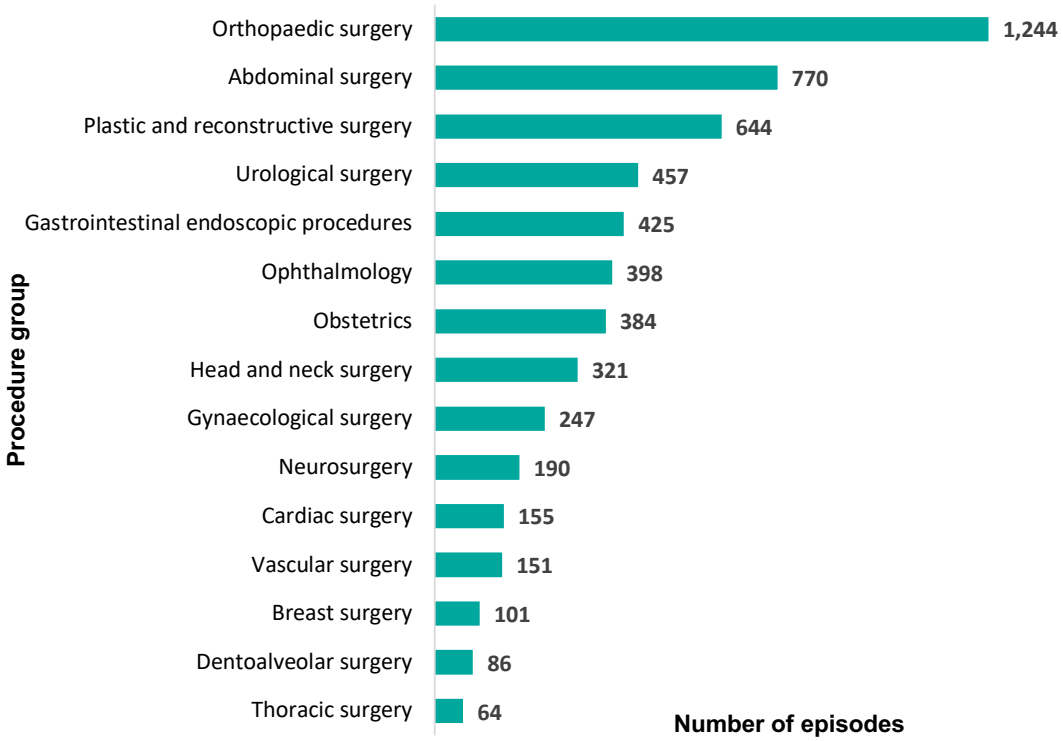
**Figure 23** Percentage of surgical episodes with an incision time documented, Surgical NAPS contributor hospitals, 2018*




* n = 4,984 surgical episodes involving an incisional procedure and assessable incision time

Each hospital could choose how to perform the Surgical NAPS audit. Audits may have been conducted as prevalence surveys (consecutive or random patients), directed surveys or other types of audits. As data were not collected on the type of audits performed, it is not possible to determine the prevalence of the surgical procedures or antimicrobials prescribed. The number of surgical episodes for each procedure group included in the 2018 Surgical NAPS analysis are shown in Figure 24.

**Figure 24** **Number of surgical episodes for each surgical procedure group, Surgical NAPS contributor hospitals, 2018***




**Note:** where there were multiple procedures per surgical episode, only the primary procedure group was included

* n = 5,637 surgical episodes

Table 19 outlines the number and percentage of hospitals that contributed data to each procedure group. It is important to note that hospitals may routinely perform only certain surgical procedures or may have audited select surgical procedure groups. Each procedure group had a minimum of sixteen hospitals contributing to the data. The percentages of hospitals contributing to the procedure groups ranged from 14.7% for thoracic surgery to 75.2% for abdominal surgery.

**Table 19** Number and percentage of participating hospitals by funding type contributing to each surgical procedure group, Surgical NAPS 2018*

| Procedure group | Public hospitals | Private hospitals | Contributing hospitals | |
|---|---|---|---|---|
| | (n) | (n) | (n) | (%) |
| Abdominal surgery | 51 | 31 | 82 | 75.2 |
| Orthopaedic surgery | 42 | 34 | 76 | 69.7 |
| Plastic and reconstructive surgery | 46 | 26 | 72 | 66.1 |
| Urological surgery | 39 | 26 | 65 | 59.6 |
| Head and neck surgery | 34 | 23 | 57 | 52.3 |
| Gastrointestinal endoscopic procedures | 33 | 15 | 48 | 44.0 |
| Gynaecological surgery | 27 | 18 | 45 | 41.3 |
| Obstetrics | 27 | 15 | 42 | 38.5 |
| Neurosurgery | 16 | 16 | 32 | 29.4 |
| Vascular surgery | 20 | 9 | 29 | 26.6 |
| Ophthalmology | 13 | 11 | 24 | 22.0 |
| Breast surgery | 9 | 12 | 21 | 19.3 |
| Dentoalveolar surgery | 8 | 10 | 18 | 16.5 |
| Cardiac surgery | 7 | 10 | 17 | 15.6 |
| Thoracic surgery | 9 | 7 | 16 | 14.7 |

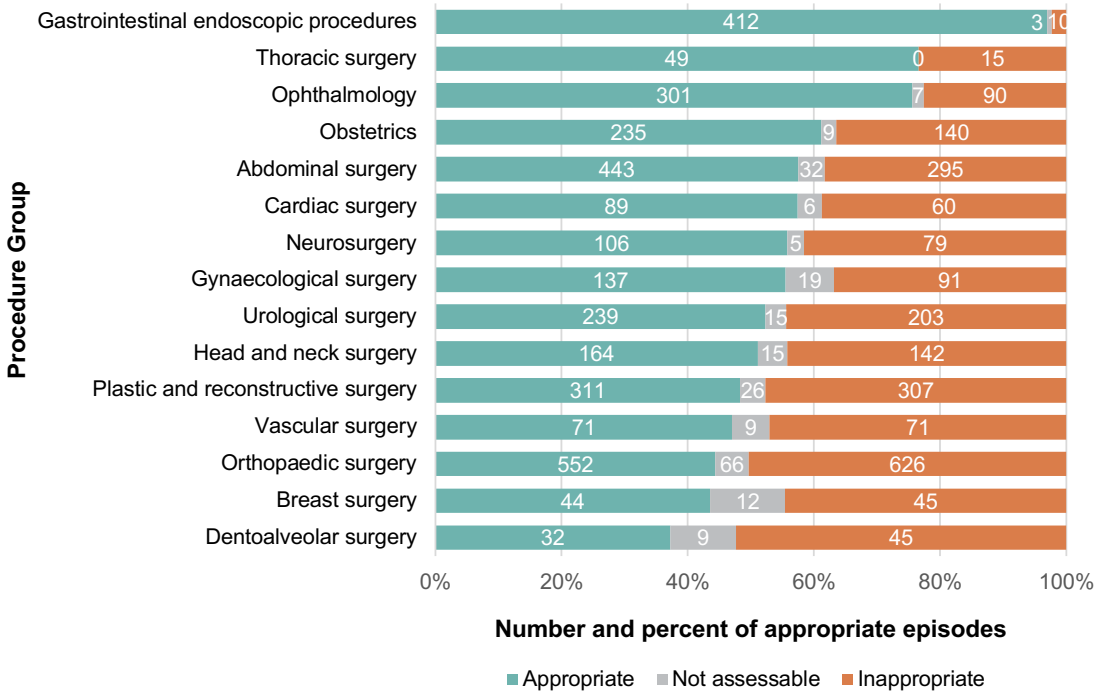
* n = 109 hospitals

The overall appropriateness of prescribing (procedural plus post–procedural) for each surgical group is shown in Figure 25. For reporting purposes, 'optimal' and 'adequate' are deemed to be appropriate, while 'suboptimal' and 'inadequate' are deemed to be inappropriate, (*see Appendix 5*).

Each surgical episode was given an overall assessment of inappropriate if any single aspect of the procedural or post–procedural prescribing was deemed inappropriate by the surveyor. This included allergy or microbiology mismatch; incorrect antimicrobial timing, dose, route, frequency or duration; if the antimicrobial spectrum was too broad or too narrow; or if the procedure did not require any antimicrobials.

When reviewed by procedure group, overall assessments of inappropriate antimicrobial prescribing were high. Inappropriateness ranged from 22.6% for ophthalmological surgery through to 52.3% for dentoalveolar surgery. An exception was gastrointestinal endoscopic procedures (2.4%) which had fewer elements of inappropriate antimicrobial prescribing.

Figure 25 Total number and percentage of episodes by appropriateness for each surgical procedure group, Surgical NAPS contributor hospitals, 2018*




* n = 5,637 surgical episodes, including all episodes where antimicrobials were prescribed as well as when none were prescribed

## 7.3 Procedural prophylaxis

Overall, of the 5,637 surgical episodes with procedural prophylaxis audited, procedural prophylaxis was inappropriate in 1,619 episodes (28.7%), (Table 20). This included surgical episodes where no procedural antimicrobials were prescribed and episodes where procedural antimicrobials were prescribed. The procedure groups with the most inappropriate prescribing overall were dentoalveolar surgery 46.0% (40 doses), plastic and reconstructive surgery 36.9% (247 doses) and urological surgery 36.0% (189 doses), as shown in Figure 26.

There were 1,606 surgical episodes (28.5%) where there was no procedural antimicrobial prescribed. Of these, 1,460 (90.9%) were deemed to be appropriate and 141 (8.8%) required procedural antimicrobials that had not been prescribed. There were 4,030 surgical episodes (71.5%) where procedural antimicrobials were prescribed and of these, 1,522 episodes (37.8%) were considered inappropriate.

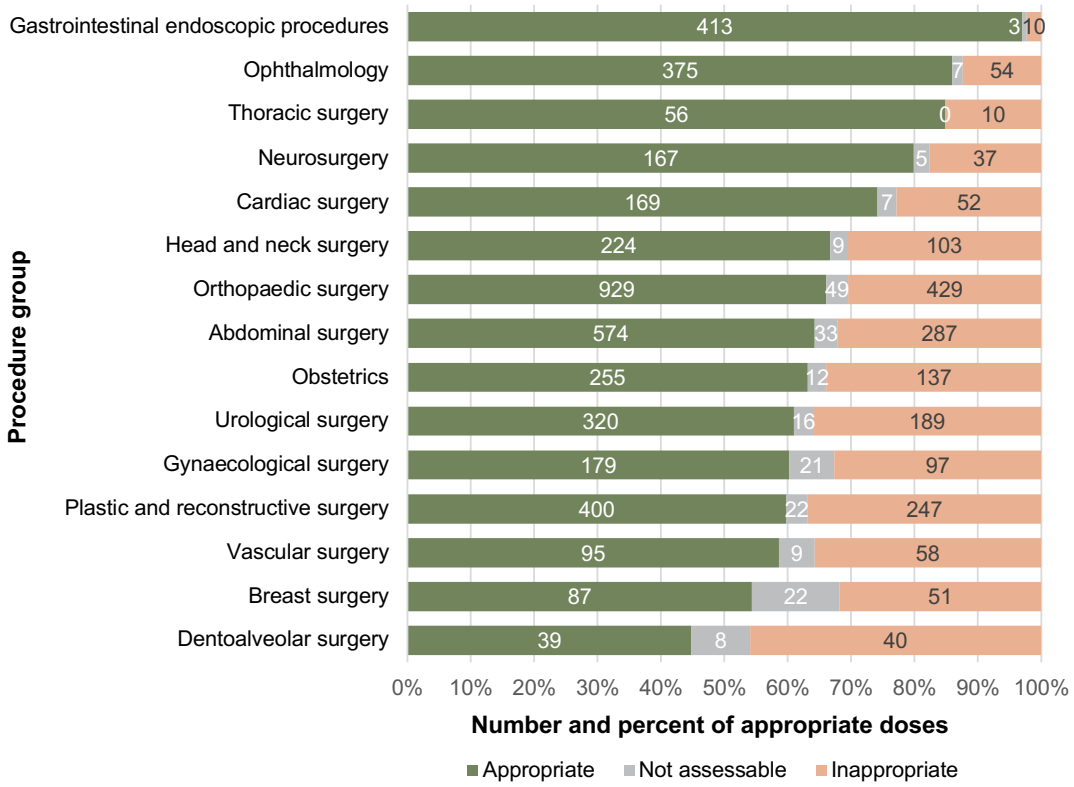
A total of 4,700 individual antimicrobial doses were given for procedural prophylaxis; 149 (3.2%) of these were repeat doses. Of all procedural antimicrobial doses 36.3% (1,704 doses) were assessed as inappropriate for at least one reason, and there were 26 episodes where repeat doses were required but not given. There were 485 doses prescribed (10.3%) where, according to guidelines, no antimicrobial was required.

**Table 20** **Appropriateness of the procedural prescribing of antimicrobials for surgical episodes* and antimicrobial doses, Surgical NAPS contributor hospitals, 2018**

| | Total | Appropriate | | Inappropriate | | Not assessable | |
|---|---|---|---|---|---|---|---|
| | (n) | (n) | (%) | (n) | (%) | (n) | (%) |
| **Surgical episodes** | **5,637** | **3,822** | **67.8** | **1,619** | **28.7** | **195** | **3.5** |
| Antimicrobial prescribed | 4,030 | 2,362 | 58.6 | 1,522 | 37.8 | 146 | 3.6 |
| No antimicrobial prescribed | 1,606 | 1,460 | 90.9 | 97 | 6.0 | 49 | 3.1 |
| Antimicrobial not prescribed when required | 141 | 40 | 28.4 | 90 | 63.8 | 11 | 7.8 |
| **Antimicrobial doses** | **4,700** | **2,822** | **60.0** | **1,704** | **36.3** | **174** | **3.7** |
| Initial dose | 4,525 | 2723 | 60.2 | 1631 | 36.0 | 171 | 3.8 |
| Repeat dose | 149 | 99 | 66.4 | 47 | 31.5 | 3 | 2.0 |
| Repeat dose not given when required | 26 | – | – | 26 | 100 | – | – |
| Antimicrobial prescribed when not required | 485 | 11 | 2.3 | 466 | 96.1 | 8 | 1.6 |

* The overall appropriateness of prescribing for a surgical episode was determined by taking the lowest ranked assessment of the individual doses, including all episodes where antimicrobials were prescribed as well as when none were prescribed. 'Optimal' and 'adequate' are deemed as being appropriate, 'suboptimal' and 'inadequate' are deemed as being inappropriate.

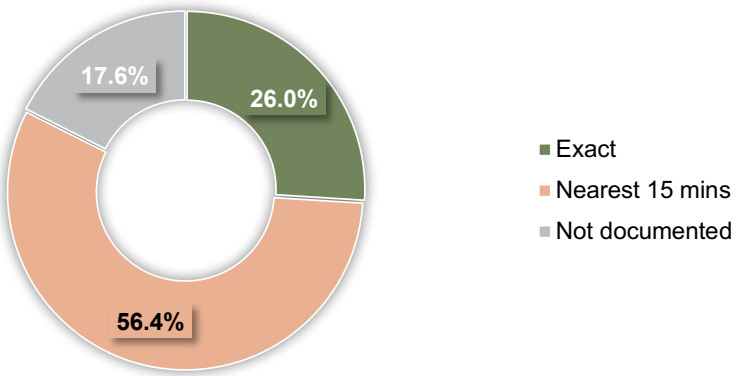
Figure 26 **Total number and percentage of procedural antimicrobial doses by appropriateness for each procedure group, Surgical NAPS contributor hospitals, 2018***




***** n = 6,306 including each dose prescribed and when no antimicrobial was prescribed

Of the 4,674 procedural antimicrobial doses prescribed, 3,852 (82.4%) had a documented administration time, 1,215 (26.0%) recorded to the exact minute and 2,637 (56.4%) to the nearest 15 minutes, (Figure 27). It is important to have a time of incision documented, as the interval between antimicrobial administration time and first incision is a key principle of appropriate surgical antimicrobial prophylaxis prescribing.[1] The optimal time for prophylactic antimicrobial administration is within the 60 minutes prior to first incision, although data suggests administration 15 to 30 minutes before first incision may be optimal. Due to its long infusion time, vancomycin should ideally be started 30 to 120 minutes before first incision. Without a documented incision time, and antimicrobial administration time, it is difficult to determine the appropriateness of the surgical antimicrobial prophylaxis timing.

