

Using periodic point-prevalence surveys to assess appropriateness of antimicrobial prescribing in Australian private hospitals

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ABSTRACT

Background: Appropriateness of antimicrobial use is a measure of key importance in evaluating safety and quality of prescribing, but has been difficult to define and assess on a wide scale. Published work is limited and has generally focused on tertiary public hospitals, whereas the private sector provides a significant proportion of care in many countries. Information on prescribing in the private hospital context is needed to identify where intervention might be required.

Aim: An antimicrobial prescribing survey (APS) tool was utilised to assess the appropriateness of antimicrobial prescribing among large private hospitals in Australia.

Methods: 'Appropriateness' of antimicrobial therapy was evaluated by a team consisting of an infectious diseases (ID) physician and specialist ID pharmacist based on clear criteria.

Results: Thirteen hospital-wide point-prevalence surveys were conducted. 3 472 inpatient medication charts were reviewed to identify 1 125 (32.4%) inpatients on 1 444 antimicrobials. An indication was documented in 911 (63.1%) of surveyed prescriptions, and overall 757 (52.4%) of antimicrobials were assessed as appropriate. Antimicrobials prescribed for treatment had a higher proportion of appropriateness when compared to antimicrobials prescribed for surgical prophylaxis (80.4% vs 40.6%). The main reason for a treatment prescription to be considered inappropriate was incorrect selection, while prolonged duration (>24 hours) was the main reason for inappropriate surgical prophylaxis prescriptions.

Conclusions: This study provides important data on antimicrobial prescribing patterns in Australian private hospitals. Results can be used to target areas for improvement, with documentation of indication and surgical antibiotic prophylaxis requiring initial attention.

KEYWORDS

antimicrobial; point-prevalence; appropriateness; treatment; surgical prophylaxis;

INTRODUCTION

Surveillance of antimicrobial use and 'appropriateness' of antimicrobial prescriptions have been identified as central to building effective antimicrobial stewardship (AMS) programs in hospitals.^{1,2} Point-prevalence surveys capture information about antimicrobial use and have been used to assess the effects of AMS interventions at local, national and international levels.³⁻⁵ Appropriateness of a prescription is an important quality measure, yet it can be difficult to define for auditing.

An Antimicrobial Prescribing Survey (APS) tool for Australian hospitals was developed at The Royal Melbourne Hospital in 2011. This tool was initially based on an international tool,⁶ but required modifications to meet local needs, including clearer definitions and online training for auditors to improve usability. The new tool was tested across four Australian states in 35 public hospitals in 2011, with many of the participating hospitals using it to conduct hospital-wide point-prevalence surveys. The audit tool was specifically designed to allow auditors to judge the appropriateness of the prescription in a consistent manner according to clear criteria.

In Australia, private hospitals provide approximately one third of all hospital beds and treat 40% of all inpatients,⁷ yet no data currently exist on patterns of antimicrobial use in this sector. These hospitals differ from public hospitals in that therapeutic decisions are usually made by visiting specialist clinicians who are not employed by the hospitals. Rather, they have a direct private arrangement with patients for managing their hospitalised care. This contrasts from the public hospital sector where there is management by teams involving employed junior medical staff.

The case-mix in private hospitals can also differ significantly from the public sector in Australia. An example of this is that private hospitals, despite only representing one third of all hospital beds, provide more than three-quarters of all orthopaedic knee procedures.⁸ In terms of AMS resources, there is currently a dearth of information on what activities are currently taking place and what resources are available in the Australian private hospital sector. Although this could potentially be true for some hospitals in the public sector, state-wide public hospital initiatives such as initial funding for electronic-based antimicrobial approval systems in 2008,⁹ has most likely meant that this sector is advancing in the provision of AMS programs.

It is unknown whether in private hospitals there is more appropriate antibiotic use, possibly due to seniority of the prescriber, or perhaps less appropriate prescribing, as private hospitals are perceived to have a very limited scope in influencing visiting specialists in their clinical practice.⁷

The aim of this prospective, multi-centre study was to utilise the newly developed APS tool to examine antimicrobial use and to assess the appropriateness of antimicrobial prescribing in Australian private hospitals.

