

Failure to implement hospital antimicrobial prescribing guidelines: a comparison of two UK academic centres

M. H. Ali¹, P. Kalima² and S. R. J. Maxwell^{1*}

¹Clinical Pharmacology Unit, University of Edinburgh, Queen's Medical Research Institute, Royal Infirmary of Edinburgh, Little France, Edinburgh EH16 4TJ, UK; ²Department of Medical Microbiology, Western General Hospital, Crewe Road, Edinburgh EH4 2XU, UK

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Background: Rational antimicrobial therapy should provide maximum benefit to patients while minimizing the development of resistant microorganisms.

Objectives: The aim of this study was to investigate (i) which antimicrobial drugs were chosen by hospital doctors faced with two common infections [community-acquired pneumonia (CAP) and urinary tract infection (UTI)], (ii) whether these choices were compliant with local guidance and (iii) the factors that influenced antimicrobial choice.

Methods: A questionnaire based on two hypothetical clinical scenarios was distributed to 316 hospital doctors across four UK NHS hospitals in two cities (Newcastle and Edinburgh).

Results: Doctors in Newcastle were significantly more aggressive in their management: more patients were admitted (CAP: 78.9% versus 48.4%, $P < 0.05$) and given antimicrobials intravenously (CAP: 53.4% versus 21.2%, $P < 0.05$). Adherence to the local hospital guideline for CAP was significantly higher in Newcastle (83.3% versus 38.0%; $P < 0.05$). Fewer than half of the doctors surveyed used the local hospital guideline when choosing an antimicrobial, and the *British National Formulary* was the most frequently used resource (>90%). Junior doctors also identified medical school teaching and opinions of senior doctors as important influences.

Conclusions: This study highlights inadequacies in the implementation and promotion of local guidelines, and demonstrates the potential for widely varying antimicrobial practices in two comparable UK cities.

Keywords: junior doctors, medical education, formulary

Introduction

The problem of antimicrobial resistance, along with its associated threat to public health, is widely accepted to be worsening.¹ The recent emergence of several multidrug-resistant bacteria has complicated patient management and increased patient morbidity and mortality.² There are several factors responsible for the development of resistance but arguably the most important is the inappropriate prescribing of antimicrobials by doctors.

Strict control on antimicrobial usage by monitoring and implementation of prescribing policies has resulted in a substantial fall in the prevalence of antimicrobial-resistant microorganisms.^{1,3} Evidence-based antimicrobial prescribing guidelines and formularies aim to foster responsible prescribing that maximizes benefit to the patient while minimizing the emergence of resistant microorganisms. Despite the large expenditure and collaborative

effort involved in formulating local antimicrobial policies, it is still unclear whether they have a major influence on clinical practice.

The aim of this study was to investigate which antimicrobial drugs were chosen by hospital doctors faced with presentations of two common infections, whether these choices were in line with local guidance and which factors were most influential in guiding antimicrobial choice. The study also aimed to compare attitudes towards antimicrobial prescribing in two similar UK academic centres.

Methods

The study was conducted in two UK NHS health regions, each containing two large teaching hospitals. In NHS Lothian (University

*Corresponding author. Tel: +131-242-9332; E-mail: s.maxwell@ed.ac.uk

CASE 1	
A 33-year-old male presents to the rapid access clinic with a recent history of cough productive with purulent sputum and pleuritic chest pain. Upon examination, the patient is febrile (38.5°C) with reduced chest expansion but is well enough to eat and drink. The patient was previously fit and healthy.	
<u>Investigations:</u>	
CXR:	Consolidation in the right lower lobe
Haematology:	80% polymorphonuclear leucocytosis
Biochemistry:	ESR 40 mm/h, CRP 12 mg/L
Blood gases:	pH 7.35, O ₂ 10.4 kPa, CO ₂ 5.5 kPa
Should this patient be admitted into hospital?	
What initial antimicrobial(s), route, dose and frequency would you prescribe for this patient?	
CASE 2	
A GP contacts you regarding a 74-year-old female who has presented with symptoms of urinary frequency, dysuria and haematuria. Upon examination, the patient is persistently febrile (38°C) and the bladder is mildly tender. The patient was previously fit and healthy and lives with her husband.	
<u>Investigations:</u>	
Dipstick tests:	positive nitrite, positive leucocyte esterase
Biochemistry:	ESR 65 mm/h, CRP 11.5 mg/L
Should this patient be admitted into hospital?	
What initial antimicrobial(s), dose and frequency would you prescribe for this patient?	