Figure 27 Percentage of procedural antimicrobial doses for which an administration time was documented, Surgical NAPS contributor hospitals, 2018*




* n = 4,674 doses of procedural antimicrobial prophylaxis

There was a significant difference between public and private hospitals in the appropriateness of procedural antimicrobials, with 40.1% and 29.5% inappropriateness respectively, (Table 21). Notably, this difference (10.6%) was greater than previous datasets (–2.9%, 2017; –1.0%, 2016).

Table 21 Appropriateness of antimicrobial prescribing for surgical episodes, by funding type, Surgical NAPS contributor hospitals, 2018

| Funding type | Surgical episodes (n) | At least one antimicrobial prescribed (n) | (%) | Total doses (n) | Inappropriate (n) | (%) |
|---|---|---|---|---|---|---|
| Public hospitals | 3,518 | 2,457 | 69.8 | 2,817 | 1,131 | 40.1 |
| Private hospitals | 2,118 | 1,573 | 74.3 | 1,857 | 547 | 29.5 |
| **Total** | **5,636** | **4,030** | **71.5** | **4,674** | **1,678** | **35.9** |

The surgical procedure groups that had the highest rate of antimicrobials prescribed procedurally were: breast surgery, 97 antimicrobials prescribed out of 101 surgical episodes (96.0%); orthopaedic surgery 1,136 out of 1,244 episodes (91.3%); and vascular surgery 129 out of 151 episodes (85.4%). The procedure groups with the highest rate of inappropriateness of antimicrobial prescribing, when an antimicrobial was prescribed, were: dentoalveolar surgery 39 out of 66 prescriptions (59.1%); head and neck surgery 99 out of 169 prescriptions (58.6%), and gastrointestinal endoscopic procedures 8 out of 15 prescriptions (53.3%); as shown in Table 22.

Table 22 Percentage prescribed an antimicrobial, number of doses prescribed and inappropriateness of procedural prescribing for surgical episodes by procedure group, Surgical NAPS contributor hospitals, 2018

| Procedure group | Surgical episodes | At least one antimicrobial prescribed | | Total doses | Inappropriate | |
|---|---|---|---|---|---|---|
| | (n) | (n) | (%) | (n) | (n) | (%) |
| Orthopaedic surgery | 1,244 | 1,136 | 91.3 | 1,294 | 415 | 32.1 |
| Abdominal surgery | 770 | 618 | 80.3 | 738 | 252 | 34.1 |
| Plastic and reconstructive surgery | 644 | 430 | 66.8 | 455 | 230 | 50.5 |
| Urological surgery | 457 | 339 | 74.2 | 406 | 182 | 44.8 |
| Head and neck surgery | 321 | 156 | 48.6 | 169 | 99 | 58.6 |
| Gynaecological surgery | 247 | 152 | 61.5 | 200 | 94 | 47.0 |
| Gastrointestinal endoscopic procedures | 425 | 14 | 3.3 | 15 | 8 | 53.3 |
| Obstetrics | 384 | 269 | 70.1 | 289 | 126 | 43.6 |
| Neurosurgery | 190 | 146 | 76.8 | 162 | 31 | 19.1 |
| Breast surgery | 101 | 97 | 96.0 | 156 | 50 | 32.1 |
| Dentoalveolar surgery | 86 | 65 | 75.6 | 66 | 39 | 59.1 |
| Ophthalmology | 398 | 323 | 81.2 | 361 | 50 | 13.9 |
| Cardiac surgery | 155 | 123 | 79.4 | 190 | 43 | 22.6 |
| Vascular surgery | 151 | 129 | 85.4 | 139 | 50 | 36.0 |
| Thoracic surgery | 64 | 33 | 51.6 | 34 | 9 | 26.5 |
| **Total** | **5,637** | **4,030** | **71.5** | **4,674** | **1,678** | **35.9** |

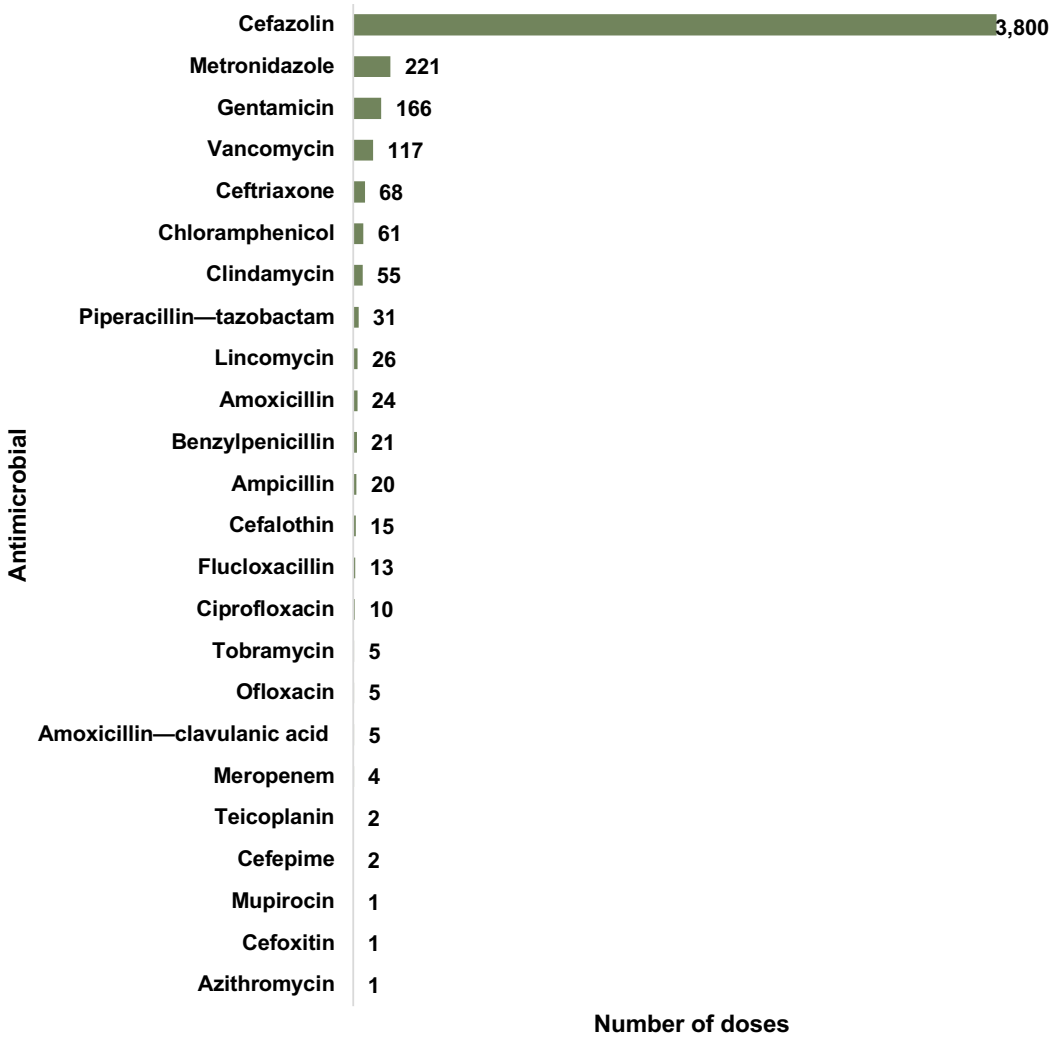
Of the 4,674 procedural antimicrobial doses that were administered, the most common routes of administration were:

- Intravenous 90.2% (4,216)
- Ocular 7.6% (357)
- Topical 2.0% (93).

Of the 93 doses that were administered topically, only 29 (31.2%) were deemed appropriate.

The most common antimicrobials prescribed procedurally are shown in Figure 28. Cefazolin was the most common antimicrobial prescribed with 3,800 doses (81.3%), and metronidazole and gentamicin were the next most commonly prescribed, with 221 (4.7%) and 166 (3.6%) doses respectively.

Figure 28 Number of antimicrobial doses given for procedural prophylaxis, by antimicrobial, Surgical NAPS contributor hospitals, 2018*




***** n = 4,674 procedural antimicrobial doses

Table 23 shows the inappropriateness of the antimicrobials prescribed for procedural prophylaxis in Surgical NAPS contributor hospitals. Some of the notable findings of inappropriate prescribing – albeit for antimicrobials for which a relatively small number of doses were prescribed overall – were for ceftriaxone (68 doses, of which 82.4% were deemed inappropriate), chloramphenicol (61 doses of which 75.4% were deemed inappropriate), amoxicillin (24 doses of which 75.0% were deemed inappropriate) and ampicillin (20 doses of which 75.0% were deemed inappropriate).

Table 23 Number of doses, percentage and inappropriateness of antimicrobials prescribed for procedural prophylaxis, Surgical NAPS contributor hospitals, 2018*

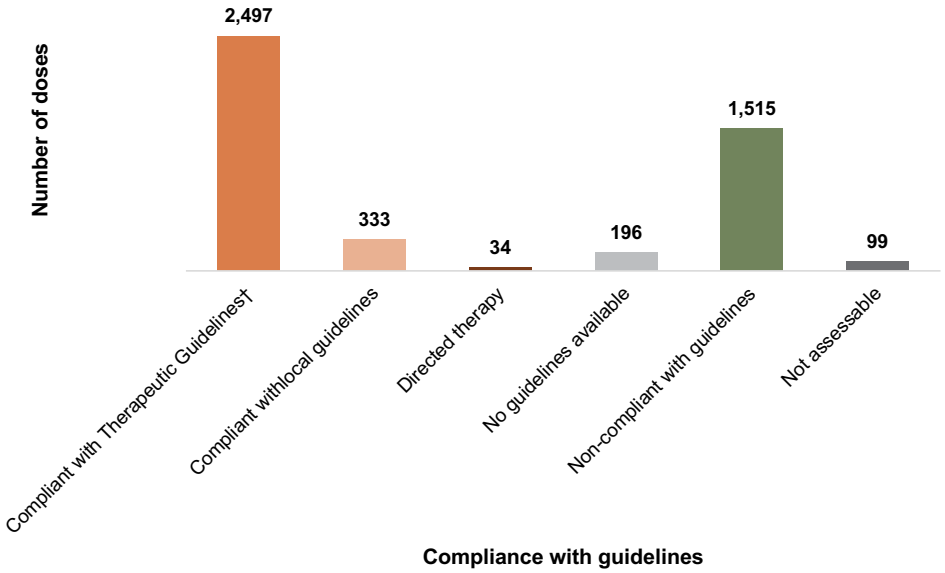
| Antimicrobial | Total doses prescribed | | Inappropriate | |
|---|---|---|---|---|
| | (n) | (%) | (n) | (%) |
| Cefazolin | 3,799 | 81.3 | 1,179 | 31.0 |
| Metronidazole | 221 | 4.7 | 103 | 46.6 |
| Gentamicin | 166 | 3.6 | 78 | 47.0 |
| Vancomycin | 117 | 2.5 | 81 | 69.2 |
| Ceftriaxone | 68 | 1.5 | 56 | 82.4 |
| Chloramphenicol | 61 | 1.3 | 46 | 75.4 |
| Clindamycin | 55 | 1.2 | 29 | 52.7 |
| Piperacillin–tazobactam | 31 | 0.7 | 12 | 38.7 |
| Lincomycin | 26 | 0.6 | 16 | 61.5 |
| Amoxicillin | 24 | 0.5 | 18 | 75.0 |
| Benzylpenicillin | 21 | 0.4 | 7 | 33.3 |
| Ampicillin | 20 | 0.4 | 15 | 75.0 |
| Cefalothin | 15 | 0.3 | 8 | 53.3 |
| Flucloxacillin | 13 | 0.3 | 9 | 69.2 |
| Ciprofloxacin | 10 | 0.2 | 5 | 50.0 |
| Amoxicillin–clavulanic acid | 5 | 0.1 | 0 | – |
| Tobramycin | 5 | 0.1 | 5 | – |
| Ofloxacin | 5 | 0.1 | 3 | – |
| Meropenem | 4 | 0.1 | 1 | – |
| Cefepime | 2 | 0.0 | 2 | – |
| Teicoplanin | 2 | 0.0 | 1 | – |
| Cefalexin | 1 | 0.0 | 1 | – |
| Cefoxitin | 1 | 0.0 | 1 | – |
| Mupirocin | 1 | 0.0 | 1 | – |
| Azithromycin | 1 | 0.0 | 1 | – |
| **Total** | **4,674** | **100** | **1,678** | **35.9** |

* Percentages are not shown for antimicrobials where n <10

Where procedural antimicrobials were prescribed, 2,497doses (53.4%) were compliant with the *Therapeutic Guidelines*,[3] 333 doses (7.1%) were compliant with local guidelines and 1,515 doses (32.4%) were non–compliant with any guidelines, (Figure 29). The number of procedural antimicrobials being prescribed for directed therapy, or when there were no guidelines available or when compliance was not assessable, were very low. When these were excluded, the overall compliance with any guidelines for prescribing procedural antimicrobials was 65.1% (Figure 30). The appropriateness of prescribed procedural antimicrobials was deemed optimal for 2,598 doses (55.6%) and inadequate for 880 doses (18.8%) (Figure 31).

Where no procedural antimicrobials were prescribed (1,606 episodes), the compliance was high with 1,321 (82.3%) being compliant with the *Therapeutic Guidelines*[3] and 101 (6.3%) being compliant with local guidelines. The appropriateness was also high with 1,460 (90.9%) deemed optimal.