METHODS

Study setting

Three large private hospitals in Australia participated in a series of point-prevalence surveys. Hospital A has 450 beds, a 15-bed intensive care unit (ICU) and approximately 85 beds dedicated to rehabilitation services. Hospital B has approximately 220 beds, including an 18-bed critical care unit inclusive of an ICU and a 24-bed cardiac unit. Hospital C has approximately 200 beds, including an 8-bed intensive care unit and 44 labour ward beds. Point-prevalence surveys were conducted

every three months commencing February 2012 for Hospital A, and May 2012 for Hospitals B and C.

A hospital-wide census was taken on the morning of each point-prevalence survey. Data collectors were assigned beds from a printed list and were asked to review all corresponding patient medication charts. Patients were included in the survey if they were an inpatient on the morning of the survey day. Patient areas excluded from the survey included labour ward beds, emergency department beds and any patients admitted to day-only stay wards such as Day Oncology and dialysis.

Data collected

Experienced clinical research co-ordinators were trained to collect data via provision of an information pack and a training session prior to administering the PPS. Data were collected from all inpatients being prescribed at least one antimicrobial at the time of chart review. Data collectors had access to the admission and progress notes, surgical notes, medication charts, and pathology and microbiology results.

Antimicrobial therapy was deemed to be for surgical prophylaxis if documented as such in any of the medication chart, patient progress notes, pre-operative assessment documents and post-operative surgical prescriptions. If no indication was documented, the antimicrobial was deemed to be for surgical prophylaxis if prescribed intra-operatively or during the immediate post-operative period, and if there was no other indication clearly documented and no relevant microbiology results available.

Antimicrobial therapy was deemed for treatment of infection ('treatment prescriptions') or non-surgical prophylaxis if documented as such in patient progress notes or on the medication chart. Antimicrobials were categorised as 'non-assessable' if no clear

indication was documented in the notes and the antimicrobial was not likely to be for surgical prophylaxis.

'Appropriateness' of antimicrobial therapy was assessed by an infectious diseases (ID) clinician and a specialist ID pharmacist, who reviewed clinical information against the national Therapeutic Guidelines: Antibiotic.¹⁰ Antimicrobial selection, dose, frequency, duration (for prophylaxis prescriptions only), hypersensitivity contraindication and microbiology investigation results (including antibiotic susceptibilities of any identified pathogens) were considered by the assessors. An "allergy mismatch" was noted if the antimicrobial was contraindicated based on documented hypersensitivity information, while "microbiology mismatch" was documented if the antimicrobial prescribed did not match pathogen susceptibility data. Duration of treatment was not considered for treatment prescriptions as this is often dependent on clinical variables that were not assessable. If there was a lack of information about the infection purportedly being treated, the treatment order was judged to be 'non-assessable'.

Surgical antibiotic prophylaxis (SAP) was judged to be inappropriate for the following reasons: if antimicrobial selection, dosage or frequency were not concordant with the Therapeutic Guidelines: Antibiotic,¹⁰ if an "allergy mismatch" were present, or if prophylaxis duration was greater than 24 hours. Antimicrobials could be judged inappropriate for more than one identified reason. If consensus on appropriateness could not be reached by the assessment team, the decision was referred to an independent senior ID clinician. Where applicable, data were also collected regarding site of infection and type of surgery.

Statistical Analysis

As each hospital-wide point-prevalence survey represented a census of all inpatients on the day of the survey, all results were without sampling error. Data are reported descriptively.

RESULTS

Thirteen hospital-wide point-prevalence surveys were conducted during the study period from February 2012 to February 2013. Hospital A participated in five surveys, while four surveys were conducted at each of Hospitals B and C. A total of 3 472 inpatient medication charts were reviewed with 1 125 patients (32.4%) on 1 444 antimicrobials during the study period. Summary data of all surveyed prescriptions at each hospital is shown in Table 1.