What are the major influences to your decisions in above questions?	
Have you referred to any resources to aid prescribing decisions in the last 12 months?	
What is your clinical grade?	

Figure 1. Hypothetical clinical cases given to doctors.

Hospitals Division), data were collected from the Western General Hospital (WGH) and the Royal Infirmary of Edinburgh (RIE). In the Newcastle-Upon-Tyne Hospitals NHS Trust, data were collected from the Freeman Hospital and the Royal Victoria Infirmary (RVI).

Doctors on the wards were handed a one-page questionnaire (Figure 1) and supervised while they completed it (unaided). This was done over a 2 week period in each centre to maximize the sample of doctors. The questionnaires were anonymous but both the place of work and clinical grade of the doctor were recorded. The first section of the questionnaire contained two hypothetical patient histories. The scenarios were intentionally written as 'grey cases' to see how doctors would interpret the severity of the case and consequently determine how they would apply the guideline. Severity was left to their clinical judgement (and any help the guideline offered). Based on the clinical information given, doctors were asked for an initial management plan. The second section asked the doctor to indicate the influences that informed their management plan and the resources they had referred to in the past 12 months to aid a prescribing decision.

The chi-squared test for independence was used to detect statistically significant relations between two categorical variables. Independent sample *t*-tests were used to detect difference between the means of two parametric variables. SPSS release 12.0.0 for Windows was used to facilitate calculations. All statistical analyses were performed at the 95% significance level.

Results

In total, 316 doctors responded to the questionnaire, 132 from Newcastle and 184 from Edinburgh. A significantly greater proportion of doctors in Newcastle than in Edinburgh chose to admit the patients with community-acquired pneumonia (CAP; 78.9% versus 48.4%, $P < 0.05$) and urinary tract infection (UTI; 41.4% versus 28.3%, $P < 0.05$).

Antimicrobial treatment for CAP

The most popular prescribing choice to treat CAP in Edinburgh was consistent with the British Thoracic Society (BTS) guideline,⁴ comprising combination therapy with amoxicillin and clarithromycin (65 doctors; 35.3%; Table 1). In Edinburgh, 70 doctors (38.0%) were prescribing according to the hospital guideline. In Newcastle, the majority of doctors chose monotherapy amoxicillin (38 doctors; 28.8%; Table 1). In Newcastle, 110 doctors (83.3%) were prescribing according to their local hospital guideline. A significantly greater proportion of Newcastle doctors than of Edinburgh doctors chose to give intravenous therapy (53.4% versus 21.2%, $P < 0.05$).

Antimicrobial treatment for UTI

Monotherapy trimethoprim and monotherapy co-amoxiclav were the most widely prescribed regimens in Edinburgh (66 doctors, 35.9%, and 63 doctors, 34.2%, respectively; Table 1). In Newcastle, monotherapy trimethoprim was the most common antimicrobial regimen prescribed by 63.6% (84 doctors). In Newcastle, 96 doctors (72.7%) were compliant with the local hospital guideline, compared with only 83 doctors (45.1%) in Edinburgh.