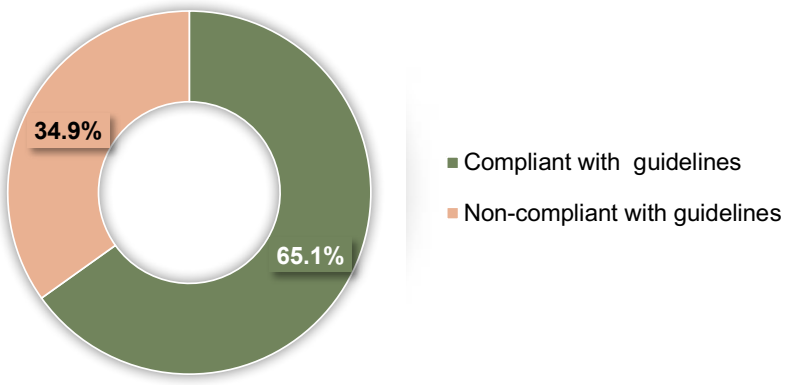
Figure 29 Number of procedural antimicrobial doses and compliance with guidelines for antimicrobial doses, Surgical NAPS contributor hospitals, 2018*




* n = 4,674 procedural antimicrobial doses

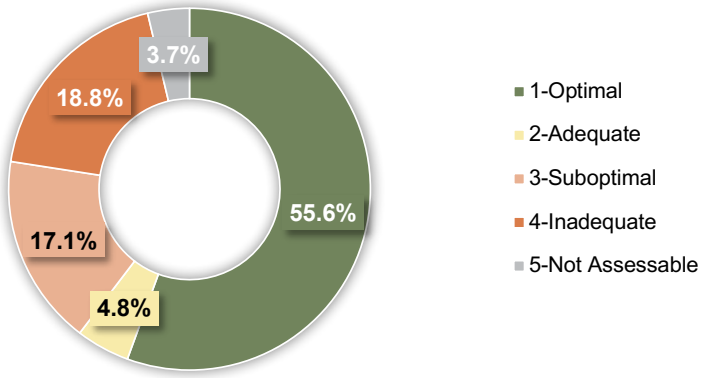
† Antibiotic Expert Group. Therapeutic Guidelines: Antibiotic. Version 15. Melbourne: Therapeutic Guidelines Limited; 2014. https://www.tg.org.au/

Figure 30 Percentage compliance with guidelines, by prescribed procedural antimicrobial dose, when guidelines are available, Surgical NAPS contributor hospitals, 2018*




* n = 4,345 includes prescribed procedural antimicrobial doses; excluding any assessed as directed therapy, no guidelines available or not assessable

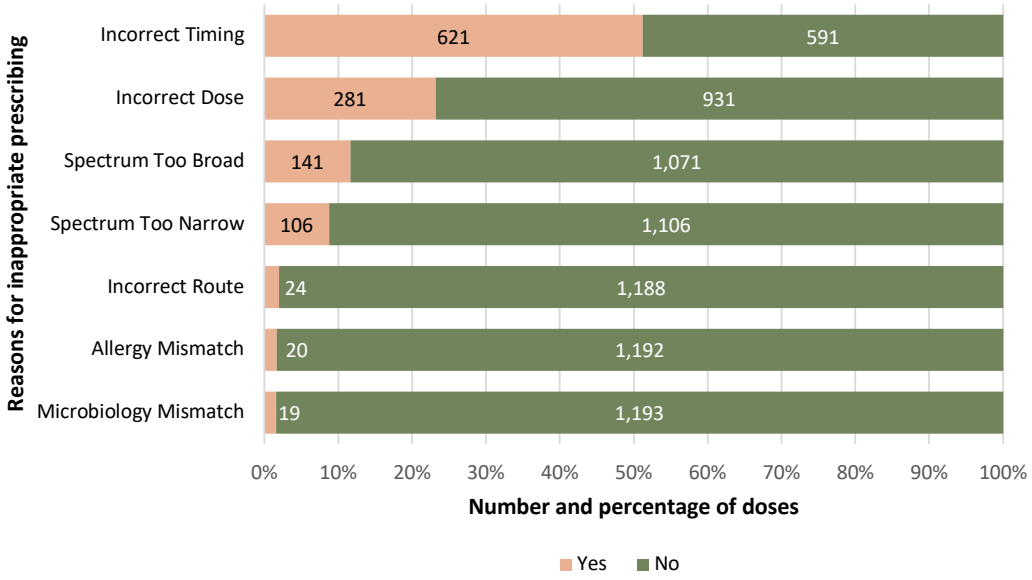
Figure 31 Percentage appropriateness of prescribed procedural antimicrobial doses, Surgical NAPS contributor hospitals, 2018*




* n = 4,674 procedural antimicrobial doses

Of the 4,189 procedural doses where antimicrobials were required, 1,212 doses (28.9%) were deemed inappropriate, with the most common reasons being incorrect timing 51.2% (621 doses), incorrect dosage 23.2% (281 doses), and spectrum too broad 11.6% (141 doses), as shown in Figure 32.

Figure 32 Reasons for inappropriateness, by number and percentage of required procedural antimicrobial doses, Surgical NAPS contributor hospitals, 2018*




* n = 1,212 required procedural antimicrobial doses deemed inappropriate

## 7.4 Post–procedural prophylaxis

Post–procedural antimicrobial prophylaxis was defined as any antimicrobial given immediately following the surgical procedure for the purpose of surgical prophylaxis. Throughout this report, for post–procedural antimicrobials, each **prescription course** of the antimicrobial is recorded and reported, including any inpatient or discharge scripts. Of the 5,637 surgical episodes, there were 531 episodes where all antimicrobials prescribed were for treatment of infection or were not assessable, these episodes were excluded from the post–procedural analysis leaving a total of 5,106 episodes for analysis.

Overall, of these 5,106 surgical episodes, post–procedural prophylaxis was inappropriate in 1,148 surgical episodes (22.5%), as shown in Table 24. This included episodes where antimicrobials were prescribed specifically for prophylaxis and episodes where no antimicrobials were prescribed. Antimicrobials that were prescribed only for the treatment of infection were excluded. The procedure groups with the most inappropriate prescribing overall were breast surgery (119 of which 42.0% were inappropriate), orthopaedic surgery (1,356 of which 38.5% were inappropriate) and head and neck surgery (343 of which 36.2% were inappropriate), as shown in Figure 33.

There were 3,086 surgical episodes (60.4%) where no post–procedural antimicrobials were prescribed, and 2,960 (95.9%) of these episodes were assessed as appropriate. There were 124 surgical episodes (2.4%) where antimicrobials were required but not prescribed. The remaining 1,728 surgical episodes (33.8%) had at least one post–procedural antimicrobial prescribed for prophylaxis, of which 1,073 episodes (62.1%) involved a prescription with an element that was deemed inappropriate. There were 678 episodes (13.3%) where an antimicrobial was prescribed when not required and a further 292 surgical episodes (5.7%) were unable to be assessed as to whether post–procedural antimicrobials had been prescribed.

Of the 1,973 antimicrobials (66.7%) prescribed for prophylaxis, (Figure 34), 1,257 (63.7%) had at least one prescription element that was deemed inappropriate. There were 715 antimicrobials (36.2%) prescribed for prophylaxis which, according to guidelines, were not required and 683 (95.5%) were deemed inappropriate.

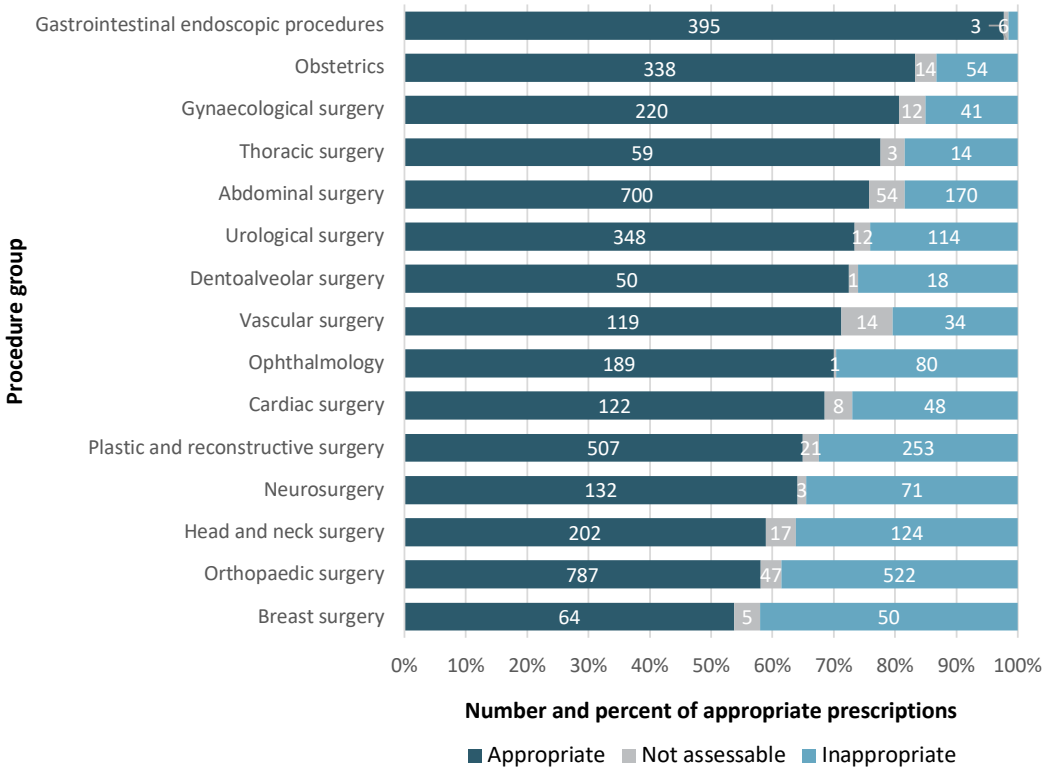
Table 24 Appropriateness of post–procedural prophylactic prescribing of antimicrobials for surgical episodes and antimicrobial prescriptions*, Surgical NAPS contributor hospitals, 2018#

| Post–procedural prophylaxis | Total (n) | Appropriate (%) | Appropriate (n) | Inappropriate (%) | Inappropriate (n) | Not assessable (%) | Not assessable (%) |
|---|---|---|---|---|---|---|---|
| **Surgical episodes** | **5,106** | **3,583** | **70.2** | **1,148** | **22.5** | **83** | **1.6** |
| Antimicrobial prescribed | 1,728 | 623 | 36.1 | 1,073 | 62.1 | 32 | 1.9 |
| Antimicrobial prescribed when not required | 678 | 62 | 9.1 | 600 | 88.5 | 16 | 2.4 |
| No antimicrobial prescribed | 3,086 | 2,960 | 95.9 | 56 | 2.4 | 51 | 1.7 |
| Antimicrobial not prescribed when required | 124 | 67 | 54.0 | 56 | 45.2 | 1 | 0.8 |
| Not assessable | 292 | 237 | 81.2 | 37 | 12.7 | 18 | 6.2 |
| **Antimicrobial prescriptions** | **2,063** | **1,272** | **43.0** | **1,524** | **51.5** | **164** | **5.5** |
| Prophylaxis | 1,973 | 682 | 34.6 | 1,257 | 63.7 | 34 | 1.7 |
| Prophylaxis prescribed when not required | 715 | 31 | 4.3 | 683 | 95.5 | 1 | 0.1 |
| Treatment | 66 | 43 | 65.2 | 16 | 24.2 | 7 | 10.6 |
| Not assessable | 24 | 3 | 12.5 | 4 | 16.7 | 17 | 70.8 |

* The overall appropriateness of prescribing for a surgical episode was determined by taking the lowest ranked assessment of the individual post–procedural prescriptions

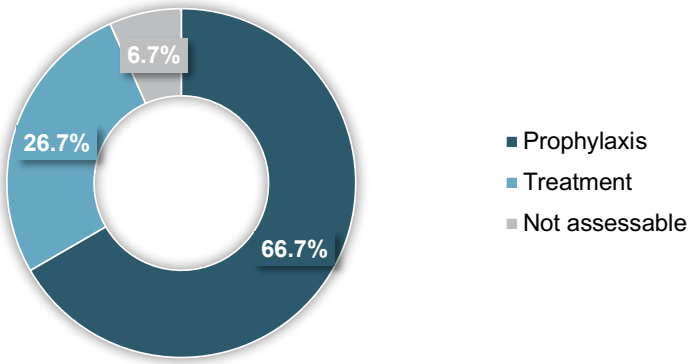
# 531 surgical episodes had only post–procedural antimicrobials prescribed for treatment of infection or were not assessable and were excluded from the analysis

Figure 33 Number of post–procedural prophylactic antimicrobial prescriptions by percentage appropriateness for each surgical procedure group, Surgical NAPS contributor hospitals, 2018*




* n = 6,046 including each dose prescribed and when no antimicrobial was prescribed

Figure 34 Percentage of indications for prescribing post–procedural antimicrobials, Surgical NAPS contributor hospitals, 2018*




* n = 2,960 post–procedural antimicrobial prescriptions

There was minimal difference between public and private hospitals in post–procedural prescribing of antimicrobials, with 63.3% (738 antimicrobials) and 64.3% (519 antimicrobials) deemed inappropriate respectively. There was a lower rate of antimicrobial prescribing in public hospitals, with 32.1% of surgical episodes (1,001 episodes) having at least one antimicrobial prescribed post–procedurally compared with 36.5% (727 episodes) at private hospitals, (Table 25).

**Table 25 Post–procedural prophylactic prescribing of antimicrobials for surgical episodes, by funding type, Surgical NAPS contributor hospitals, 2018***

| Funding type | Surgical episodes | At least one prophylactic antimicrobial prescribed | | Total doses | Inappropriate | |
|---|---|---|---|---|---|---|
| | (n) | (n) | (%) | (n) | (n) | (%) |
| Public hospitals | 3,114 | 1,001 | 32.1 | 1,166 | 738 | 63.3 |
| Private hospitals | 1,992 | 727 | 36.5 | 807 | 519 | 64.3 |
| **Total** | **5,106*** | **1,728** | **33.8** | **1,973** | **1,257** | **63.7** |

* 531 surgical episodes had post–procedural antimicrobials prescribed for treatment of infection only and were excluded from the analysis

The surgical procedure groups that had the highest rate of prophylactic antimicrobials prescribed post–procedurally were cardiac surgery 71.1% (106 antimicrobials), orthopaedic surgery 66.1% (771 antimicrobials) and neurosurgery 49.4% (85 antimicrobials). The procedure groups with the highest rate of inappropriateness when post–procedural prophylaxis was prescribed were dentoalveolar surgery (14 antimicrobials of which 100% were inappropriate), gynaecological surgery (31 antimicrobials of which 93.5% were inappropriate) and urological surgery (102 antimicrobials which 87.3% were inappropriate), (Table 26).

Table 26 Post–procedural prophylactic prescribing of antimicrobials for surgical episodes, by procedure group and percentage inappropriate, Surgical NAPS contributor hospitals, 2018

| Procedure group | Surgical episodes | At least one antimicrobial prescribed | | Total doses | Inappropriate | |
|---|---|---|---|---|---|---|
| | (n) | (n) | (%) | (n) | (n) | (%) |
| Orthopaedic surgery | 1,167 | 771 | 66.1 | 824 | 447 | 54.2 |
| Abdominal surgery | 639 | 84 | 13.1 | 119 | 96 | 80.7 |
| Plastic and reconstructive surgery | 479 | 172 | 35.9 | 222 | 176 | 79.3 |
| Urological surgery | 424 | 82 | 19.3 | 102 | 89 | 87.3 |
| Head and neck surgery | 300 | 109 | 36.3 | 124 | 107 | 86.3 |
| Gastrointestinal endoscopic procedures | 418 | 2 | 0.5 | 3 | 2 | 66.7 |
| Gynaecological surgery | 230 | 25 | 10.9 | 31 | 29 | 93.5 |
| Obstetrics | 370 | 46 | 12.4 | 68 | 38 | 55.9 |
| Neurosurgery | 172 | 85 | 49.4 | 93 | 65 | 69.9 |
| Breast surgery | 94 | 38 | 40.5 | 53 | 44 | 83.0 |
| Ophthalmology | 396 | 163 | 41.2 | 169 | 77 | 45.6 |
| Dentoalveolar surgery | 82 | 14 | 17.1 | 14 | 14 | 100 |
| Cardiac surgery | 149 | 106 | 71.1 | 112 | 42 | 37.5 |
| Vascular surgery | 131 | 18 | 13.7 | 25 | 20 | 80.0 |
| Thoracic surgery | 55 | 13 | 23.6 | 14 | 11 | 78.6 |
| **Total** | **5,106** | **1728** | **33.8** | **1,973** | **1,257** | **63.7** |

Of the 1,973 antimicrobial prescriptions for post–procedural prophylaxis only, the most common routes of administration were:

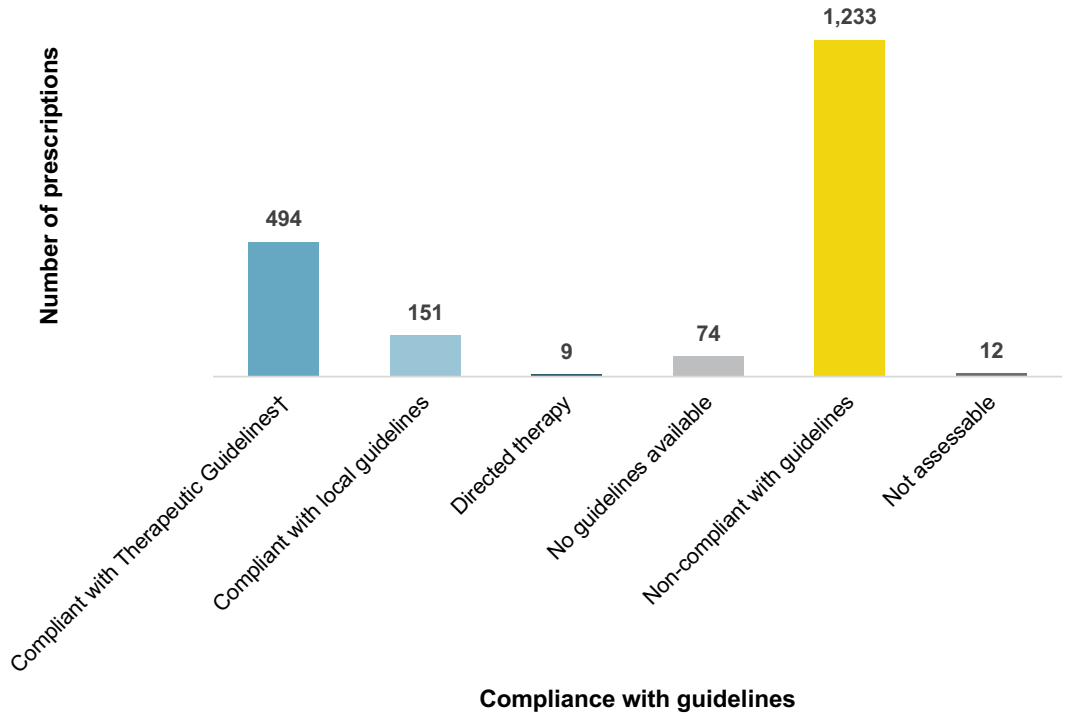
- Intravenous 65.3% (1,288 antimicrobials)
- Oral 23.0% (454 antimicrobials)
- Ocular 7.8% (153 antimicrobials).