Sixty-nine percent of all patients on antimicrobial therapy in Hospital A were admitted under a surgical case mix, while 48% and 37% of all patients on antimicrobial therapy were surgical cases in Hospitals B and C, respectively. Appropriateness of prescriptions for treatment and SAP are shown in Table 2. Less than half of SAP prescriptions were documented as such. 47.3% of all prescriptions reviewed were for treatment with the respiratory tract and skin and soft tissue being the most common sites of infection (Table 3). 32.6% of prescriptions were classified as SAP and more than half of these were for orthopaedic surgical cases (Table 4). Figure 1 and 2 show the percentage of inappropriate prescriptions for treatment and SAP respectively for each hospital during the study period. The most common reasons for inappropriateness was “incorrect drug/ drug combination” for treatment prescriptions and “prolonged duration (>24 hours)” for SAP (Figure 3).

DISCUSSION

These data suggest that the burden of antimicrobial use in large Australian private hospitals is comparable to that described in tertiary public hospitals in the existing published literature, with around a third (32.4%) of inpatients receiving antimicrobials on any given day across the 13 hospital-wide point prevalence surveys. International hospital point prevalence surveys have previously shown the proportion of patients on antimicrobials to range from 16% to 32%,^{5,6,10-12} while one previous hospital-wide survey in an Australian public hospital recorded 43% of inpatients being on antibiotics.¹⁴

This study identified key areas for improvement in antimicrobial prescribing practice in the private hospital setting. One important potential quality indicator for antimicrobial prescribing assessed by this study was whether an indication for antimicrobial therapy was documented in patient notes. Hospitals B and C had a higher documentation rate (72% each) than that reported in a previous international study (64%),⁶ whereas hospital A had a lower rate (58%). For SAP, documentation was particularly poor with only prescriptions for gynaecological surgery having a documentation rate of greater than 50%. The proportion of antimicrobial prescriptions where appropriateness was 'non-assessable' due to poor documentation ranged from 12.8% to 38%. Without adequate documentation, communication between staff members is impeded, and opportunities to evaluate and review medication use are limited. Strategies to encourage or enforce (in the case of mandatory fields in electronic prescribing) such documentation should be further explored.

Of those prescriptions that were assessable, approximately 80% of prescriptions for treatment of infection were judged to be appropriate. Of the 99 treatment prescriptions judged as inappropriate, incorrect antimicrobial selection was the main problem. This suggests that better access to prescribing guidelines and education initiatives may be

required to help improve empiric prescribing decisions. In addition, more timely access and response to microbiology results, and perhaps better liaison with clinical microbiologists may also be necessary to improve the adequacy of directed antimicrobial therapy.

SAP accounted for a third (32.6%) of all antimicrobial prescriptions surveyed during the study period. In comparison to treatment prescriptions, the appropriateness of prescriptions for SAP was low. In fact, only SAP for orthopaedic and neurosurgical procedures had appropriateness greater than 50%. The main reason for SAP to be judged as inappropriate was prolonged durations of therapy (greater than 24 hours).

The recommendations for SAP in the national guidelines, Therapeutic Guidelines: Antibiotic, are for one to two perioperative doses of antibiotics, with no recommendation for antibiotic therapy to continue beyond 24 hours after surgery for most operations.¹⁰ However, findings in this study suggest that SAP is routinely being continued beyond 24 hours, with no justification documented. A previous study conducted in Australia looking specifically at SAP in public hospitals found a much higher rate of compliance with the national guidelines.¹⁵ However, assessment of appropriateness in that study was made on the basis of antibiotic choice and the timing of the first dose in relation to the time of surgery. Duration of prophylaxis, as an appropriateness criterion, was excluded for the simple reason of poor documentation.

The second most common reason for inappropriate SAP was incorrect antibiotic selection. It was interesting to note that a high proportion of these incorrect selections were due to the use of oral antibiotics, which were used in a high proportion of patients undergoing plastics and urological procedures. Oral antibiotics also significantly contributed to prolonged SAP as all of these were prescribed for greater than 24 hours,

sometimes up to a week post operatively. This finding suggests that the use of local SAP guidelines may be an important starting point for private hospitals to consider.

Overall, the rate of inappropriate prescribing over time seemed to remain consistent; however, there was an observed decrease in the percentage of inappropriate treatment prescriptions over time for hospital B, whilst an opposite pattern was observed for hospital C. A trend analysis of this data was not performed as there are only a limited number of data points for each hospital and no interventions performed during the study period. However, it will be interesting to see if these observations continue in any future point prevalence surveys, particularly after introduction of an AMS program at each of the hospitals.