Prescribing influences and information resources

In both cities, current hospital practice was cited as the greatest determinant on antimicrobial prescribing. Guidelines were a much greater influence in Edinburgh than in Newcastle (121 doctors, 65.8%, versus 55 doctors, 41.7%). The greatest influences on pre-registration house officer prescribing were medical school teaching and the opinions of senior doctors, whereas antimicrobial prescribing by senior house officers was more influenced by hospital practice and guidelines. Of all doctors in the survey, 94% had used the *British National Formulary*

Failure to implement antimicrobial guidelines

Table 1. Proportion of respondents making specific empirical antimicrobial choices

Edinburgh		Newcastle	
Antimicrobial regimen	% doctors (n)	Antimicrobial regimen	% doctors (n)
CAP			
amoxicillin + clarithromycin	35.3 (65)	amoxicillin ^a	28.8 (38)
amoxicillin ^a	24.5 (45)	amoxicillin + erythromycin ^a	24.2 (32)
co-amoxiclav + clarithromycin ^a	13.6 (25)	amoxicillin + clarithromycin ^a	21.2 (28)
co-amoxiclav	9.8 (18)	cefuroxime ^a	6.8 (9)
amoxicillin + erythromycin	2.7 (5)	amoxicillin + cefuroxime	3.0 (4)
amoxicillin + ceftriaxone	1.6 (3)	cefuroxime + clarithromycin ^a	2.3 (3)
amoxicillin + penicillin	1.1 (2)	co-amoxiclav + erythromycin	1.5 (2)
amoxicillin + co-amoxiclav	1.1 (2)	co-amoxiclav	1.5 (2)
none given	10.3 (19)	ciprofloxacin	1.5 (2)
		penicillin	1.5 (2)
		none given	7.6 (10)
UTI			
trimethoprim	35.9 (66)	trimethoprim ^a	63.6 (84)
co-amoxiclav ^a	34.2 (63)	cefuroxime	7.5 (10)
ciprofloxacin ^a	10.9 (20)	ciprofloxacin	6.8 (9)
trimethoprim + co-amoxiclav	4.9 (9)	cefalexin ^a	6.0 (8)
co-amoxiclav + ciprofloxacin	2.7 (5)	co-amoxiclav	3.0 (4)
amoxicillin	2.2 (4)	trimethoprim + ciprofloxacin	2.3 (3)
trimethoprim + cefalexin	1.6 (3)	trimethoprim + nitrofurantoin ^a	1.5 (2)
trimethoprim + amoxicillin	1.6 (3)	nitrofurantoin ^a	1.5 (2)
none given	6.0 (11)	amoxicillin	1.5 (2)
		none given	6.1 (8)

^aLocal guideline recommendations.

(*BNF*) in the past 12 months, whereas only 43% had referred to their local hospital guideline; 39% had used the *BTS* guideline.

Discussion

The central aim of this study was to investigate what prescribing choices junior hospital doctors make when faced with two common infections and what influences and resources play a part in their choices. The main findings were that (i) the most important influences on prescribing choice were medical school teaching and the lead provided by senior doctors, (ii) adherence to the local hospital guidelines varied from 83 to only 38%, (iii) in spite of considerable efforts to produce local guidance only a minority of prescribers use it, with most preferring to refer to the *BNF* and (iv) there were clear differences between centres in approach to the same clinical scenarios.

Antimicrobial choice and compliance with local guidelines

In Edinburgh, 41% of doctors complied with the local hospital guideline when treating CAP and a similar proportion of doctors complied with the local hospital guideline for UTI. This compared with adherence rates of more than 80 and 72%, respectively, amongst Newcastle doctors. Variations in hospital guideline uptake have been attributed to different factors, including the doctor's knowledge, attitude and behaviour.⁵ Poor guideline adherence results from inadequate dissemination of the recommended information.^{6,7} To date, no optimal method of

distributing guidelines has been identified, with information compiled in handbooks, ward posters and group educational meetings all resulting in low awareness.⁷ Doctors may be sceptical about locally developed guidelines, having doubts about their scientific validity and the level of expertise involved in their development. This may be the case particularly when local and national guidelines vary, as was the case for CAP treatment in Edinburgh. The perceived validity of the recommendations made by a respected national organization may explain the high uptake of the *BTS* guideline in our study.⁶