Of the 454 antimicrobials that were administered orally, only 56 prescriptions (12.3%) were deemed appropriate and only 23 of the 77 topical prescriptions (29.9%) were deemed appropriate.

Where post–procedural antimicrobials were prescribed for prophylaxis, 494 prescriptions (25.0%) were compliant with the *Therapeutic Guidelines*,[3] 151 (7.7%) were compliant with local guidelines and 1,233 (62.5%) were non–compliant with any guidelines, (Figure 35). There were low rates of post–procedural antimicrobials being prescribed for directed therapy, where there were no guidelines available or where compliance was not assessable. When these were excluded, the overall compliance with any guidelines for prescribing post–procedural antimicrobials was 34.3%, (Figure 36). The appropriateness of prescribed post–procedural antimicrobials was deemed optimal for 510 prescriptions (25.8%) and inadequate for 986 (50.0%), Figure 37.

Of the 3,086 episodes where no post–procedural antimicrobials were prescribed, the compliance and appropriateness were very high – 89.1% (2,751 episodes) were compliant with the *Therapeutic Guidelines*[3] and 5.2% (161 episodes) were compliant with local guidelines, with 95.9% of these surgical episodes being deemed optimal.

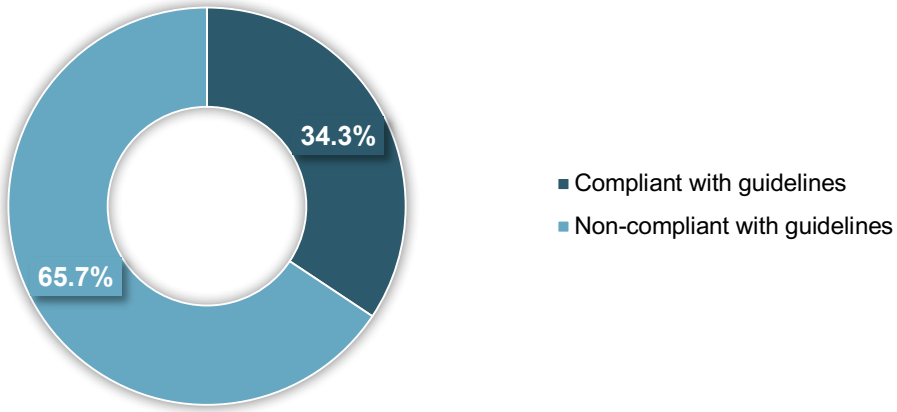
**Figure 35** **Number of prescriptions for post–procedural antimicrobial prophylaxis that complied with guidelines, Surgical NAPS contributor hospitals, 2018***




* n = 1,973 prescriptions for post–procedural prophylaxis

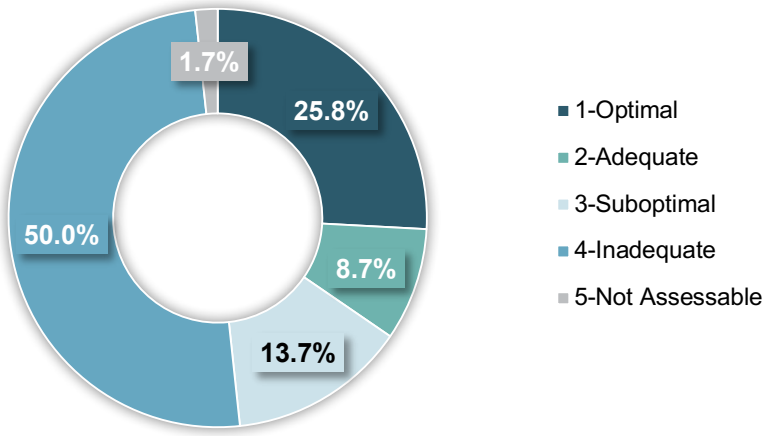
† Antibiotic Expert Group. Therapeutic Guidelines: Antibiotic. Version 15. Melbourne: Therapeutic Guidelines Limited; 2014. https://www.tg.org.au/

Figure 36 Percentage compliance with guidelines of post–procedural antimicrobial prophylaxis prescriptions, where guidelines were available, Surgical NAPS contributor hospitals, 2018*




* n = 1,878 includes prescribed procedural antimicrobial doses; excluding any assessed as directed therapy, no guidelines available or not assessable

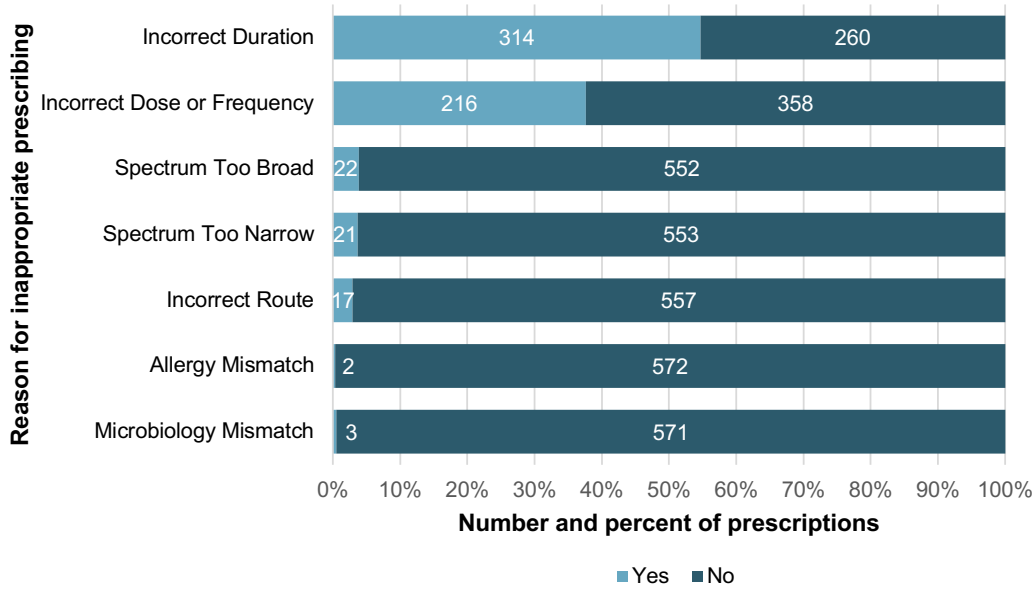
Figure 37 Percentage appropriateness of post–procedural antimicrobial prophylaxis prescriptions, Surgical NAPS contributor hospitals, 2018*




* n = 1,973 post–procedural antimicrobial prescriptions

Of the 1,258 post–procedural prophylactic prescriptions where antimicrobials were required, 574 episodes (45.6%) were deemed inappropriate, with the most common reasons being incorrect duration 317 (54.7%), incorrect dose or frequency 216 (37.6%) and spectrum too broad 22 (3.8%), as shown in Figure 38.

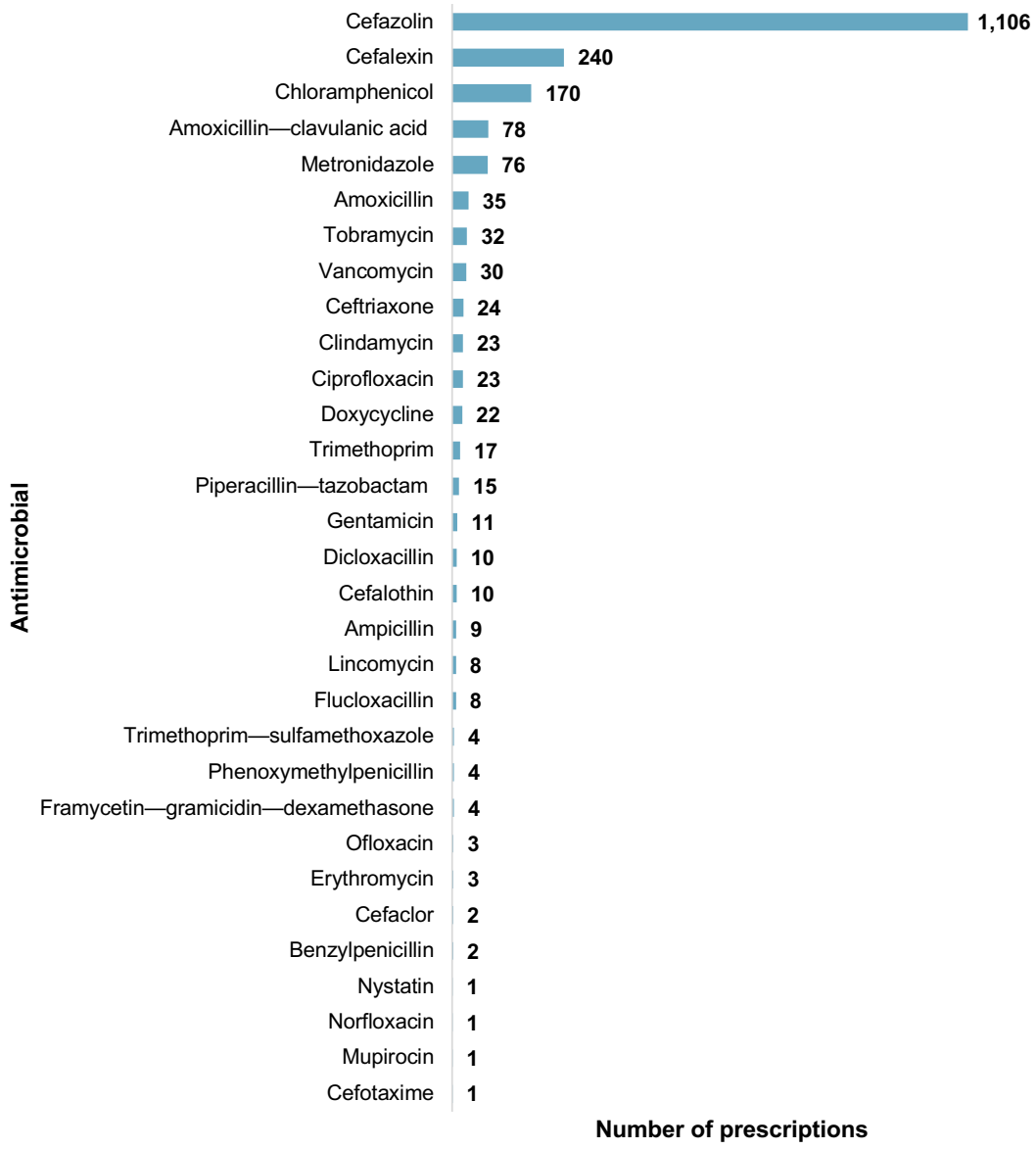
Figure 38 **Reasons for inappropriateness, number and percentage of post–procedural antimicrobial prescriptions for prophylaxis, Surgical NAPS contributor hospitals, 2018***




***** n = 574 required procedural antimicrobial doses deemed inappropriate

The most common post–procedural antimicrobials prescribed are displayed in Figure 39. The greatest number of prescriptions were for cefazolin 56.1% (1,106 antimicrobials), cefalexin and chloramphenicol were the next most commonly prescribed with 12.2% (240 antimicrobials) and 8.6% (170 antimicrobials) respectively.

Figure 39 Number of antimicrobials prescribed for post–procedural prophylaxis, Surgical NAPS contributor hospitals, 2018*




* n = 1,973 prescriptions for post–procedural prophylaxis

## 7.5 Duration of prophylaxis

As the administration time was not recorded for many of the antimicrobials prescribed, the duration of post–procedural prophylaxis was based on the calendar days of prescribing and reflects days of antimicrobial therapy rather than exact durations of therapy. Antimicrobial use beyond 48 hours was therefore used as a marker for prolonged post–procedural prescribing for this report, with results displayed being an under–representation of the true rate of prescribing for greater than 48 hours, due to using days of therapy.

There was a minor difference in the duration of post–procedural surgical prophylaxis prescribed between public and private hospitals, with 39.2% (457 antimicrobials) prescribed in public hospitals and 27.9% (225 antimicrobials) prescribed in private hospitals having greater than 48 hours of surgical prophylaxis prescribed, (Table 27). There was large and differing range in the duration of prescriptions for public (1–40 days) and private (1–68 days) hospitals, there was no difference in the median length of prescribing of two days. On average, 34.67% of total post–procedural prophylactic antimicrobial prescribing was for greater than 48 hours.

**Table 27** **Duration of post–procedural prophylaxis by funding type, Surgical NAPS contributor hospitals, 2018**

| Funding type | Antimicrobial prescriptions | Duration range | Duration median | Duration > 48 hours | |
|---|---|---|---|---|---|
| | (n) | (days) | (days) | (n) | (%) |
| Public hospitals | 1,166 | 1–40 | 2 | 457 | 39.2 |
| Private hospitals | 807 | 1–68 | 2 | 225 | 27.9 |
| **Total** | **1,973** | **1–68** | **2** | **682** | **34.6** |

There was a range of prescribing durations for the various surgical procedure groups, with median days of duration ranging from 2–9 days, (Table 28). The procedure groups with the greatest median duration were ophthalmology (median 9 days, range 1–33 days), breast surgery (median 6 days, range 1–13 days), head and neck surgery (median 6 days, range 1–21 days) and dentoalveolar surgery (median 6 days, range 4–9 days).

Table 28 Duration of post–procedural prophylaxis, number of prescriptions by procedure group and percentage greater than 48 hours, Surgical NAPS contributor hospitals, 2018

| Procedure group | Antimicrobial prescriptions (n) | Duration range (days) | Duration median (days) | Duration > 48 hrs (n) | (%) |
|---|---|---|---|---|---|
| Orthopaedic surgery | 824 | 1–52 | 2 | 59 | 7.2 |
| Abdominal surgery | 119 | 1–40 | 3 | 46 | 38.7 |
| Plastic and reconstructive surgery | 222 | 1–35 | 6 | 153 | 68.9 |
| Urological surgery | 102 | 1–29 | 4.5 | 53 | 52.0 |
| Head and neck surgery | 124 | 1–21 | 6 | 100 | 80.6 |
| Gastrointestinal endoscopic procedures | 3 | 3–4 | 4 | 2 | 66.7 |
| Gynaecological surgery | 31 | 2–9 | 3 | 11 | 35.5 |
| Obstetrics | 68 | 1–12 | 2 | 11 | 16.2 |
| Neurosurgery | 93 | 1–13 | 2 | 15 | 16.1 |
| Breast surgery | 53 | 1–13 | 6 | 36 | 67.9 |
| Ophthalmology | 169 | 1–33 | 9 | 154 | 91.1 |
| Dentoalveolar surgery | 14 | 4–9 | 6 | 14 | 100 |
| Cardiac surgery | 112 | 1–68 | 2 | 14 | 12.5 |
| Vascular surgery | 25 | 1–19 | 3 | 12 | 48.0 |
| Thoracic surgery | 14 | 2–11 | 2 | 2 | 14.3 |
| **Total** | **1,973** | **1–68** | **2** | **682** | **34.6** |

The route of administration also had an impact on duration of therapy. There was a median of two days of therapy for intravenously administered antimicrobials compared to fourteen days of therapy for antimicrobials administered via the ocular route. There were also prolonged durations for oral and topical administration, which had a median of six and seven days of therapy respectively, (Table 29).