The results of the present study provide the most detailed picture of contemporary antimicrobial prescribing in Australian private hospitals. Furthermore, accuracy of the data in representing day-to-day prescribing of antimicrobials has been enhanced by the fact that point prevalence surveys were carried out quarterly over a 12 month period. Use of an assessment team consisting of an ID clinician and a specialist ID pharmacist supports the concept of antimicrobial management teams that contribute to improved quality and safety of antimicrobial prescribing.¹⁶ The regular surveillance of antimicrobial use and appropriateness is important for private facilities seeking to implement AMS programs and interventions in the future.

Limitations to this study include that the information collected was dependent on the training and knowledge of individual data collectors. Although each of these data collectors was provided with an information pack and detailed in-service, variability between data collectors could not completely be eliminated. In addition, assessment of appropriateness was based on data collected at that particular point in time and

information that potentially affected antimicrobial use that was not documented could not be taken into account. Also, appropriateness of antimicrobial selection was based on the assumption that the clinician diagnosis was accurate. The duration of therapy was not assessed for prescriptions other than SAP, which might further affect the assessment of appropriateness. It was important to note that analysis of inappropriate selection was not differentiated based on the spectrum of activity (ie either excessively broad or narrow for the intended indication). Future studies should aim to use a more detailed framework in defining appropriateness so as to identify reasons for non-concordant selection of antimicrobials. Finally, although this study gave an in-depth view of antimicrobial prescribing in the three hospitals surveyed, these hospitals represent only a small proportion of all private hospitals in Australia. There is future scope to conduct multiple point-prevalence surveys in a larger group of Australian private hospitals.

In summary, the present study indicates that there may be significant issues with antimicrobial prescribing in the Australian private hospital sector with lack of documentation of indication being one such issue highlighted in this study.

Antimicrobials prescribed for treatment were generally appropriate, however, inappropriate therapy was observed to occur frequently in SAP and this should be a major target for any future AMS initiatives.

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TABLES

Table 1: Summary data of surveyed prescriptions at each hospital: documentation of indication and appropriateness assessment

Patient charts reviewed	Hospital A (n = 2206)		Hospital B (n = 622)		Hospital C (n = 644)		Total (n = 3 472)	
	n (%)	Range (%)	n (%)	Range (%)	n (%)	Range (%)	n (%)	Range (%)
Patients on antimicrobial therapy	716 (32.5)	(29.1 to 33.9)	228 (36.7)	(34.7 to 39.9)	181 (28.1)	(25.0 to 31.9)	1 125 (32.4)	(25.0 to 39.9)
Antimicrobial prescriptions reviewed	(n = 911)		(n = 299)		(n = 234)		(n = 1 444)	
Antimicrobial prescriptions where indication documented	526 (57.7)	(51.2 to 63.4)	216 (72.2)	(59.7 to 78.8)	169 (72.2)	(58.0 to 78.9)	911 (63.1)	(51.2 to 78.9)
Antimicrobial prescriptions assessed as appropriate	449 (49.3)	(45.3 to 54.8)	175 (58.5)	(49.3 to 65.0)	133 (56.8)	(32.0 to 64.6)	757 (52.4)	(32.0 to 65.0)
Antimicrobial prescriptions assessed as inappropriate	276 (30.3)	(22.9 to 39.0)	70 (23.4)	(21.3 to 26.9)	43 (18.4)	(8.3 to 30.0)	389 (27.0)	(8.3 to 39.0)
Antimicrobial prescriptions that were non-assessable	186 (20.4)	(12.8 to 25.1)	54 (18.1)	(13.8 to 23.9)	58 (24.8)	(16.9 to 38.0)	298 (20.6)	(12.8 to 38.0)

NOTE: In Tables 1 and 4, 'Range' refers to the results obtained across point-prevalence surveys undertaken at each hospital