A large proportion of junior doctors questioned in this study identified medical school teaching and senior doctors as major influences on their antimicrobial prescribing. This might also explain the divergent attitudes towards severity assessment and admission seen between the two centres. It is also notable that undergraduate teaching in Edinburgh recognizes trimethoprim as a first-line drug in UTI while hospital guidelines recommend co-amoxiclav or ciprofloxacin. Although undergraduate pharmacology teaching appears to influence junior doctors' prescribing, there remains concern that it fails to provide sufficient grounding to enable graduates to be rational and effective prescribers.⁸ The influence of senior doctors upon prescribing agrees with previous data.⁹

Prescribing influences and resource use

In spite of all the information published to help antimicrobial prescribing, the *BNF* (a general prescribing reference covering all

clinical drugs prescribable on the NHS issued to all doctors and found on all UK hospital wards) remains the definitive resource, being used by 95.7% of Edinburgh doctors and 92.5% of Newcastle doctors. This highlights the importance of perceived validity, brand recognition and availability, and their potential to overshadow the implementation of locally developed guidelines. Implementation may be improved by the enthusiastic support for and evaluation of local materials. The pharmacy department in Newcastle employs an antimicrobial pharmacist to supervise antimicrobial prescribing and implement local guidelines. The use of broad-spectrum and new, potent antibiotics is limited. Centres with a dedicated antimicrobial pharmacist-led unit have demonstrated improved clinical outcome and high guideline adherence.¹⁰

In conclusion, this study has highlighted the inadequacy of local antimicrobial guideline implementation in some academic centres and shows that, in spite of efforts to provide local guidance, the *BNF* remains the choice of reference for many UK doctors. Further work should focus on the reasons why some centres are more successful at implementation of local guidelines and why doctors still prefer a general prescribing reference to guide their antimicrobial choices.

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Transparency declarations

None to declare.

References

1. House of Lords Select Committee on Science and Technology. Resistance to antimicrobials and other antimicrobial agents. London: Stationery Office, 1998.
2. Guerin F, Buu-Hoi A, Mainardi JL *et al.* Outbreak of methicillin-resistant *Staphylococcus aureus* with reduced susceptibility to glycopeptides in a Parisian hospital. *J Clin Microbiol* 2000; **38**: 2985–8.
3. Betts RF, Valenti WM, Chapman SW *et al.* Five-year surveillance of aminoglycoside usage in a university hospital. *Ann Intern Med* 1984; **100**: 219–22.
4. British Thoracic Society. BTS guidelines for the management of community acquired pneumonia in adults. *Thorax* 2001; **56** Suppl 4: 1–64.
5. Cabana MD, Rand CS, Powe NR *et al.* Why don't physicians follow clinical practice guidelines? A framework for improvement. *JAMA* 1999; **282**: 1458–65.
6. Mol PGM, Rutten WJM, Gans ROB *et al.* Adherence barriers to antimicrobial treatment guidelines in teaching hospital, The Netherlands. *Emerg Infect Dis* 2004; **10**: 522–5.
7. Brown EM. Guidelines for antibiotic usage in hospitals. *J Antimicrob Chemother* 2002; **49**: 587–92.
8. Ellis A. Prescribing rights: are medical students properly prepared for them? *BMJ* 2002; **324**: 1591.
9. Pearson SA, Rolfe I, Smith T. Factors influencing prescribing: an intern's perspective. *Med Educ* 2002; **36**: 781–87.
10. Gross R, Morgan AS, Kinky DE *et al.* Impact of a hospital-based antimicrobial management program on clinical and economic outcomes. *Clin Infect Dis* 2001; **33**: 289–95.