Table 29 **Duration of post–procedural prophylaxis by route of administration, Surgical NAPS contributor hospitals, 2018**

| Route of administration | Antimicrobial prescriptions (n) | Duration range (days) | Duration median (days) | Duration > 48 hours (n) | (%) |
|---|---|---|---|---|---|
| Intravenous | 1,288 | 1–52 | 2 | 100 | 7.8 |
| Oral | 454 | 1–68 | 6 | 369 | 81.3 |
| Ocular | 153 | 1–35 | 14 | 141 | 92.2 |
| Topical | 77 | 1–32 | 7 | 71 | 92.2 |
| Enteral | 1 | – | 5 | 1 | – |
| **Total** | **1,973** | **1–68** | **2** | **682** | **34.6** |

Table 30 shows the antimicrobials that were prescribed for post–procedural surgical prophylaxis. Of these, the antimicrobials with the greatest duration were cefalexin (median 6 days, range 1–68 days), cefazolin (median 2, range 1–52 days) and amoxicillin–clavulanic acid (median 6 days, range 2–40 days). There were high rates of inappropriateness for many of the antimicrobials prescribed, antimicrobials of note with high rates of inappropriateness were dicloxacillin 100% (10 prescriptions), trimethoprim 94.1% (17 prescriptions) and cefalexin 90.0% (240 prescriptions).

Table 30 Number of prescriptions, duration of post–procedural prophylaxis and percentage inappropriate, by antimicrobial, Surgical NAPS contributor hospitals, 2018*

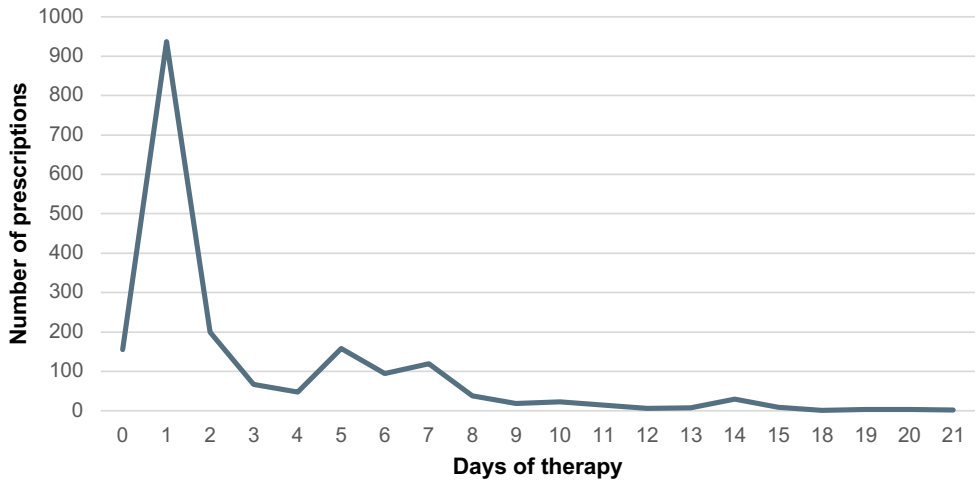
| Antimicrobial | Prescriptions | Range | Median | Duration > 48 hours | | Inappropriate | |
|---|---|---|---|---|---|---|---|
| | (n) | (days) | (days) | (n) | (%) | (n) | (%) |
| Cefazolin | 1,106 | 1–52 | 2 | 68 | 6.1 | 611 | 55.2 |
| Cefalexin | 240 | 1–68 | 6 | 214 | 89.2 | 216 | 90.0 |
| Chloramphenicol | 170 | 1–35 | 9 | 162 | 95.3 | 96 | 56.5 |
| Amoxicillin–clavulanic acid | 78 | 2–40 | 6 | 63 | 80.8 | 63 | 80.8 |
| Metronidazole | 76 | 1–31 | 1 | 26 | 34.2 | 60 | 78.9 |
| Amoxicillin | 35 | 2–11 | 6 | 31 | 88.6 | 31 | 88.6 |
| Tobramycin | 32 | 1–16 | 8 | 28 | 87.5 | 11 | 34.4 |
| Vancomycin | 30 | 1–7 | 2 | 3 | 10.0 | 17 | 56.7 |
| Ceftriaxone | 24 | 1–4 | 2 | 4 | 16.7 | 21 | 87.5 |
| Clindamycin | 23 | 1–9 | 2 | 4 | 17.4 | 16 | 69.6 |
| Ciprofloxacin | 23 | 1–16 | 6 | 21 | 91.3 | 19 | 82.6 |
| Doxycycline | 22 | 1–9 | 1 | 1 | 4.5 | 0 | 0.0 |
| Trimethoprim | 17 | 1–10 | 8 | 12 | 70.6 | 16 | 94.1 |
| Piperacillin–tazobactam | 15 | 2–11 | 3 | 6 | 40.0 | 10 | 66.7 |
| Gentamicin | 11 | 1–5 | 1 | 1 | 9.1 | 6 | 54.5 |
| Dicloxacillin | 10 | 1–8 | 7 | 8 | 80.0 | 10 | 100 |
| Cefalothin | 10 | 2–3 | 2 | 0 | 0.0 | 8 | 80.0 |
| Ampicillin | 9 | 2–6 | 2 | 2 | 22.2 | 7 | – |
| Flucloxacillin | 8 | 2–15 | 5 | 5 | 62.5 | 7 | – |
| Lincomycin | 8 | 1–3 | 2 | 0 | 0.0 | 8 | – |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Framycetin–gramicidin–dexa-methasone | 4 | 8–21 | 9.5 | 4 | 100 | 2 | – |
| Trimethoprim–sulfamethox-azole | 4 | 7–29 | 8.5 | 4 | 100 | 4 | – |
| Phenoxymethylpenicillin | 4 | 6–8 | 6.5 | 4 | 100 | 4 | – |
| Ofloxacin | 3 | 2–12 | 6 | 2 | 66.7 | 3 | – |
| Erythromycin | 3 | 5–8 | 7 | 3 | 100 | 3 | – |
| Benzylpenicillin | 2 | 3 | 3 | 0 | 0.0 | 2 | – |
| Cefaclor | 2 | 5–10 | 7.5 | 2 | 100 | 2 | – |
| Norfloxacin | 1 | 6 | 6 | 1 | 100 | 1 | – |
| Mupirocin | 1 | 4 | 4 | 1 | 100 | 1 | – |
| Nystatin | 1 | 9 | 9 | 1 | 100 | 1 | – |
| Cefotaxime | 1 | 9 | 9 | 1 | 100 | 1 | – |
| **Totals** | **1,973** | **1-68** | **2** | **682** | **34.6** | **1257** | **63.7** |

* Percentages are not shown for antimicrobials where n <10

When prescribing post–procedural prophylaxis, there is a propensity to prescribe for defined periods of time. This is evident in Figure 40, where the peaks correspond to the number of prescriptions prescribed for one, five, seven and 14 days of therapy. These traditional treatment durations of greater than 24 hours are commonly used for antimicrobials, although they are not based on any formal evidence, have not been proven to be necessary for prophylaxis for any conditions, and are not recommended by any national guidelines.

**Figure 40** **Prescription duration, days of post–procedural prophylaxis up to 21 days, Surgical NAPS contributor hospitals, 2018***




* n = 1,924 prescriptions for post–procedural prophylaxis

## 7.6 30–day outcomes

The collection of 30–day patient outcome data can be difficult, as patients may not present to the hospital that performed the surgical procedure either for follow–up appointments or if complications occur. With this in mind, data collection was optional for the 30–day outcome measures.

Thirty–two (29.4%) facilities opted to collect these data; 1,706 (30.3%) surgical episodes were captured.

Outcome data relating to those episodes were as follows:

- 47 (2.8%) surgical site infections, 55.5% of which had an element of prescribing deemed inappropriate
  - 26 superficial (55.3%)
  - 12 deep incisional (25.5%)
  - 9 organ space (19.1%)
- One *Clostridioides difficile* infection (0.06%)
- 17 (1.0%) multi–drug resistant organism infections, 52.9% of which had an element of prescribing deemed inappropriate
- 8 (0.5%) unplanned intensive care unit admissions, 37.5% of which had an element of prescribing deemed inappropriate
- 46 (2.7%) unplanned hospital readmissions, 45.7% of which had an element of prescribing deemed inappropriate
- 6 deaths (0.4%).

# 8

# Evaluation

# 8 Evaluation

## 8.1 Surgical NAPS 2017 evaluation

As there was an extensive evaluation of the Surgical NAPS performed following the 2016 survey and there were no changes implemented for the 2017 survey, another formal evaluation of the Surgical NAPS was not performed after the 2017 data collection period. Similarly, no changes were made prior to the 2018 data collection period.

## 8.2 Surgical NAPS 2018 evaluation

### 8.2.1 Evaluation methodology

An evaluation survey was conducted using SurveyMonkey® to explore auditors' perceptions of the current usability and limitations of the Surgical NAPS. The survey was emailed to participants at facilities that completed the Surgical NAPS in 2018 (n=106). A total of 35 responses were received representing 33% of participating facilities. There was relatively even representation from the public (51%) and private (46%) sectors. The majority of the respondents (66%) were based in major metropolitan cities and 34% were from regional centres.

### 8.2.2 Review of the data collection fields

#### Surgical details

The majority of auditors found the *Surgical details* section to be easy to collect. However, more than 30% of respondents found it difficult to find information in the patient medical records for the following fields:

- *Time of first incision*
- *Wounds classification*
- *Excessive blood loss.*

*Time of first incision* and *wounds classification* are essential information required to determine the appropriateness of the surgical prophylaxis given and must remain in the survey. *Excessive blood loss* was not seen to be essential information to determine appropriateness of the surgical prophylaxis given.

#### Risk factors

A significant number of risk factors were deemed not to be useful to collect by the majority of respondents. For instance, 53% of respondents found that collecting information on *rheumatic heart disease in Aboriginal/Torres Strait Islanders* was of minimal value. This is likely due to the small population of patients where this risk factor is present. The following risk factors had more than 30% of respondents questioning their usefulness:

- *Previous radiation therapy*
- *Rheumatic arthritis*
- *Congenital heart disease*
- *Peritoneal or haemodialysis.*

#### Peri–operative doses

Feedback was received from 24 respondents on the *Documented administration time* section of *Peri–operative doses*. The *Exact time* of administration has long been a difficult field for auditors to complete (70%), whereas only 26% found it challenging to determine when an antimicrobial dose had been given to the *Nearest 15 minutes*. Conversely, collecting the *End time* for antimicrobial infusions is not essential for assessing the appropriateness of peri–operative antibiotic doses.

#### Post–operative antimicrobials

While only 8 respondents gave feedback on the *Post–operative antimicrobials* and *End date and time* fields, almost all found it difficult to collect. This is likely due to incompleteness of documentation in the medical records. Free text comments from the SurveyMonkey® indicate that it is common for medical records to be as brief as "For discharge, cephalexin script provided".

#### 30 Day follow up

Only 27% of respondents attempted the optional *30 Day follow up* section in 2018. This is not unexpected, as these data can be challenging to collect unless the patient returns to the hospital for outpatient review or is readmitted with complications. The most common reason (56%) for not attempting this section was lack of time for data collection.

### 8.2.3 Other feedback

#### Surgical NAPS reports

- 90% of respondents found the reports to be useful and provided enough flexibility to generate the reports they desired.

#### Appropriateness assessment guide

- A great majority (86%) of respondents found the appropriateness assessment guide to be easy to follow and relevant to practice.

#### Time and Resources

- 68% of respondents found the amount of information required to be appropriate whereas 32% found it to be too much.
- The majority (68%) of auditors used the paper forms for data collection and entered the data online at a later stage.
- Time required for data collection ranged from 4 to 30 minutes with most respondents spending 15–20 minutes collecting data for each patient.
- Time required for data assessment and decision making ranged from 2 to 20 minutes per patient with most auditors spending less or equal to 10 minutes.
- All auditors found the NAPS website to be either user friendly or difficult at first but improved once they have become more familiar with the website. No respondent found it to be a negative experience.
- 90% of respondents felt confident in their ability to assess compliance with guidelines.

#### Future Surgical NAPS participation

- 91% of respondents were willing to participate in Surgical NAPS in the future.
- The most significant barriers in participating in future Surgical NAPS were reported to be inadequate staffing to administer the survey and to enter survey data.

### 8.2.4 Summary

The majority of auditors found the survey to be relevant and useful to clinical practice, and most had positive experiences navigating the NAPS website. Some auditors found the information collected to be excessive, especially with regards to the *Risk factors* section of the data collection form. These fields, along with many others, have been reviewed with plans to rationalise the data collection, with the aim of making the survey more user–friendly and less time consuming to administer, (*see 9 Proposed future improvements*).

# 9

# Proposed future improvements

# 9 Proposed future improvements

Following on from both the official feedback for the Surgical NAPS 2018 evaluation survey, as well as informal feedback throughout the Surgical NAPS data collection periods 2016 – 2018, the following improvements are to be implemented.

- A decision was made to remove the *Excessive blood loss* data field from the survey as this circumstance is relatively rare, the data is difficult to collect, and it is not currently included in data analysis. This information is relevant when assessing whether a second dose of prophylactic antibiotic is required peri–operatively. However, such incidences are rare, and this information could be included in the comments section rather than be a dedicated field.

- The *Risk factors* data collection field will be rationalised and shortened with the aim to only collect the most relevant information that would significantly impact on the choice of surgical antimicrobial prophylaxis. This was also based on changes in version 16 of the *Therapeutic Guidelines: Antibiotic*.[13]

  Risk factors to be removed include:

  - *Peritoneal or haemodialysis*
  - *Pregnancy*
  - *Rheumatoid arthritis*
  - *Previous radiation therapy*
  - *Presence of prosthesis*
  - *One or more of*
    - *Prosthetic cardiac valve*
    - *Previous infective endocarditis*
    - *Congenital heart disease with defects*
    - *Rheumatic heart disease in Aboriginal/ Torres Strait Islanders*
  - *For gastroduodenal or oesophageal procedures*
    - *Reduced gastric acidity or motility*
  - *For Biliary Surgery*
    - *Acute cholecystitis*
    - *Obstructive jaundice*
    - *Common bile duct stones*
    - *Non–functioning gallbladder*

- A decision was made to remove the *End time* for procedural antimicrobial infusions as 68% of respondents found it difficult to complete this section and did not impact greatly on the assessment of appropriateness for surgical prophylaxis.

- There was the decision to add some flexibility to the *End date and time* for post–operative antimicrobials by adding "*Or estimated*" to allow for situations where the exact end date of oral or topical antimicrobials is difficult to determine. Conversely, the *End time* will be made a compulsory field for intravenous therapies, as it should be easy to determine from the medication chart when the last dose of an intravenous antimicrobial was administered.

- The field *Was this a repeat dose?* will also be removed as this is easily determined from the data entered and does not need to be a separate data field.

- The current fields *Peri–operative antimicrobials not required* and *Post–operative antimicrobials not required* will both moved to the front of the reasons for non–compliance with guidelines data collection section to make it more user–friendly. Once either of these fields are ticked in the electronic data entry portal, the appropriateness assessment will automatically register as '*4 – inadequate*' as per the Surgical NAPS appropriateness assessment guide (***see*** *Appendix 5*) and no further assessments will be required.

- A field named "*Total surgical prophylaxis given ≥24 hours*" will be added to the database to allow for times when the exact *End time* for post–operative surgical prophylaxis is unknown but is known to be greater than 24 hours. This is to allow assessment of total surgical prophylaxis greater than or equal to 24 hours to be in line with current guideline recommendations and best practice.