Table 2: Appropriateness of *treatment* and *SAP* prescriptions

Treatment prescriptions	Total (n = 683)	
	n (%)	Range (%)
Treatment prescriptions assessed as appropriate	549 (80.4)	(68.2 to 95.2)
Treatment prescriptions assessed as inappropriate	99 (14.5)	(6.0 to 27.3)
Treatment prescriptions that could not be assessed	35 (5.1)	(0.0 to 14.8)
SAP prescriptions (n = 471)		
	n (%)	Range (%)
SAP prescriptions assessed as appropriate	191 (40.6)	(23.5 to 100)
SAP prescriptions where indication was documented	204 (43.3)	(8.3 to 100)

Table 3: Sites of infection and appropriateness of therapy

	Total (n = 684) (%)	Appropriate %	Non assessable %
Respiratory	214 (31.3)	81.8	0.5
Skin and soft tissue	122 (17.8)	79.5	3.3
Urinary tract	83 (12.1)	90.4	6.0
Bone and joint	70 (10.2)	74.3	18.5
Intra-abdominal	62 (9.1)	83.9	3.2
Not specified (including febrile neutropenia)	41 (6.0)	70.7	14.6
Bacteraemia/ fungemia	33 (4.8)	87.9	6.1
Gastrointestinal (eg salmonellosis, <i>C. difficile</i> infection etc.)	23 (3.4)	82.6	0.0
Cardiovascular	13 (1.9)	92.3	7.7
Otorhinolaryngology	11 (1.6)	81.8	0.0
CNS	9 (1.3)	100	0.0
Gynaecology	2 (0.3)	0.0	50
Other	1 (0.1)	1	0.0

NOTE: The total number of sites of infection (n = 684) is greater than the number of 'treatment prescriptions' (n = 683) because some antimicrobials were prescribed for more than one site of infection

Table 4: Types of surgery and appropriateness of prophylaxis

	Total (n = 471) (%)	Appropriate %	Indication documented %
Orthopaedic	244 (51.8)	54.9	48.0
Cardiothoracic	76 (16.1)	25.0	32.9
General surgery	39 (8.3)	20.5	41.0
Neurosurgery	35 (7.4)	51.4	31.4
Plastics	22 (4.7)	13.6	50.0
Vascular	21 (4.5)	28.6	47.6
Urology	18 (3.8)	16.7	33.3
Gynaecology	9 (1.9)	0.0	88.9
Otorhinolaryngology	6 (1.3)	0.0	50.0
Maxillofacial	1 (0.2)	0.0	0.0

