Antimicrobial prescribing in a regional hospital: impact of collaboration with a new on-site pharmacy service

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Introduction:

The healthcare system relies on diligent **antimicrobial prescribing**. Inappropriate antimicrobial prescribing has the potential to cause significant harm. There are many well-evidenced barriers to effective establishment of Antimicrobial Stewardship (AMS) Programs in rural and remote hospitals. These include **culture of independence and self-reliance by local clinicians, lack of resources including access to onsite Infectious Disease (ID) Specialists, inadequate feedback on institutional prescribing patterns and inability to meaningfully benchmark performance.**[1]

Pharmacists play a central role in reviewing and monitoring antimicrobial prescriptions, implementing restricted formulary listings, providing education and feedback to clinicians, and are therefore ideally placed to influence prescribing practices. **Pharmacist** involvement in AMS programs is therefore recommended as a component of the multidisciplinary approach to promoting appropriate antimicrobial prescribing.[2]

Objectives:

- Describe the impact of a newly established clinical pharmacy service on antimicrobial prescribing at a regional rural General Practitioner (GP) led hospital
- Explore areas of suboptimal antimicrobial prescribing for further improvement
- Review of total antimicrobial cost per patient day

Methods:

A retrospective cross-sectional audit of patient medical records was conducted pre- and post-implementation of a new clinical pharmacy service. All adult patients who had presented with sepsis, cellulitis, urinary tract infections and pneumonia between May and August 2015 and repeated for same time period in 2018 were included.

Appropriateness of antimicrobial prescriptions was assessed according to the **N**ational **A**ntimicrobial **P**rescribing **S**urvey (NAPS) guidelines as follows; 1) optimal - if prescribed therapy follows either the recommended therapy as per the **Therapeutic Guidelines** or locally endorsed guidelines; 2) adequate - if it did not follow the Therapeutic Guidelines but was a reasonable alternative choice for the likely causative pathogen; 3) suboptimal - if it was an unreasonable choice for the likely causative pathogen including excessively broad spectrum of cover or unnecessary overlap in spectrum of activity; and 4) inadequate - if therapy was unlikely to treat the causative organism or if antimicrobial therapy was not indicated.[3]

Optimal and adequate prescriptions were deemed "appropriate", while suboptimal and inadequate prescriptions were classified as "inappropriate".

Costs were assessed based on average cost per patient day of administered antimicrobials for the two groups. Cost comparisons were based only on acquisition costs of antimicrobials as per the hospital contract prices for 2015 and 2018. A comparison of cost (acquisition) between appropriate and inappropriate therapy was also performed.

Results:

A total of 273 Antimicrobial prescriptions (1690 doses) from 110 eligible patient admission records were reviewed

- 115 pre hospital pharmacy (2015)
- 158 post hospital pharmacy (2018)

No significant difference between the groups in baseline characteristics were observed (**Table 1**).

A total of 86% of patients in the post intervention group were reviewed by a clinical pharmacist during their admission.

There was a significant improvement in overall prescribing of antimicrobial therapy after the introduction of a clinical pharmacy service. Appropriate therapy was increased from **57%** in 2015 to **82%** in 2018 (p=0.0013). Optimal therapy was prescribed in **35%** of antimicrobial orders in 2015 and **68%** in 2018 (p=0.0015). Inadequate prescribing was reduced from **18%** to **5%** in 2018 (figure 1)

Ceftriaxone, **benzylpenicillin** and **gentamicin** were the top three antimicrobials which were prescribed inappropriately in 2015 (n=14, 7 and 6 respectively), while in 2018 ceftriaxone was the main culprit for inappropriate prescribing (n=12). Reasons for inappropriate prescribing were most commonly wrong dose or inappropriate spectrum of antimicrobial activity for the infection. (Table 2)

The cost of antimicrobial therapy per patient day was halved from $10 and $5.33, pre and post introduction of clinical pharmacy service respectively. Cost of inappropriate therapy per patient day was reduced from **$6** in 2015 to **$4.25** in 2018.