- All date fields in the electronic database will have extra data validation added to prevent erroneous dates being entered and to improve overall data quality.

- Pop–up warning messages will be added to appear when incongruous selection of guideline compliance and reasons for guideline non–compliance are selected to assist with overall data quality.

- The online reports for the *Dashboard, Detailed* and *Benchmarking* will be completely rebuilt following user feedback and epidemiology input.

- There has also been proposed the creation of an inbuilt online eLearning module to assist in the training of auditors and improve data validity and consistency.

- The *Therapeutic Guidelines: Antibiotic* was updated in April 2019,[13] and as such modifications to the Surgical NAPS Appropriateness Assessment Guide will be made to reflect this update and will be presented in future Surgical NAPS reports for 2019 data and beyond.

# 10 Conclusions

# 10 Conclusions

The second report into surgical prophylaxis antimicrobial prescribing in Australian hospitals confirms the results of the 2016 Surgical NAPS pilot report and previous Hospital NAPS reports. It has again identified the following priority areas for targeted quality improvement initiatives for antimicrobial surgical prophylaxis prescribing:

- Documentation of surgical incision time and administration time for antimicrobials
- Timing of procedural antimicrobial administration
- Compliance with guidelines for surgical antimicrobial prophylaxis
- Duration of therapy for post–procedural antimicrobials, when required
- Improved procedural prescribing, particularly for ceftriaxone, cefoxitin, cefalothin and chloramphenicol
- Improved post–procedural prescribing, particularly for dicloxacillin, trimethoprim and cefalexin and amoxicillin
- Improved procedural prescribing for indications, particularly dentoalveolar, cardiac abdominal, and head and neck surgery
- Improved post–procedural prescribing for indications, particularly dentoalveolar, gynaecological, urological, thoracic, breast and cardiac surgery.

Participation in the Surgical NAPS is voluntary, and hospitals may choose not to participate every year or to alternate between the different available NAPS surveys. For the 2017 Surgical NAPS, being the second year of the audit, the increase in uptake by hospitals was encouraging and indicates that the survey will play an important role in improving surgical antimicrobial prophylaxis in Australian hospitals. A smaller increase in hospital uptake of the Surgical NAPS was noted between 2017 and 2018. As it is further developed and improved, the Surgical NAPS has the potential to be a practical and useful tool for meaningful comparisons at a local and national level.

We anticipate greater uptake of the Surgical NAPS to coincide with the recent published update of the *Therapeutic Guidelines: Antibiotic*.[13] Modifications of the Surgical NAPS have been undertaken to reflect these guideline updates and facilitate accurate assessments of guideline compliance. Further refinements to the data collection fields and improvements to the online data entry portal will also be undertaken to help decrease time taken to complete the survey and to improve data validity and consistency. Further improvements will include the development of an online training module and improved reports.

The Surgical NAPS audit has more complex data collection than the Hospital NAPS, in that it has been designed to provide longitudinal data on a patient's surgical episode. The increased data that the Surgical NAPS collects provides greater ability to analyse different surgical procedure groups for hospital antimicrobial stewardship programs and allow benchmarking for key priority areas. It has the potential to support enhanced education and improvement of prescribing practices. The Surgical NAPS is an audit tool that may be more useful for some health service organisations and may play a particularly important role in the private hospital sector where surgery accounts for a high proportion of activity.

As the use of surgical antimicrobial prophylaxis has been deemed to be inappropriate in many settings, and antimicrobials are often used for longer than necessary, the ACSQHC will continue to work to develop guidance in this area, including:

- Promoting action 3.16c of the National Safety and Quality Health Service, Preventing and Controlling Healthcare Associated Infection Standard,[14] which requires action to improve appropriateness of antimicrobial prescribing
- Collaborations with the Royal Australasian College of Surgeons and other key stake holders to improve prescribing for surgical antimicrobial prophylaxis
- Working with the states, territories and the private sector to promote ongoing monitoring of surgical antimicrobial prophylaxis and appropriateness of use in Australian hospitals.

# Appendix 1: Procedure groups

The procedures listed in the Surgical NAPS database are text–searchable for ease of navigation. These have been adopted from The Royal Australasian College of Surgeons Morbidity Audit and Logbook tools.[15]

The surgical procedure groups listed were:

- Abdominal surgery
  - anorectal
  - bariatric and other
  - biliary
  - colorectal
  - gastro–oesophageal
  - hepatic
  - pancreas and duodenum
- Breast surgery
- Cardiac surgery
- Dentoalveolar surgery
- Gastrointestinal endoscopic procedures
- Gynaecological surgery
- Head and neck surgery; including ear, nose and throat surgery
  - laryngology
  - otology
  - rhinology
- Neurosurgery
  - cerebrovascular
  - peripheral nerve
  - spinal
  - other
- Obstetrics
- Ophthalmology
- Orthopaedic surgery
- Plastic and reconstructive surgery
- Thoracic surgery
- Urological surgery
  - endoscopic procedures
  - laparoscopic procedures
  - open procedures
  - other
- Vascular surgery
  - dialysis access

# Appendix 2:
# Surgical NAPS data comparison, 2016 – 2018

The official data collection period for the 2016 Surgical NAPS report was from 18 April to 3 November 2016. As the Surgical NAPS data collection methodology encourages retrospective auditing, data for the 2016 calendar year continued to be entered after the publication of the 2016 report. Therefore, the current 2016 dataset published in this report is larger than the dataset previously described in the 2016 Surgical NAPS public report. There was an increase of 20 hospitals and 864 extra surgical episodes were added. Similarly, the data for the 2017 report increased by 216 surgical episodes to 7,399, although with no increase in number of hospitals participating.

From 2016 to 2017 the number of hospitals participating in the Surgical NAPS increased from 87 to 106, (Figure 2A–1). This increase was mainly due to improved participation by the private sector. The number of reported surgical episodes also increased from 4,921 to 7,399, an increase of 2,478 episodes. As there was one facility with an unusually high proportion of 'not assessable' prescriptions (57/82; 69.5%), this facility was removed for the procedure group comparison analysis. In 2018, there was only an increase of 3 hospitals from 2017, for a total on 109 participating hospitals. There was although a corresponding decrease in the number of surgical procedures to 5,637, a decrease of 1,762 episodes.

Figure 2A–1 Number of participating public and private hospitals, Surgical NAPS 2016 to 2018

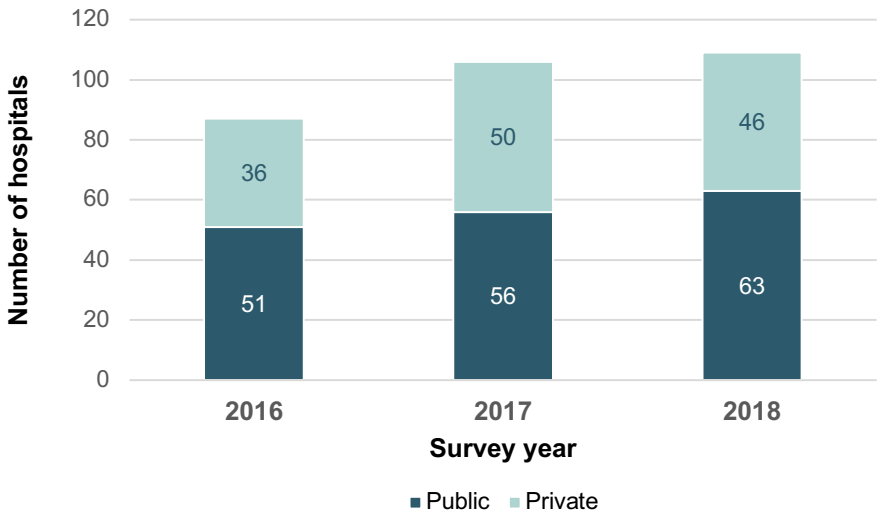



Table 2A–1 shows the percent change in inappropriateness for the different procedure groups when comparing their procedural antimicrobial prophylaxis, from 2016 to 2017 and from 2017 to 2018. From 2016 to 2017, there were seven procedure groups that had a decrease in inappropriateness, with the greatest decrease seen in vascular surgery (9.0%), breast surgery (5.2%) and neurosurgery (2.7%). There were seven procedure groups that had an increase in inappropriateness, with the greatest increase seen in cardiac survey (18.3%), obstetrics (9.8%) and dentoalveolar surgery (7.7%). Overall there was an increase in inappropriateness of 3.7%. From 2017 to 2018, there were eleven procedure groups that had a decrease in inappropriateness, with the greatest decrease seen in cardiac surgery (27.8%), ophthalmology (13.2%) and abdominal surgery (10.6%). There were four procedure groups that had an increase in inappropriateness, with the greatest increase seen in breast surgery (6.1%), vascular surgery (5.9%) and head and neck surgery (5.1%). Overall there was a decrease in inappropriateness of 5.9%.

Table 2A–2 shows the percent change in inappropriate prescribing for the different procedure groups for post–procedural antimicrobial prophylaxis from 2016 to 2017 and from 2017 to 2018. From 2016 to 2017, there were nine procedure groups that had a decrease in inappropriateness, with the greatest decrease seen in neurosurgery (20.7%), orthopaedic surgery (7.4%) and obstetrics (7.2%). There were six procedure groups that had an increase in inappropriateness, with the greatest increase seen in ophthalmology (7.9%), thoracic surgery (2.8%) and urological surgery (2.7%). Overall there was a decrease in inappropriateness by 2.4%. From 2017 to 2018, there were six procedure groups that had a decrease in inappropriateness, with the greatest decrease seen in cardiac surgery (28.6%), thoracic surgery (19.3%) and ophthalmology (11.8%). There were nine procedure groups that had an increase in inappropriateness, with the greatest increase seen in neurosurgery (15.7%), head and neck surgery (7.0%) and vascular surgery (5.1%). Overall there was an increase in inappropriateness of 1.1%.

From both Table 2A–1 and Table 2A–2, it can be seen that there is wide variation in the inappropriateness of antimicrobial prescribing for surgical prophylaxis, within the surgical procedure groups, for both procedural and post–procedural prescribing. This highlights the difficulty in comparing appropriateness from year to year with differing participating facilities and numbers of episodes within the various surgical procedure groups.

Table 2A–1 Procedure group comparison data for number and percent of overall inappropriate procedural antimicrobial prescribing per surgical episode, Surgical NAPS contributor hospitals, 2016 to 2018

| Procedure group | 2016 | | | 2017 | | | % change 2016–2017 | 2018 | | | % change 2017–2018 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Number of episodes | Inappropriate (number, %) | | Number of episodes | Inappropriate (number, %) | | | Number of episodes | Inappropriate (number, %) | | |
| Abdominal surgery | 777 | 339 | 43.6 | 1,093 | 481 | 44.0 | + 0.4 | 770 | 257 | 33.4 | – 10.6 |
| Breast surgery | 79 | 29 | 36.7 | 206 | 65 | 31.6 | – 5.2 | 101 | 38 | 37.6 | + 6.1 |
| Cardiac surgery | 331 | 115 | 34.7 | 266 | 141 | 53.0 | + 18.3 | 155 | 39 | 25.2 | – 27.8 |
| Dentoalveolar surgery | 78 | 33 | 42.3 | 178 | 89 | 50.0 | + 7.7 | 86 | 40 | 46.5 | – 3.5 |
| Gastrointestinal endoscopic procedures | 482 | 16 | 3.3 | 458 | 15 | 3.3 | 0.0 | 425 | 9 | 2.1 | – 1.2 |
| Gynaecological surgery | 329 | 78 | 23.7 | 451 | 131 | 29.0 | + 5.3 | 247 | 77 | 31.2 | + 2.1 |
| Head and neck surgery | 234 | 61 | 26.1 | 514 | 132 | 25.7 | – 0.4 | 322 | 99 | 30.7 | + 5.1 |
| Neurosurgery | 101 | 27 | 26.7 | 296 | 71 | 24.0 | – 2.7 | 190 | 34 | 17.9 | – 6.1 |
| Obstetrics | 367 | 102 | 27.8 | 412 | 155 | 37.6 | + 9.8 | 384 | 127 | 33.1 | – 4.5 |
| Ophthalmology | 167 | 35 | 21.0 | 103 | 25 | 24.3 | + 3.3 | 398 | 44 | 11.1 | – 13.2 |
| Orthopaedic surgery | 981 | 284 | 29.0 | 1,741 | 604 | 34.7 | + 5.7 | 1,244 | 384 | 30.9 | – 3.8 |
| Plastic and reconstructive surgery | 404 | 156 | 38.6 | 819 | 308 | 37.6 | – 1.0 | 643 | 239 | 37.2 | – 0.4 |
| Thoracic surgery | 53 | 12 | 22.6 | 63 | 13 | 20.6 | – 2.0 | 64 | 9 | 14.1 | – 6.6 |
| Urological surgery | 445 | 197 | 44.3 | 689 | 298 | 43.3 | – 1.0 | 457 | 166 | 36.3 | – 6.9 |
| Vascular surgery | 93 | 38 | 40.9 | 110 | 35 | 31.8 | – 9.0 | 151 | 57 | 37.7 | + 5.9 |
| **Grand Total** | **4,921** | **1,522** | **30.9** | **7,399** | **2,563** | **34.6** | **+ 3.7** | **5,637** | **1,619** | **28.7** | **– 5.9** |

Table 2A–2 Procedure group comparison data for number and percent of overall inappropriate post–procedural antimicrobial prescribing per surgical episode, Surgical NAPS contributor hospitals, 2016 to 2018

| Procedure group | 2016 | | | 2017 | | | % change 2016–2017 | 2018 | | | % change 2017–2018 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Number of episodes | Inappropriate (number, %) | | Number of episodes | Inappropriate (number, %) | | | Number of episodes | Inappropriate (number, %) | | |
| Abdominal surgery | 777 | 64 | 8.2 | 1,093 | 74 | 6.8 | – 1.5 | 770 | 67 | 8.7 | + 1.9 |
| Breast surgery | 79 | 21 | 26.6 | 206 | 60 | 29.1 | + 2.5 | 101 | 33 | 32.7 | + 3.5 |
| Cardiac surgery | 331 | 188 | 56.8 | 266 | 143 | 53.8 | – 3.0 | 155 | 39 | 25.2 | – 28.6 |
| Dentoalveolar surgery | 78 | 21 | 26.9 | 178 | 45 | 25.3 | – 1.6 | 86 | 14 | 16.3 | – 9.0 |
| Gastrointestinal endoscopic procedures | 482 | 2 | 0.4 | 458 | 3 | 0.7 | + 0.2 | 425 | 1 | 0.2 | – 0.4 |
| Gynaecological surgery | 329 | 12 | 3.6 | 451 | 21 | 4.7 | + 1.0 | 247 | 23 | 9.3 | + 4.7 |
| Head and neck surgery | 234 | 55 | 23.5 | 514 | 114 | 22.2 | – 1.3 | 322 | 94 | 29.2 | + 7.0 |
| Neurosurgery | 101 | 38 | 37.6 | 296 | 50 | 16.9 | – 20.7 | 190 | 62 | 32.6 | + 15.7 |
| Obstetrics | 367 | 46 | 12.5 | 412 | 22 | 5.3 | – 7.2 | 384 | 20 | 5.2 | – 0.1 |
| Ophthalmology | 167 | 37 | 22.2 | 103 | 31 | 30.1 | + 7.9 | 398 | 73 | 18.3 | – 11.8 |
| Orthopaedic surgery | 981 | 349 | 35.6 | 1,741 | 491 | 28.2 | – 7.4 | 1,244 | 413 | 33.2 | + 5.0 |
| Plastic and reconstructive surgery | 404 | 101 | 25.0 | 819 | 159 | 19.4 | – 5.6 | 643 | 137 | 21.3 | + 1.9 |
| Thoracic surgery | 53 | 17 | 32.1 | 63 | 22 | 34.9 | + 2.8 | 64 | 10 | 15.6 | – 19.3 |
| Urological surgery | 445 | 44 | 9.9 | 689 | 87 | 12.6 | + 2.7 | 457 | 71 | 15.5 | + 2.9 |
| Vascular surgery | 93 | 7 | 7.5 | 110 | 6 | 5.5 | – 2.1 | 151 | 16 | 10.6 | + 5.1 |
| **Grand Total** | **4,921** | **1,002** | **20.4** | **7,399** | **1,328** | **17.9** | **– 2.4** | **5,637** | **1,073** | **19.0** | **+ 1.1** |

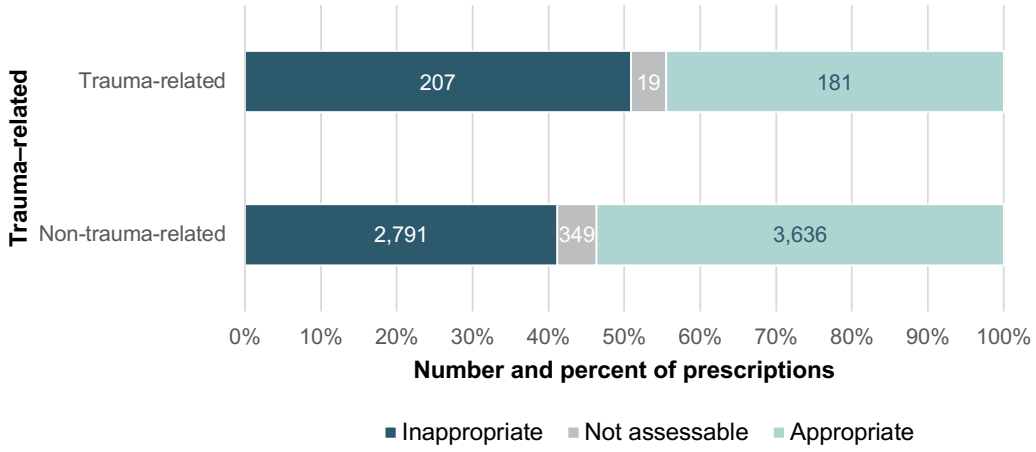
# Appendix 3: Sub–analysis of risk factors, 2017

Surgical procedures with certain risk factors may have a greater rate of inappropriate prescribing. Prescribing antimicrobial prophylaxis for complex surgeries, in time–critical situations, or when there is a perceived increased risk of infection may result in deviations from accepted guidelines or local prescribing policies. Examples of these situations could include trauma, emergency procedures or the insertion and removal of prosthetic material. An analysis of these risk factors may highlight a trend towards inappropriate prescribing practices.