NOTE: General surgery includes upper gastrointestinal and colorectal surgery

FIGURES

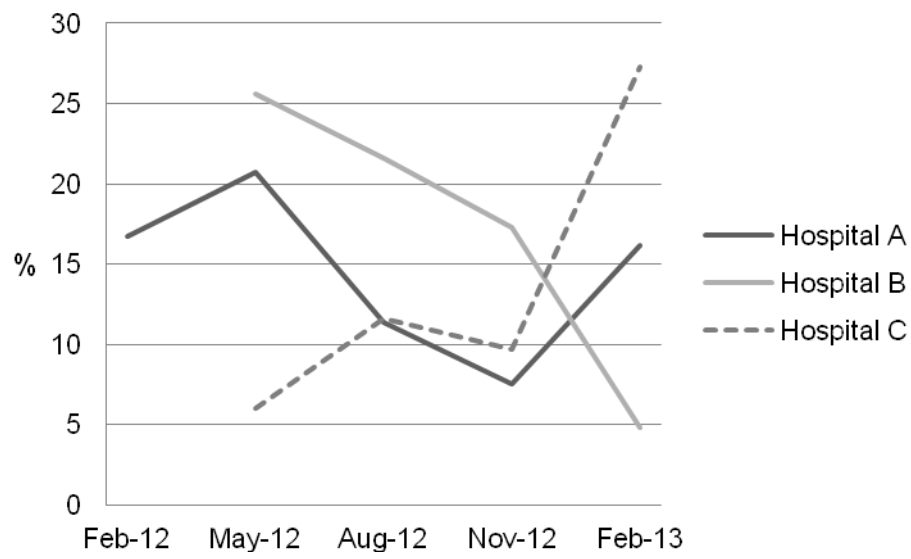
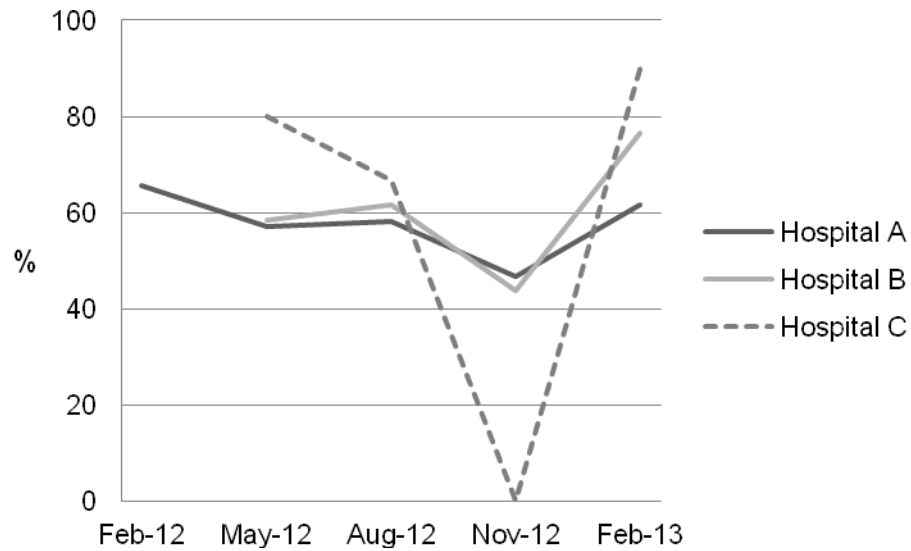
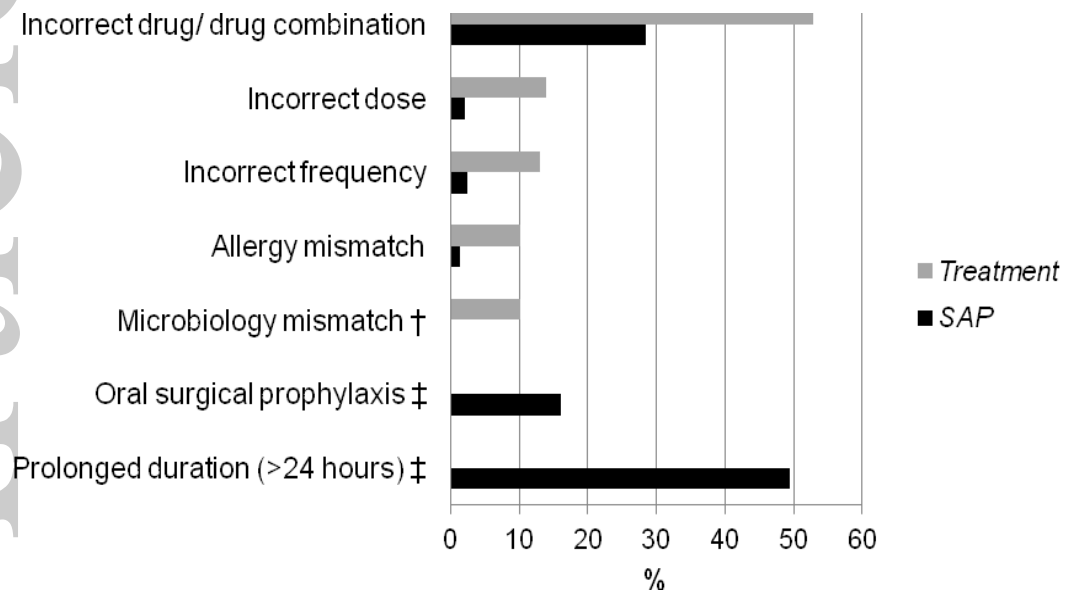
Figure 1: Inappropriateness over time: *treatment* prescriptionsFigure 2: Inappropriateness over time: *SAP* prescriptions

Figure 3: Reasons for inappropriate *treatment* and *SAP* prescriptions



† - only applicable for *treatment* prescriptions

‡ - only applicable for *SAP* prescriptions