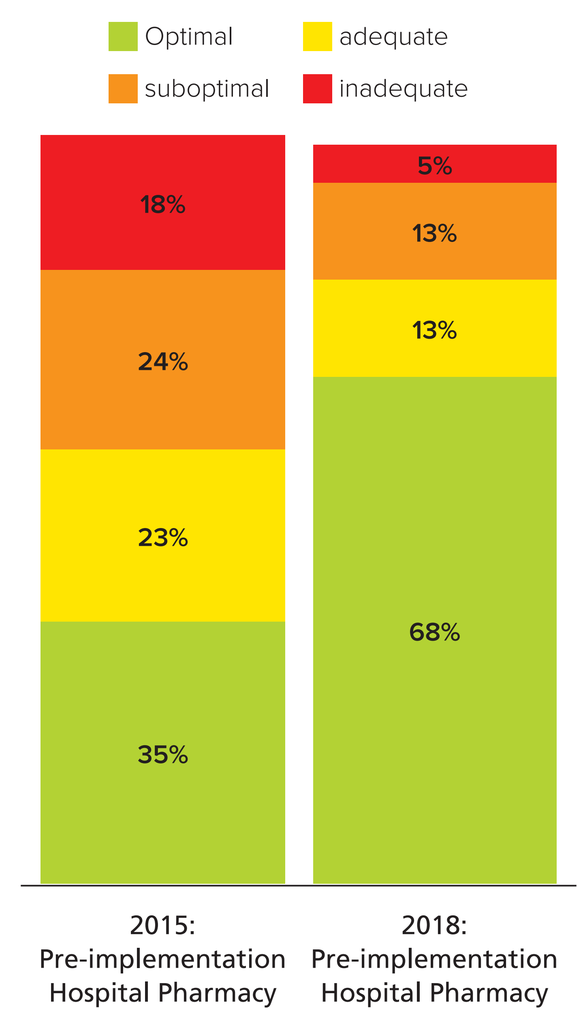

Figure 1 Changes to antimicrobial prescribing patterns pre- and post-implementation of a clinical hospital pharmacy service

	All patients n=110	2015, n=46	2018, n=64	p Value
Age (years, mean)	67	66	67	0.33
Gender, Female	54 (49%)	16 (35%)	38 (60%)	0.01
ATSI (yes)	22 (20%)	6 (13%)	16 (25%)	0.42
History of adverse antibiotic drug reaction (yes)	18 (33%)	6 (13%)	12 (19%)	0.64
Indication				
-CAP	41 (37%)	17 (37%)	24 (38%)	0.95
-UTI	27 (25%)	8 (17%)	19 (30%)	0.14
-Cellulitis	32 (29%)	18 (39%)	14 (22%)	0.05
-Sepsis & Febrile Neutropenia	10 (9%)	3 (7%)	7 (11%)	0.43
Length of stay (mean)	6	5.2	6.7	0.07
CRP (mean)				0.49
SMART COP				0.07
-Mild (0-2)	11 (10%)	8 (17%)	3 (5%)	
-Moderate (3-4)	17 (15%)	5 (11%)	12 (19%)	
-Severe (>5)	6 (5%)	2 (4%)	4 (6%)	
SIRS (meets)	59 (54%)	24 (52%)	35 (55%)	0.80
qSOFA (meets)	20 (18%)	10 (22%)	10 (16%)	0.41
Severity of disease				0.84
-Mild	9 (8%)	3 (7%)	6 (9%)	
-Moderate	27 (25%)	12 (26%)	15 (23%)	
-Severe	74 (67%)	31 (67%)	43 (67%)	
ID discussion recorded	12 (11%)	5 (11%)	7 (11%)	0.97

Table 1 Baseline patient characteristics

(ATSI: Aboriginal and Torres Strait Islander, CAP: Community Acquired Pneumonia, UTI: Urinary Tract Infection, CRP: C-Reactive Protein, SMART COP: Score for Pneumonia Severity, SIRS: Systemic inflammatory response syndrome, qSOFA: Quick sequential organ failure assessment score, ID: Infectious Disease)

Class	Antimicrobials inappropriately prescribed, 2015 (n=50)	Antimicrobials inappropriately prescribed, 2018 (n=30)
Cephalosporins	Ceftriaxone 14 (28%), Cefazolin 3 (6%), Cefalexin 1 (2%), Cefotaxime 1 (2%), Cephalothin 1 (2%)	Ceftriaxone 12 (40%), Cefazolin 1 (3%)
Penicillins	Benzylpenicillin 7 (14%), Flucloxacillin 4 (8%), Penicillin 1 (2%)	Amoxicillin 3 (10%), Flucloxacillin 3 (10%), Amoxicillin/Clavulanic acid 2 (7%), Piperacillin/Tazobactam 2 (7%)
Macrolides	Roxithromycin 5 (10%), Clarithromycin 2 (4%), Azithromycin 1 (2%)	Roxithromycin 3 (10%), Azithromycin 1 (3%)
Other	Gentamicin 6 (12%), Ciprofloxacin 1 (2%), Clindamycin 1 (2%), Doxycycline 1 (2%), Metronidazole 1 (2%)	Gentamicin 1 (3%), Vancomycin 1 (3%)

Ranking	Most common indication for inappropriate prescription, 2015	Most common indication for inappropriate prescription, 2018
1	Spectrum too broad (n=19)	Dose (n=14)
2	Dose (n=17)	Spectrum too broad (n=13)
3	Spectrum too narrow (n=17)	Spectrum too narrow (n=8)

Table 2 Rate of inappropriate prescribing

Conclusion:

The implementation of a clinical pharmacy service in a regional rural GP led hospital can significantly improve antimicrobial prescribing practices and provide considerable cost savings. The results provide baseline data for future benchmarking of AMS activities in the region and allow implementation of strategies for improvement of antimicrobial prescribing at a local level. Over prescribing of **ceftriaxone** was found to be an area which will benefit from additional education as a result of this audit.

References:

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