## Trauma

Trauma–related procedures may have a greater rate of inappropriate procedural and post–procedural prescribing due to perceived increased risk of wound contamination. Of all surgical episodes 5.7% (407/7,183) were recorded as trauma–related in the 2017 Surgical NAPS and the rate of inappropriate prescribing was 50.9% (207/407) versus 41.2% (2,791/6,776) for non–trauma related surgical episodes, (Figure 3A –1).

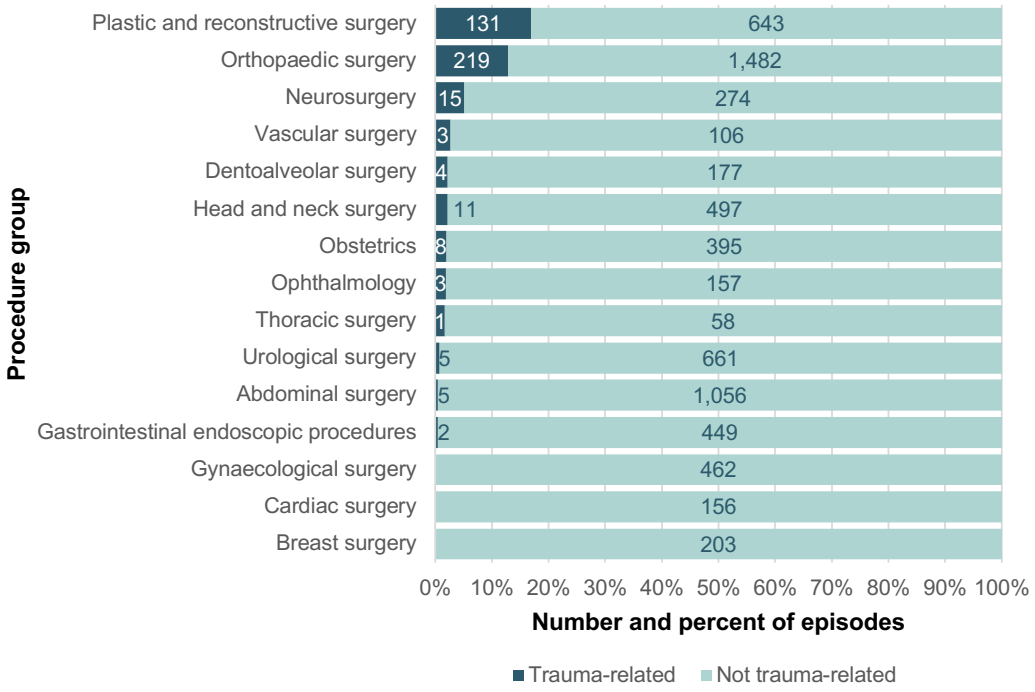
Figure 3A–1 Appropriateness of prescribing (procedural and post–procedural) for trauma–related surgical procedures, Surgical NAPS contributor hospitals, 2017*




* n = 7,183 episodes

The procedure groups with the highest rate of trauma–related surgical episodes were plastic and reconstructive surgery 16.9% (131 episodes), orthopaedic surgery 12.9% (219 episodes) and neurosurgery 5.2% (15 episodes), (Figure 3A–2). All other procedure groups had very low rates of trauma–related surgical episodes.

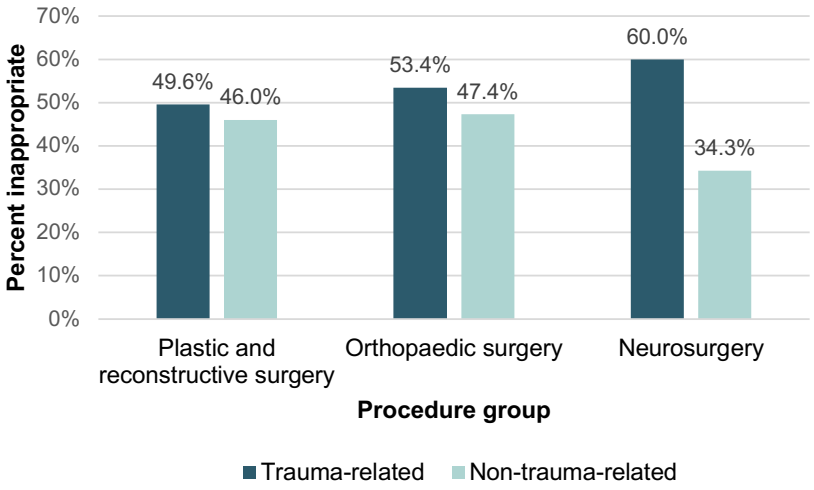
Figure 3A–2 Number of trauma–related episodes by procedure groups, Surgical NAPS contributor hospitals, 2017*




* n = 7,183 episodes

Figure 3A–3 shows the percentage of inappropriate prescribing for the surgical procedure groups with the three highest rates of trauma–related procedures. From this analysis it is evident that these groups have higher rates of inappropriate emergency prescribing compared to prescribing for non–trauma–related procedures.

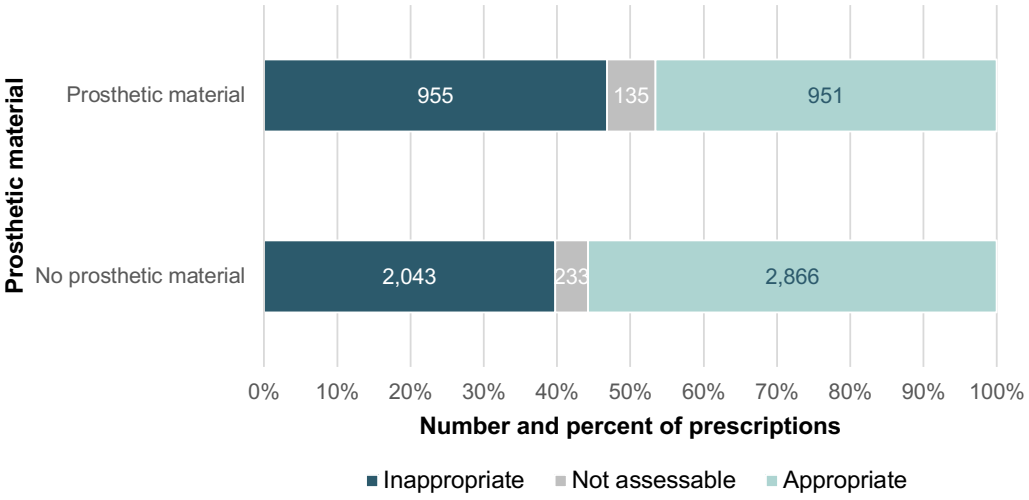
Figure 3A–3 Percentage of inappropriate antimicrobial prescribing for the top three trauma–related prescribing procedure groups, Surgical NAPS contributor hospitals, 2017




## Insertion or removal of prosthetic material

Procedures requiring the insertion or removal of prosthetic material may have a greater rate of inappropriate procedural and post–procedural prescribing due to perceived increased infection risk. Of all surgical episodes 28.4% (2,041/7,183) were recorded as having insertion or removal of prosthetic material in the 2017 Surgical NAPS and the rate of inappropriate prescribing was 46.8% (955/2,041) with prosthetic material versus 39.7% (2,043/5,142) for those without prosthetic material, (Figure 3A–4).

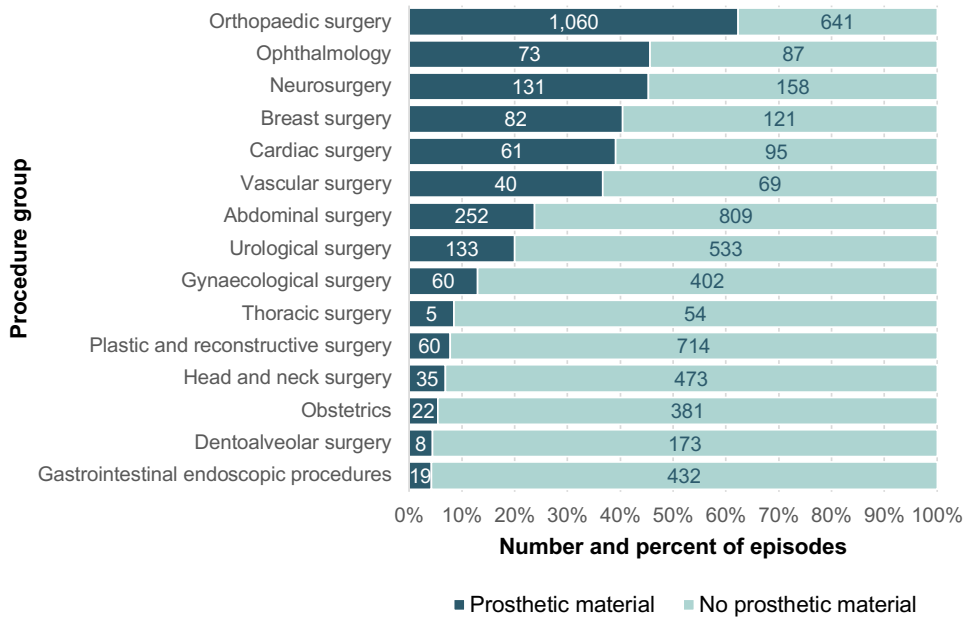
Figure 3A–4 Appropriateness of prescribing with insertion or removal of prosthetic material, Surgical NAPS contributor hospitals, 2017*




* n = 7,183 episodes

The procedure groups with the highest rate of episodes for insertion or removal of prosthetic material were orthopaedic surgery 62.3% (1,060 episodes), ophthalmology 45.6% (73 episodes) and neurosurgery 45.3% (131 episodes), (Figure 3A–5).

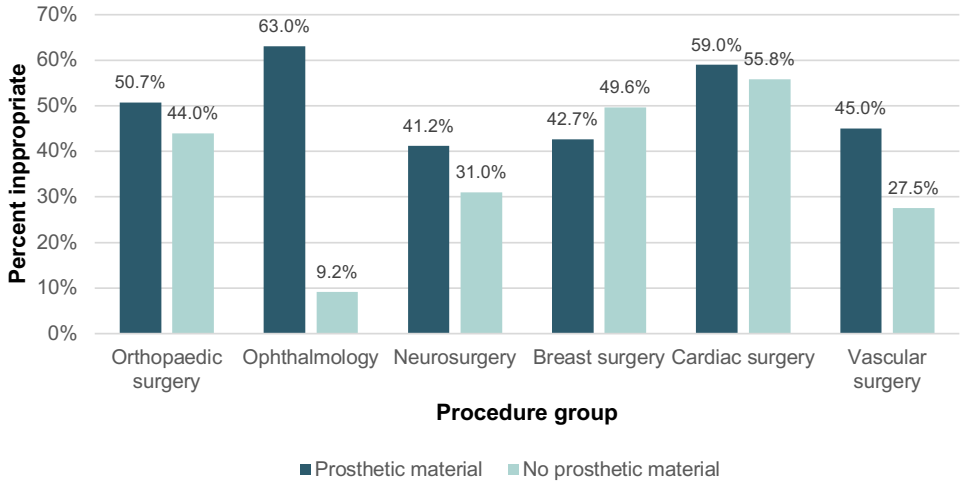
Figure 3A–5 Number of episodes with insertion or removal of prosthetic material by procedure groups, Surgical NAPS contributor hospitals, 2017*




* n = 7,183 episodes

Figure 3A–6 shows the percentage of inappropriate prescribing for the surgical procedure groups with the six highest rates of procedures involving prosthetic material. From this it is evident that the procedure groups have varying rates of inappropriate prescribing when prosthetic material is involved, although there is a trend for more inappropriate prescribing when prosthetic material is involved, in particular for ophthalmology and vascular surgery.

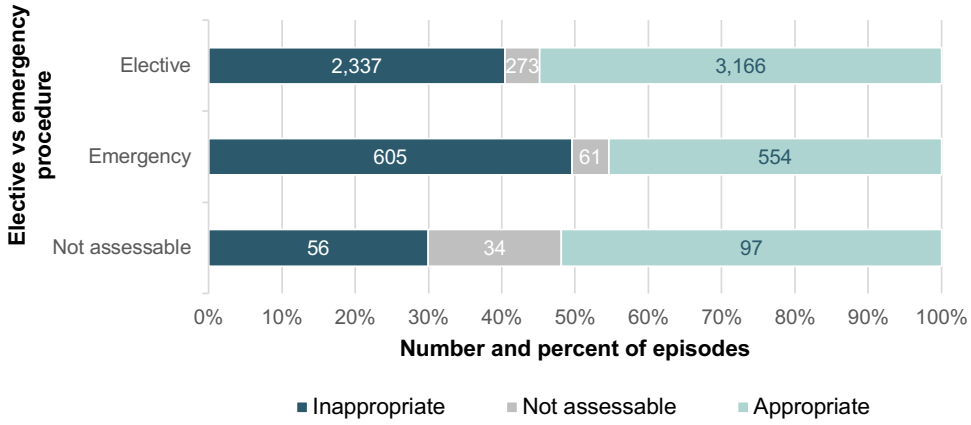
Figure 3A–6 Percentage of inappropriate antimicrobial prescribing for the top six procedure groups with insertion or removal of prosthetic material, Surgical NAPS contributor hospitals, 2017




## Emergency surgery

Emergency procedures may need to be performed with minimal advance warning and these time constraints could encourage a higher rate of inappropriate prescribing. Of all surgical episodes 17.0% (1,220/7,183) were recorded as emergency procedures in the 2017 Surgical NAPS and the rate of inappropriate prescribing was 40.5% (2,337/5,776) for elective surgical episodes versus 49.6% (n=605/1,220) for emergency surgical episodes, (Figure 3A–7).

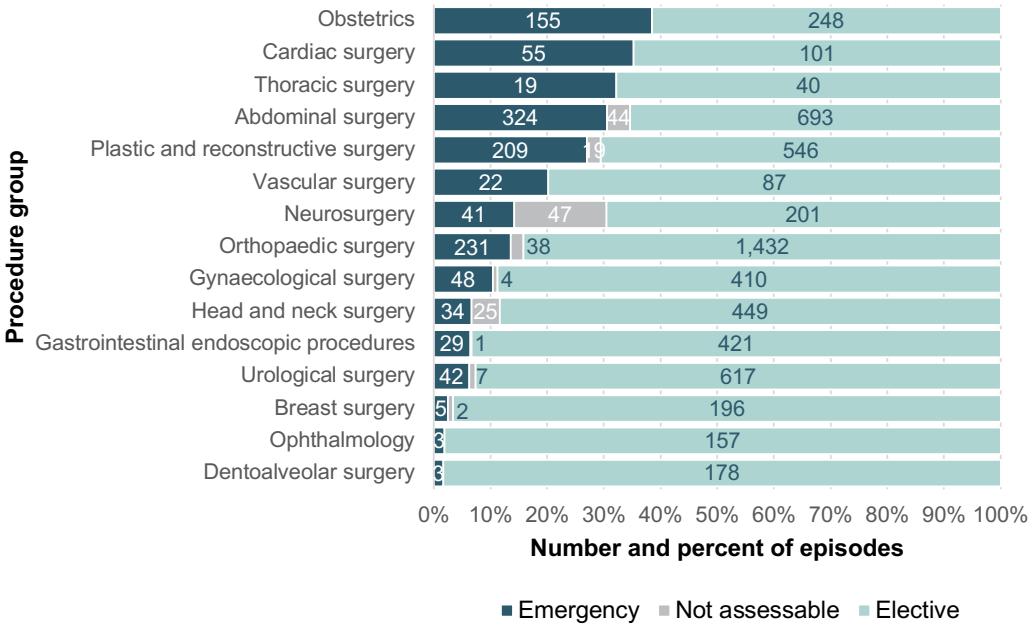
Figure 3A–7 Appropriateness of prescribing for emergency versus elective procedures, Surgical NAPS contributor hospitals, 2017*




* n = 7,183 episodes

The procedure groups with the highest rate of emergency surgical episodes were obstetrics 38.5% (155 episodes), cardiac surgery 35.3% (55 episodes) and thoracic surgery 32.2% (19 episodes), (Figure 3A–8).

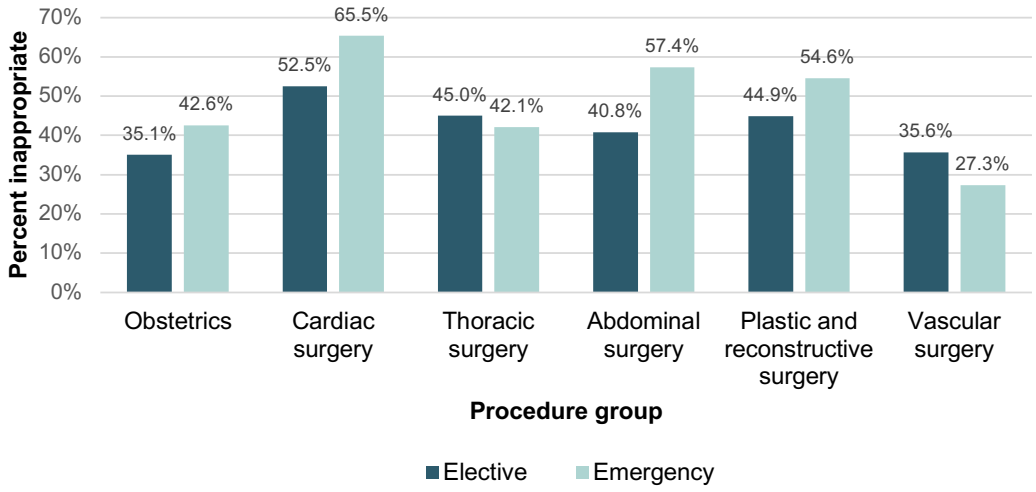
Figure 3A–8 Number of emergency procedures by procedure groups, Surgical NAPS contributor hospitals, 2017*




* n = 7,183 episodes

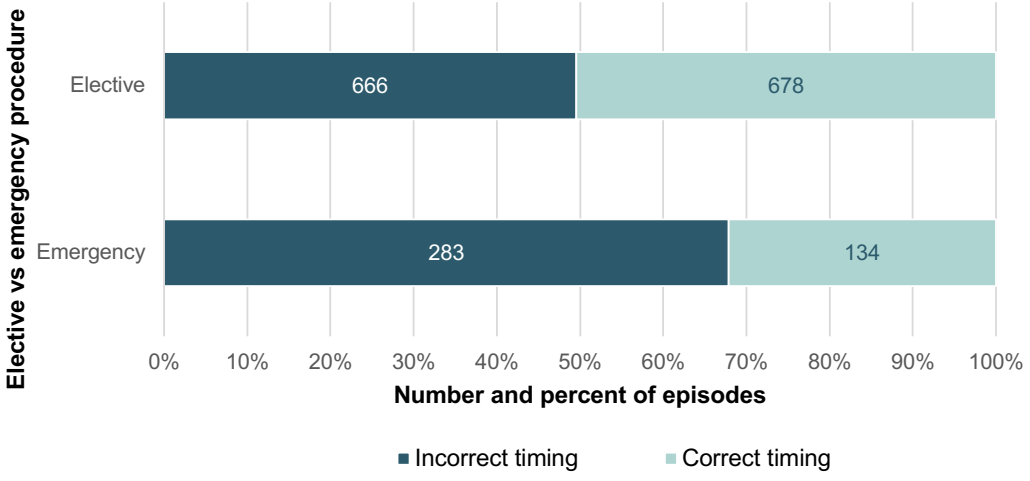
Figure 3A–9 shows the percentage of inappropriate prescribing for the surgical procedure groups with the six highest rates of emergency surgeries. The majority have higher rates of inappropriate prescribing for emergency procedures, although there are some for which the reverse is true (thoracic surgery and vascular surgery).

Figure 3A–9 Percentage of inappropriate antimicrobial prescribing for the top six procedure groups with emergency procedures, Surgical NAPS contributor hospitals, 2017




For inappropriate elective and emergency prescribing, incorrect timing was selected as a reason for inappropriate procedural prescribing in 49.6% and 67.9% of cases respectively, (Figure 3A–10).

Figure 3A–10 Number and percent of emergency versus elective surgical episodes with incorrect timing chosen as reason for inappropriate antimicrobial prescribing, Surgical NAPS contributor hospitals, 2017*




* n = 1,761 episodes

# Appendix 4:
# Surgical NAPS data collection form

SURGICAL NAPS National Antimicrobial Prescribing Survey

GUIDANCE | NCAS

| Patient identification Number | Date of birth / age | Gender | Date of admission | Date of discharge | Specialty | Height *cm* | Weight *kg* | eGFR / CrCl *ml/min* |
|---|---|---|---|---|---|---|---|---|
| | / / | M / F / O | / / | / / | | | | |

## Surgical details

**Surgery date** / / **Surgery this admission** ❒ Initial ❒ subsequent

**Procedures** ❒ emergency ❒ elective ❒ not assessable

❒ trauma ❒ removal/insertion of prosthetic material ❒ excessive blood loss

**Surgeon code**

**Anaesthetist code**

**Time of first incision** : ❒ not documented ❒ not applicable

If not documented or not applicable; surgery start time *(or estimated)* :

**End time** *(or estimated)* :

**Wound classification**

❒ clean ❒ clean-contaminated ❒ contaminated ❒ dirty ❒ unknown ❒ not applicable

**ASA score** ❒ 1 ❒ 2 ❒ 3 ❒ 4 ❒ 5 ❒ 6 ❒ unknown

## Risk factors

❒ none identified

**All procedures**

❒ current smoker
❒ diabetes
❒ peritoneal or haemodialysis
❒ obesity (BMI>30)
❒ pregnancy
❒ rheumatoid arthritis
❒ current malignancy
❒ previous radiation therapy
❒ immunocompromised
❒ systemic corticosteroids
❒ other immunosuppressive treatments
❒ presence of prostheses
❒ MRSA colonisation
❒ MDR Gram negative colonisation
❒ one or more of:
- prosthetic cardiac valve
- previous infective endocarditis
- congenital heart disease with defects
- rheumatic heart disease in Aboriginal/Torres Strait Islanders

**Transrectal prostatic biopsy**

❒ quinolone therapy in preceding 3 months
❒ recent travel to Asia or Southern Europe in preceding 6 months

**Gastroduodenal or oesophageal procedures**

❒ reduced gastric acidity or motility
❒ gastrointestinal bleeding
❒ gastric outlet obstruction
❒ perforation

**Biliary surgery**

❒ acute cholecystitis
❒ obstructive jaundice
❒ common bile duct stones
❒ non-functioning gallbladder

## Allergies and adverse drug reactions to antimicrobials

❒ nil known ❒ not documented ❒ present; *specify drug and nature*

## Surgical or clinical notes, microbiology, radiology

## Existing antimicrobial therapy

*Any antimicrobial for treatment or medical prophylaxis or another condition. Prescribed in the **24 hours prior** (72 hours if on dialysis) to the procedure*

❒ none prescribed ❒ not assessable

| Antimicrobial | Route | Dose | Date and time of last dose |
|---|---|---|---|
| | | | / / : |
| | | | / / : |
| | | | / / : |
| | | | / / : |

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## Peri-operative doses

*Include all antimicrobials commenced for the purpose of prophylaxis.*

*Record each dose on a separate line, including any repeat doses.*
*Include any documented topical antimicrobials (e.g. cement beads, soaks, sponges, irrigations, etc.)*

| Antimicrobial | Route | Dose | Documented administration time: Not assessable | Nearest 15 minutes | Exact time | Start time | End time | Was this a repeat dose? | Guideline compliance (1-6) | Allergy mismatch | Microbiology mismatch | Incorrect dose | Incorrect route | Incorrect timing | Spectrum too broad | Spectrum too narrow | Peri-operative antimicrobials not required | Procedure requires antimicrobials | Appropriateness (1-5) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | : | : | | | | | | | | | | | | |
| | | | | | | : | : | | | | | | | | | | | | |
| | | | | | | : | : | | | | | | | | | | | | |
| | | | | | | : | : | | | | | | | | | | | | |
| ❒ *Repeat dose required, but not given* | | | | | | | | | 4 | | | | | | | | | | 4 |
| ❒ *No antimicrobial prescribed* | | | | | | | | | | | | | | | | | | | |

## Post-operative antimicrobials

*Record those only relating to the procedure, including any inpatient or discharge scripts*

| Start date and time* | End date and time* | Antimicrobial | Route | Dose | Freq | Indication: For prophylaxis only | For treatment of infection related to the procedure | Not assessable | Guideline compliance (1-6) | Allergy mismatch | Microbiology mismatch | Incorrect dose / frequency | Incorrect route | Incorrect duration | Spectrum too broad | Spectrum too narrow | Post-operative antimicrobials not required | Procedure requires antimicrobials | Appropriateness (1-5) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| / / : | / / : | | | | | | | | | | | | | | | | | | |
| / / : | / / : | | | | | | | | | | | | | | | | | | |
| / / : | / / : | | | | | | | | | | | | | | | | | | |
| / / : | / / : | | | | | | | | | | | | | | | | | | |
| / / : | / / : | | | | | | | | | | | | | | | | | | |
| *If time unknown, write unknown | | ❒ *None prescribed* | | | | | | | | | | | | | | | | | |

## 30 Day follow up

**Surgical site infection** ❒ none identified ❒ not assessable
❒ identified; *select one type and list any relevant microbiology*

- ❒ superficial
- ❒ deep incisional
- ❒ organ space
- ❒ prosthesis

Microbiology

| | | | |
|---|---|---|---|
| *Clostridium difficile* infection | ❒ yes | ❒ no | ❒ unknown |
| MDR organism | ❒ yes | ❒ no | ❒ unknown |
| Unplanned ICU admission | ❒ yes | ❒ no | ❒ unknown |
| Unplanned hospital readmission | ❒ yes | ❒ no | ❒ unknown |
| Death | ❒ yes | ❒ no | ❒ unknown |
| Other morbidity *(if yes, specify)* | ❒ yes | ❒ no | ❒ unknown |

### Guideline compliance

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

### Appropriateness

1. Optimal
2. Adequate
3. Sub-optimal
4. Inadequate
5. Not assessable

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# Appendix 5:
# Surgical NAPS appropriateness assessment guide

| | Appropriate | | Inappropriate | | |
|---|---|---|---|---|---|
| | 1 - Optimal | 2 - Adequate | 3 - Suboptimal | 4 - Inadequate | 5 - Not assessable |
| Allergy mismatch | Where antimicrobials are prescribed exactly according to Therapeutic Guidelines or local guidelines – antimicrobial choice, dose, route, timing and duration; or where there is an appropriate reason for deviation from guidelines<br><br>*If any reason is selected for incorrect prescribing, the prescription will no longer be optimal.* | | Mild or non-life threatening allergy mismatch | Life threatening allergy mismatch | Where there is insufficient information available or the case is too complex for assessment. |
| Microbiology mismatch | | | | Antimicrobial used is too narrow (where sensitivity results available) | |
| Incorrect dose or frequency | | | Dose or frequency too high (with exception of gentamicin) | Dose or frequency too low<br><br>Gentamicin dose too high or too frequent | |
| Incorrect route | | | An intravenous antimicrobial has been prescribed when the patient is able to safely take it orally | The prescribed route does not reach the site of infection or surgery | |
| Incorrect timing | | Repeat dose given too soon (including patients who were already on existing antimicrobial therapy)<br>*taking into consideration patients with renal impairment* | Antimicrobial prophylaxis given less than 15 minutes before surgical incision (with exception of vancomycin)<br><br>Vancomycin started less than 30 minutes before surgical incision | Antimicrobial prophylaxis given greater than 60 minutes before surgical incision (with exception of vancomycin)<br><br>Vancomycin started greater than 120 minutes before surgical incision<br><br>Repeat dose given too late (including patients already on existing antimicrobial therapy)<br>*taking into account renal impairment* | |
| Incorrect duration | | | | Surgical prophylaxis greater than 24 hours (except where guidelines endorse this) | |
| Spectrum too broad | | | Choice of antimicrobial is too broad<br>Additional antimicrobial added unnecessarily | | |
| Spectrum too narrow | | | | Choice of antimicrobial does not cover likely organisms | |
| Procedure does not require any antimicrobials | | | | Procedure does not require any antimicrobials, but antimicrobials were still prescribed | |
| Procedure requires antimicrobials | | Patient already on existing antimicrobials where last dose would have provided sufficient prophylaxis for the duration of the procedure | | Procedure requires antimicrobials but no antimicrobials were prescribed<br>AND<br>there were no existing antimicrobials | |
| Repeat dose required, but not given | | | | This will automatically be selected for auditors | |
| No antimicrobial prescribed | No antimicrobial required | | | Procedure requires antimicrobials but no antimicrobials were prescribed and there were no pre-existing antimicrobials | |

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# Acknowledgements


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On behalf of the National Centre for Antimicrobial Stewardship, the Australian Commission on Safety and Quality in Health Care and the Australian Government Department of Health, we would like to thank all participating hospitals and auditors for their time and effort in collecting and entering the data, in contributing to the Antimicrobial Use and Resistance in Australia (AURA) Surveillance System report and to their continued commitment to improving safety and quality across the Australian healthcare system.

## Funding

**Funding for the Surgical National Antimicrobial Prescribing Survey is provided by the:**

- The Australian Government Department of Health
- The Australian Commission on Safety and Quality in Health Care
- The National Centre for Antimicrobial Stewardship
- The Guidance Group

SURGICAL NAPS National Antimicrobial Prescribing Survey

NCAS National Centre for Antimicrobial Stewardship

GUIDANCE